



**Alberta  
Motor  
Association**



# Ability Over Age: Assessing Older Drivers

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# Driving in a Graying Population

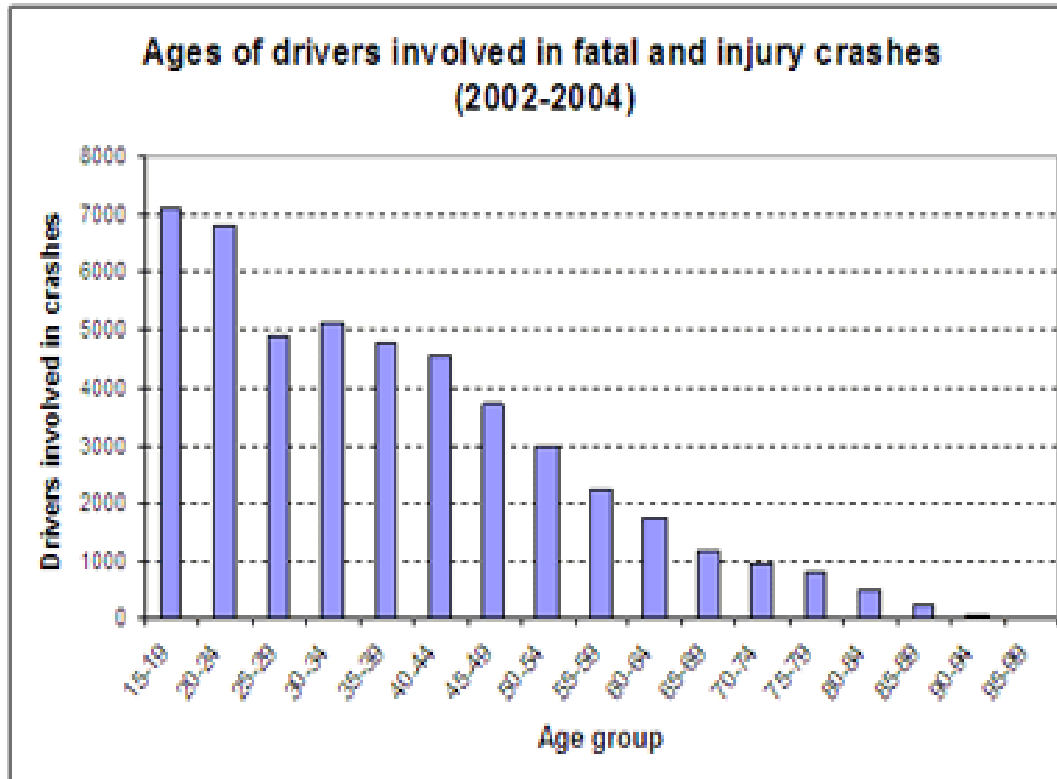
- Population aging as a world-wide trend
  - By 2058, perhaps earlier, one in four Canadians will be over 65 yrs of age.
  - There will be a gender imbalance with older women far outnumbering older men.
- Increase in older drivers
  - By 2040, the number of older drivers will double!



# The Value of Driving

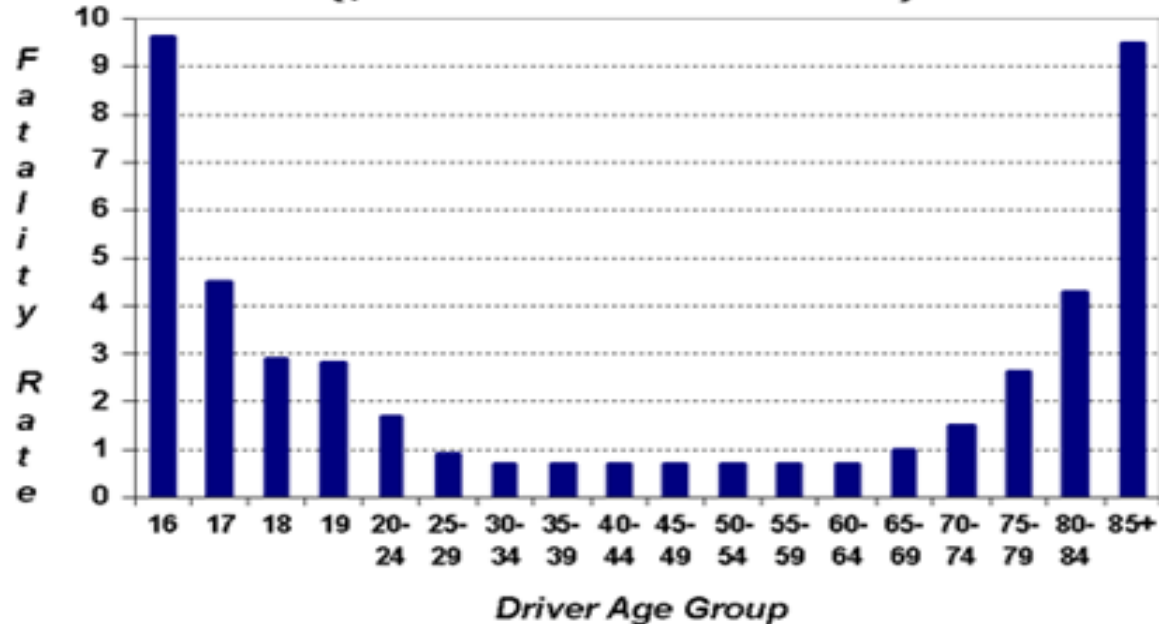
- North American reliance on private automobile.
  - Role in independence, social support, instrumental activities of daily living, enjoyment.
- Driving cessation associated with;
  - Increased isolation, lower activity, depression and likelihood of death.

