

Mileage-based accident risks of pedelec riders

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1 BACKGROUND AND AIM

In a previous paper, we analyzed accidents of pedelec riders in 2019 and examined possible changes over the past years [1]. We found that pedelec accidents still essentially resemble the classic two-wheeler accident characteristics, with certain specifics (e.g., higher age of riders involved in an accident, higher proportion of single-bicycle accidents, higher proportion of out-of-town accidents). Even though the number of pedelecs and pedelec accidents has increased in recent years, no qualitative changes in the characteristics of accidents compared to previous years seem to have occurred.

We now have a large data base of riders and accidents and new data sources that offer the possibility for calculating accident risks by mileage-based analyses. In addition to absolute accident numbers, relative accident parameters are of particular interest for accident research and prevention. Using the same amount of physical effort pedelecs can be used to cover longer distances than bicycles. At the same time, longer distances increase the probability of being involved in an accident. On average, pedelec users cover 1.8 times as many kilometers per day as bicycle users do [2]. We now have nationally representative data on the mileage of pedelec riders, so we can calculate mileage-based accident risks and get new insight into pedelec accidents. For comparison the accident risks of bicycle riders are used.

2 METHOD

To calculate the mileage-based accident risks, on the one hand, accident data were queried from the Research Data Center of the Statistical Offices of the Federal States [3]. These included all police-reported pedelec and bicycle accidents with personal injury in Germany, both in town and out-of-town (no federal highways). Only riders who were at least 18 years old were included. In 2019, a total of 10,348 pedelec riders and 62,378 cyclists were involved in an accident with personal injury. On the other hand, the data set of the study "Mobility in Germany (MiD 2017)" [4] was used to calculate the annual mileage. The data set contains a total of 7,129 trips by pedelec and 79,221 trips by bicycle, reported by people over 18 years of age.

We calculated the mileage-based accident risk of a) being involved in an accident, b) causing an accident and c) being seriously injured or killed in an accident. For this purpose, a quotient was formed for eight age groups of their share in the total number of a) accident involved pedelec or bicycle riders of all age groups, b) pedelec or bicycle riders who caused the accident of all age groups, c) seriously injured or killed pedelec or bicycle riders of all age groups and their share in the total mileage by pedelec or bicycle riders of all age groups.

If the quotient takes the value "1", the accident risk of an age group corresponds to the mileage of that age group. Values greater than "1" indicate an increased mileage-based risk, values less than "1" indicate a low risk.

3 RESULTS

3.1 Mileage-based accident risk of being involved in an accident

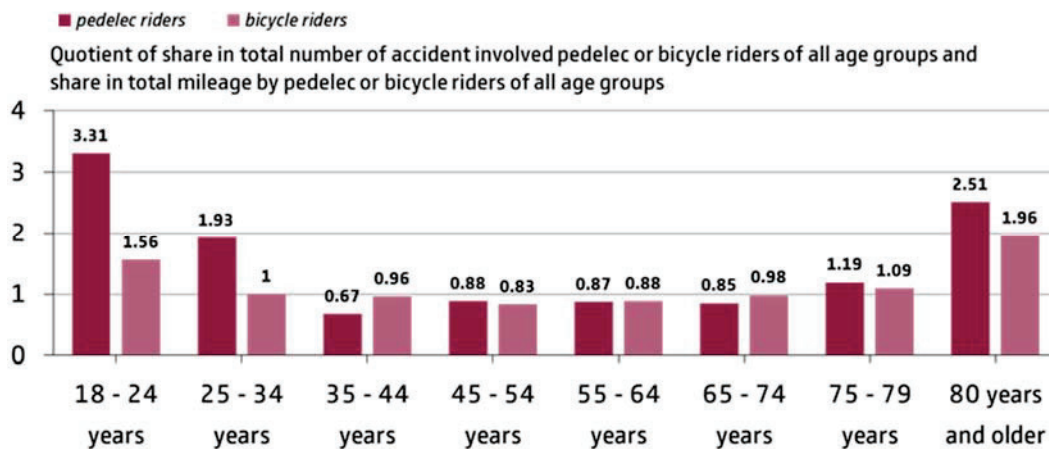


Figure 1: Mileage-based accident risk of being involved in an accident with personal injury for pedelec and bicycle riders of different age groups, year 2017.

