

THE FRAGILITY OF OLDER ROAD USERS IN BRITAIN

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Abstract

As people get older they become more physically fragile. If they are involved in an accident, they are more likely to be injured. If they are injured, they take longer to recover and are more likely to die.

Data on casualties of traffic accidents that include gender, age, road user type and severity are available for Britain since 1985. These permit the calculation of the percentage of casualties who die by age, gender and road user type. The risk of dying as a pedestrian in Britain rises from 2 percent of casualties at age 30 to 12 percent at age 90 for men, and from 1 percent at age 30 to 9 percent at 90 for women. These percentages are different for different types of road user.

The curves of percentage fatalities can be converted into fragility indices by normalizing by the percentage who die at some early middle age. This largely removes the effects of road user type and highlights the effect of changing physical fragility. For example, in Britain male pedestrians aged 90 are 4.7 times more likely to die if injured than those aged 30 to 39, while female pedestrians are more than seven times more likely. Virtually all the data shows that the fragility of women increases more with age than that of men.

There is clear evidence that the occupant protection provided by cars has improved since 1985. The percentage of car driver casualties killed has at least halved since that date. The fragility index for car drivers has changed less than the percentage who die, though there is some suggestion that modern cars are providing relatively more protection for older drivers.

Key words

Fragility of road users Road casualties Age Gender User type

1. Introduction

As people grow older, they become more physically fragile. That is, if they are involved in a given accident they are more likely to be injured, and if injured, they are more likely to die from those injuries (Evans, 2000).

Because of the increase in fragility with age, older road users are more likely to die than younger people if they are involved in a traffic accident. This is a major cause of the increases in the rates of death and serious injury for older road users that appear in the road safety statistics.

This paper reviews the data available on how road users' fragility changes with age, gender and type of road user, and whether fragility is changing over time. It is based on road casualty statistics for Great Britain (Department for Transport, annual). Where data is available in other countries, particularly Sweden and USA, the patterns found in Britain appear to be similar elsewhere.

2. Fragility and fragility index

Older people tend to have a lower than expected involvement in road accidents, but a higher than expected rate of deaths in road accidents. As an example, Figure 1 compares the percentage of casualties aged 70 and over in Britain in 2010 to the percentage of the population aged 70 and over.

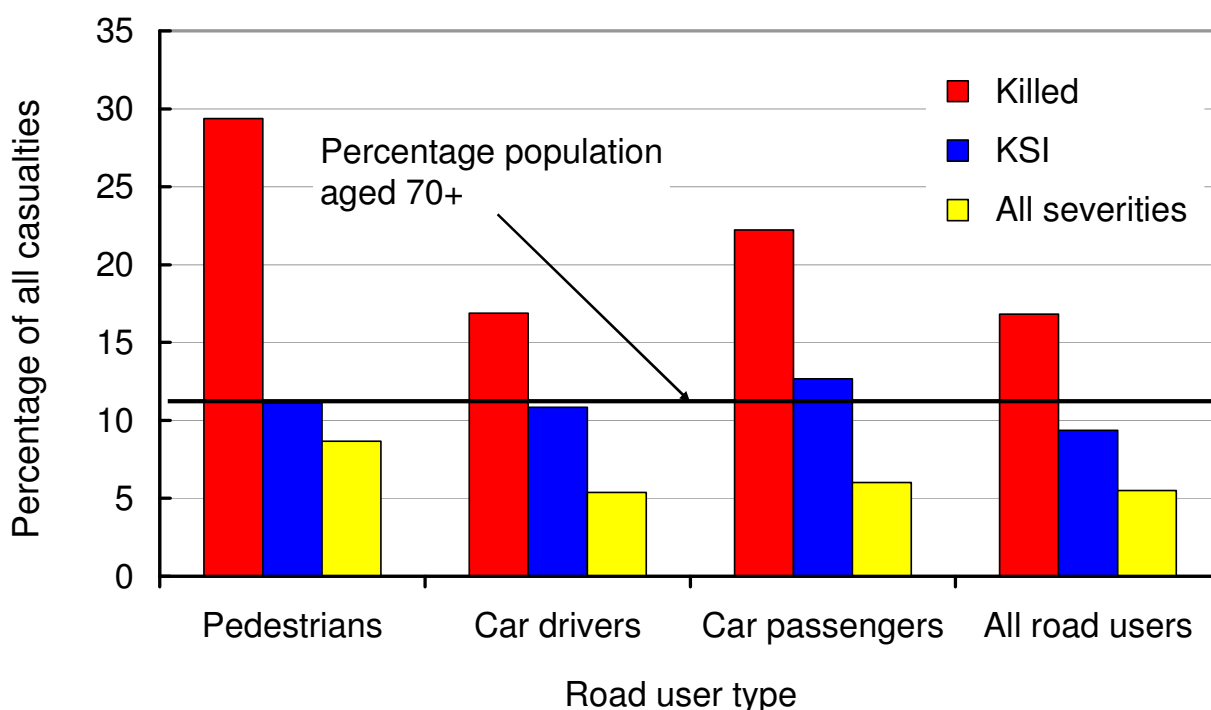


Figure 1 The percentage of casualties aged 70 and over compared to the percentage of the population aged 70 and over Britain 2010