# Collisions and Age



# Collisions and Age

## Driver Fatality Rate (per 100 million VMT)



Source: FARS 2001 and NHTSA 2001

# Collisions and Age

- Controlling for exposure, older drivers are more collision-involved, more likely to die or be seriously injured.
- This may be, in part, a low-mileage bias (Hakamies-Blomqvist et al. 2002).
- Older drivers are more likely to be involved in collisions involving intersections, merging, yielding right-of-way.
  - This despite strategic efforts to reduce risk.

# The Challenge

- Though controversy over relative safety of older drivers...
  - Cost of collision greater for them.
  - Some older groups, particularly those with medical or cognitive impairment, are at particular risk.
    - More than ½ of those diagnosed with dementia drive 3 yrs post-diagnosis.
  - Need reliable way to identify those who pose risk.



# Who's In Charge?

- In Alberta, Driver Fitness and Monitoring that deals with all drivers, including older drivers.
  - Anyone can report concerns.
  - Legal obligation to report medical conditions that MAY impact driving.
  - May require medical exam, screening or on-road assessment.
  - Clearly not realistic and usually falls to physicians or family members.



# Who's In Charge?

- Medical exam for driving fitness at 75, 80 and then every 2 yrs.
  - CCMTA publishes medical standards listing 14 medical categories that may warrant concern!
- Physicians receive little training in geriatrics or driving fitness
- Lack systematic, evidence-based rules for making decision.
- Other professional involvement (e.g., occupational therapists).

# Abilities and Driving Safety

- Driving as complex behavior
  - Sub-tasks of navigation, lane control and hazard avoidance
  - Smiley (2004) division of strategic, tactical and operational behaviors
    - Strategic – planning route, etc.
    - Tactical – situation-dependent decisions like gap acceptance.
    - Operational – often unconscious like scanning
    - Amenable to training!



# Abilities and Driving Safety

- Physical

- Strength, flexibility and range of motion.

- Sensory and perceptual

- Visual acuity, contrast sensitivity, depth perception, motion perception, peripheral vision, hearing, reaction time.

- Cognitive

- Memory, attention, vigilance, hazard perception.

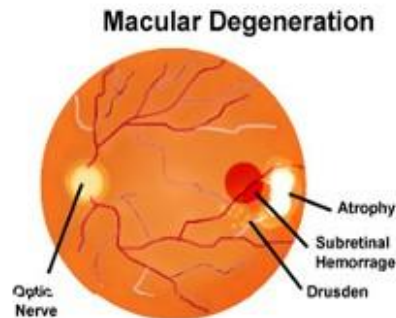
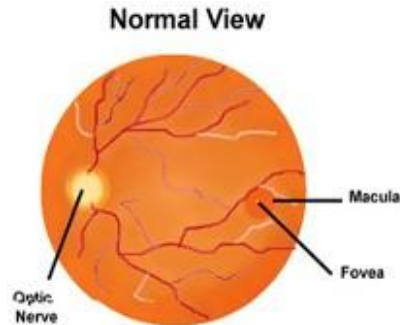


# Aging and Driving Abilities

## ■ Medical

- Heart disease and risk of loss of consciousness.
- Neurological disorders including stroke, Parkinson's and dementia.
- Depression
- Medications and substance abuse.
- Sleep disorders and fatigue.

