Analysis of pedelec accidents in Germany

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ABSTRACT

Pedelecs are becoming more and more popular in Germany. This paper assesses the road safety of pedelec riders by means of a comprehensive analysis of pedelec accidents. The characteristics of police-reported pedelec accidents in 2019 are analysed and compared with those of bicycle accidents. In doing so, the age distribution, gender distribution, casualties, location of accident, type of accident, cause of accident, and other party involved are examined. The results show that accidents involving pedelec riders differ in relevant aspects from accidents involving cyclists. A new risk group, elderly pedelec riders, seems to emerge for which appropriate prevention measures need to be implemented.

Keywords: pedelec, bicycle, accident analysis

INTRODUCTION

Pedelecs, also known as electric bicycles or e-bikes, are becoming more and more popular in Germany. The sales figures have been rising for years. While in the year 2014 480,000 pedelecs had been sold, the figure was already at 1.36 million in 2019. The share of pedelecs in the total bicycle market was 31.5% in 2019 (ZIV, 2020), which means that almost every third bicycle sold in the year 2019 was a pedelec.
At the same time also the number of casualties has increased as can be seen in the accident statistics (Figure 1, Figure 2). While in the year 2014, a total of 2,220 pedelec riders were injured or killed in a traffic accident inside and outside of built-up areas, in 2019 a total of 10,585 persons was counted (Federal Statistical Office of Germany, 2015, 2020). Of these persons, 7,878 pedelec riders were slightly injured, 2,589 were seriously injured, and 118 were killed (Federal Statistical Office of Germany, 2020).

Figure 1. Trends in the number of injured pedelec riders and in the number of pedelecs sold between 2014 and 2019 (data from Federal Statistical Office of Germany, 2015 – 2020 and ZIV, 2015 - 2020)

Figure 2. Trends in the number of killed pedelec riders
Figure 2. Number of pedelec riders killed in a traffic accident between 2014 and 2019 (data from Federal Statistical Office of Germany, 2015 – 2020)

Unfortunately, the development of the distance travelled by pedelec cannot be demonstrated, since such data has not been collected regularly in Germany so far. Due to the increasing sales figures though it can be assumed that the distance travelled by pedelec has also increased over the last years. The associated increase in the number of casualties suggests that new challenges for road safety might emerge. To examine this, accidents of pedelec riders will be analysed and compared to accidents of riders of conventional bicycles.

1 METHOD

Included in the analyses were pedelec and bicycle accidents with personal injury inside and outside of built-up areas reported to the German police in the year 2019. These included collisions with other road users as well as single bicycle crashes. Only data of pedelec and bicycle riders 18 years and older were used. Data were compared with respect to age distribution, gender distribution, casualties, location of accident, type of accident, cause of accident (as noted by the police), and other party involved.

2 RESULTS

In 2019 in Germany, a total of 10,348 pedelec riders (older than 18 years) who were involved in accidents with personal injury were registered. In the same year, 62,378 bicycle riders were registered. The analyses showed the following results.

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1 Data were provided by Statistical Office of the state Saxony-Anhalt, Halle (Saale), 2021.
2.1 Age distribution

About 62% of pedelec riders involved in an accident with personal injury were at least 55 years old. This was true for only 36% of cyclists. Closely examined, 37% of pedelec riders involved in an accident were 65 years and older (cyclists: 19%), 18% were 75 years and older (cyclists: 10%). Therefore, the proportion of elderly riders among those involved in accidents was higher for pedelec riders than riders of conventional bicycles.

2.2 Gender distribution

With respect to gender distribution no difference was found between accident involved pedelec and bicycle riders. Among all pedelec riders involved in an accident with personal injury 59% were male. This was true for 62% of riders of conventional bicycles.

2.3 Casualties

Figure 3 shows the percentages of injured and killed pedelec and bicycle riders. Of pedelec riders who were injured or killed in an accident 24.7% were seriously injured and 1.1% was killed. Of cyclists 17.7% were seriously injured and 0.5% was killed. Therefore, the consequences of an accident were more serious for pedelec riders than for cyclists.

![Figure 3. Percentages of injured and killed pedelec riders and cyclists](image)
2.4 Location of accident

Pedelec and bicycle accidents mainly occurred inside of built-up areas. However, the proportion of pedelec riders involved in an accident outside of built-up areas (18 %) was almost twice as high as the proportion of cyclists (10 %).

2.5 Type of accident

In Germany, the type of accident describes the conflict situation that led to an accident. It does not describe the actual collision but indicates how the conflict was triggered prior to the potential collision. The analyses here showed that the share of riders involved in a “riding accident” is higher for pedelec riders (22 %) than cyclists (15 %). A riding accident is characterized by the rider losing control of his or her bicycle (e.g., due to inappropriate speed or misjudgement of the road conditions), without other road users having contributed to this. As a result of uncontrolled bicycle movements, however, a collision with another road user may occur.

2.6 Other party involved

Figure 4 shows the other party involved in pedelec and bicycle accidents. The share of riders who had a single-bicycle accident was higher among pedelec riders (33 %) than among cyclists (23 %). If a collision between two road users occurred, car drivers were somewhat less often recorded as other party involved for pedelec riders (45 %) than they were for cyclists (52 %).
2.7 Cause of accident

Accident causes listed in the official accident statistics in Germany are taken from the standard traffic accident notices by the police officers who attend the accident. For pedelec and bicycle riders involved in an accident no striking differences were found regarding the share of the different accident causes. Only the cause “inappropriate speed” was registered slightly more often as accident cause for pedelec riders (11 %) than for cyclists (8 %). On the other hand, “unlawful use of the carriageway or of other parts of the road” was noted as accident cause slightly less often for pedelec riders (8 %) than for cyclists (11 %).

