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Editorial

Driving Safety in Healthy Aging and Age-Related Diseases

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Special Issue: Driving Safety in Healthy Aging and Age-Related Diseases

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The percentage of older people is strongly increasing worldwide. By 2050 a third of the population in the OECD countries will be older than 65. This demographic change also increases the number of older people who want to stay mobile or have to, because of economic needs. Mobility, particularly the driving of the own vehicle, are core requirements for older people's quality of life and health.

Driving requires different sensory, motor and cognitive functions. With increasing age declines in most of these functions can be observed in the laboratory and real life. However, functional changes occur with a large inter-individual differences since many environmental and lifestyle factors influence them. Such functional changes may also influence performance in everyday tasks, particularly when they are complex and there is time pressure. One such task is driving. Indeed, visual and cognitive factors can explain most of the age-related changes in the ability to drive safely.

Since the visual system perceives most traffic-relevant information age-related changes in vision are most relevant for driving. Such changes include reductions in visual acuity and contrast sensitivity, increased glare sensitivity, and a reduced field of view.

Motor changes due to increasing include diminishing muscle strength and movement speed.

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This may slow down emergency actions or prolong braking time. Further, neck flexibility, essential for looking back during driving, is strongly reduced with age. Finally, motor coordination and dexterity also deteriorate with rising age.

Cognitive problems of older persons are often overlooked despite their high importance for the driving ability of elderly adults. In particular, the so-called executive functions, which control lower-level functions, are highly relevant for driving. Executive functions include the inhibition of irrelevant information and the updating of memory and the switching between tasks. Further, they control attention, which is necessary for visual search and attention switching and distribution. For example, visual search, i.e., the scanning of the visual scene in order to detect a target stimulus is already impaired in people in their sixties. Hence in real traffic important targets and threats are possibly detected later or not at all by older drivers.

The effects of increased age on driving safety may be enhanced by age-related diseases, such as stroke or diabetes mellitus which are very frequent in older age. In addition, respective pharmacological treatments may cause side effects, affecting driving safety. Hence the special issue will also include the impact of age-related diseases and drug treatment of these conditions on driving fitness and safety in elderly drivers. In particular, diseases of the visual system, the central nervous system (i.e., stroke, depression, dementia and mild cognitive disorder, and Parkinson's disease), sleep disorders, as well as cardiovascular diseases, diabetes mellitus, musculoskeletal disorders, and frailty will be included in the special issue. In particular, positive effects of treatments of age-related diseases on driving safety are welcome.

Older people often drive inconspicuously despite impaired functions and overestimating their own driving performance. This is firstly because routine traffic situations such as highway driving rely mainly on highly automated processes, which show a less age-related decline. Moreover, many older people have developed compensation strategies such as slow driving selecting well-known routes to cope with complex situations. Also compensation mechanisms such as stronger preparation in complex situations are frequent in the elderly. However, some of those strategies are unsatisfactory since they may encumber other drivers (e.g., slow driving) or the driver himself (e.g., avoidance of certain routes).

Nevertheless, the accident rate of older drivers per distance driven is relatively high. In particular, drivers over 75 years who drive less than 3000 km yearly have the highest accident risk. Moreover 75% of drivers aged 75 and above who are involved in an accident are primarily responsible for the accident. A closer look at the accidents shows that they occur in specific situations such as giving right of way, turning, driving backward, and complex traffic junctions. Accident rates, however, underestimate the problems since accidents can be avoided by the driver himself or other traffic participants in most critical situations. More often, near-accidents that do not appear in the statistics likely happen, but may be remarked on by fellow passengers.

Apart from having problems in certain situations, older drivers are also more vulnerable than younger ones due to their more fragile organisms. For example, the bones and ribs are not so flexible in older than younger persons, which is even aggravated by osteoporosis, a common disease in higher age. Such lower flexibility usually leads to more severe injuries in an accident, and even security belts could cause fatal injuries in old drivers.

Even more vulnerable in cars are elderly cyclists. To ride a bicycle requires not only the skills of car drivers, i.e., coping with sometimes complex situations and interacting with other drivers, but also the skill of handling the bicycle which is not performed automatically as handling a car. Many

older people have not used a bicycle for years and hence their cycling skills are low, which the cyclist often does not realize. Indeed, accidents with older cyclists increase steadily, mainly for e-bikes with higher weight and speed.

These facts show that measures are necessary to increase safety and support for older drivers.