For all types of road user, the percentage of casualties of all severities is less than the percentage aged 70+ in the population, but the percentage of fatal casualties exceeds the percentage in the population. This shows that people aged 70 and over are under-involved in road accidents but over-represented in the deaths caused by road accidents.

The reason for this is that fragility causes the percentage of casualties who die to increase with increasing age. Figure 2 shows this percentage of fatal casualties for pedestrians, car drivers and car passengers in Britain, averaged for 2006 to 2009. For pedestrians aged 30 to 50, about 2 per cent of casualties of traffic accidents die from their injuries. For those aged 60 to 70 the percentage is 3.6%; for 70 to 80, 5.8 per cent and for 80 and over, 8.6 per cent. The percentages for car occupants are lower because they are less vulnerable, but the pattern is similar. The curves for car drivers and passengers are almost identical.

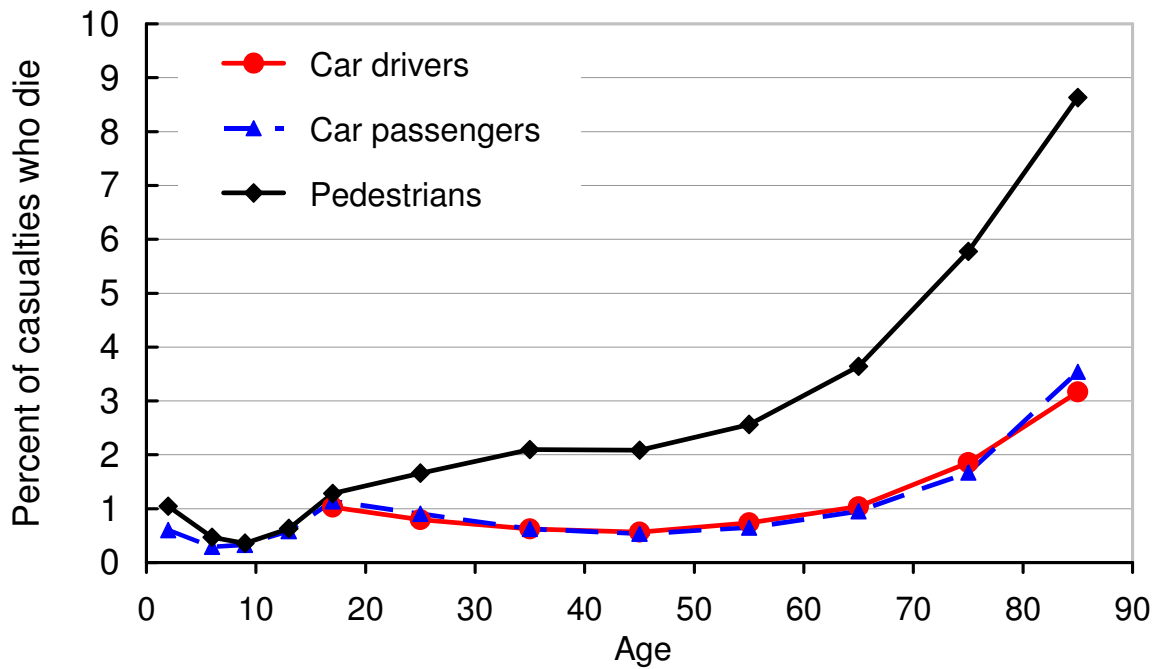


Figure 2 The percentage of road accident casualties who die Britain, 2006 - 09

The physical fragility of the person injured can be separated from the degree of protection provided by a vehicle by deriving a 'Fragility Index'. This is the fragility of a particular road user divided by the fragility of that type of road user at a particular age, often 30 to 39. This is shown for pedestrians and car occupants in Figure 3, and it will be seen that the variation in fragility index with age is very similar for pedestrians, car drivers and car passengers. The index is higher for young car occupants, and this probably reflects the greater severity of the accidents that these road users experience, which means that their chance of survival is lower.

