

Summary:

## **Making Vision Zero real: Prevention of accidents and injuries among elderly pedestrians**

Elderly pedestrians are in many ways a disadvantaged group of road users. They have an increased accident risk and more severe injuries once involved in an accident. They also suffer from more long-lasting impairments when injured, including loss of life years and reduced quality of life. High accident risk, a subjective feeling of insecurity or sustained injuries all are likely to reduce walking and thereby physical activity. High physical activity is associated not only with higher mobility and quality of life, but also with reduced risk of accidents and injuries. Safety measures are most promising when they increase physical activity, e.g. by physical and motivational training, by providing practical aids, and by making pedestrian infrastructure less complex, less demanding and more attractive. Addressing specific functional impairments seems less promising. This has been found in a review of international literature and analyses of Norwegian accident statistics.

***Elderly pedestrians have larger risk of accidents and injuries than younger pedestrians and injuries have more severe consequences for quality of life.***

Elderly pedestrians are not precisely defined group of road users. "Elderly" refers to the fact that accident and injury risk increase as a function of increasing age. The age from which walking becomes more dangerous lies around 60-70 years. There are large individual differences, depending on the degree of physical and mental activity, illness, and other factors.

***Changes of cognitive and physiological functions, behaviour and attitudes, and increasing vulnerability are contributing factors to the increase of accident and injury risk.***

Contributing factors to increasing accident risk are complex, they may compensate or reinforce each other, and it does not seem possible to identify any single "responsible" factors.

A number of perceptive and cognitive functions are declining with increasing age, a fact which is often assumed to contribute to increased accident risk. These deficiencies are however to a large degree compensated, either by changed behaviour or by increased experience, changes in attitudes, lifestyle etc. No systematic relationships have for example been found between sight (visual accuracy), hearing or cognitive abilities (except dementia) and accident risk.

Performance changes that have been found to be related to increased accident risk are reduced processing speed, selective and divided attention. These changes cause difficulties mostly in situations that are complex or require quick reactions. Reduced visual performance, especially the useful field of visual and peripheral vision, is also likely to be a contributing factor in accidents, including falling accidents. Reduced strength and motor abilities may contribute to accidents as well, e.g. by increasing crossing times, reducing the possibilities to jump out of the way and by increasing the risk of falling accidents. Numerous other changes that occur with increasing age may also contribute to accident risk, both positively (e.g. increasing experience, compensating strategies, increased caution) and negatively (e.g. anxiety, overcaution, decreased compliance with traffic laws).

Finally, vulnerability increases with increasing age, mainly due to increased risk for fractures and longer recovery periods. Injuries have therefore frequently more serious and more long-lasting consequences among older people.

***Older pedestrians are most at risk in situations which are complex or require quick judgements and actions.***

In general, all traffic situations which are complex or require quick responses increase the accident risk of pedestrians. Accident types where older pedestrians are overrepresented are therefore intersection accidents and accidents involving a pedestrian crossing a road, especially a road with four or more lanes or an unsignalized pedestrian crossing. These findings are based on international research. In Norwegian accident statistics less pronounced differences between accident types can be found.

***Older pedestrians are more at danger of falling accidents, and falling accidents have more severe consequences among older than among younger pedestrians.***

Falling accidents occur far more often among older pedestrians than among younger ones, and they have more severe consequences among older people (hip fractures). Falling accidents are likely to be much more frequent than collisions with motor vehicles. Data are however difficult to obtain and almost no information is available from Norway. In collisions with vehicles, older pedestrians also sustain more and more severe injuries than younger pedestrians, especially at higher vehicle speeds.

***Adjusting the environmental conditions to the requirements of older pedestrians and improving health and mobility on a broad basis are the most promising safety measures for older pedestrians.***

At least three types of measures can be considered for improving the safety of older pedestrians: Measures that directly address older people, measures that address the (environmental) walking conditions for older people, and post-accident measures.

