Key data concerning traffic and health data relevant for transportation safety of older traffic participants

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Abstract

This representative study analyses the possible coherence between health aspects and the mobility and risk behavior of the elderly: The obtained interview data was linked to the results of the BASt-projects “Life situation, attitudes and behavior of elderly drivers of both sexes” from 1986 as well as “Elderly people in the future safety-system ‘road – vehicle – person’” (AEMEIS) from 1998. The examinations concerning state of health as well as medication were carried out in consideration and on the basis of the substance-risk classification for pharmaceuticals, from the EU research project “Driving under the Influence of Drugs, Alcohol and Medicines” (DRUID). One can adhere to the outcome that the elderly are more frequently on medication that is relevant to traffic safety as well as affected by respective illnesses. A compensation of these effects is carried out in terms of an increased usage of alternative means of transportation to the car; especially (older) men however do drive their car under the influence of these drugs and illnesses.

Keywords: older drivers; health; medication; risk factors; driving practice; compensation.

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1. Introduction

Against the background of the demographic change, a future change in the age structure of the population of the Federal Republic of Germany is expected. This forecast is connected not only with an increased proportion of older people in the total population, but also with a growing number of older driving license holders and road users.

1.1. Aims of the research project “AGE-V3”

The aim of the research project “Key data concerning traffic and health data relevant for transportation safety of older traffic participants – AGE-V3” thus consists in the comprehensive examination of the mobility behavior of older people. In addition, traffic safety-related health data, i.e. diseases and medication, was collected to analyze connections to mobility behavior.

By means of a previous BASt study, first conclusions could be drawn concerning a significant correlation between physical health aspects and the mobility and risk behavior of the elderly (Rudinger & Jansen, 2003).

The following representative study bridges a gap by analyzing the possible coherence between health aspects on the one hand and the mobility and risk behavior of the elderly on the other hand.

Another aim of the project consists in the development of target group appropriate recommendations in order to be able to contribute to an improvement concerning the needs and problems of older road users.

1.2. Relevance of the project results

The results were used to develop measures, which allow for the requirements and difficulties of older traffic participants to be acknowledged and can be helpful for future decision making processes in traffic security, traffic planning and traffic policy.

Therefore, the results of the project should help to give representatives from the fields of research, medicine, traffic safety, transport planning and transport policy, further insights that were gained about the health limitations and polymedicative influences faced by older road users (Holte, 2011) – to let these findings become usable for future in-depth research questions, political decision-making and design processes.

2. Methodology

The implementation of the research project “ZSt-FE 82.0346/2008” was carried out in a cooperation of the Center for Evaluation and Methods (ZEM) at the University of Bonn with the Leibniz Institute for Employment Research at the Technical University of Dortmund (IfADo), project group “Ageing and CNS changes”.

2.1. Work organization

The substantive competencies of ZEM in the implementation of research projects with a focus on older road users (Rudinger, 2002) and the methodological skills of ZEM in the design, implementation and evaluation of representative surveys were usefully complemented concerning relevant medical transport and traffic psychology by the expertise of the project team of IfADo led by Prof. Dr. Falkenstein in the field of basic and application-oriented cognitive aging research (Falkenstein et al., 2011).

Concerning the existing study “Key data concerning traffic and health data relevant for transportation safety of older traffic participants (AGE-V3)”, the analysis of the knowledge acquisition resulted from a description of the mobility behavior of the target group (ZEM), the health data relevant for traffic security (IfADo) as well as the differences concerning mobility behavior caused by health factors (ZEM). Furthermore, the comparison of older (50 years and up) and younger (between 16 and 49 years) traffic participants (ZEM) produced suggestions for the development of measures of traffic security, always reflecting the needs of older traffic participants.

2.2. Planning aspects

The analysis concerning state of health as well as medication of the subjects were carried out in consideration and on the basis of the substance-risk classification for pharmaceuticals, taken from the EU research project “Driving under the Influence of Drugs, Alcohol and Medicines“ (DRUID) (Schulze et al., 2012).

The planning of the survey was based on a broad literary research as well as on already existing ascertainments and results of concluded research projects by BASt, especially the study worked on in behalf of BASt named “Elderly people in the future safety-system ‘road – vehicle – person’ (AEMEIS)“ (Jansen et al., 2001). On the
basis of this planning the obtained data could be linked and compared to the results of the BASt-projects “Life situation, attitudes and behavior of elderly drivers of both sexes” from 1986 (Hartenstein et al., 1990) as well as “Elderly people in the future safety-system ‘road – vehicle – person’ (AEMEÎS)” from 1998.