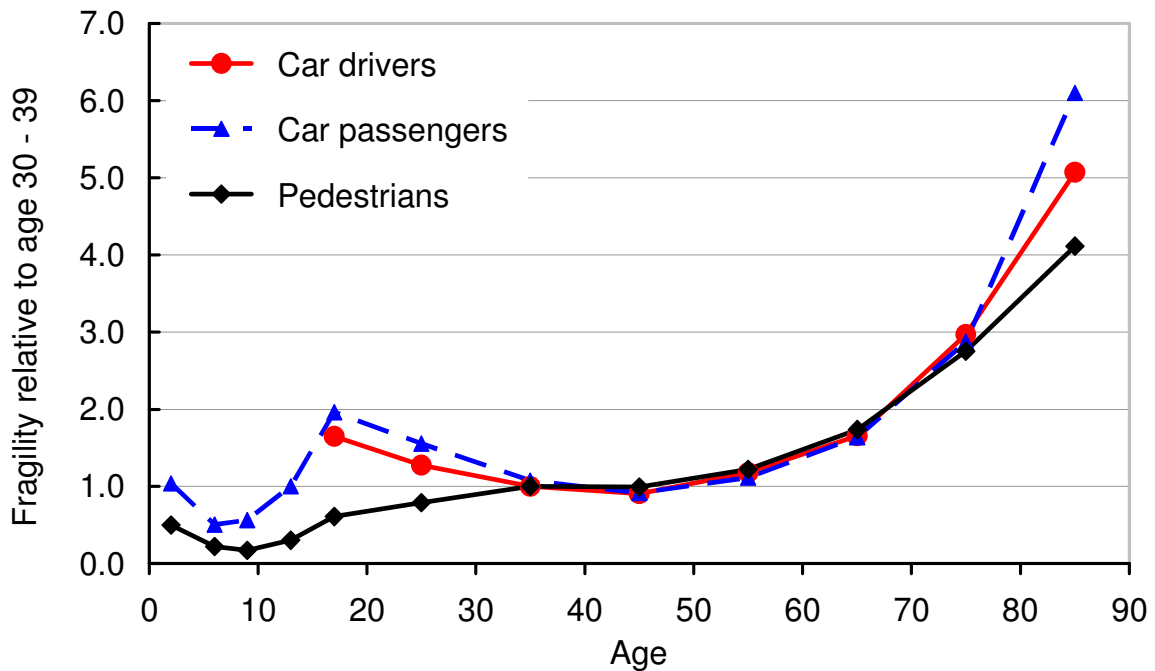


Figure 3 The fragility index for road accident casualties relative to the percentage aged 30-39 who die, Britain, 2006 - 09

3. Effect of gender on fragility

The British road casualty data for 2004 to 2009 have been analysed on line to provide the number of fatal, seriously injured, slightly injured and total casualties categorised as pedestrians, car users and motor vehicle users by age and gender. The following section uses the averages for the period 2004 to 2009 to reduce variability.

3.1 Pedestrians

Figure 4 shows the percentage of male and female pedestrian casualties who died in Britain for the period 2004-09. At all ages a higher percentage of male casualties die. This is probably caused by men taking greater risks and therefore being involved in less survivable accidents.

