Road safety of the elderly: Human factors

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Ageing and Safe Mobility
Outline

- Demographic change and mobility
- Mobility and ageing: Deficits and compensations
- Frequency and type of accidents of older road users
- Preventive and interventive measures
- Conclusions
The society of the future ... 

- ...will be a gray-haired, international, **mobile** society with an increasing number of older road users
- ... because its structure implies a growing need and increasing necessity for mobility for every age group!
- ... **Mobility** ... key factor of **quality of life in old age** ... (5th Report on the Elderly BMFSFJ, 2005)
Safe mobility

- So, it is a central social concern to ensure safe mobility of older people for as long as possible.
- A bunch of road safety measures is already available, concerning:
  - traffic management (1)
  - human factors (2)
  - vehicle engineering (3)
  - Infrastructure (4)
- This presentation focuses on human factors.
Demographic change and its implications for mobility – safety perspective

- Does the demographic change influence the **number** of road accidents?
- Is there an increasing number of **older people** who are involved in road accidents?
Demographic change and mobility: Increasing number & intense mobility of the elderly ... (details later)

- ... however, is reflected in **rising numbers** of accidents of the elderly
- This promotes the discussion on older drivers mainly in the following aspects
  - Ageing processes
  - Accident involvement
  - Fitness to drive
  - Driver license (for a limited time?)
- Regular mandatory testing_????

Just two examples of the Media Bias
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Normal ageing and ability to drive safely

- Even in normal ageing many aspects of sensory, cognitive and motor abilities (e.g. reaction time, attention, memory…) deteriorate in later adulthood.

- It is usually assumed that these deficits contribute to a decline in the ability to drive safely.

- In addition physical fragility and vulnerability also may affect driving safety.
In addition the prevalence of:

- **illness** (especially multiple morbidity)
- **medication** (especially multiple medication)

...increases with increasing age of older adults.

So, fitness to drive can be impaired due to:

- **Alzheimer’s disease** (middle stage)
- **Parkinson’s disease** (especially due to sudden naps)
- **Diabetes**
Road safety-relevant performance impairments may lead to improper driving, such as:

- incorrectly **changing the lane**
- failure to observe the **priority** of other road users or traffic signs
- mistakes when **turning**
- mistakes when **entering the flow of traffic**
- insufficient safety **distance**

Some examples will follow
At-fault crash involvement ratios

Figure 49: At-fault crash involvement ratios for two vehicle crashes at intersections with different controls, based on FARS data (Stutts et al., 2009).
Left turn crashes

Figure 48: Relative accident involvement ratio for left turn crashes by age group (Chandraratna, Mitchell, & Stamatiadis, 2002).
Erroneous driver actions leading to accidents

Figure 41: Different erroneous driver actions leading to accidents by age (source: Statistisches Bundesamt, 2012a).
Improper vs. “correct” ( = much more typical) behaviour of older drivers

- Older drivers usually
  - drink less alcohol.
  - don’t drink and drive.
  - drive at safer speeds.
  - are less likely to take risky actions on the road.
  - comply with the rules.
  - don’t behave aggressively.
  - compensate deficits in driving competence
Factors enabling safe driving behaviour

Figure 17: Schematic model of factors enabling safe driving behaviour as proposed by Anstey et al. (2005).
The individual differences in these factors are getting larger and larger with increasing age, i.e. increasing heterogeneity regarding road accident risk as well. These facts do not allow any statement at what age the ability to drive diminishes to what extent.
Ageing processes may lead to impairments, but ageing is characterized also by

- the ability to **change** and train behaviour
- stronger **safety-oriented** attitudes and behaviour
- less risky lifestyles (e.g. decrease in sensation-seeking)
- the ability to **compensate** performance impairments / **self-regulation**
So, adapted driving compensates for age-related impairments on strategic and tactical level (Michon, 1978)

- Efficient **trip management** (*no trips during rush hour*)
- Routes where you can ride **more comfortably**
- **No long distances** (*to avoid the need for sustained attention over an extended period of time*)
- **Fewer trips** (*especially at night*)
- Avoidance of **complex traffic** situations (*such as large confusing intersections*)
- Avoiding of **unknown new routes** (*especially at night and with poor visibility*)
Compensatory behaviour at different levels of the driving task (Weller 2010)