2.3. Data collection

To obtain up-to-date, representative key data concerning mobility and health of the target group, telephone surveys of n=2,000 persons aged 50 years and up, as well as n=1,000 persons aged between 16-49 years were conducted.

3. Results

3.1. Mobility und traffic participation

Concerning the availability of means of transport, there is a virtually universal coverage of older people with automobiles and bicycles. The high degree of ownership of cars and driving licenses (92 %, see table 1) is also reflected in their use, since about 60 percent of the older survey participants mentioned a daily usage.

Table 1. Driving licenses held among the target group

<table>
<thead>
<tr>
<th>Driving licence type</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile</td>
<td>2768</td>
<td>92 %</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>791</td>
<td>26 %</td>
</tr>
<tr>
<td>Scooter/Moped/Small Motorbike</td>
<td>520</td>
<td>17 %</td>
</tr>
<tr>
<td>Truck</td>
<td>381</td>
<td>13 %</td>
</tr>
<tr>
<td>Total</td>
<td>305</td>
<td>100 %</td>
</tr>
</tbody>
</table>

3.2. General health status and medication

The individual visual acuity is considered positive by the majority of the older people: Only about twelve percent of respondents aged 50 years or older currently have vision problems or suffer from a disease of the eyes. The complaints given relate mainly to night and photopic vision as well as glare sensitivity. These health problems are already well known among the elderly. Concerning diseases of the eye, mainly cataracts and glaucoma (glaucoma) as well as macular degeneration (AMD) were specified. Approx. 36 percent of older drivers are on medication for these diseases – predominantly for the reduction of intraocular pressure in glaucoma and against corneal dehydration – which can affect visual performance and hence responsiveness.

13 percent of the elderly are affected by equilibrium problems. Arlevert (for the treatment of vertigo), which may reduce responsiveness as a side effect, is the most widely taken medication.

Problems caused by walking or bending over are more commonly known among the elderly (23 percent), particularly because of back, intervertebral discs and hip problems. Therefore, a large part of the older respondents is also receiving medical treatment as well as medication. Analgesics such as Ibuprofen, Diclofenac and Voltaren are the most frequently mentioned and can also reduce responsiveness as a side effect.

Approx. 45 percent of older respondents suffer from a cardiovascular disease, most commonly high blood pressure by 36 percent. Accordingly, high intakes of agents to treat high blood pressure (antihypertensives) from different substance classes are reported. All antihypertensive agents may reduce responsiveness as a side effect.
Twelve percent of the elderly suffer from diabetes; over 90 percent of these affected are receiving medical treatment and take medication (antidiabetics). The most commonly cited drugs are Metformin (a biguanide) and insulin-based medication. Metformin is unlikely to increase the accident risk risk by hypoglycaemia, which insulins are very likely to do. Here, the blood sugar levels by the persons concerned must be well controlled and measured before each car use.

Chronic pain disorders were cited by 13 percent of the elderly, especially arthritis, rheumatism, and back pain. As pain killers, Ibuprofen (e.g. Ibuflam), Diclofenac (e.g. Voltaren) and Metamizole (e.g. Novalgin) are most commonly mentioned. Painkillers, analgetics and antihypertensives), analgetics and antihypertensives, are especially mentioned drugs are antidepressants (e.g. Citalopram). These do often show traffic-related side effects such as drowsiness, dizziness, blurred vision and absent-mindedness.

Eight percent of the older respondents suffer from mental health problems, especially from depression. Accordingly, the most frequently mentioned drugs are antidepressants (e.g. Citalopram). These do often show traffic-related side effects.

Thus, the most common diseases mentioned for the group of elders are high blood pressure, chronic pain and depression. Accordingly, drugs against hypertension (antihypertensives), analgetics and antidepressants are among the most commonly ingested. Painkillers and antidepressants are in particular associated with traffic-related side effects.

3.3. Mobility-related diseases and drugs – differences in mobility behavior

Based on the survey results, one can adhere to the outcome that the elderly are more frequently on medication that is relevant to traffic safety as well as affected by respective illnesses than younger traffic participants. A compensation of these effects is carried out by the elderly in terms of an increased usage of alternative means of transportation to the car; especially (older) men however do drive their car after taking an antidepressant.

A central concern of this research project is to investigate potential differences in mobility that can be observed in the presence of traffic safety-related diseases as well as the ingestion of traffic-related drugs.

