Comparison of European Countries with and without age based screening of older drivers

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Abstract

Road traffic fatalities and fatality risk in Belgium are analysed for different road user types with a focus on elderly road users. The absolute fatality numbers and the fatality risk indicate cyclists and pedestrian fatalities as the most worrying problems. By comparing the risk for car drivers to themselves and to others, the elevated risk for car drivers is shown to be mostly due to an elevated risk for the elderly driver self, and much less to other road users.

To evaluate whether screening elderly drivers to prevent unfit drivers from taking part in traffic would help to reduce the risk for elderly drivers, five countries who start screening elderly drivers at the age of 70 (Denmark, Finland, Ireland, Netherland, and Slovenia), are compared to five countries that have an unlimited driver’s license (Austria, Belgium, France, Germany, and Poland). While the fatality rate among the car drivers in the screening countries was generally lower, this was not the case for car drivers from 70 up. For pedestrians the fatality rate was also lower in the screening countries, and this difference was constant across the whole life-time.

Keywords: Fatality risk, fatality rate; comparison transport modi; comparison countries.

Introduction

Due to the ageing of the societies and the increased mobility in elderly people, an increasing part of the drivers is part of this demographic group: the elderly. More than two decades ago researchers started to worry about the accident rate in elderly drivers. Due to an age-related decline in perceptual, cognitive, and physical functions and an increase in chronic diseases, there is a general decline in fitness to drive in the elderly population. And indeed, it was found that although the absolute number of accidents are declining with age, this is due to a reduction in population and in mileage while the risk for accidents per kilometer driven is increasing from an age of 75 on (OECD, 2001; Vaa, 2003; DaCoTA, 2012).

There are two reasons for the increased risk per kilometer in elderly drivers that have nothing to do with a possible regression of their fitness to drive. The most important reason for the increased risk is probably the frailty of elderly drivers due to which they become severely injured or even die of the consequences in an accident that would be much less harmful for a younger person (Li, Braver, & Chen, 2003; DaCoTA, 2012). Moreover elderly drivers typically have a lower mileage than younger ones, and the risk per kilometer is higher for all drivers who drive shorter routes, which is mainly due to the type of road that short routes are driven on (Langford, 2006). Nevertheless, accident causation data suggest that not only the risk to get injured or killed increase with age but also the risk to cause accidents (Statistisches Bundesamt, 2012).

1.1. Age based screening?

Although it is clear that there are great differences in how people age and at what moment their fitness is too compromised to keep driving a car, the need for monitoring the fitness of elderly drivers has been felt, especially as not all drivers are aware to what extent their functioning is compromised. As a consequence, 12 European countries have a mandatory screening procedure for elderly drivers. Although the age at which this procedure...
starts varies, for the majority of the countries it starts at 70 (Cyprus, Denmark, Finland, Ireland, Malta, Netherland, Slovenia).

However, age-based screening is far from being undisputed. Rather it has been concluded in a number of reviews from literature that no positive effect of a screening procedure can be demonstrated (Vlakveld & Davidse, 2011; CONSOL, 2013). Elderly people are generally careful drivers and mostly take measures themselves to compensate for a regressing fitness to drive by either adapting their driving patterns (not driving in darkness, during rush-hour, or on routes unknown to them) or by stopping to drive altogether (Meng & Siren, 2012). It is also argued that even with scientifically validated tests, many drivers are prohibited from driving who would never have an accident (Martin, Marottoli, & O’Neill, 2013). Forced driving secession is associated with an increased chance of depression and on giving up to live independently (Windsor, Anstey, Butterworth, Luszczy, & Andrews, 2007; Ragland, Santariano, & MacLeod, 2005). Additionally a substantial part of older people rely on driving a car and remain without unfulfilled mobility needs when stopped driving (CONSOL, 2013; GOAL, 2013). Moreover, drivers who lose their license will (hopefully) tend increase the number of trips made walking and cycling. In these unprotected transportation modes, elderly road users might have an even higher risk when compared to car drivers. In two studies it has consequently been found that while the introduction of an age-based driver screening has not led to a reduced number of accidents with elderly drivers, it did lead to an increased number of accidents with elderly pedestrians (Siren & Meng, 2012; Hakamies-Blomqvist, Johansson, & Lundberg, 1996).