As can be seen in Fig. 1, among pedelec riders, riders between the ages of 18 and 24 have the highest mileage-based risk of being involved in an accident with personal injury. For them, the risk is 3.3 times higher than one would expect based on their share in total mileage. The second highest mileage-based risk of being involved in an accident was found for pedelec riders aged 80 and older (quotient: 2.5), the third highest risk was found for pedelec riders aged between 25 and 34 (quotient: 1.9). A slightly increased mileage-based risk can be seen for pedelec riders between 75 and 79 years of age (quotient: 1.2).

Comparing the two types of two-wheelers, and looking at quotients greater than 1, we see a significantly higher risk for pedelec riders than for bicycle riders in the age groups 18 to 24 years old (difference: +1.75) and 25 to 34 years old (difference: +0.93). In the age group 80 years and older there is also a higher risk for pedelec riders than for bicycle riders, although the difference (+0.55) is not as large here as in the other two age groups.

Adult pedelec riders between 35 and 74 years of age do not show an increased mileage-based accident risk of being involved in an accident. There is also no difference in the accident risk compared to bicycle riders of the same age.

The results for the mileage-based accident risk of causing an accident are very similar.

3.2 Mileage-based accident risk of getting seriously injured or killed

Among pedelec riders, riders 80 years and older have the highest mileage-based risk of being seriously injured or killed in an accident. Their risk is 3.2 times higher than one would expect based on their share in total mileage. The second highest mileage-based risk of being seriously injured or killed in an accident was found for pedelec riders between the ages of 18 and 24 (quotient: 1.8), the third highest risk was found for pedelec riders between 75 and 79 years (quotient: 1.4).

Comparing the two types of two-wheelers, and considering quotients greater than 1, there is a significantly higher risk for pedelec riders than for bicycle riders in the age groups 18 to 24 years old (difference: +0.75) and 25 to 34 years old (difference +0.47). In old age, the difference between bicycle riders and pedelec riders is only 0.28 (for riders between 75 and 79 years) and 0.27 (for riders 80 years and older).

Adult pedelec riders between 35 and 74 years of age do not show an increased mileage-based accident risk of being seriously injured or killed in an accident. There is also no difference in the accident risk compared to bicycle riders of the same age.

4 DISCUSSION

For the first time, the mileage-based accident risks for pedelec riders were calculated and compared with those of bicycle riders. An increased mileage-based risk of being involved in an accident or causing an accident was found for younger (18- to 34-year-old) and elderly (over 75-year-old) pedelec riders. Such a pattern is also evident for bicycle riders, but the ratios are especially higher for younger (18- to 34-year-old) pedelec riders than for bicycle riders of the same age. For elderly (75 years and older) pedelec riders, the difference to bicycle riders is smaller. In the younger age groups, riders might be overconfident of their own abilities and/or might be more willing to take risks. It is also possible that younger riders exploit the potential of the pedal assistance to achieve higher speeds more than elderly riders do. Age, in turn, brings about (nonpathological) changes in physical and mental performance. This can lead to difficulties in handling two-wheelers, even at lower speeds. In addition, pedelecs are significantly heavier than normal bicycles due to the technology installed. The mileage-based risk of being involved in an accident or causing an accident is higher for younger and elderly pedelec riders than for cyclists of the same age. A pedelec-specific risk seems to add here.

The mileage-based risk of becoming seriously injured or killed in an accident is increased for pedelec riders and cyclists over 75 years of age. Here, there is not much difference between the types of two-wheelers. It seems that the high physical vulnerability of elderly riders becomes determinant. A clearly higher mileage-based risk of becoming seriously injured or killed in an accident compared to bicycle riders of the same age was found for pedelec riders between 18 and 24 years. This finding is somehow unexpected, and the development here should be further monitored.

5 CONCLUSIONS

Pedelecs are still mostly ridden by elderly people. However, elderly people have a particularly high risk of accidents. Therefore, various measures should be taken (e.g., advice when buying a pedelec, participation in pedelec courses/training, wearing a bicycle helmet). Elderly riders would particularly benefit if the pedal assistance power of the pedelec was more closely linked to their own muscle power.

A new focus is on younger pedelec riders. Although pedelec riders between the ages of 18 and 34 are few in absolute numbers, they have a clearly higher accident risk, in relation to their mileage, than other pedelec riders under the age of 75 or than bicycle riders of the same age. This trend should be monitored further. It is expected that this group will continue to grow.

To further investigate the reasons for the higher pedelec accident risks specific data on the course of the accident, especially the speed at the time of the accident, will be required. In addition, it would also be useful to have up-to-date and representative mobility data, especially on mileage to cover more recent developments.

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