The differences in the survey results for the sufferers from illnesses – that were identified as relevant for road safety – show a clear adaptation of the mobility behavior to their own health: For diseases of the eye, heart, vascular and metabolic disorders as well as mental and neurological disorders, lower frequencies and intensities of use of license requiring means of transport were reported.

The same applies to medication: The higher the “highest risk” level – measured via the DRUID classification – of ingested drugs for a person was, the fewer miles were covered by car as a driver and the less likely the use of a motorcycle or bicycle (see table 2).

Table 2. Automobile usage (driving performance p.a.) as reported for different DRUID-risk medication groups

<table>
<thead>
<tr>
<th>Driving performance p.a.</th>
<th>Risk category 0 Medication</th>
<th>Risk category I Medication</th>
<th>Risk category II Medication</th>
<th>Risk category III Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Percentage</td>
<td>N</td>
<td>Percentage</td>
<td>N</td>
</tr>
<tr>
<td>less than 1.000km</td>
<td>127</td>
<td>6 %</td>
<td>62</td>
<td>11 %</td>
</tr>
<tr>
<td>less than 3.000km</td>
<td>195</td>
<td>9 %</td>
<td>48</td>
<td>8 %</td>
</tr>
<tr>
<td>less than 5.000km</td>
<td>180</td>
<td>9 %</td>
<td>63</td>
<td>11 %</td>
</tr>
<tr>
<td>less than 10.000km</td>
<td>456</td>
<td>22 %</td>
<td>146</td>
<td>25 %</td>
</tr>
<tr>
<td>less than 20.000km</td>
<td>636</td>
<td>31 %</td>
<td>178</td>
<td>30 %</td>
</tr>
<tr>
<td>more than 20.000km</td>
<td>428</td>
<td>21 %</td>
<td>63</td>
<td>11 %</td>
</tr>
<tr>
<td>No (more) driving.</td>
<td>60</td>
<td>3 %</td>
<td>26</td>
<td>4 %</td>
</tr>
<tr>
<td>Total</td>
<td>2082</td>
<td>100 %</td>
<td>586</td>
<td>100 %</td>
</tr>
</tbody>
</table>
3.4. Age effects

The self-reports on the general health status show a major age-related difference: The older participants rate their own general health status as significantly poorer in comparison to the younger target group (see table 3).

<table>
<thead>
<tr>
<th>General health status</th>
<th>16-49 years</th>
<th>Percentage</th>
<th>+ 49 years</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>very bad</td>
<td>3</td>
<td>0 %</td>
<td>22</td>
<td>1 %</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>1 %</td>
<td>26</td>
<td>1 %</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>1 %</td>
<td>56</td>
<td>3 %</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>1 %</td>
<td>43</td>
<td>2 %</td>
</tr>
<tr>
<td>5</td>
<td>34</td>
<td>3 %</td>
<td>253</td>
<td>13 %</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>4 %</td>
<td>182</td>
<td>9 %</td>
</tr>
<tr>
<td>7</td>
<td>132</td>
<td>13 %</td>
<td>327</td>
<td>17 %</td>
</tr>
<tr>
<td>8</td>
<td>323</td>
<td>31 %</td>
<td>582</td>
<td>30 %</td>
</tr>
<tr>
<td>9</td>
<td>277</td>
<td>27 %</td>
<td>277</td>
<td>14 %</td>
</tr>
<tr>
<td>very good</td>
<td>198</td>
<td>19 %</td>
<td>207</td>
<td>10 %</td>
</tr>
<tr>
<td>Total</td>
<td>1037</td>
<td>100 %</td>
<td>1975</td>
<td>100 %</td>
</tr>
</tbody>
</table>

According to the current state of research it is assumed that only a minority of seniors are on the road as motorists under the influence of drugs and diseases. Accordingly, an adjustment to the personal mobility behavior occurs for a large proportion of this age group, so that an adequate safety is maintained.

In this respect, two major differences in the comparison of the two age groups – based on effect sizes – emerged in the present investigation: It turns out for dealing with the medication for insomnia and pain disorders that it is significantly more common in the younger age group to drive a car under the influence of these preparations. Furthermore, it is assumed that the health situation of older road users in Germany is fundamentally different from the situation of the younger age group due to a significantly more frequent multimorbidity and polypharmacy.

As a result of the analysis of the survey results it is clear that this statement can be confirmed: There was even absolutely no traffic safety relevant disease in the survey data from which the group of the elderly would not have been affected significantly more often. This applies to visual impairments, hearing problems, equilibrium disorders, knees and joint problems, heart and vascular diseases, diabetes, lung diseases, etc.

