Les 26e Entretiens du Centre Jacques Cartier

Les Aînés et la Sécurité routière

LYON 26 et 27 novembre 2013

Partenaires de l'événement

LE CENTRE JACQUES CARTIER

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DÉCENNIE D'ACTION POUR LA SÉCURITÉ ROUTIÈRE 2011-2020

SÉCURITÉ ROUTIÈRE TOUS RESPONSABLES

Service public fédéral Mobilité et Transports
Mobilité et Sécurité routière

CIRRELT

RÉSEAU DE RECHERCHE EN SÉCURITÉ ROUTIÈRE

BIVV-IBSR

Québec
- Ministère des Transports
- Société de l'assurance automobile

LES CARACTÉRISTIQUES PHYSIQUES ET MENTALES SONT PLUS IMPORTANTES QUE L'ÂGE DANS LA PRÉVISION DES APTITUDES À LA CONDUITE CHEZ LES AÎNÉS

Prof. dr. Tom Brijs – Transportation Research Institute - Hasselt University, Belgium

26 November 2013,
Colloque 13 Jacques Cartier, Lyon

Outline

Introduction

Study

Results

Implications for screening and training

Introduction

Driving is a complex activity that requires a diverse set of skills for which we need:

- Physical abilities
  - Strength, flexibility, range of motion
- Visual abilities
  - Static visual acuity, dynamic visual acuity, contrast sensitivity, glare sensitivity
- Cognitive abilities
  - Working memory, selective attention, processing speed

These abilities can be affected by age, and thus may increase the risk of having a car crash

Mobility is seen as:

- The ultimate symbol of independence
- An important instrument against social exclusion and depression (Eby, et al., 2009; Marottoli, et al., 1997)

Driving cessation should only be decided if there are convincing indications of a significantly increased crash risk (Siren & Meng, 2011)

Need for a clinical assessment instrument that is highly predictive for crashes

Chronical age is only a weak predictor (Sommer, et al., 2004)

Our goal: Provide tailored training programs to senior drivers, targeted at those skills that need and can be (re)trained

First a detailed assessment is needed

Research questions:

- Which typical driving situations pose problems for older drivers?
- Which specific skills (motor, visual, cognitive) are needed in which of these driving situations?
- *Can these skills be (re)trained?*
- *What are effective training strategies?*
- *Is (re)training sustainable?*
- …

Study

Recruitment: Geriatrics department of the Jessa hospital, senior university, local newspaper, local senior's website and flyers

Participants were transported by taxi (due to the risk of simulator sickness)

Compensation:

- After clinical assessment: box of chocolates or cookies
- After driving assessment: €5 gift certificate

55 Participants (mean age 76 years):

- Age >70 years
- A driver's licence + still active driving
- No stroke or sequel in the last four months

Participants

Mini-Mental State Examination (MMSE; 0-30): 28.22

Useful Field of View (UFOV; 16.7 – 500ms):

UFOV-processing speed: 33.82ms

Some decrease in central vision and/or processing speed

UFOV-divided attention: 152.57ms

Some decrease in divided attention

UFOV-selective attention: 277.92ms

Normal selective attention

Assessment procedure

Clinical assessment

Clinical assessment

Intake conversation

- By geriatric specialist
- Medical history, driving habits
- Use of medication (with specific attention for sleep medication)
- Explanation of testing procedure

Traffic knowledge

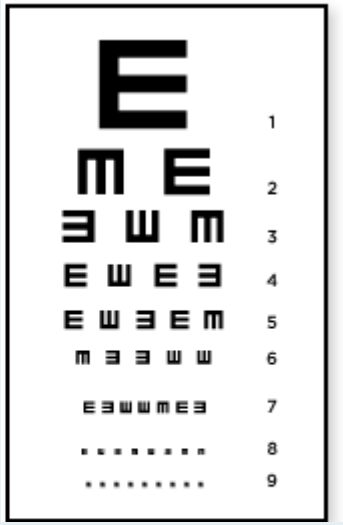
- Road sign recognition test (part of the stroke driver screening assessment SDSA)