# Disease and Vision – Macular Degeneration



# Disease and Vision - Cataract

Normal, clear lens

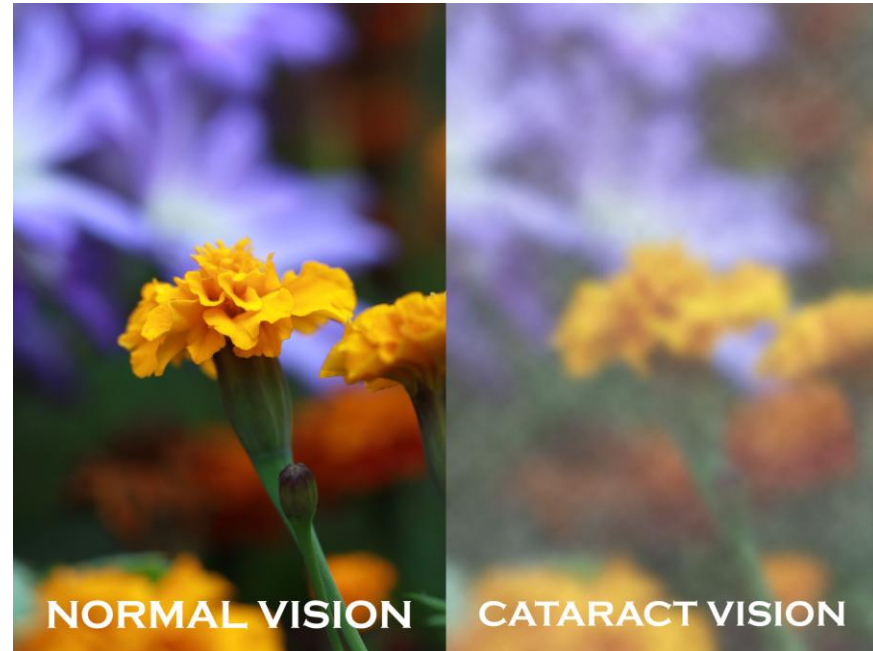


Lens clouded by cataract

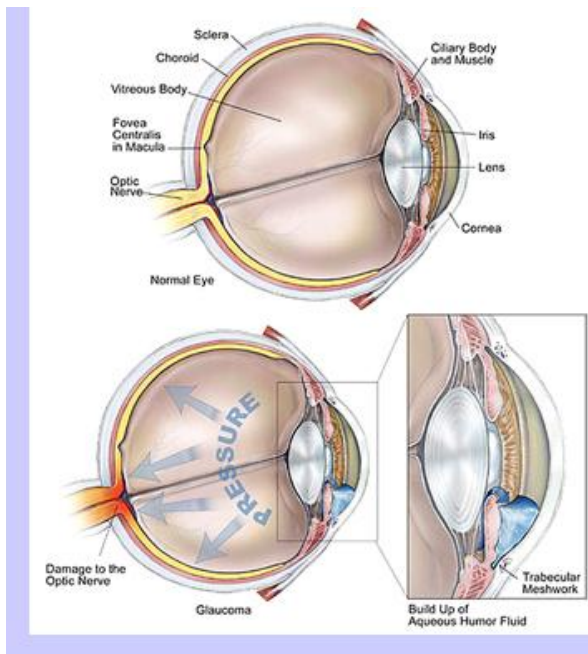


A cataract is an opacity of the normally clear lens which may develop as a result of aging, metabolic disorders, trauma or heredity

ADAM.



# Disease and Vision - Glaucoma





# Aging and Driving Abilities

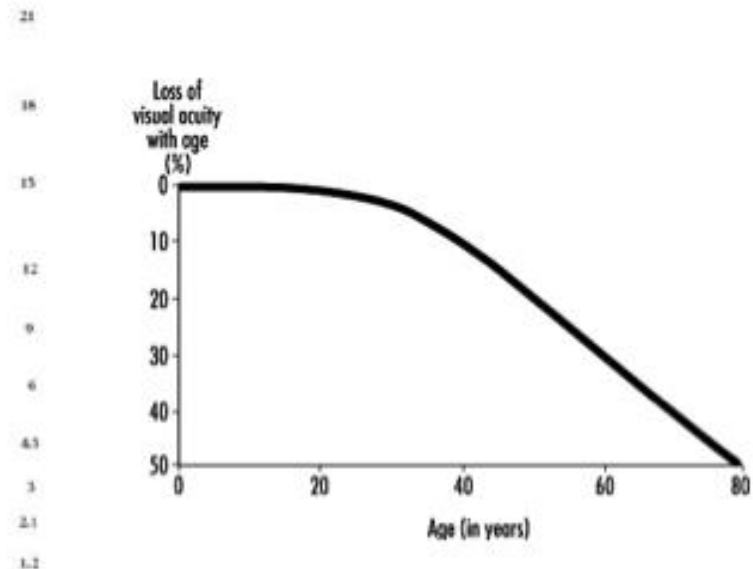
## ■ Physical

- Loss of muscle mass and muscle function with impact on speed of response.
- Range of motion, particularly neck rotation and role in shoulder-checking.
- Loss of height/poor posture and scanning.