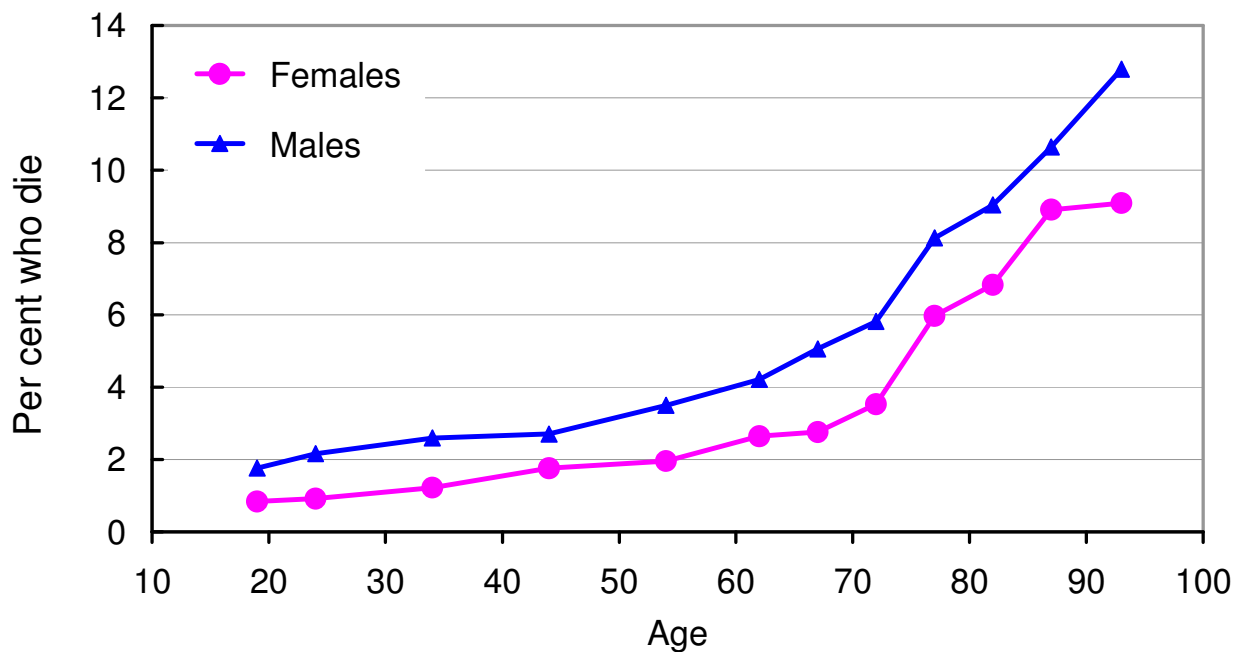


Figure 4 The percentage of male and female pedestrian casualties who die Britain 2004-09

From this can be derived a fragility index for pedestrian fatalities, relative to ages 30 to 39, and this is shown in Figure 5. Despite the large difference in the percentage of male and female casualties who die, the fragility index for men and women is similar up to age 70. For older ages, the fragility index for women is larger than for men, which is consistent with the greater probability of women experiencing osteoporosis in later life.

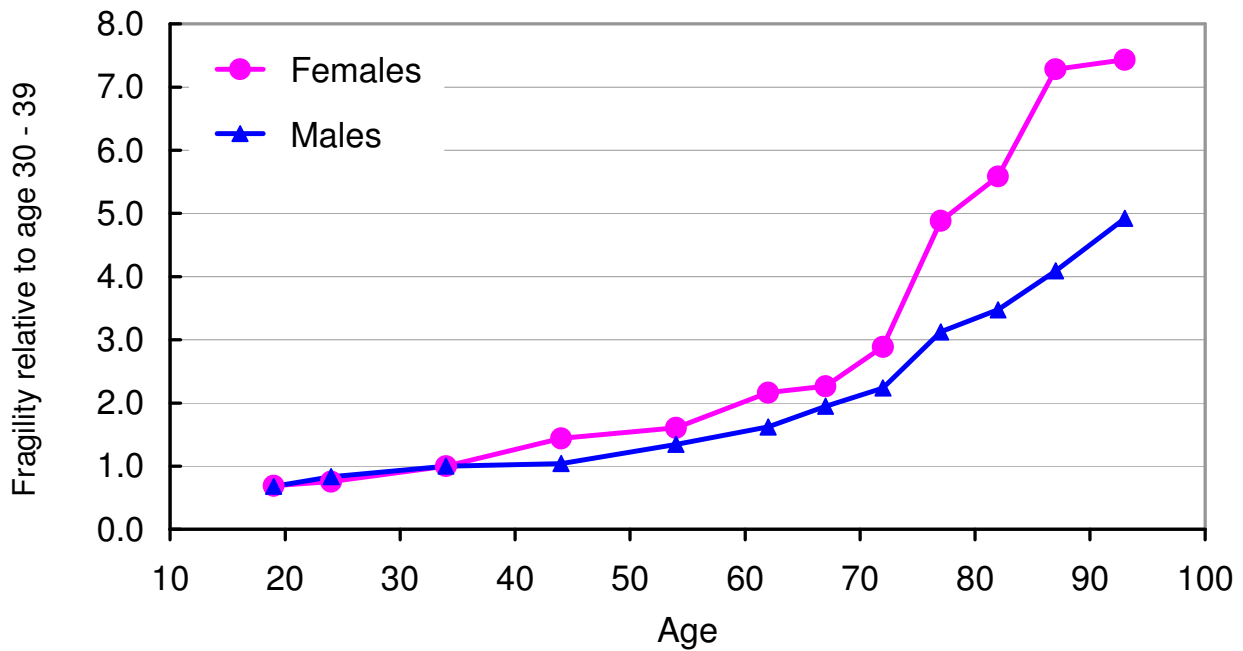


Figure 5 The fragility index for male and female pedestrian casualties relative to ages 30 to 39 Britain 2004-09

3.2 Car occupants

Figure 6 shows the percentage of male and female car occupants who die, for Britain 2004-09. Again, the percentage is higher for men than women at all ages, but the difference reduces with increasing age. This again probably reflects the involvement of younger men in less survivable accidents.