Visual abilities

- Snellen E chart: visual acuity

Motor abilities

- Timed Get-up-and-go test
- Four test balance scale
- Functional reach test

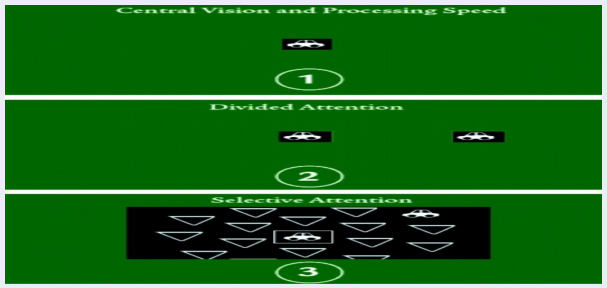


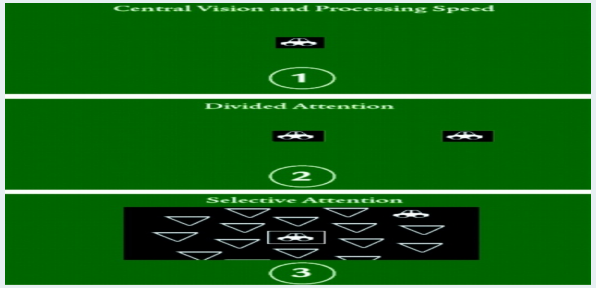
Cognitive abilities

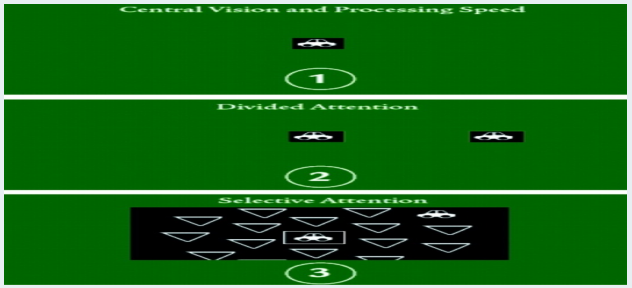
- Mini Mental State Examination (MMSE; Folstein, et al. 1975)
  - 7 items: orientation to time and place, attention and concentration, immediate and delayed recall, language and constructional ability
- Montreal Cognitive Assessment (MoCA; Nasreddine, et al. 2005)
  - 11 items: alternating trail making, visuoconstructional skills (cube & clock), naming, memory, attention, sentence repetition, verbal fluency, abstraction, delayed recall, orientation
- Forward digit span task
  - Working memory

Cognitive abilities (continued)

- Useful Field of View (UFOV – PC based version; Ball, et al. 2006)
  - Processing speed: Identification of target
  - Divided attention: Identification of target + location of 2nd target
  - Selective attention: Identification of target + location of 2nd target among distractors







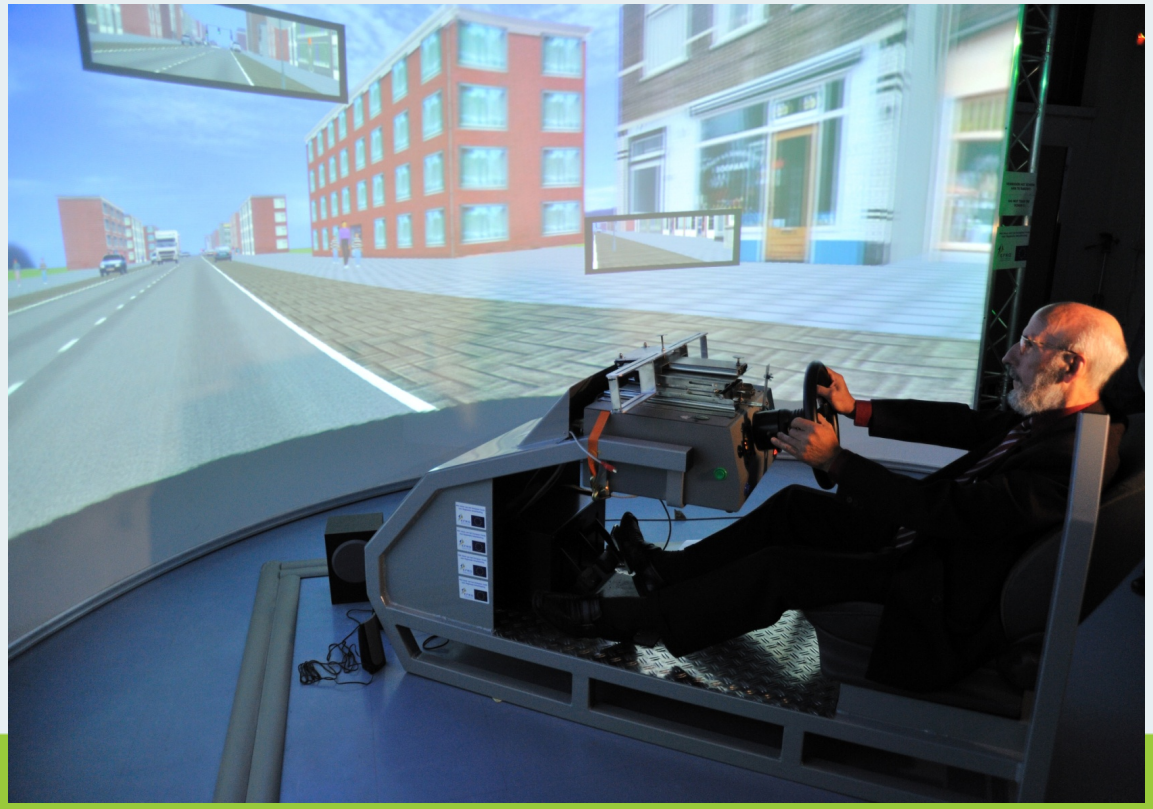
Cognitive abilities (continued)