As for the medication, a similar picture emerges: Whether blood pressure, diabetes or heart medications – the group of the elderly ingests several of these preparations significantly more often than the younger respondents.

3.5. Gender effects

Concerning the individual diseases, women are increasingly affected by sleep problems, while men rate their hearing ability negatively in a gender comparison.

Women are more frequently in treatment, which applies statistically relevant with vision problems, walking difficulties, diabetes, as well as lung and bronchial diseases.

Concerning medication, a significant gender effect can be noted: In general, it is significantly more common among women to ingest medication, especially for the treatment of pain. Only regarding the treatment of vascular diseases, men show a higher value concerning their intake of medication.

In addition, it should be noted that men reported significantly more often to have driven a motor vehicle under the influence of alcohol or medication several times. This concerns drug treatment of heart and vessels, walking difficulties, lung and bronchial diseases, diabetes and pain (see table 4) as well as taking medicines for other reasons. Women expressed more cautiousness on this topic.
Table 4. Car driving after the intake of pain killers among gender groups

<table>
<thead>
<tr>
<th>Driving frequency</th>
<th>Female</th>
<th></th>
<th>Male</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>never before</td>
<td>12</td>
<td>50 %</td>
<td>6</td>
<td>29 %</td>
</tr>
<tr>
<td>once before</td>
<td>1</td>
<td>4 %</td>
<td>0</td>
<td>0 %</td>
</tr>
<tr>
<td>on several occasions</td>
<td>11</td>
<td>46 %</td>
<td>15</td>
<td>71 %</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100 %</td>
<td>21</td>
<td>100 %</td>
</tr>
</tbody>
</table>

3.6. Model results

Within the scope of the model tests of this evaluation and in comparison to multimorbidity and polypharmacy, self-efficacy – if driving practice was considered – turned out to be a better predictor of the accident risk. Concerning traffic safety, as much driving practice as possible might provide an important compensational function.

The previously discussed assumption that the elderly adapt their traffic behavior to their disease and medication status can be confirmed by the performed path and model analyses. However, the attempt to create a model with the DRUID risk-weighted drugs as an independent variable, the frequency of driving under the influence of drugs as a mediator as well as traffic accidents as the dependent variable provided no statistically significant effect of polypharmacy or multi-morbidity on the number of accidents.

The model calculations based on the Federal Highway Research Institute (BASt) scales for action competence expectancy as well as driving experience and accident figures, however, point to a model which can be classified as age-specific:

For the youngest age group (16-40 years of age) among the survey, the data in fact showed a much better fit of a model in which the current driving practice acts as a mediator of road safety than in the case of the older respondents (see fig. 1).

Fig. 1. Mediation model for young drivers.

Across all age groups, a possible intervention level to increase road safety has been demonstrated hereby: As the action competence expectancy is related to the driving experience, a starting point to influence both the subjective experience of road users as well as road safety in general in a positive way may consist in specific training of the driving task – with particular attention to compensatory behavior. Given the statistically significant direct influence of competence expectancy on the annual mileage, it can be concluded that (even and especially older) road users should have a comprehensive driving experience.
3.7. Conclusion

At the level of the survey results, it can be pointed out that older respondents are ingesting traffic safety-related medication much more often. In addition, particularly (older) men are driving more frequently under the influence of these drugs.

In the model tests carried out as part of the evaluation, self-efficacy or competence expectations – in relation to specific traffic situations – provided a more appropriate predictor of accident risk in comparison with multimorbidity and polypharmacy. An important compensation function for traffic safety could be identified in a sufficient driving experience.

4. Implications

The results of this research were used to suggest the development of measures adequate for the target group, which allow for the requirements and difficulties of older traffic participants to be acknowledged and can be helpful for future decision making processes in questions of traffic security, traffic planning and traffic policy.

4.1. Multimorbidity and polypharmacy

In a representative survey commissioned by the Federal Highway Research Institute (BASt) in 2004 it was shown by Holte & Albrecht (2004) that multimorbidity in particular contributes to increasing the risk of accidents.

The results of the present study, however, argue for an expansion of the taken perspective, since in the framework of the implemented nationwide representative survey of older people, an essential influence of multimorbidity and polypharmacy in particular on traffic safety could not be detected. Medication and morbidity alone do not determine, therefore, the risk of accidents. Perhaps this is a result of individual adaptation of the mobility behavior to the respective health constitution.