Measures that directly address older people are less likely to be successful when they address specific functional impairments. Almost none of the factors that are commonly assumed to be related to increased injury risk among older pedestrians have been found to be related to actual injury risk. In order to address the more

complex risk factors that are related to accident risk, more complex measures are required. Examples are falls prevention programmes and other programmes that increase physical activity. Thereby physical and cognitive skills that are relevant in traffic can be maintained and improved, and vulnerability may be reduced due to increased fitness. Such programmes may also include training programmes for specific skills such as attention, or assist in finding adequate compensation strategies for decreased skills such as impaired vision or walking difficulties.

Other measures that reduce injury risk among older pedestrians are practical aids such as appropriate footwear, anti-sliding devices for shoes (spikes), orientation aids in unknown areas which reduce attention demands. Older people who are especially at risk of falling accidents also may benefit from hip protectors.

The environmental walking conditions for older people can be improved by

- reducing the complexity of road crossings, e.g. median islands, signal phases for turning traffic,
- increasing the available crossing time for pedestrians, e.g. longer signal phasing or puffin signals,
- improving road maintenance and winter maintenance in order to reduce obstacles and slipperiness,
- speed reducing measures in traffic environments that are used by motorized and non-motorized traffic,
- improving pedestrian protection in vehicle design.

Most of these measures additionally increase the accessibility for older pedestrians who have difficulties with walking, and may therefore also have favourable effects for mobility and, consequently, health. Positive effects on physical activity and mobility can also be expected from other measures that make walking more attractive.

Post accident measures that are likely to be favourable especially for older people are devices that facilitate contact with medical services (mobile phones or special devices). Such devices may also reduce anxiety while walking. Rehabilitation programmes for older people that include both physical and motivational training components have been found to reduce the probability of complications, re-injuries, pain and loss of mobility. Thereby, rehabilitation may considerably improve the quality of life of injured older pedestrians.

***The social and health effects of pedestrian safety measures are greater when injury risk among older pedestrians is reduced, compared to measures that only address younger pedestrians.***

Older people are less resistant to injuries than younger people, and injuries are often more severe, more long-lasting, and have more consequences for quality of life. Measures that reduce injury risk among pedestrians can therefore be expected to have larger positive health effects among older people than among younger people. Additionally, injuries may lead to vicious cycles of reduced mobility and increased (re-) injury risk. Once mobility is reduced after an injury, physical activity decreases, and reduced physical activity leads to further impairments, increased vulnerability, and reduced quality of life.

When measures that reduce injury risk, also make walking more attractive (or less impossible) for older people, still larger health effects can be expected. Increased physical activity reduces accident and injury risk because mental and physical abilities are better maintained, and vulnerability reduced. Additionally, physical fitness and wellbeing increase.

***Pedestrian safety measures have different effects on safety, mobility and quality of life among older and younger pedestrians and the values and socioeconomic effects of these effects are different.***

The socioeconomic effects of measures addressing especially older pedestrians can be assumed to be different from the socioeconomic effects of other pedestrian safety measures. Quantifying these effects is however difficult, and economic values are not available for a number of aspects that are relevant for older pedestrians. Available values are identical for all groups of road users or for all age groups, although there may be differences between older and younger pedestrians.

If the safety effects on the whole will have larger or smaller economic values is difficult to estimate. Medical costs are often higher for older people and welfare loss due to injuries is also likely to be larger because older people are more vulnerable, and injuries are often more long lasting and may have stronger effects on the quality of life. Property damage, productivity loss and travel delays on the other hand are smaller in pedestrian accidents than in other accidents. Feelings of discomfort or insecurity are only seldom included in socio-economic analyses. Effects on such aspects may be larger among older pedestrians. Effects on mobility may also be larger for older pedestrians than for younger pedestrians. Travel times are likely to be less relevant for older pedestrians because of more recreational trips and fewer work related trips. Different trip purposes are however not taken into accounts in the values of travel times. Travel distances and obstacles may be far more relevant for older pedestrians than for younger ones. Effects on mobility, health and quality of life are difficult or impossible to evaluate. Such effects are complex, and values are not always available.