Elderly people in fatal traffic accidents. Analysis of the LMU Safety Accident Database with results from Accident reconstruction, autopsy and ideas of countermeasures from the technical and medical perspective.

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Abstract

At the fatal accident database from the Institute of Forensic Medicine since 2004 approximately 150 Traffic accidents per year with fatal outcome have been collected and documented. In a first analysis of a subsample from the years 2004-2006 accidents with accident causators over 65 years have been elaborated to get a first picture about this group. For car accidents approximately 39% male car drivers and 28% of female car drivers showed an acute medical vigilance problem as the main cause for the accident. As well the injury pattern from seniors is different. Especially thoracic injuries in higher AIS regions (AIS 3+) are much more common compared to younger belted car occupants. Also increasing problems with vision and age have been worked out in comparing different age classes. In future these problems should be clearly addressed in more research and especially better protection systems (i.e. belt systems and pretensioners for older occupants) as well as adaptive active Safety Systems with respect to driver attention should be standard equipment in cars.

Keywords: older drivers, medical conditions, thoracic injuries, future adapted passive (belt) and active systems

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Introduction

In the year 2030 approximately every 5th Car Driver (20%) in Germany will be over 65 years old, which is the double incidence compared to the year 2008 (10%).

Current statistics from US and Switzerland show especially for the age group 80+ a relatively high accident causation risk as well as a high injury and death risk, which comes even closer to the high risk group of the 18-24 year old males.

![Figure 1](image)

**Figure 1**: Deaths per 100 000 drivers by driver age and person type, 1993–97 FARS and 1995 NPTS. (Source: Braver et al.)

Material and Methods

The purpose of this study was to analyze the typical crash scenarios and the injury patterns of drivers >65 years. The advantage of the data material is that in all cases a compete autopsy from the fatally injured car driver was undertaken, so the injury pattern as well as acute and chronic medical preconditions could be matched with the accident situation. The accident was documented by technical experts and mostly reconstructed.

Data sources

At the Institute of Forensic Medicine 3,000 autopsies per year will be carried out. Hereby 150 cases annually reflect Traffic Accidents, this represents approximately 20% of all Fatal Traffic Accidents in the State of Bavaria. For this study accidents from the years 2004 – 2006 have been analyzed.
Results

Overall 65 cases with male drivers and 25 cases with female drivers have been identified.

Triggering Event

Here the Event which causes the car crash was identified as following:

![Triggering Event Fatal Accident > 65 yo Driver](image)

Figure 2: Triggering Event of the Fatal car crash (> 65 year old Drivers Male & Female)

An acute medical condition was for 39% of the male drivers and 28% of the female drivers the Accident Causator. A misinterpretation of vision was for 17% of the males and 12% of the females the reason for a severe fatal car crash. Suicide was committed in 11% (males), Fatigue (Highway, Country road and city) was overall present at 6% and 8%. No case was found in combination with alcohol and drugs; a vigilance problem due to pharmaceuticals was estimated in 2% (male) and 4% (female).

Vision

Overlooking or oversight is not a phenomenon only for older patients, but our investigators should compare accident causators from different age classes to monitor a possible difference between age classes.

Unlike in most previous studies, here crashes resulting in fatal injuries data were examined. As well studies with injured occupants only in addition to fatalities should be carried out. Nevertheless this was a first attempt of exploring the effect of older drivers and other road users to provide a more complete understanding of traffic safety risks associated with aging.
Figure 3: Probably reduced vision by age group (fatal car crashes)

The age groups < 65 years showed a probably reduced vision in 19%, whereas in the higher age groups approximately double (47% and 39%) cases with probably reduced vision occur in our accident material.

This correlates well with the observations from ophthalmologists, whereas psychological observations did not show any significant difference. Nevertheless it is obvious that in aged patients glaucoma and cataract show higher incidences.

This can be demonstrated with observations from the Ophthalmologic Centre from Wurzburg University (Prof. Gramer) that i.e. at glaucoma some areas of vision are reduced (= Skotom).

Figure 4: Blind spots at Glaucoma patients
Unfortunately the brain gives the patient the subjective impression that the vision is completely normal, whereas significant blind spots in the vision could hide a child with a ball. The typical accident here matches with the overriding of a pedestrian from right or left.

Figure 5: Real Traffic Situation

Figure 6: Traffic Situation for the glaucoma patient (Source Prof. Gramer Univ. Wurzburg)
Acute Medical Episode

### Medical Causes at accidents with reduced state of awareness N = 33

<table>
<thead>
<tr>
<th>Condition</th>
<th>Frequency in %</th>
</tr>
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<tbody>
<tr>
<td>Heart</td>
<td>67%</td>
</tr>
<tr>
<td>Syncope / LOC</td>
<td>27%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3%</td>
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</tbody>
</table>

**Figure 7: Medical Cause Acute Medical event**

In the investigated material heart failure was documented in 67%, the second highest frequency was shown with syncope’s (sudden consciousness) where no organic failure could be diagnosed by autopsy. Diabetes was diagnosed at 3%.

In Japanese survey as well aortic aneurisms, Lung Tuberculosis and Liver cirrhosis next to heart failures have been observed.

Other studies with autopsy results matched with a relevant number of traffic accidents are very rare. This requires a relevant research area for future observations.

### Injury pattern of seniors

It is well known from the literature that the thorax from seniors is more vulnerable for rib fractures and haemato- and pneumothorax where the ability for the lung to breathe is restricted.

In the case material 75% of the seniors > 65 years showed a thoracic injury, whereas only 39% showed a head injury. Relevant Abdominal injuries had a frequency of 6% whereas spinal injuries occur with 3%.

This very different injury pattern compared to younger car occupants, where in general head injuries are dominating.

### Discussion and Countermeasures

The study showed that acute medical conditions cause in a relevant number fatal car crashes for senior drivers and it could be estimated that this number will rise due to the demographic change in Europe, North America and China. As well fatigue and reduced eye vision show for elderly age groups a relevant accident causation scenario.

Ideally driver monitoring systems should be implemented, which can detect a loss of consciousness and fatigue (micro sleep). These systems should automatically stop the car and call emergency with a GPS Signal.

As well active systems should assist the driver ideally with automatic breaking if the driver overlooks a pedestrian/bicycle other vehicle. Nevertheless even the healthy aged driver over 80 years should critically check up his vision and overall ability to drive due to medical preconditions.

For a better passive safety seat belts, belt pretensioners and airbag systems should be constructed also for older car occupants with a reduced belt loading in the thoracic body region.
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