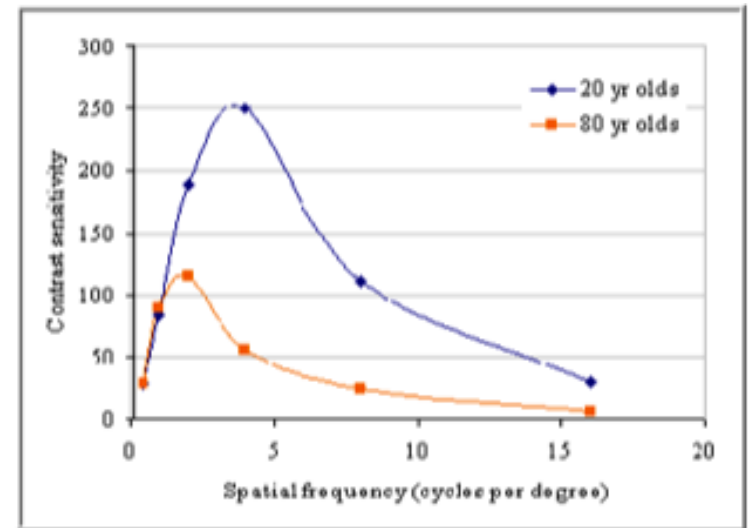
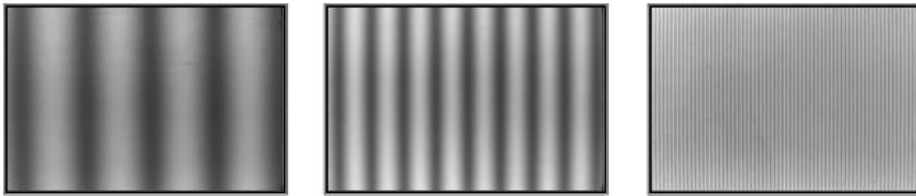
# Aging and Driving Abilities

