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

MBU Medical Biomechanical Accident Analysis
Institute of Forensic medicine

Wolfram Hell
Matthias Graw
150 Traffic accidents with fatalities / per year
(20% from all fatal accidents in Bavaria)
1,500 Cases 2004 - 2014
Institute for Legal Medicine Munich (Head: Matthias Graw):
- biggest forensic institute in Germany
- 3,000 legal autopsies, 15,000 reports and expertises per year
- courses in legal medicine at both Universities in Munich, the Ludwig-Maximilians University and the Technical University Munich
- scientists and experts from the fields: medicine, pharmacology and toxicology, biology, physics and engineering
- investigations and expertise for hospitals, courts, police, insurance companies, commercial and private clients and government authorities
- access to all departments of the faculty of medicine including radiology (CT, MR and X-ray)
Interdisziplinary Approach
HADDON MATRIX

HUMAN (Medicine, Psychology)

VEHICLE (Engineering Science)

ENVIRONMENT (Street architecture)
LMU-SAD 70-80% of traffic deaths die within the first hour at the accident scene and will be NOT covered in conventional accident databases.

All accidents with fatalities – few details (Bundesamt für Statistik)

Less severe accidents with fatalities – high information depth (GIDAS, Traumanetzwerk)

LMU-GDB closes information gap

→ fatalities + detailed information
150 retrospective Accidents/Year
50 cases prospective/Year

- Deep understanding in Epidemiology of Accidents and Injury Causation
- Accident Chart, Autopsy, Drugs/Alcohol/Pharmaceuticals, Reconstruction, Simulation

Interdisciplinary Approach

Medicine, Accident reconstruction

Safety technology, Prevention
LMU-SUD-Data: Retrospective material from 2003 – 2014

NEW: In-depth Analysis: From 1.6.2013 Case analysis Direct at accident scene
Traffic Fatalities Germany

Zahl der im Straßenverkehr getöteten Menschen

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>5,361</td>
<td>5,091</td>
<td>4,949</td>
<td>4,477</td>
<td>4,152</td>
<td>3,648</td>
<td>4,009</td>
<td>3,600</td>
</tr>
</tbody>
</table>

Goal Traffic Ministry: 2010 – 2020 - 40%

Zahl der von der Polizei aufgenommenen Verkehrsunfälle mit Verletzten

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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</table>

Quelle: Statistisches Bundesamt

2013 2014 1st Half
3,338 - 7% + 6%

Goal not reached
In the year 2012 per day 10 People are killed in Traffic, 1.050 have been injured

Per Day the police has reported 6.522 Accidents
Every 8 Minutes a Traffic participant has been severely injured
Every 18 Minutes a child under 15 years has been in an accident
Every 146 Minutes a Human was dying
Every 4,9 Hours a Car-Occupant was killed
Every 15 Hours a Motorcyclist was dying
Every 17 Hours a Pedestrian was killed
Every 22 Hours a bicyclist lost his life
Every 9 days a Child was dying
Seniors: Are we prepared

• No – we only talk about the problem

• Prof. Krüger IZVW
  Würzburg University

Prof. Krüger Universität Würzburg
Main Accident Causes Seniors

1. Give Way
2. Mistakes at turning
3. Mistakes at rear driving and parking

Source: Prof. Dr. Heiner Bubb, Lehrstuhl für Ergonomie, Technische Universität München
Seniors
Safe as BestAger?
Getötete Fahrradfahrer nach Altersgruppen und Geschlecht

Anzahl

Alter in Jahren

Unter 10 | 10 - 14 | 15 - 17 | 18 - 20 | 21 - 24 | 25 - 34 | 35 - 44 | 45 - 54 | 55 - 64 | 65 - 75 | über 75

Männlich | Weiblich

n=5 | n=17 | n=2 | n=4 | n=9 | n=17 | n=29 | n=50 | n=50 | n=32 | n=41

n=5 | n=9 | n=2 | n=9 | n=1 | n=15 | n=80 | n=78
EXTRADURAL HEMATOMA DUE TO TEAR OF MIDDLE MENINGEAL ARTERY AT THE FORAMEN SPINOSUM BY FRACTURE OF THE BASE OF THE SKULL