- Attention Network Test (ANT – PC based version; Fan, et al. 2002)
  - Determining the direction of the arrow in the middle with the help of no cue, center cues, spatial cues and (in)congruent cues
  - Three attention networks:

1. Alerting network = alerting to achieve & maintain an alert state
2. Orienting network = orienting to turn attention toward stimuli and select a stimulus from an array of potentially relevant stimuli
3. Executive network = mediating planning, decision making, error detection, conflict resolution and inhibitory control

Driving simulator assessment

Fixed-based medium-fidelity driving simulator (STISIM M400; Systems Technology Incorporated) with a 135°field of view seamless curved screen



Three different road types:

- Rural, urban, highway

Four different speed zones:

- 50 km/h, 70 km/h, 90 km/h and 120 km/h

Driving situations that are problematic for older drivers were selected:

- Turning left at an intersection with gap selection (Yan et al., 2007)
- Giving way at an intersection or zebra crossing (Zhang et al., 1998)
- Responding to road signs, signals and road hazards (Bao & Boyle, 2008)

Sessions:

- Short practice session: get familiar with simulator: accelerating, decelerating, changing gear
- Practice session: 6.8 km
- Experimental session: 17.2 km

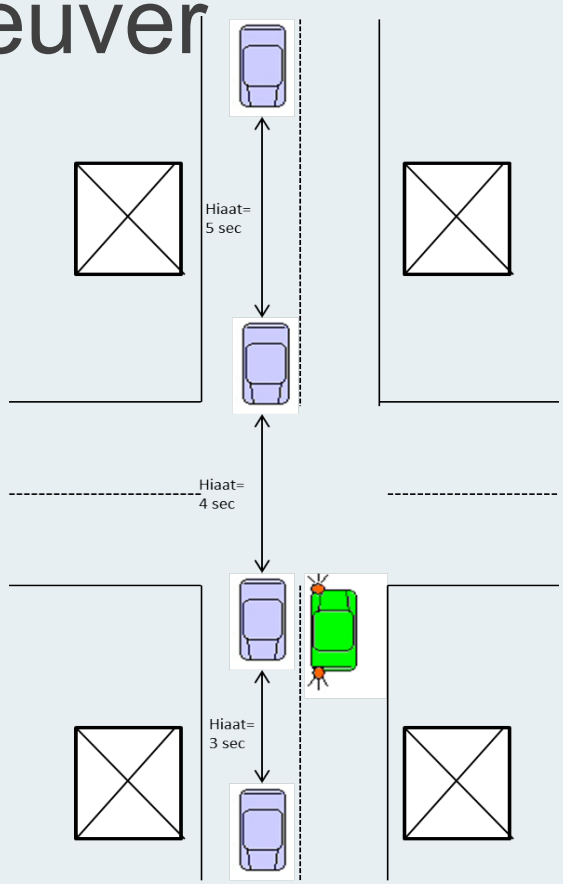
Order of the sessions was counterbalanced between-subjects

Dependent driving measures

- Mean speed during uninterupted driving
- Standard deviation of lateral position (SDLP) during uninterupted driving
- Gap acceptance during a left turn maneuver
- Complete stop at intersections with stop signs
- Mean following distance
- Detection- and reaction time to road hazards
- Crashes with pedestrians, vehicles and barriers

Gap acceptance: left turn maneuver

- Time headway between 2 vehicles on the major road into which a left-turn driver chooses to turn
- 2 speed zones: 50 km/h & 70 km/h
- Due to simulator sickness: turning left using horn