3 DISCUSSION

The results described above suggest that pedelec accidents differ in certain aspects from bicycle accidents. The share of elderly riders is significantly higher among pedelec riders involved in an accident than among bicycle riders involved in an accident. This is not surprising since it is meanwhile known that pedelecs in Germany are predominantly ridden by elderly persons (Nobis and Kuhnimhof, 2018; UDV, 2016). Also, the consequences of an accident with respect to injuries are more serious for pedelec riders. They have a higher share of killed or seriously injured riders compared to cyclists. Pedelec riders are more often involved in accidents outside of built-up areas than bicycle riders are. Presumably, pedelec riders more often ride outside of built-up areas. They seem to use their pedelec more often for recreational and leisure riding than cyclists do and tend to travel longer distances (Nobis and Kuhnimhof, 2018). With respect to the type of accident, pedelec riders more often than cyclists seem to lose control of their bike (without other road users having contributed to this). It was also shown that the share of single-bicycle accidents is higher among pedelec riders.
A few years ago, the German Insurers Accident Research found similar results with respect to the characteristics of pedelec accidents in Germany (UDV, 2017). Back then accidents of pedelec riders and cyclists that were reported to the German police in the years 2012 to 2015 were analysed. Data came from 8 of the 16 federal states and one city in another federal state. Similar results were also found by Panwinkler and Holz-Rau (2019) using the official accident statistics of the whole Federal Republic of Germany for the years 2014 until 2017. They also showed that pedelec accidents were more severe than bicycle accidents. The mean age of injured and of killed pedelec riders was higher than that of cyclists. They also found that pedelec riders were more likely to have accidents in rural areas than cyclists were. Pedelec riders also showed a higher share of riding accidents and were more likely to have single-bicycle accidents. The fact that the results of 2019 described above are similar to earlier findings suggests that qualitatively no major changes have occurred over the last couple of years with respect to the characteristics of pedelec accidents. Nevertheless, accidents should be further monitored to reveal potential changes in the future. There are indications that there is an increasing demand for pedelecs also among younger persons (18 to 44 years old; Platho et al., 2019).

When looking at the results, one must keep in mind that data were taken from official accident statistics and therefore only include accidents that were reported to the police. There seem to be systematic differences in what kind of accidents get reported to the police. When it comes to bicycle accidents there is a high number of unreported cases. Often the police are only called if someone has suffered serious injuries or if it cannot be clarified who caused the accident. Von Below (2016) estimates the number of unreported cases of bicycle accidents in Germany to be between 58 and 88 %. This figure also differs depending on the other party involved in the accident. For single-bicycle accidents it is 88 to 96 %, for collisions with passenger cars 26 to 47 %. According to a current study by Platho et. al (2019) who analyzed pedelec accidents by means of surveys and official accident statistics, the proportion of pedelec accidents that is not
recorded by the police but in which the rider had to be treated in a hospital was about two thirds. Since pedelecs are more expensive than bicycles, the willingness to report accidents for insurance claims might be higher, but this assumption has not yet been proven. Von Below (2016) also found that in bicycle accidents the distribution of the reported other party involved varies greatly depending on the data source used. She found that the proportion of reported single-bicycle accidents in all accident situations is much higher if injured cyclists in hospitals are asked about the accident situation than if official accident statistics are consulted. On the other hand, if accident statistics are consulted a higher share of collisions with passenger cars is found than in surveys among cyclists or surveys among injured cyclists in hospitals. The share of reported collisions with pedestrians or other cyclists, then again, is higher when surveying cyclists than when consulting official accident statistics or surveying injured cyclists in hospitals.

Another problem with pedelec data in official accident statistics concerns the correct classification of this vehicle type in the standard traffic accident notices by the police officers who attend the accident. Platho et al. (2019) found that less than 30% of pedelec accidents were classified correctly as such. The others were mainly misclassified by the police either as an accident with a conventional bicycle or with a speed-pedelec.

Last but not least, considering only the absolute accident figures might be problematic because it disregards exposure. Elderly persons seem to travel longer distances by pedelec than younger persons do. To account for the increase in riding for elderly riders, it is necessary to calculate accident rates per kilometres travelled by age group.

4 CONCLUSIONS AND PROSPECTS

Based on the analyses it can be concluded that new challenges for road safety work are emerging. Accident involved pedelec riders are predominantly elderly riders. For this risk group (75 years and older) appropriate prevention measures (e.g., education, (guided) practical
training aside public roads, advice from bicycle dealers when choosing bike) need to be implemented.

Furthermore, it is important to continuously monitor the characteristics of pedelec riders and their accidents. This is essential to identify changes and to evaluate the effectiveness of road safety measures. Also, a constant assessment of the distance travelled by pedelec would be beneficial, so that mileage-related accident analyses can be performed.

Knowledge about pedelec accidents derived from official accident statistics should be supplemented by information from surveys among pedelec riders who have experienced an accident.

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