To increase safety, medical and sometimes psychological tests are mandatory in several countries for older drivers to renew their driving license. However, this does not necessarily mean that safety is increased. For example, the number of fatal accidents in Finland, which requires a medical test for older drivers, is not lower than in Sweden, a country without such a test. One reason for such failures is the type of tests required. Usually only cursory and short medical tests are used. When cognitive tests are administered in addition, they are often designed for dementia diagnosis, such as the Mini-Mental State Examination (MMSE). Such tests are unsuitable for measuring the physical, sensory, and cognitive skills essential for driving.

The most important issue is the identification of unfit older drivers. An obvious and direct method is an on-road driving assessment, usually conducted by a driving instructor, which a traffic psychologist sometimes accompanies. Meanwhile there are standardized and even PC-based driving protocols that aim at more objectivity. However, such on-road assessments are costly and require appropriate equipment and time resources. In addition the real traffic is not always challenging, which depends on the time and location of the assessment ride, and of course on the competence and experience of the driving instructor. Hence elderly may show no problems even though they would probably be revealed in complex situations. An alternative is driving in a simulator with the advantage of administering and repeating sufficiently difficult scenarios. As with driving tests in real traffic, this methodology requires adequate equipment and skilled experts to yield reliable results. Also the feeling of being in real traffic is absent in simulators, while there is often simulator sickness in older persons. A third and promising alternative is to administer off-road tests of cognitive but also visual and motor functions that are important for driving. This reminds me of the periodic car inspection in which the car's functions but not its behavior in real traffic are checked.

The crucial issue with such testing is the selection of the most appropriate tests for sufficiently predicting driving fitness and accident rate. Single and ill-chosen tests have no predictive power. Meanwhile however, carefully compiled test batteries that include tests of the most important functions relevant to driving appear to have a high predictive power. Such off-road assessments should also include interviews that ask for risk factors such as avoidance behavior, relatives' reports of unsafe driving, the number of (minor) accidents in the past years, and reduced driving practice.

All those assessment methods are only meaningful if there are accompanied and followed by measures to support older drivers, particularly those with driving problems. Otherwise assessments are likely avoided if voluntary, and dreaded if mandatory. Such measures could be information and guidance campaigns, the design of age-friendly traffic and car environments, or training measures to improve an older driver's individual driving skill.

Information campaigns address the older public, giving information about factors influenceing driving fitness (e.g. certain diseases and drugs), strategies for coping with certain driving situations, and training possibilities to increase driving performance. They are relatively easy to organize. However, the success of such campaigns depends on whether practical courses in groups accompamy them.

Since certain traffic situations, such as turning left at complex crossroads, are particularly difficult for older drivers, decreasing those problems with an age-friendly street design appears straightforward. For example, left turns should be protected by traffic lights or by well-visible guidelines. Also at crossroads or roundabouts distracting and traffic-irrelevant information such as advertisements should be minimized. Complex areas should be structured and traffic routing should be marked by coloring. On the other hand, well-designed car technology such as high doors and seats and broad circumferential visibility can help elderly drivers. Above all, route guidance systems are highly important for the elderly since they reduce the need for memory and visual search. However, to be helpful and not distracting, such systems have to meet certain requirements.

The third measure is individual training for older drivers. The most straightforward training is to take driving lessons with a driving instructor in real traffic. They require well-trained driving instructors who know the problems of older drivers, as well as sufficiently difficult traffic locations. If properly conducted, such lessons can strongly improve driving fitness in older drivers, mainly for poor drivers.

An off-road variant is training specific skills (such as visual search) or coping with difficult driving scenarios with the help of programs running on a personal computer or a driving simulator. The PC has the advantage of being cheap and everywhere available, so it might be possible to conduct such training even at home, after proper instruction.

A further possibility is direct training in functions that are necessary for driving. While visual functions can hardly be trained, motor and cognitive functions are trainable. For example, head movements and strength can be well-trained and improve the trained functions.

In the cognitive domain, visuospatial skills and the division of spatial attention can be trained, resulting in better and longer driving. Also physical training is known to improve not only motor but also cognitive functions. However, only very few studies improvements in driving fitness due to such trainings. Since such training is very easy to conduct, and often even at home, further studies on this topic are warranted.

The present special issue aims at addressing most of the mentioned issues, and any other issues concerning older drivers and how to help them keep driving as long as possible.