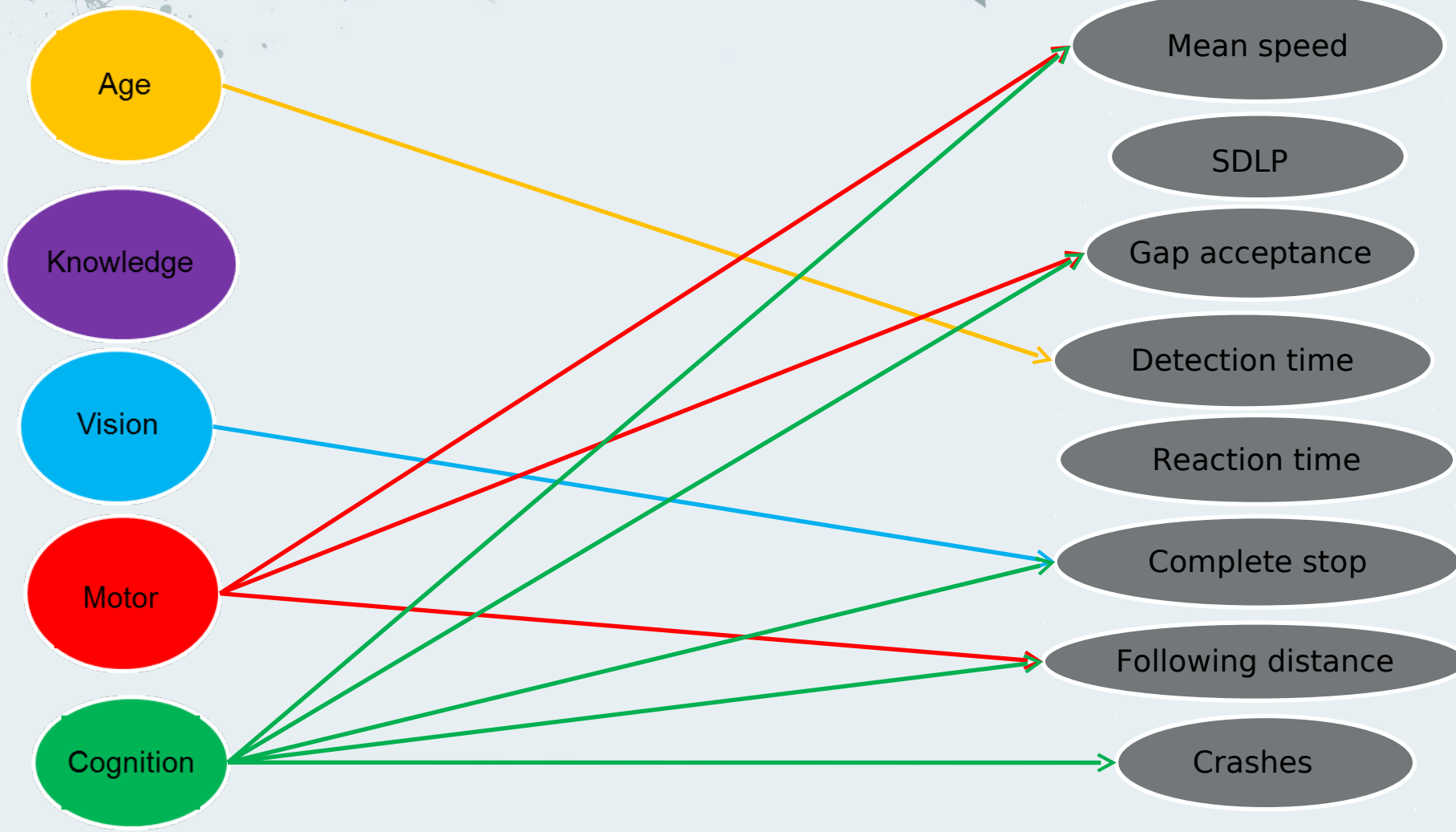
Detection- and reaction time to road hazards

- Detection time =

onset time of throttle release time – onset time of road hazard

- Reaction time =

onset time of braking – onset time of throttle release


Age
Knowledge
Vision
Motor
Cognition
Mean speed
SDLP
Gap acceptance
Detection time
Reaction time
Complete stop
Following distance
Crashes

Results

- Most studies so far investigated the relationship between general driving ability (outcome on road test) or crash history and different functional abilities with limited predictive accuracy
- This study shows a more differentiated and complex relationship between different driving tasks and different functional abilities
- Even in a relatively healthy group of seniors, differences in cognitive abilities are related to differences in driving performance on specific driving task
- This study also showed that general tests of cognitive ability (e.g. MMSE, MoCA) are outperformed by more specific tests (UFOV Divided attention).