- Sensory-perceptual (largely vision)
  - Acuity



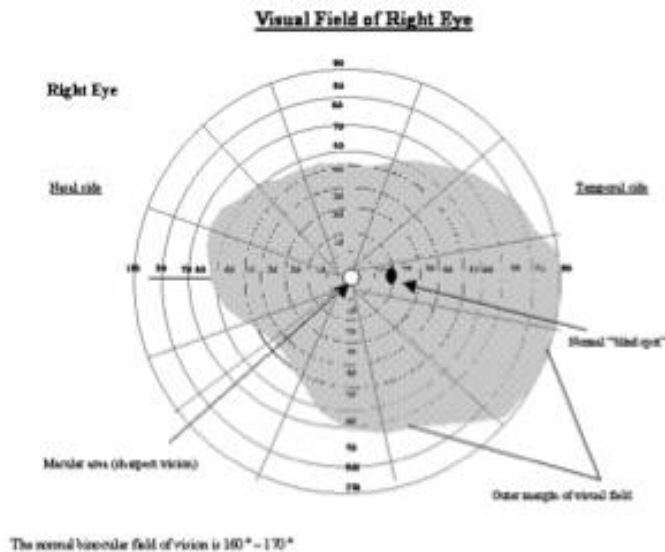
# Aging and Driving Abilities

- Sensory-perceptual (largely vision)
  - Contrast sensitivity



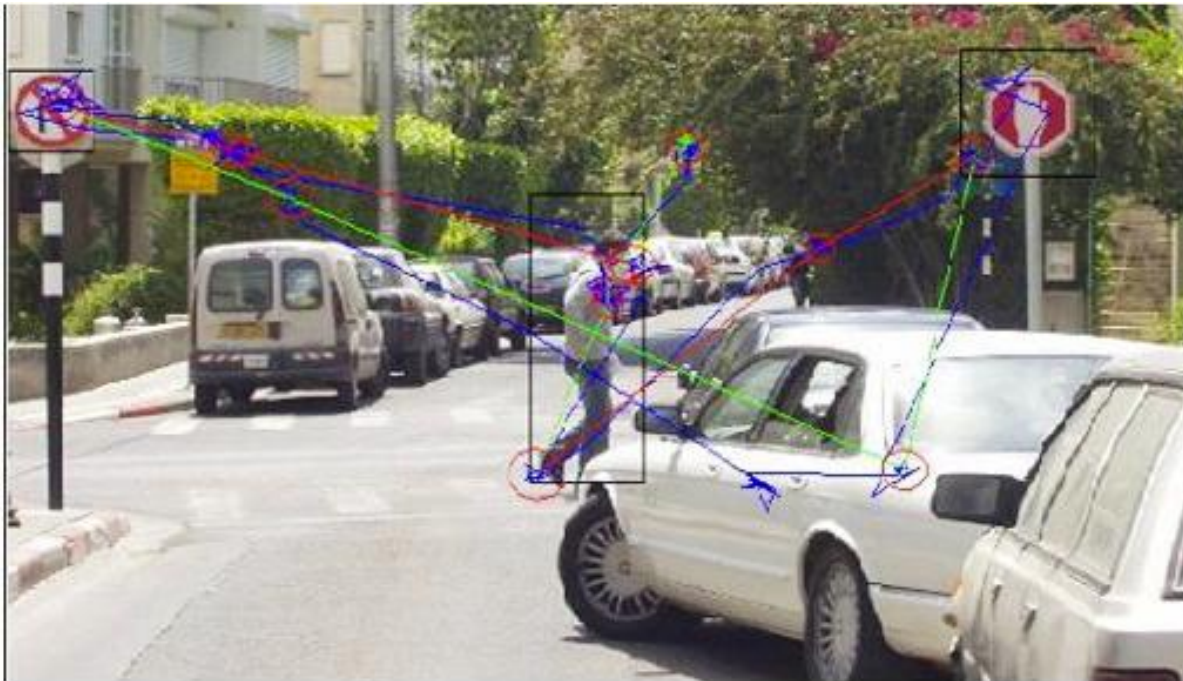
# Aging and Driving Abilities

- Sensory-perceptual (largely vision)
  - Visual fields and the UFOV



# Aging and Driving Abilities

- Sensory-perceptual (largely vision)
  - Eye movements and visual search



# Aging and Driving Abilities

- Sensory-perceptual (largely vision)
  - Pupil size, lens opacity and light scatter





# Aging and Driving Abilities

## ■ Cognition

- Working memory (Delayed recall)
- Orientation (MMSE, MOCA)
- Attention (Visual search, Trails A)
- Executive control (Trails B)
- Processing speed (Digit symbol)

# Evidence on Predictors of Driving Safety

- Anstey et al. (2005) review 13 studies of abilities related to driving. Good predictors included:
  - Attention including UFOV.
  - Reaction time.
  - Memory.
  - Trails A and B.
  - Some mental status measures.
  - Falls, heart disease, arthritis.



# Evidence on Predictors of Driving Safety

- Staplin et al (2003) report results of Maryland Older Driver Study.
  - Best predictors of collision were flexibility, strength, working memory, UFOV, missing information, Trails A and B, high and low contrast acuity.



# Evidence on Predictors of Driving Safety

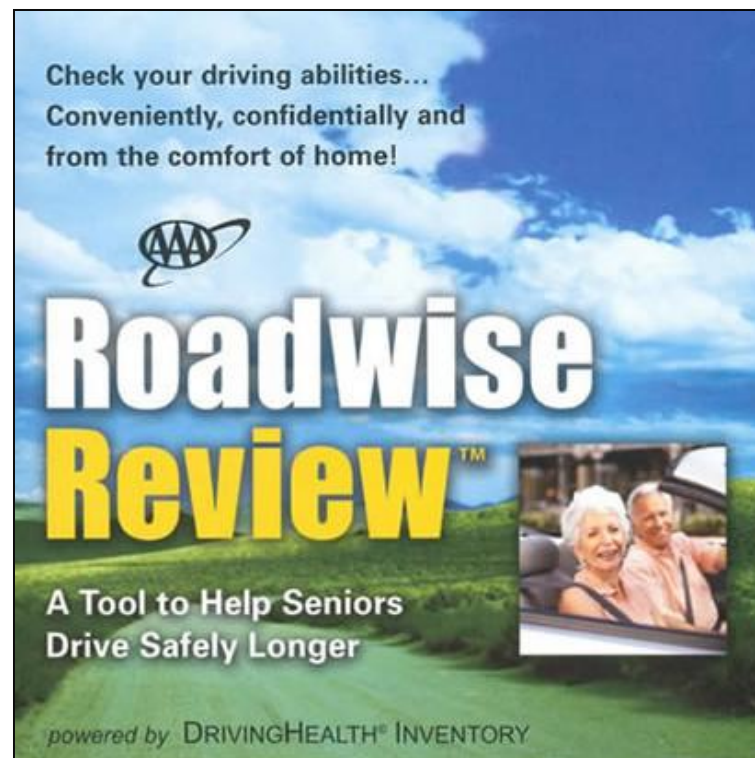
## ■ Wood et al. (2011)

- Multi-level battery including vision, cognition, hazard perception.
- On-road assessment of 80 community-dwelling drivers 65-88 yrs old.
- Hazard perception alone 75% sensitivity and 61% specificity.
- HPT with color choice RT, exposure, motion sensitivity and sway has 80% sensitivity and 73% specificity.

# Evidence on Predictors of Driving Safety

- Dobbs & Schopflocher (2010) tested two samples of referred elders with probable dementia.
  - Used SIMARD – Screen for the Identification of Medically At-Risk Drivers.
  - Paper and pencil tests to assess memory, speed, attention, verbal and visuospatial skills.
  - Outcome was DriveABLE pass or fail.
  - Good prediction ~ 80% but 1/3 indeterminate.

# Evidence on Predictors of Driving Safety – Roadwise Review





# The Roadwise Review

- Based on Maryland Older Driver Study (Staplin et al., 2003).
- Marketed and distributed by AAA/CAA as a screening tool for driving safety.
- Now available on-line.