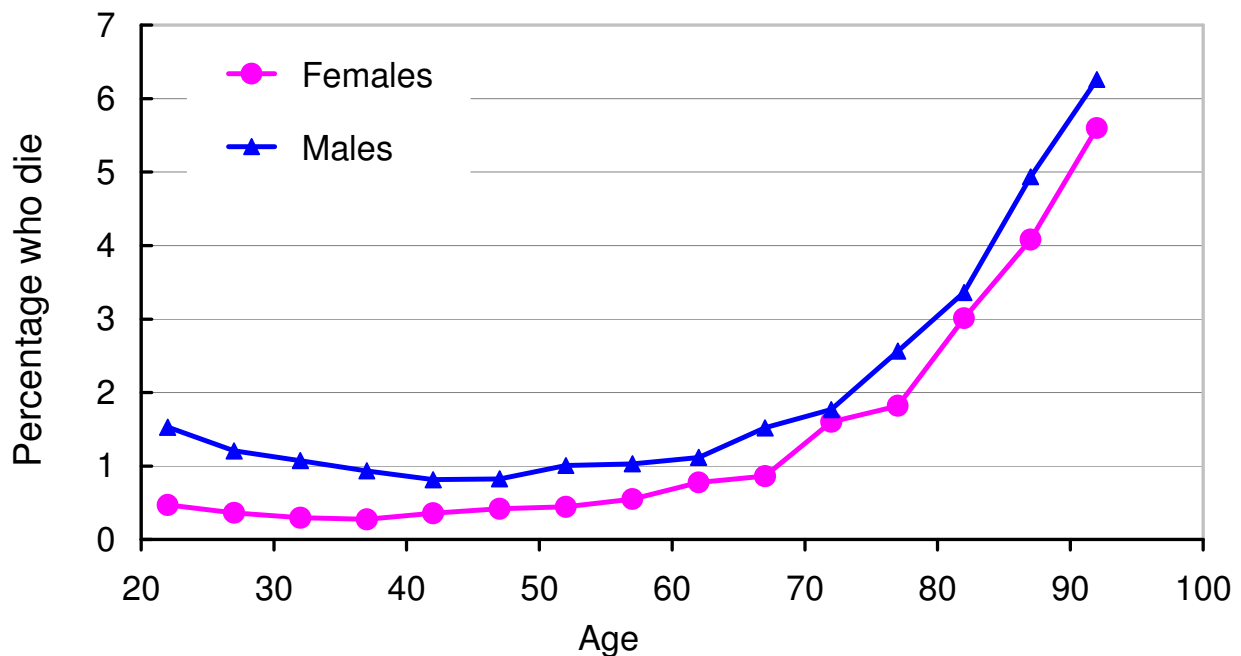


Figure 6 The percentage of male and female car occupant casualties who die Britain 2004-09

Figure 7 shows the corresponding fragility index for car occupants, relative to ages 30 to 39. The index is fairly similar for men and women up to an age of about 55, after which

it increases sharply for women. This may suggest that occupant protection systems in cars are not as well designed for older women as for men and younger women.