Knowledge-based Behaviour
- Only drive known routes
- Make more breaks in longer journeys
- Chose your route to avoid difficult situations

Rule-based Behaviour
- Avoid overtaking
- When turning wait until there is no other car

Skill-based Behaviour
- Drive slower to avoid having to react fast
- Only drive familiar vehicles

Strategic Level
Manoeuvring Level
Control Level
16 Behavioural Adaptation and Older Drivers

Sjaan N. Koppel and Judith L. Charlton

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One of the greatest apparent *paradoxes* of the older driver literature is

- that a demographic group with the **highest level of disabilities** (including cognitive impairment)
- has arguably the most enviable **safety profile** of any age group.

*Wisdom, altruism, strategic and tactical thinking* help the older driver to adapt.
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Accidents and accident risk
Some basic results

- Relatively **low accident** risk of older drivers.

- But quite often we hear just the opposite. There are the main reasons why:
  - Media-bias
    - Media often publish negative or critical information about older drivers. The more this happens, the more people believe it’s true.
  - Frailty-bias
  - Mileage-bias
Injured drivers in 2002 and 2008 (MiD, 2008)

Injured drivers (of passenger cars, motorcycles, mopeds, small mopeds or trucks) per 1 billion kilometres*

Germany 2002 and 2008

*MiD data

age groups

Reference: Holte, 2012

MiD-Daten Alter

* MiD data

injured drivers (Pkw-, Motorrad-, Moped-, Mofa- und Lkw-Fahrer) per 1 Milliarde Kilometer*

Deutschland 2002 und 2008
Seniors cause less accidents involving personal injury than any other age group

Main parties responsible for driving accidents involving personal injury per one million driving licences (passenger cars), 2008

Age group, yrs. 18-25 25-65 65-75 75+

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With age, the severity of injury increases along with the accident rate - also increasing with age - per (billion) km.

Frailty-Bias: Great Britain

Frailty-Bias: Switzerland

Crashes: Injured per 100 million kilometers driven by age of car driver (Ewert, 2013)
Passenger vehicle driver crash involvements per million miles (USA)


Ageing and Safe Mobility

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Georg Rudinger
Fatal passenger vehicle driver crash involvements per million miles (USA)

Small proportion of seniors as victims in accidents but increased proportion for fatalities

Proportion of elderly people as victims or getting killed in an accident by type of traffic in 2012

Percentage of seniors of the population 21%

K.Rompe - StBA (2013): Unfallgeschehen 2012
Vulnerability, fragility

Fig. 12. Fragility – the percentage of people injured in traffic accidents who die in Britain 2006–2009.
Accidents and accident risk
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  - Mileage-bias
With decreasing mileage risk of accidents per km is increasing in all age groups. With very low mileage, it increases dramatically in 75+ (!)
Low-Mileage-Bias *(another perspective)*

No increased crash risk for older drivers if km driven per year were taken into account

**BUT** the risk of being *at fault* of an accident increases with *decreasing mileage*
Brief summary (1)

- Car drivers up to age 75 or 80 are, on average, no more likely to be involved in a slight injury accident than younger drivers on the basis of casualties per driving licence per year.

- The rate of car driver casualties per mile driven does increase for ages over 70, and increases by almost a factor of three for drivers aged 80 and over.
Brief summary (2)

- Corresponding fatality rates rise much more rapidly with increasing age, because of the physical fragility of older people which increases with age.

- In a collision older drivers are at greater risk of injury or death themselves (and their front-seat or back-seat passengers – seniors as well), because of their greater physical fragility that results from ageing.
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Interventive measures at a glance
Identify hazard potentials, activate safety potentials

1. Statutory regulation / design of traffic environment

2. Consulting, Trainings, Campaigns
   - detect age-related deficits
   - know and accept alternatives

3. Technology development
   - assess fitness to drive realistically

Compensation
Safety
Statutory regulation, e.g. **age-based obligatory medical testing**

- The added value of age-based obligatory medical testing remains unclear at this stage and so recommendations for the introduction of such tests at EU level would be premature (EU-project MEDRIL, 2006)

- There is no evidence that screening to identify drivers who should no longer be driving has improved since 2006:
  - Still lack of **empirical evidence** (decision problems – False Positives!!??)
  - **alternative measures** are available
  - unbalanced **cost-benefit ratio**
Evaluation of procedures for renewing driving licenses in 27 EU Member States

“There is no evidence supporting the assumption that general age-based assessments have any safety benefits.”