1.2. Objective

In the present study we will investigate fatal accidents with elderly victims and/or drivers in Belgium. We will look at the absolute number and at the risk per km and compare these to the figures for younger age-groups. We will see, that the results do not indicate the necessity of an age-based screening procedure. To test this question further we will investigate the number of car-driver and pedestrian fatalities from several European countries and compare the evolution across age-groups for those countries that have mandatory age-based screening at age 70 to those of countries that do not have age-based screening at all.

2. Absolute number of fatalities

In Figure 1, the number of fatalities in Belgium are given per transport modus and per age category.

![Fig. 1. Number of fatalities per type of road user and age-group Belgium: 2008-2012. Source: Statistics Belgium; Infographics BRSI](image)

In terms of the absolute number of fatalities, the age-groups above 50 are, generally speaking, less concerning than the younger groups. For the road users of 65 and above, we do see however, a rising share of pedestrian and cyclist fatalities. More than half of the seniors who died in traffic was a cyclist or a pedestrian. Or the other way around: almost half (49%) of the killed pedestrians was above 65 and almost a third (31%) was 75 and above. Similarly for cyclists, we find that 47% of the cyclists killed on Belgian roads was 65 or older. The number of fatally injured car drivers is however, strongly reduced from age 65 on and keeps decreasing. One might, however, argue that elderly car driver can also be involved in accidents that harm other road-users.
Therefore in Figure 2, the number of car drivers is given of involved in fatal accidents of which they were not themselves the victim.

3. Fatality risk

While the total number of fatalities among the car drivers and their victims are low, this could be due to a reduction in mobility. To correct for the effect of a decreased mobility the risk of a fatality per billion travelers kilometers is calculated. In Figure 3, the risk is given for elderly road users (65-74 years and 75+ years) and for comparison the mean risk across all age-groups. The risks are calculated separately for the different transport modi.

Fig. 2. Number of drivers involved in accidents in which another person died. Belgium 2008-2012. Source: Statistics Belgium, Infographics BRSI

Fig. 3. Number of fatalities per million travelers-kilometers. Source BELDAM (2009), Statistics Belgium (2007-2011); Infographics BRSI
Most strikingly, we see a dramatically increased risk for elderly cyclists and pedestrians. This due to two tendencies. Per kilometer travelled, pedestrians and cyclists have a much higher risk than car occupants and moreover, elderly road users, especially those of 75 and older have a much higher risk than other age groups. If we compare the risk of the age group of 75+ to the mean risk, the fatal risk for car drivers is 3.7 times higher, that for pedestrians 4.1 times and the risk for elderly cyclists is 6.5 times higher than the average risk for cyclists. To conclude, if we look at the increase of risk in elderly road users, it is mainly the cyclists we should worry about.

While cyclists and pedestrians rarely hurt other road users, for car drivers it can be important to look at the risk they pose for themselves as well as the risk they might pose for others. In Figure 4 the number of car drivers involved in fatal accidents per billion travelers km is given for different age groups, separating car drivers who were the victims themselves and those who were involved in an accident with another fatal victim. The risk for each age category is divided by the average risk. As a consequence, the relative risks in Figure 4 can be interpreted as the factor by which the risk for a particular age group exceeds the mean risk.

![Image of Figure 4](image)

**Fig. 4. Number of drivers in fatal accidents per million travelers km. Source BELDAM (2009), Statistics Belgium (2007-2011); Infographics BRSI**

The well-known U-shaped risk curve can be seen in the grey part of the bars. Young drivers as well as old drivers have a higher risk to die in an accident. If we consider involvement in accidents in which someone else died, the elderly drivers still have a somewhat elevated risk, but only by a factor 1.8 in comparison with the average risk. These results can be understood when considering the differences in physical vulnerability between younger and older drivers. A large part of the increased risk to themselves in older drivers is due to their frailty and higher chance to die of an accident that would be less dangerous for a younger person (Li, Braver, & Chen, 2003). The risk to be involved with in an accident with another fatal victim is probably a good estimate for their increased risk to cause an accident. For younger drivers, these two types of risk are more or less equal.