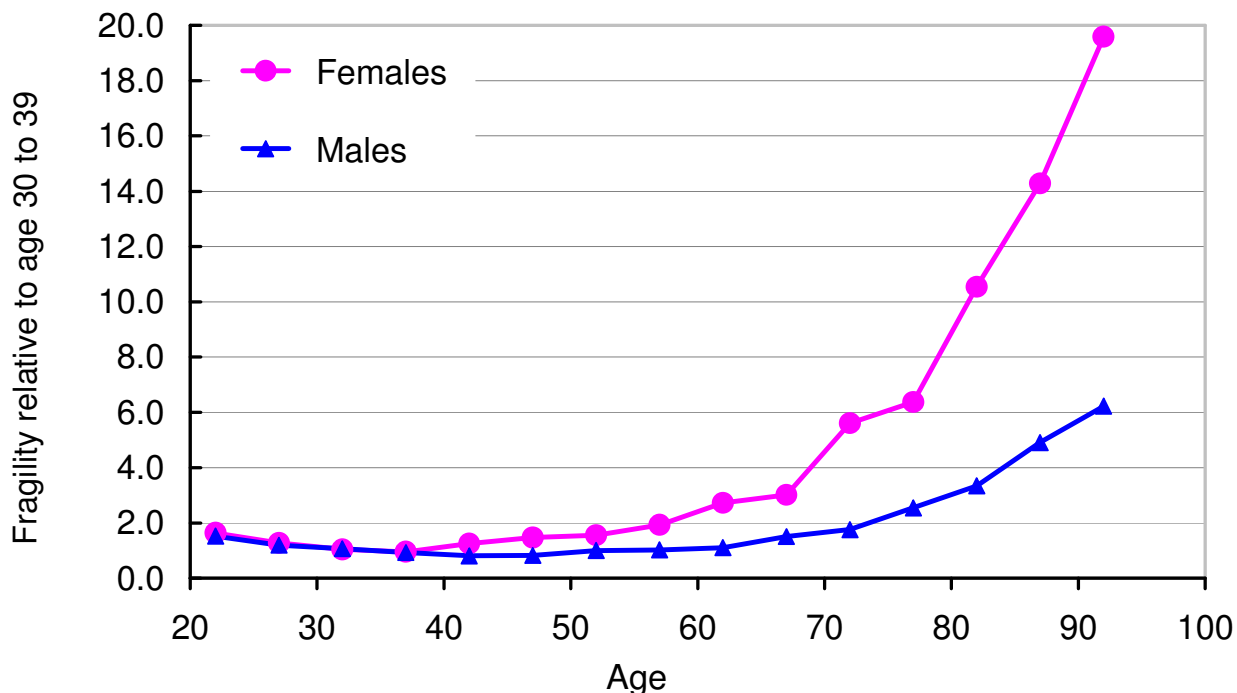


Figure 7 The fragility index for male and female car occupant casualties relative to ages 30 to 39 Britain 2004-09

4. Changes over time

The percentage of casualties who die in accidents has reduced over the period 1985 to 2010. Figure 8 shows this for pedestrians in Britain, where the reduction, particularly for older people, is very clear. This may reflect improved emergency medical services.

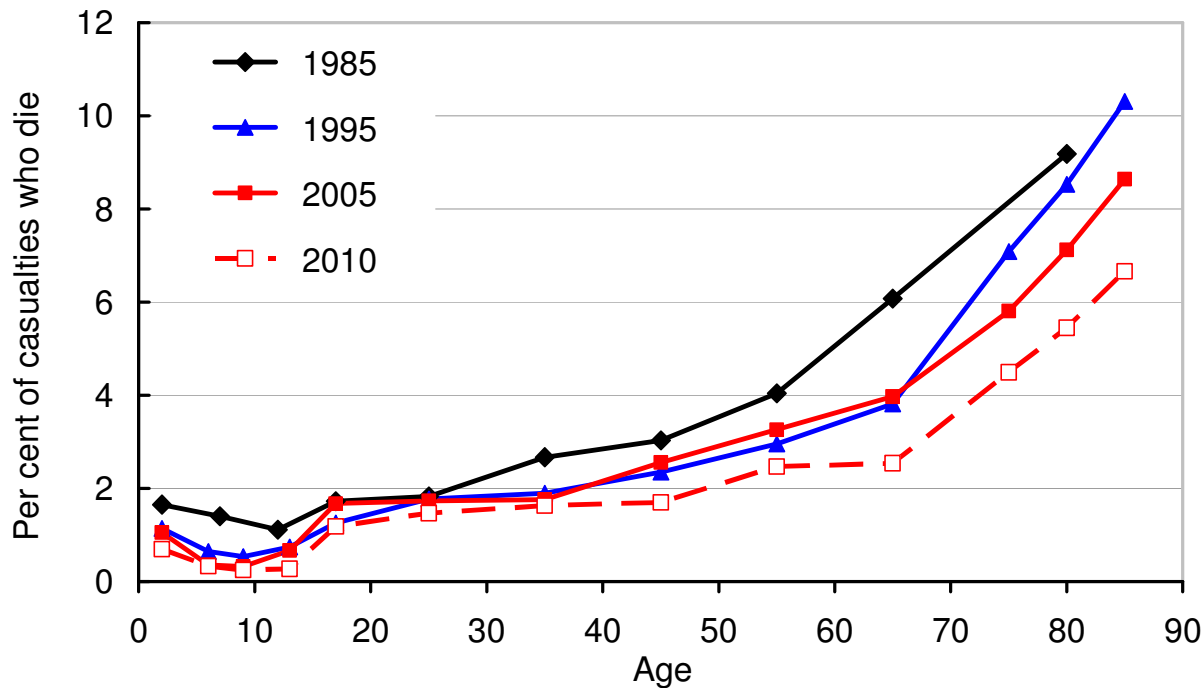


Figure 8 The percentage of pedestrian casualties who die Britain 1985, 1995, 2005 and 2010

However, the reduction in the percentage of pedestrians who die does not change the fragility index for pedestrians very much, though it is lower for 2010, Figure 9.