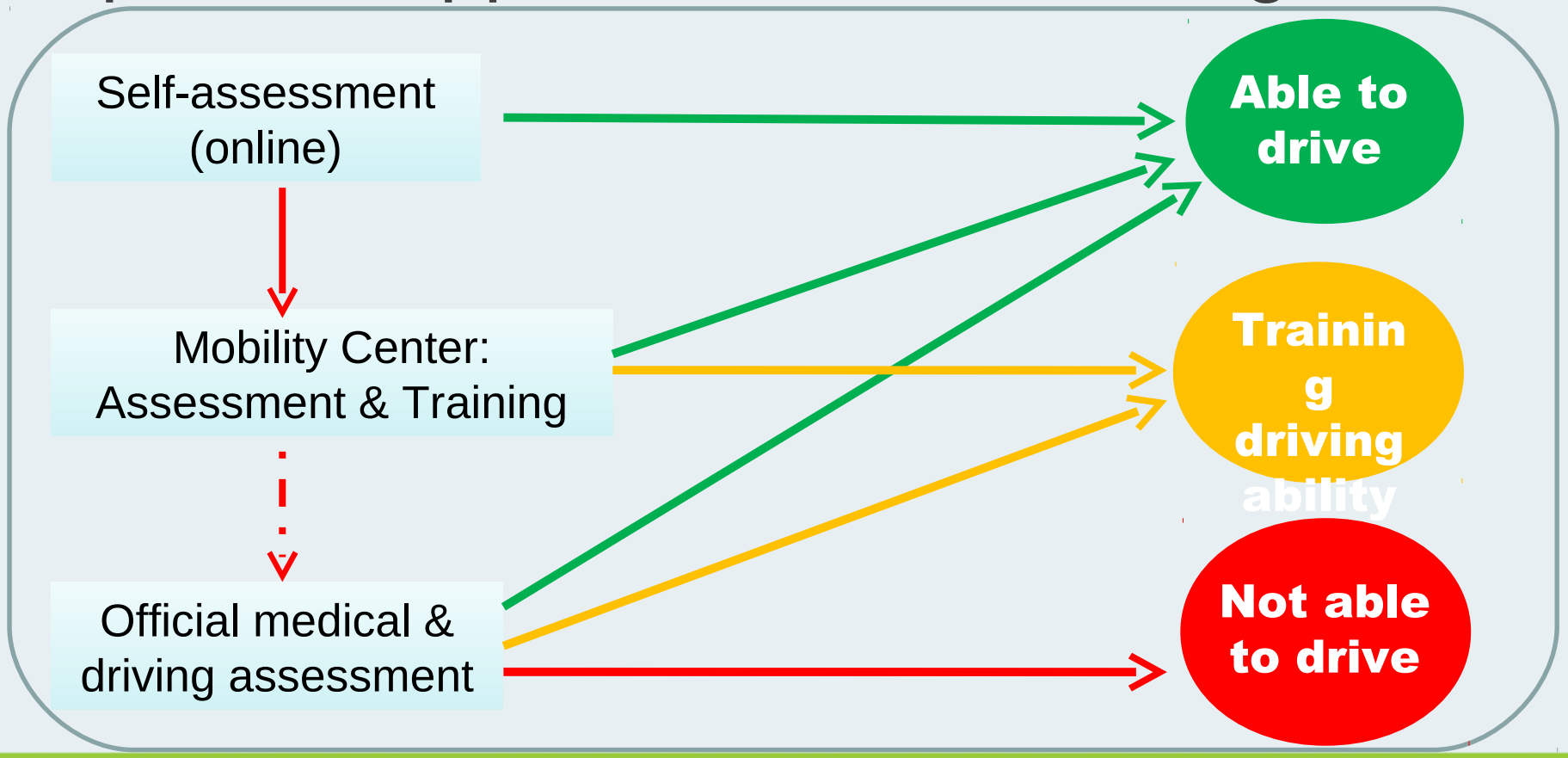
Implications for screening

- Current age-based screening practices for license renewal often focus on visual or motor abilities only, with limited or no evaluation of cognitive abilities
- Specific tests of cognitive abilities seem more predictive than general tests
- Nevertheless, the validity of functional abilities as predictors of driving performance remains too low (variance explained: 25-30%). Functional abilities at most potential INDICATORS (not PREDICTORS) of reduced driving abilities. (Role of compensation)
- Indicators could be used as a ‘filter’ for more elaborate screening (e.g. in driving simulator or on road)

Implications for driver training

- Training of driving skills can be beneficial to extend period of safe driving
  - Fits in principle of lifelong learning (also in traffic!)
  - Proactive and positive approach
- But, to maximize effectiveness and efficiency, training
  - Should be preceded by an analysis of driving skills that need re-training
  - Should focus on driving skills that need retraining instead of ‘general driving’

A positive approach towards driving



Thank you for your attention!

Questions?

Email: tom.brijs@uhasselt.be