There is **no general and universal deterioration** of competencies and abilities in the ageing process.

Age **alone** doesn’t increase the accident risk of older drivers. Therefore **generally preventive measures alone won’t be adequate**.

There are several **high risk groups** within the general population of older road users. Therefore one **needs special preventive measures** for those **different** target groups.

Just an example: **BASt-Project „PROSA“ PROfiles of Seniors with Accidents**
**Profiles of Seniors with Accidents - Group 1:** *Innocents, all ages (young old - old old)*

[Older drivers form a **very heterogeneous** group concerning road safety and road safety relevant human factors]

- Relatively small number of accidents
  - medium mileage per year
  - low burden with diseases
  - low consumption of pharmaceuticals
  - unsuspicious objective driving performance indicators.
Profiles of Seniors with Accidents - Group 2: Culprits, younger seniors - Lifestyle/Personality

- Relatively large number of accidents
  - comparatively low age
  - high mileage per year
  - low awareness of driving ability problems
  - openness to illegal behaviour in traffic
  - low burden with diseases
  - low consumption of pharmaceuticals
  - unsuspicious objective driving performance indicators.
Profiles of Seniors with Accidents - Group 3: Culprits, older seniors – „the peaks of the curves“

- Relatively large number of accidents
  - comparatively advanced age
  - low mileage per year
  - high awareness of driving ability problems,
  - high burden with diseases (cp. AGE V3)
  - high consumption of pharmaceuticals
  - distinctive compensatory behaviour
  - objective driving performance indicators below average.

Exactly the right clients for the GP-program
Person-centered "specific preventive" approaches e.g. "GP-Model"

1. Statutory regulation / design of traffic environment
2. Consulting, Trainings, Campaigns
3. Technology development
4. Compensation

- detect age-related deficits
- know and accept alternatives
- assess fitness to drive realistically
Physicians are important contact persons ("multipliers") and competent persons of trust.

- Physicians are in the position to inform their elderly patients about individual conditions and requirements related to traffic safety.
- They could promote appropriate settings on traffic and travel behavior, on mobility in general and
- Make a significant contribution to improve road safety of senior citizens.
Individual counseling by physicians

- In order to enable the physicians to carry out this task competently
- A continuing medical education for physicians (CME) has been developed including
  - Training about medically relevant issues of road safety
  - Information on diseases and drugs that can impair the ability to drive (see DRUID classification)
  - A validated screening test to obtain a first indication of the performance of a patient
  - A manual on medically relevant topics of road safety
### DRUID-Classification of medicines
#### Labelling system / Pictograms

<table>
<thead>
<tr>
<th>Category</th>
<th>Your risk in traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>![Category I Pictogram]</td>
</tr>
<tr>
<td>II</td>
<td>![Category II Pictogram]</td>
</tr>
<tr>
<td>III</td>
<td>![Category III Pictogram]</td>
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</tbody>
</table>

*Note: Pictograms show varying levels of risk with colors ranging from green to red.*
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Context-oriented approaches: Technology, Design and Infrastructure (following keynotes)
Older drivers are characterized by **risk potential** (deficits, performance impairments) and **safety potential** (experience, attitudes, motives, ability to learn, compensatory strategies).

Because of their **safety potentials** older drivers have a **lower annual** rate of accidents than any other age group.

And overall, the elderly are much less involved in an accident (absolute number of accidents) than all other age groups.

On the other hand, due to demographic development an **increase in accident involvement** of older drivers is **expected**.
Conclusions

□ However, we do not support a mandatory aptitude test for older drivers, since there is no expectation of gaining safety benefits.

■ There are a number of alternative measures that can be implemented to improve the road safety of older people.

□ Basically, future strategies should not be based on a deficit model, but on a facilitation model (use of individual safety potentials)

■ So, the GP-Model for example, is about ensuring the independence of living through preservation of skills and encouragement for mobility in the context of realistic options.
The speaker says, "Thank you... for your attention"