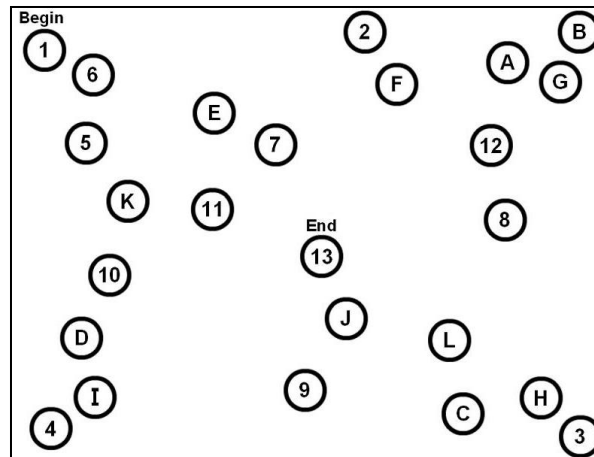
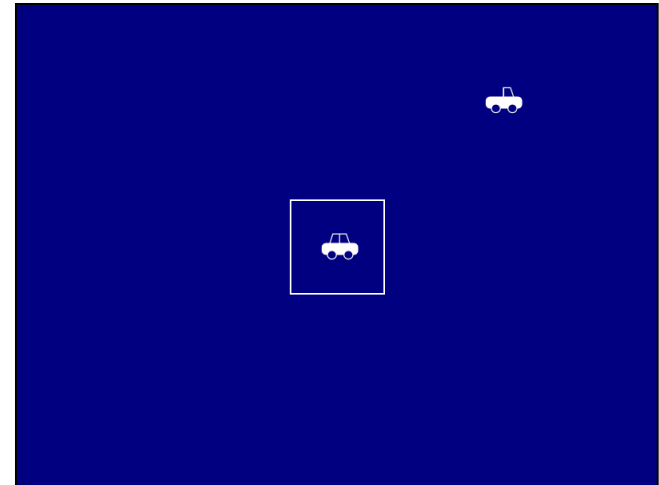
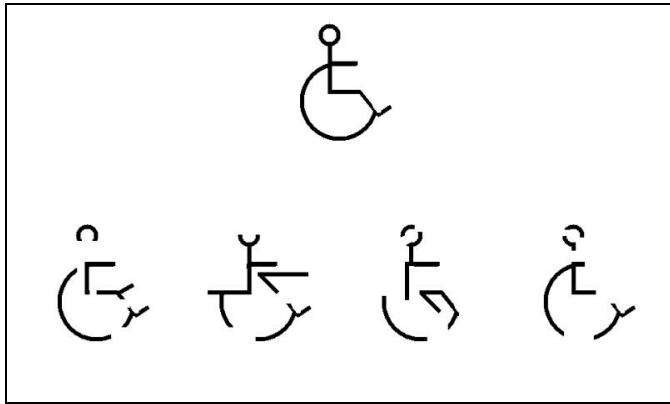


# The Roadwise Review

## ■ Tests

- Walking speed
- Head/neck flexibility
- High and Low Contrast Acuity
- Visualizing Missing Information
- UFOV
- Working Memory
- Visual Search (Trails A and B)

# The Roadwise Review





# The Roadwise Review

- Scialfa et al. (2010) – No subtest alone or in combination predicts self-reported collisions in healthy older drivers.
- Edwards et al. (2008) – UFOV and Trails B predict 2-yr retrospective self-reported collisions.



# The Roadwise Review

- Bédard et al. (2011) – Roadwise Review does not predict performance on standardized on-road assessment in healthy older drivers.
- Scialfa et al. (under review) – walking speed, hazard perception test and color vision, predicts pass/fail on on-road test at 75% accuracy.





# Screening Tests Summarized

- Some evidence that on-road performance can be predicted from screening tests.
  - Largely limited to healthy drivers.
  - Approximately 70% to 80% classification accuracy.
- Disagreement on preferred tests.
- Face validity, usability, time requirements and feasibility at issue.



# Screening Tests Summarized

- Need for multi-source approach including:
  - Screening tests
  - Mental status
  - Clinical interview
  - Collision history
  - Independent sources



