

## Characterization of micromobility crashes in Spain (2016-2020)

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### 1 INTRODUCTION

Micromobility has a direct impact on the urban area, since it tries to make cities more liveable, offering an alternative transport option that contributes to reduce air and noise pollution. Additionally, it promotes intermodality, promotes money savings, reduces parking space and helps to avoid road congestion in cities that have their own lanes for the use of micromobility vehicles such as bicycles, stand-up e-scooters (e-scooters) and other personal mobility vehicles (PMVs) [1, 2].

In Spain, micromobility has significantly increased in recent years, through the increase in the supply and demand for bicycles and other PMVs, mainly e-scooters.

There are many reasons that have motivated users to prioritize the bicycle and the other PMVs over other means of transport. In addition to the growing concern for health and the environment, the COVID-19 pandemic has also driven the growth in the use of the different PMVs in 2020 [2, 3]. According to data from Global Public Transport Report [4], published by the mobility application Moovit, 31% of Spaniards have used bicycles, scooters or e-scooters in 2020, increasing their use by 7% since 2019.

However, in parallel and because of the increase in PMVs exposure, the number of crashes involving users of these vehicles has also increased in recent years. For this reason, among road safety researchers, interest and concern for the study of this kind of crashes have also increased.

The aim of this research is to characterize the crashes in Spain in which at least one PMV (bicycle, e-scooter or other PMV) is involved between the years 2016 and 2020.

### 2 DATA BASE

The crash data bases of the General Directorate of Traffic (DGT) of these 5 years have been used for this research. From these, the e-scooters and other PMVs involved in these crashes have been identified and classified in the following categories: (1) “e-scooters”; (2) “other PMVs”, which includes segways, skateboards and electric wheelchairs; and (3) “unspecified PMV”, which includes those vehicles that are for personal mobility, but it is not possible to know what type according to the available data.

### 3 RESULTS

In Spain, between 2016 and 2020, 305,689 crashes took place on urban roads. Of these, a total of 29,913 crashes involved at least one PMV (including bicycles and other PMV). Figure 1 shows the evolution of the number of bicycles and other PMVs involved in crashes and the evolution of micromobility crashes over the analysed period. The number of bicycles involved in these crashes has remained approximately stable over these years, although with a slight decrease. However, a clearly growing trend is observed in the rest of PMVs analysed, especially in recent years. The number of micromobility crashes evolution follows a trend similar to the number of bicycles involved in these crashes until 2018, when the number of micromobility

crashes began to increase, coinciding with the year when the other PMVs involved in crashes started to increase.

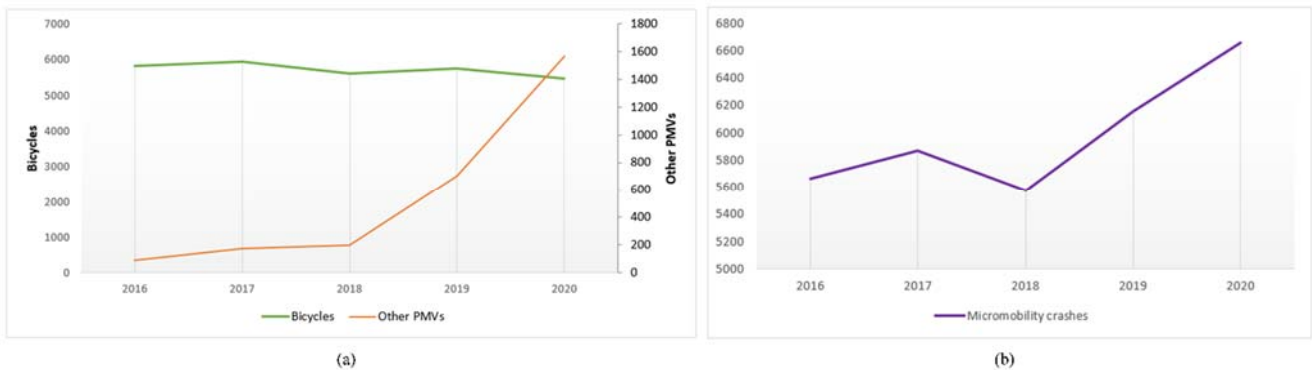


Figure 1: Evolution of micromobility users (a) and crashes (b) in urban areas in Spain (2016-2020).

The stagnation of the reduction in the number of bicycles involved in crashes, as well as the increase the rest of PMVs involved in these collisions and the micromobility crashes, have motivated this research. In this study, these crashes have been characterized through their severity, the day they occurred, the type of crash and whether it occurred at an intersection.

The micromobility crashes occur mainly on working days and almost 35% of them involved only PMVs. The main types of crashes are side-impact collisions. However, accidental falls, pedestrian collisions and sideswipe collisions are also important. Moreover, 44.05% of the crashes took place at intersections and they are slightly more serious. Therefore, research should focus on these locations to minimize the amount of these crashes and their severity.