4.2. Self efficacy, compensation and driving practice

According to the results presented in this study, a statistically significant role for the risk of accidents especially among the older road users lies in psychological constructs such as empowerment or self-efficacy expectations.

Driving experience proves to be of great importance for road safety of older drivers: A high driving experience can – according to the survey data – be able to reduce the number of accidents as well as to provide a compensatory mechanism against any age-related uncertainty regarding the coping with the driving task(s).

These results – presented and discussed as part of the development of the mediation model for the older drivers – are consistent with the results of an up to six times higher increase in the accident rate in the age group from 75 years on – coupled with a mileage of less than 3,000 km per year as well as a lower mileage performance and consequently rarer vehicle use within the age group from 65 years on in average.

Thus, a central conclusion from these results should be to ensure a sufficient driving experience of older people. Boasting a classic performance improvement through practice, in the best case even a feedback effect can thereby be achieved as repeated successful management of the driving task in turn could increase the self-efficacy expectations of elderly drivers.

A further recommendation in this context relates to the compensation of age-related performance degradation by specified, regular exercise of, for example, working memory and other skills that are relevant to the driving task.

4.3. Risk medication and self-control

Related to the medication of individual diseases it can be stated generally that the elders ingest – as expected – medications of relevance for road safety more frequently. Especially the older men often drive under the influence of drugs which are critical for road safety. Since this group is also frequently affected by the respective diseases, it must be specifically sensitized to the risks of driving under the influence of drugs relevant to traffic safety.

In this context, the in-house medical treatment situation is of essential importance for road safety advice for older road users – in light of the realization that a mandatory medical-traffic-psychological “fitness to drive”-investigation of older road users in Germany has not yet been provided, and the limitations of fitness to drive at a higher age do consist primarily of medical reasons. The legislation aims to date on a critical self-control from (not only) older drivers, which seems – according to the present survey results – to be present only in a limited
way, especially for (not only) older men: This group is driving very frequently under the influence of traffic safety-related medication. An individual critical self-examination and self-responsibility does not seem to be given to a sufficient extent – at least with respect to the assessment of the risk potential of drugs for their own ability to drive – according to the survey results, especially within men.

A major recommendation in this case relates to the awareness of (older) men to the effects of ingested medications on their driving ability to provide improved possibilities of self-control.

4.4. The general practitioner (GP) as a “consultant for older road users”

Moreover, it seems of high importance to use the fact of higher medical-care – as it is pointed out in the survey results – within the elderly by their respective family doctor productively: The family doctor should act as a “consultant” concerning their individual mobility and road safety. This results in the need for adequate training and qualification programs for family doctors.

A central advisory role in this context can therefore be fulfilled by the family doctor: As the elderly are much more frequently found in medical treatment, this fact should be used productively. The general practitioner (GP) as an important point of contact and resource person of trust of older road users can be a key element in this context because he can assess the physical and psychic processes of change that affect the mobility fitness competently and objectively. In addition, his judgment is usually respected and accepted by his patients.

However, doctors must be prepared and trained more precisely as part of their everyday treatment before taking on such a function as a “consultant for older road users”. Required for a successful takeover of this role of a “mobility/driving guide” is – besides the above-mentioned aspects of mobility capability – for example an extensive knowledge of the diseases as well as drugs that can impair the ability to drive (e.g. in the form of the DRUID classification) on the part of the physician. Appropriate instruments as part of the Federal Highway Research Institute (BASTs) projects “VeBO” (Kocherscheid et al., 2007) – for training of treating physicians – and “SCREEMO” (Engin et al., 2011) – to review “fitness to drive”-relevant performance areas in medical practice economically – have already been developed for a long time.

Thus, it appears of highest importance to use the – according to the survey results – frequently medical treatment of the elders productively, in the sense that the family physician should act as a “consultant” regarding one's own mobility as well as traffic safety (Kocherscheid, 2011). This results in the need for adequate training and qualification measures for the general practitioners (GPs).

4.5. Follow-up studies

Based on the inventory submitted by this study, follow-up studies are recommended to, on the one hand, further investigate the influences of individual diseases and medications that could be identified as relevant for traffic safety and, on the other hand, to illuminate the compensating effect of the driving experience on road safety of older road users – for example in terms of the possibilities of “competence-trainings” of older road users.

A further recommendation touches the compensation of age-related performance degradations through regular training programs – e.g. working memory training – as well as other skills which are of relevance for the task of driving.

References