# On-Road Assessment

## ■ Characteristics

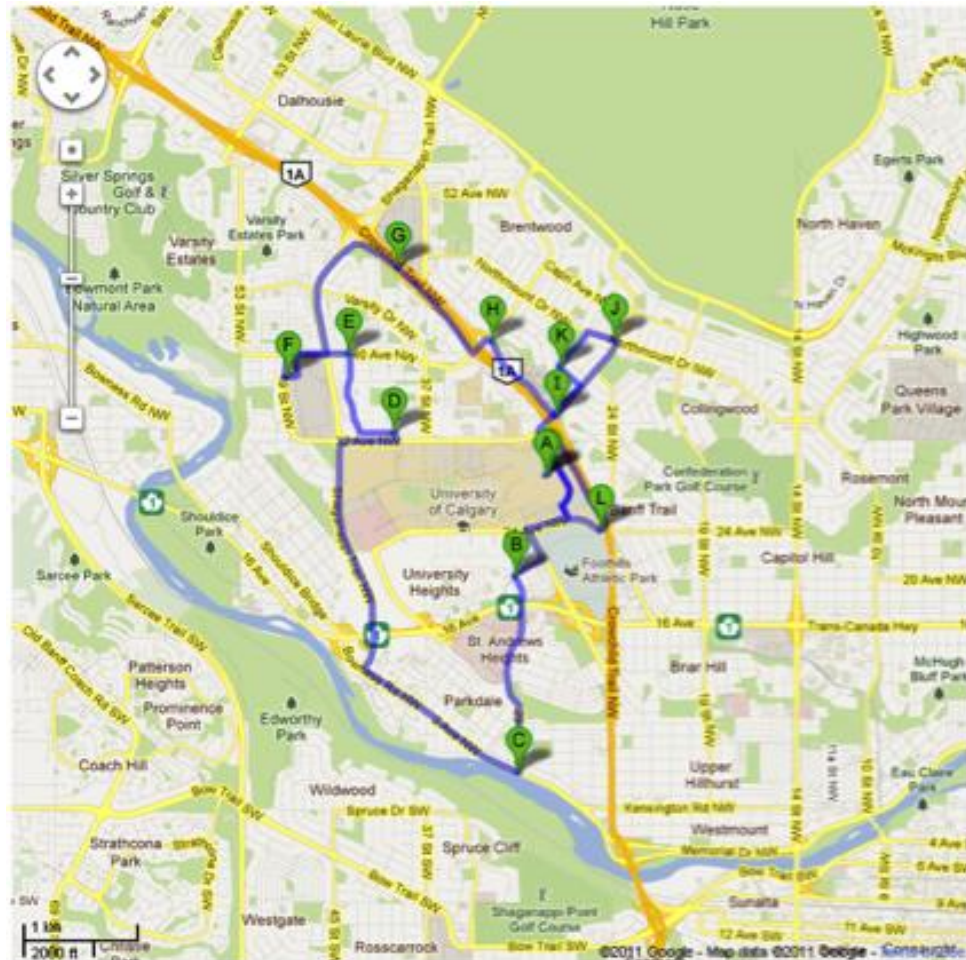
- Approximately 20 km
- Typically 40 minutes
- Mixed residential/commercial
- Varies depending on place of residence, evaluator, etc.
- Typically in one's own vehicle.



# On-Road Assessment

- Dimensions of Evaluation
  - Lane control, parking, intersections, merging and overtaking, braking, speed maintenance, scanning.
  - Generally points accumulate for mistakes.
  - Automatic failures along multiple dimensions.
  - May involve written component for sign recognition and rules.

# On-Road Assessment



# On-Road Assessment

- Scialfa et al. (under review)
- Almost 70 healthy, current drivers between 56 and 89 yrs. No remarkable collision history.
- More than 50% failed on-road test! (see also Dobbs et al., 1998).
  - Common errors involve scanning, speed, intersections, turns, changing lane position.

# On-Road Assessment

## ■ Issues

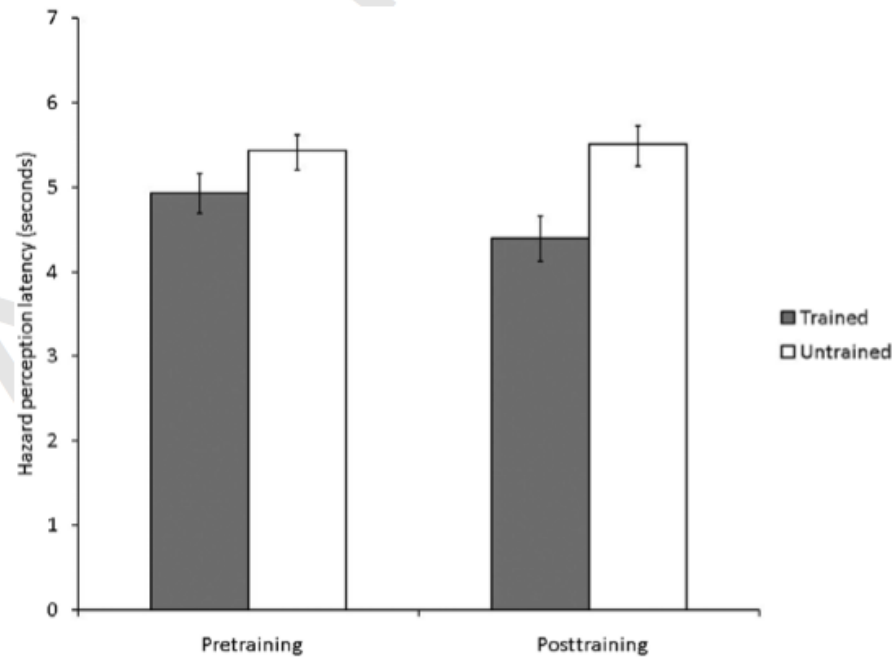
- Familiarity and demands of route.
- “Normal” errors vs. critical errors.
- Who pays? Required vs. elective assessments.
- Alternative assessments (e.g., DriveABLE).
- One-shot assessment vs. naturalistic driving.
  - Role of embedded technologies in future.