Figure 2 shows the distribution of micromobility crashes in Spain, considering the involved user, from 2016 to 2020. In 2016 there were a higher proportion of crashes between PMV and motorized vehicles and a lower proportion of crashes in which only one PMV was involved. Nevertheless, the evolution of micromobility crashes in Spain remained approximately stable until 2020. Compared to 2019 data, in 2020 the proportion of crashes involving only one PMV has increased by more than 6.7% and the proportion of collisions between PMVs by almost 1%. However, the proportion of crashes between PMVs and pedestrians decreased by 1.66% and there was also a 5.89% reduction in the proportion of collisions between PMVs and motorized vehicles compared to 2019.

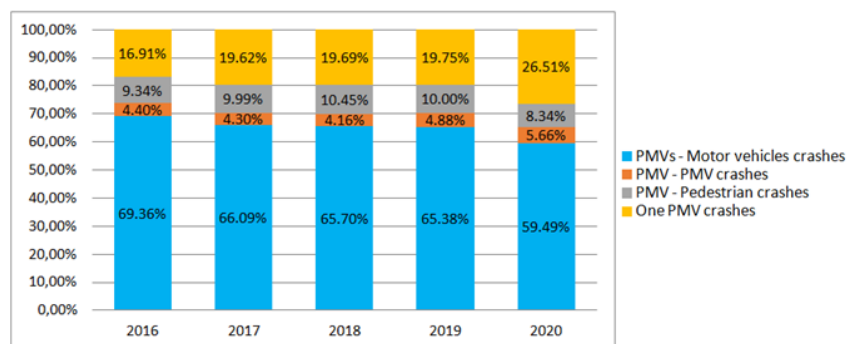


Figure 2: Distributions of users involved in micromobility crashes (2016-2020).

Regarding crash severity based on the user involved, the results show that most micromobility crashes are slightly or seriously injured (more than 90%) and less than 10% are fatal crashes. Most of micromobility fatal and seriously injured crashes occur between PMVs and motor vehicles. However, there is also a high proportion of crashes involving only one PMV (Figure 3). Therefore, further research about this type of collision is needed.

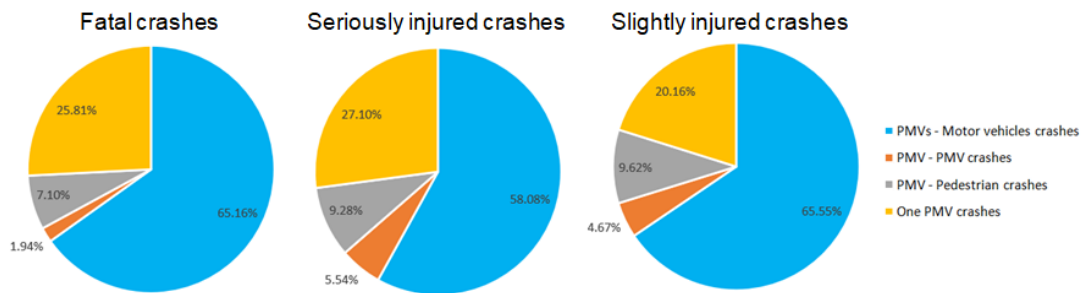


Figure 3: Micromobility crashes distribution based on severity and users (2016-2020).

The distribution of the crash types involving only one PMV is shown in Figure 4, where it can be seen that the most frequent crashes have been due to falls (57.57%) and overturning (19.32%).

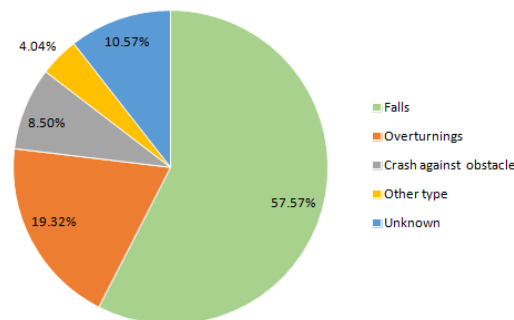


Figure 4: Crash types distribution involving only one PMV in Spain (2016-2020).

#### 4 CONCLUSIONS

In recent years there has been an increase in urban crashes involving at least one PMV. Although the number of bicycles involved in these crashes has remained approximately stable, the presence of the rest of PMVs and its crashes has increased significantly, especially since 2018. In this research, an analysis of these crashes has been carried out with the aim of characterizing them.

Results showed that most severe crashes occur at intersection and between micromobility users and motor vehicles. However, a significant proportion of seriously injured and fatal crashes are those that involve only one bicycle or other PMV riding alone. Therefore, further research about the causes and consequences of this kind of crashes is needed. Research should also focus on crashes involving pedestrians, since, although they do not represent a large percentage of crashes, pedestrians are the most vulnerable users.

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#### REFERENCES

- [1] G. Oeschger, P. Carroll and B. Caulfield, "Micromobility and public transport integration: The current state of knowledge", *Transportation Research Part D* 89 (2020), pp. 102628.
- [2] G. Dias, E. Arsenio and P. Ribeiro, "The Role of Shared E-Scooter Systems in Urban Sustainability and Resilience during the Covid-19 Mobility Restrictions", *Sustainability* 13 (2021), pp. 7084.
- [3] R. Buehler and J. Pucher, "COVID-19 Impacts on Cycling, 2019–2020", *Transport Reviews* 41 (2021), pp. 393-400.
- [4] Moovit, *Informe Global de Transporte Público*, 2020. Available in (13/04/2022): [www.moovit.com](http://www.moovit.com).