CLOT EXPOSED ON SKULL BASE BY REFLECTION OF DURA
Seniors – better with helmet
Aged pedestrians
Older Pedestrian Crashes

Casualties per 100,000 population

Serious Injuries

Fatalities
Alterseffekte

Pedestrian Fatality Probability

Older Pedestrians

Younger Pedestrians

Source: USA - Digges 2001
Aged Dummy necessary
Injury Severity by Age

Source: USA - Digges 2001
Belted older drivers 40 times more likely to sustain a chest fracture than younger drivers (Padmanaban 2001)

Older occupants more likely to suffer serious internal chest injuries and have a higher rate of complication (Augenstein 2001)

85% of older motorists killed in crashes died from chest injury of which roughly half suffered only a simple rib fracture (Wang et al, 1996)
Seniors at steering wheel
Epidemiology

Figure 1  Deaths per 100 000 drivers by driver age and person type, 1993–97 FARS and 1995 NPTS.

Swizerland

Accident risk CH

Casutt, G: Alterseffekte auf die Fahrsicherheit bei Schweizer Kraftfahrern im Jahr 2010
Seeger, Forensic Medicine Zürich
> 70 years

- healthy seniors up to 80 years
- healthy geriatrics over 80 years
- Seniors with diseases
Over 1/3rd of the cases (36 %) in der SUD-Seniors goes to the category Acute medical disorder

Approx. 1/4 (28 %) are Turning Accidents
Triggering Event 65+ Fatal accident

- Vigilance Medical Cause
- Misinterpretation Vision
- Unforeseeable Event Suicide
- Misinterpretation opponent vehicle
- Vigilance Fatigue
- Misinterpretation Street
- Misinterpretation Weather
- Unforeseeable Event other traffic participant
- Vigilance Inattention
- Vigilance Pharmaceuticals
- Unforeseeable Event Ghost Driver
- insufficient image outer appearence
- Vigilance Alcohol
- Vigilance Distraction
- insufficient Load Securing
- Misinterpretation own vehicle
- Vigilance Drugs

Frequency in %

Male (n=64)
Female (n=25)
Frequency in %

Ability to see not reduced (n=72)

Ability to see probably reduced (n=43)
Glaukoma

- Klassifikation nach Aulhorn

- **Stadium I:** relative Skotom
- **Stadium II:** absolute Skotom ohne Verbindung zum blinden Fleck
- **Stadium III:** absolute Skotom mit Verbindung zum blinden Fleck
- **Stadium IV:** absolute Skotom über zwei Quadranten
- **Stadium V:** nur noch temporale Restinsel erhalten, Verlust der zentralen Sehschärfe

Quelle: E. Gramer, G. Gramer
Fitness to drive

- At 20% of GCS and 40% der NTG Patients severe deficits not possible for driving a vehicle
Fatal car accidents with 65+ yo drivers LMU SAD

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

<table>
<thead>
<tr>
<th>Condition</th>
<th>Frequency in %</th>
</tr>
</thead>
<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>
</tr>
</tbody>
</table>

Frequency in %
Medical origin at fatal accidents (Ischikawa Japan)

<table>
<thead>
<tr>
<th>Todesursache</th>
<th>Anzahl der Fälle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischämische Herzerkrankungen</td>
<td>22</td>
</tr>
<tr>
<td>Zebrovaskuläre Erkrankungen</td>
<td>5</td>
</tr>
<tr>
<td>Erkrankungen der Aorta (Aortenaneurismen)</td>
<td>5</td>
</tr>
<tr>
<td>Leberzirrhose</td>
<td>1</td>
</tr>
<tr>
<td>Lungentuberkulose</td>
<td>1</td>
</tr>
</tbody>
</table>

Y. Motozawa, M. Hitosugi et al. Kido: Sudden death while driving a four-wheeled vehicle: an autopsy analysis, Tochigi, Japan, 2008
Real FATAL accidents
Acute medical disorder
Syncope LOC at country road

- Mercedes C-Class (elderly)
- Fiat Barchetta

- Very severe injuries with long term consequences for the Fiat front occupants
Eye-Tracking
Acute Medical Origin

- More research urgently necessary
Proposed car sticker in Russia for elderly

Source: Elena Klatt
We will be all older
• Thank you for your attention