# Training Older Adults in Hazard Perception

- Horswill et al. (2010)
  - 28 licensed drivers aged 65-94 yrs.
  - ~ 40 scenes previously used in HPT and shown to predict crash risk.
  - A random 1/2 of the sample had “running commentary” training of about 20 minutes.



# Training Older Adults in Hazard Perception



*Figure 1.* Mean hazard perception latencies (in seconds) before and after training/control intervention. Error bars represent standard errors of the mean.

# Training Older Adults in Scanning

- Lavalliere, et al. (2009).
  - 20+ drivers approximately 70 yrs old.
  - ½ given specific video-based feedback to improve blind-spot checking while turning or overtaking.

# Training Older Adults in Scanning

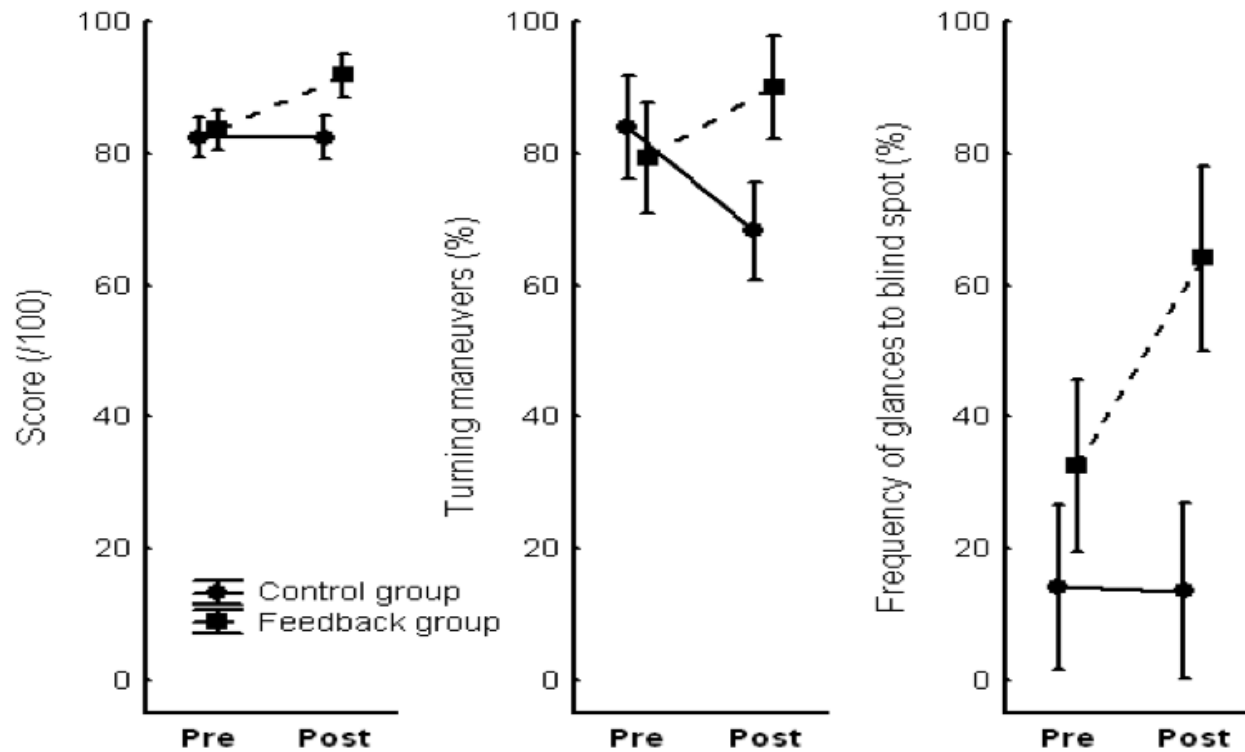


Figure 1. On-road standardized score (left panel), frequency of successful turning maneuvers (middle panel) and frequency of blind spot verification before lane change maneuvers (right panel).



# The Future

- Increasing importance of professional training (e.g., physicians and other health-care professionals).
- Creation, evaluation and implementation of screening instruments for widespread use.
- Evolution of on-road assessments for older drivers.
- Training tools (e.g., DriveSharp).



# Thanks

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