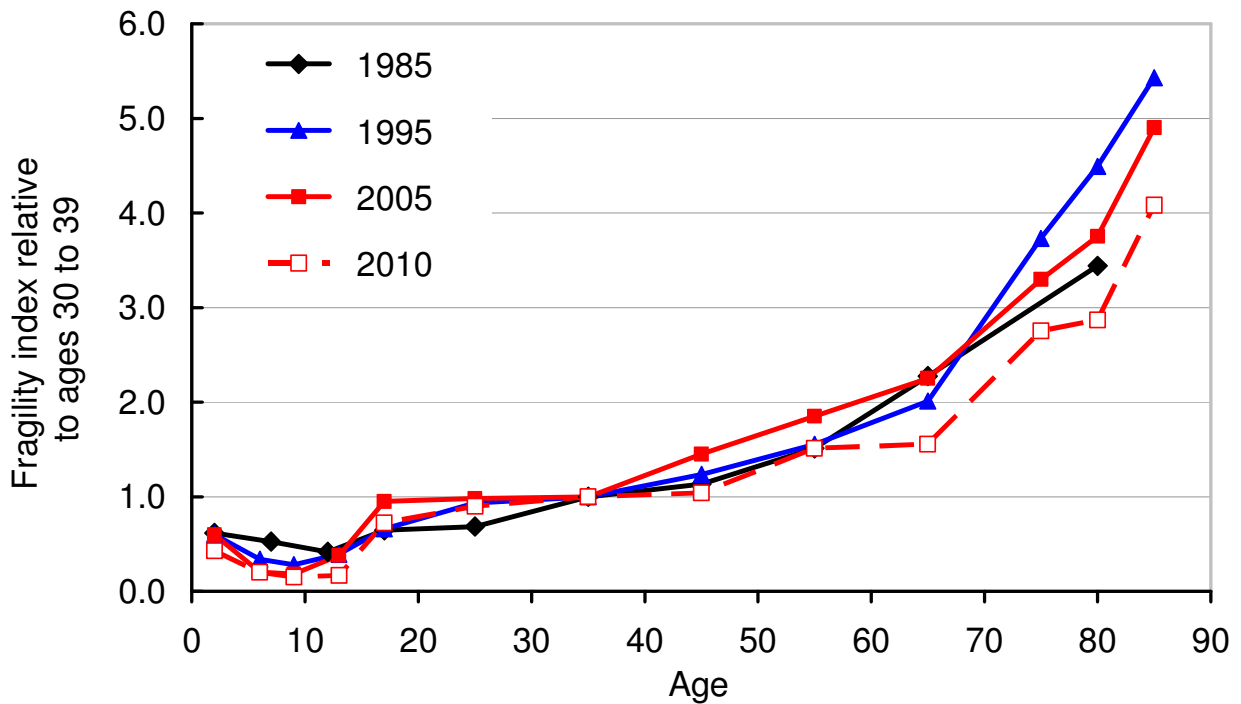


Figure 9 Fragility index for pedestrian casualties relative to ages 30 to 39 Britain 1985, 1995, 2005 and 2010

Somewhat similar results are found for car drivers. Figure 10 shows the percentage of car driver casualties who die. The reduction in this percentage between 1985 and 2010, from 1.1 per cent to 0.5 per cent for those aged 30 to 39, is very clear. This must be a result of the improved occupant protection provided by modern cars.

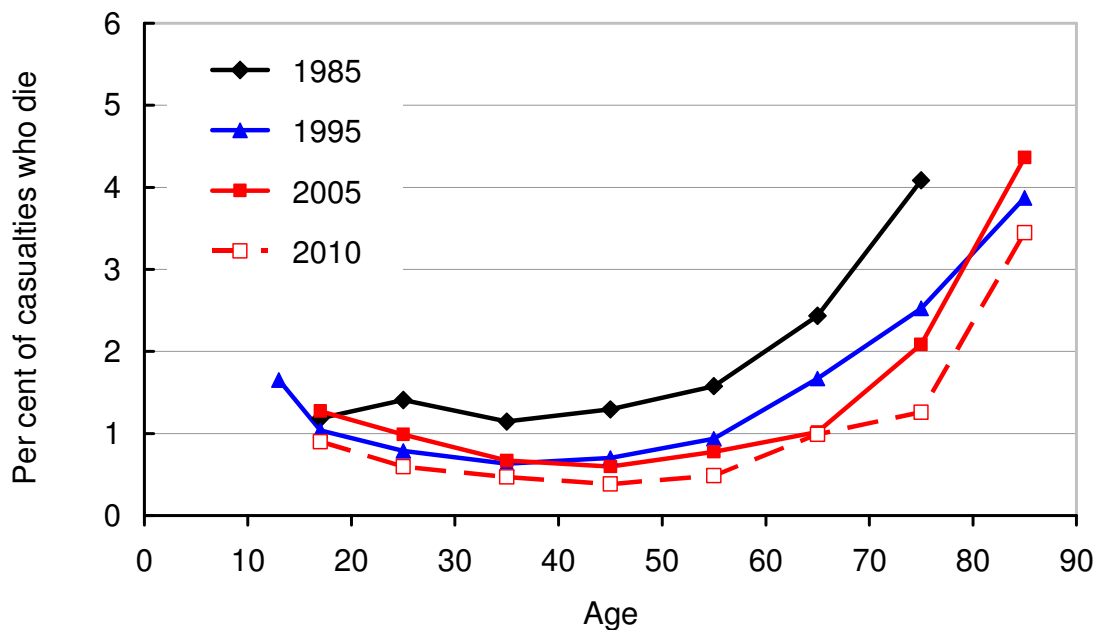


Figure 10 The percentage of car driver casualties who die Britain 1985, 1995, 2005 and 2010

As with pedestrians, the fragility index for car drivers varies much less between 1985 and 2010 than does the percentage of car driver casualties who die (Figure 11). There is some indication of a reduction in the index for older people in 2005 and 2010, which may indicate that car design is providing relatively more occupant protection for older drivers. However, even in 2010, drivers aged 80 and over are more than five times as fragile as drivers aged 30 to 60, and this explains most of the increase in the fatality rate for older car drivers.