### 4. Country comparisons

Many European countries have implemented some kind of procedure to ensure that elderly drivers are controlled with respect to their fitness to drive. In the Figure 5 an overview is given of the screening measures that are implemented in the various countries as presented by the CONSOl project.

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*This does not mean that accidents taken into account here were all caused by the elderly drivers. In Belgium the accident statistics do not contain causation data. However, in the data which involved the death of someone else, there is no reason to assume that the distribution of responsibility should be different from that in other age groups, which would leave the proportion of accidents caused by the driver in question in each age group be the same.*
It is interesting to compare the distribution of fatalities across the lifetime in different countries. If screening measures are a successful tool to prevent unfit seniors from driving than the countries in which such a screening tool is implemented should have a stronger decrease in elderly-driver fatalities (given population) than those countries in which no such measure is implemented.

Another potential effect of an age-based screening procedure could be seen in the victims of other traffic modes. Seniors who are not allowed to drive a car anymore might have to rely more on walking mostly combined with the use of public transport (Hakamies-Blomqvist, Johansson, & Lundberg, 1996) (Siren & Meng, 2012).

4.1. Method

We selected those countries for which the drivers’ license has unlimited validity (Austria, Belgium, Bulgaria, France, Germany, and Poland) and those countries which have implemented a screening procedure from the age of 70 on (Cyprus, Denmark, Finland, Ireland, Netherlands, Slovenia). Bulgaria and Cyprus were removed from the analysis because they had no or very incomplete fatality data. For each country the number of car-driver and pedestrian fatalities for each year of age were downloaded from the CARE database for the years 2007 to 2012 (except for Slovenia where data are available 2007 – 2011). The fatalities for each country, year, and age-year, were analyzed relative to the size of the respective group in the population (Eurostat). The distribution across the age-years was modelled with a generalized additive model, assuming a binomial distribution for the number of fatalities within a given age-year group. The relation between fatality rates and age was modeled as a smooth non-linear function using thin plate regression splines (Wood, 2003). The figures below show the estimated relationships together with 95% confidence bands.

4.2. Results car drivers

The curves fitted by country to the fatality rates of car drivers are given in Figure 6.
The general pattern of fatality rates among car-drivers is comparable across countries. There is a strong peak for young drivers usually just above 20 years and a much smaller “hill” for older drivers. The steepness and the onset of the “elderly hill” varies. To see whether this variation is systematic between countries that have age-based screening and those that have an unlimited driver’s license, the factor “country” was replaced by a factor that only differentiates between those country that have an age-based screening and those who do not, the curves are estimated as given in Figure 7.
Considering the whole range of age, the countries with age-based screening (Denmark, Finland, Ireland, Netherlands, Slovenia) have a favorable result: their fatality rates are significantly lower than those of the countries that have unlimited licenses (Austria, Belgium, Bulgaria, France, Germany, and Poland) suggesting that generally speaking the screening countries have a better developed road safety. However, this advantage is not present for elderly road users, where there is no difference between screening countries and countries with unlimited licenses. Note that the results cannot be due to differences in age-structure between the countries, as the modelled fatalities are corrected for the size of population in each age-year.

The results could implicate that the countries introducing age-based screening have a higher mobility among elderly road users, as the fatality rates are corrected for the population size of each group but not for kilometers driven. Nevertheless, this would mean that the screening countries did not succeed in selectively only allowing those seniors to drive who can safely do so.

Another reason for the relative increase of senior fatalities in the screening countries could be a false sense of security for those drivers who are allowed to keep their license. Depending on the quality of the screening procedure and the interval of screening it might not always be possible to correctly identify those drivers with an increased risk. A positive evaluation could confirm a driver who might otherwise be doubtful about his or her own fitness to drive that there is no need to worry – which might actually increase the risk.

