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

Ages of drivers involved in fatal and injury crashes (2002-2004)

Drivers involved in crashes

Age group
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 $\frac{1}{2}$ 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

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

  - 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

Check your driving abilities... Conveniently, confidentially and from the comfort of home!

Roadwise Review™
A Tool to Help Seniors Drive Safely Longer
powered by: DRIVINGHEALTH® INVENTORY
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

Diagram with various symbols and numbers indicating a network or map.
Scialfa et al. (2010) – No subtest alone or in combination predicts self-reported collisions in healthy older drivers.

The Roadwise Review


- 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 ½ 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

  - 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).
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