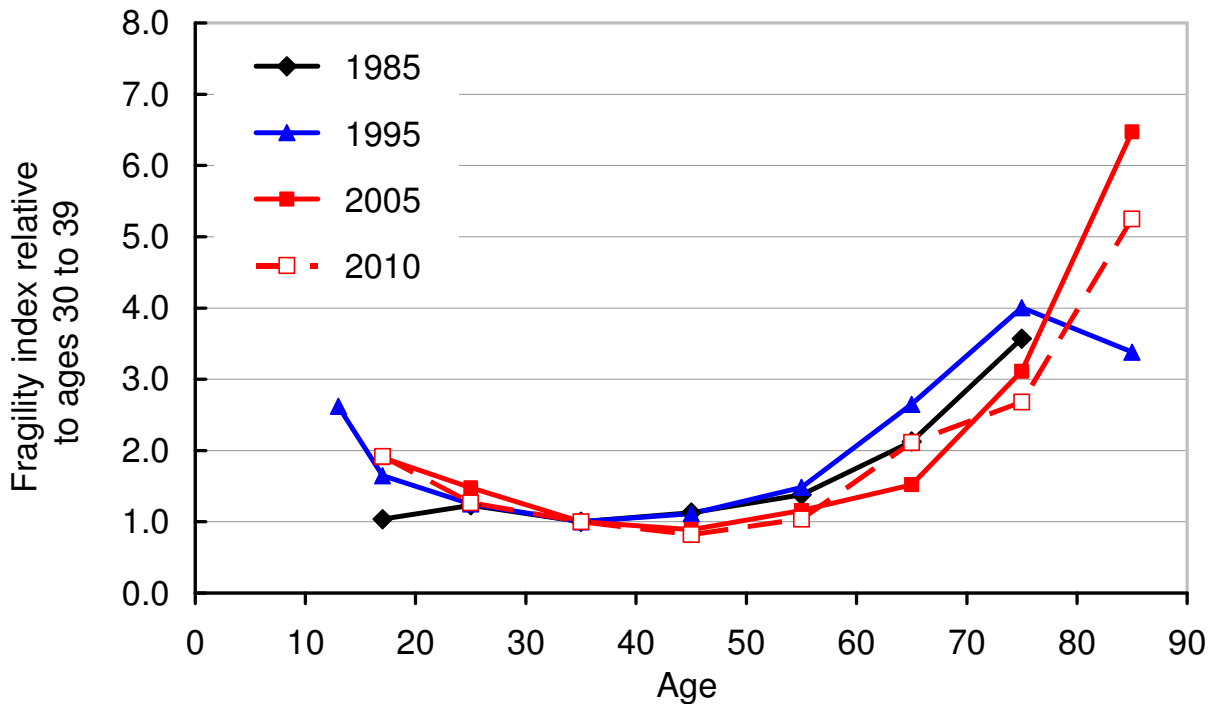


Figure 11 Fragility index for car driver casualties relative to ages 30 to 39 Britain 1985, 1995, 2005 and 2010

5. Discussion and conclusions

The data presented in this paper shows clearly the increase with age in the percentage of road traffic casualties who die. This increase is due to physical fragility, as the fragility index shown in Figure 3 is similar for pedestrians and car occupants, although the indices shown in Figures 5 and 7 are not so similar. There is some indication that the fragility index for older car drivers has reduced since 1985, suggesting that modern cars are providing relatively more occupant protection for older drivers. Alternatively, this could be a result of improved emergency rescue and medical services. There is certainly clear evidence, from the reduction between 1985 and 2010 in the percentage of car driver casualties who die, that cars are providing improved protection for occupants of all ages.

For both pedestrians and car occupants, a smaller percentage of female casualties die at all ages. This probably reflects the severity of accidents in which they become involved. The fragility indices for men and women are generally similar up to age 55 (for car occupants) or 70 (for pedestrians). For older ages, the index for women is higher

than for men. This is consistent with women being more likely than men to experience osteoporosis in later life.

It is believed that a detailed examination of the fragility of male and female road casualties has not been reported before.

6. References

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