4.3. Results pedestrians

The curves fitted by country to the fatality rates of pedestrians are given in Figure 8.
For pedestrians we also see a general pattern across all countries: the fatality rate is relatively flat for the young and middle aged and rising for the elderly. There are however, strong differences between countries concerning the onset of that increase of fatalities for older pedestrians (the extreme being Poland who do not have a “flat” part and fatality rates start rising right at 18 years of age). Note that these rates consist of the fatality for each group corrected for its population. Differences between countries can be due to differences in road risk for pedestrians but also due to differences in pedestrian mobility.

To test, whether age-based screening of car drivers has an effect on pedestrian fatalities, the factor “country” is replaced with a factor that only differentiates between those country that have an age-based screening and those who don’t. The curves fitted to the pedestrian fatality rates for those two groups of countries are presented in Figure 9.
Fig. 9. Smoothed function of fatality rates (fatalities/(population-fatalities)) for car-drivers from countries with age based screening at 70 and countries without any screening. Bands represent 95% confidence intervals. Source CARE (2008-2012), Eurostat (2008-2012) infographics BRSI.

Similar to the main effect in the fatality rate for car-drivers, the countries with age-based screening have a lower fatality rate for pedestrians than those with unlimited licenses, again suggesting that generally speaking the countries who have introduced age based screening are the ones with more successful road safety strategies. In the case of pedestrians there is no clear change of that pattern at any age.

5. Discussion

At the example of Belgium the number of fatalities and the fatality risk per kilometers driven was investigated for elderly and middle-aged drivers. It can be concluded that in terms of absolute number only one concern for elderly road users is indicated: that of vulnerable road users. More than half of all fatal victims among elderly road users were pedestrians and cyclists. Or considered in terms of vulnerable road user fatalities – almost half of the pedestrians (49%) and the cyclists (47%) killed in Belgian traffic were 65 or older.

In terms of fatality risk per km driven a general increase can be observed from 75 years on. Again, the vulnerable road users are far more worrying than the car occupants. In particular for cyclists the increase in risk between the middle-aged comparison group (35-64) and the aged cyclists (75+) is much stronger than the increase for car-drivers.

The Belgian accident data, do consequently not point to car drivers as a target group for measures that prevent road users from putting themselves at risk by taking part in traffic. The reason why car drivers are the focus of attention in the question of whether one should prevent unfit drivers from taking part in traffic must therefore lie in the risk that they might pose to other road users.

When analyzing the fatality risk for car drivers differentiating the risk to themselves and the risk that they pose to others, the risk ratio halves for the risk that elderly drivers have for accidents in which they are not the victim. This means instead of a risk that is 4 times as high as a middle-aged driver (which we see in risk to be fatally injured oneself) the risk to be involved in an accident that kills someone else is only twice as high as for middle aged drivers. We can therefore estimate that about half of the “elderly driver risk increase” is due to their increased frailty.

To evaluate whether screening elderly drivers to prevent unfit drivers from taking part in traffic helps to reduce fatalities among elderly drivers, five countries who start screening elderly drivers at the age of 70 (Denmark,
Finland, Ireland, Netherlands, and Slovenia), are compared to five countries that have an unlimited driver’s license (Austria, Belgium, France, Germany, and Poland). While the fatality rate among car drivers was analysed to investigate whether age-based screening protects car drivers, the fatality rate among pedestrians was analysed to address the question whether there are unwanted by-effects of this measure. The results indicate that while those countries that have age-based screening have generally a lower fatality rate among car drivers, this is not the case for drivers of 70 years and older. As a consequence – relative to the other age groups – the elderly drivers are more at risk in those countries that have aged-based screening, not less. Explanations in terms of a more prolonged mobility in the screening countries have to be discussed, but the results indicate that aged-based screening does not reach the desired results of selectively preventing elderly drivers at risk from driving. The fact that - relatively speaking - elderly drivers in the screening countries are even more at risk is worrying and it should be investigated whether a screening procedure does not create a false sense of security.

On the other hand the results do not support the fear that forced driving secession could increase pedestrian mobility among the elderly and thus increase the number of killed pedestrians. Like for car drivers, the screening countries have lower fatality rates for pedestrians than those countries with an unlimited driver’s license. Contrary to the pattern observed for car drivers, the difference in pedestrian fatality rates between the two types of countries remains more or less stable across the life-time.

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