Hungarian Law Enforcement 2025/Special Issue 127–139.
DOI: 10.32577/MR.2025.KSZ.1.8
CRIME FORENSICS

Investigation of Fatal Road Traffic Accidents Involving Passenger Cars Based on Vehicle Age in Hungary

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Amongst the causes of road traffic accidents, mechanical failure of cars due to their mechanical condition appears with the most minor proportion. Authorities do not examine the possible impacts of the vehicles' mechanical condition and age on the severity of the road accidents they are involved in. The data on fatal road accidents involving cars will be presented and analysed based on the age composition of the vehicle fleet. The basis of the research is the deep analysis of the concluded investigation documents of fatal road accidents between 2016 and 2017 in all the counties of Hungary since the accident statistics of the Central Statistical Office do not include the data uncovered during the investigation or the accident causes determined at the end of the process. In 2016, the average age of passenger cars was 13.9 years, while the average age of passenger cars involved in accidents where fatalities occurred was 15.5 years. In 2017, the average age of passenger cars was 14.1 years, while the average age of passenger cars involved in accidents was 15.5 years. In cases where another vehicle was involved in the accident, but no one died, the average age of vehicles was 12.1 years in 2016 and 10.9 years in 2017. During accidents, nearly 40% of road users did not use seat belts, which also adversely affected the outcome of the accidents. The ageing of the vehicle fleet harms the severity of accident outcomes, as the passive safety features of more modern vehicles – if used – provide more effective protection for road users.

Keywords: traffic accident, average age of vehicles, vehicle fleet, Hungary

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Introduction

Data analysis of road traffic accidents is an important feature of the prevention of road traffic accidents. Data is collected by the Police during the case investigation of the accident. Collecting the data enables the National Accident Prevention Committee, as the responsible organisation, to elaborate on accident prevention strategies.[2] The Central Statistical Office and Police collect various data on the circumstances of the accidents. Such data includes the accident location, weather, visibility and road conditions, the categories of vehicles, the gender and age of the individuals involved in the accident, all categorised by causative factors, as well as the causes of the accident.[3] Regarding vehicles, the make, year of manufacture and location of the vehicle is also recorded, and this information is forwarded to the Central Statistical Office (KSH) by the police. However, data on the ages of vehicles in fatal road accidents is not collected, making such an analysis unavailable. The database of the Central Statistical Office contains information about the average age of vehicles present on the roads in Hungary, with breakdowns available concerning the types of passenger cars.

The technical malfunction of the vehicle is rarely named as the cause of most of the incidents. In the years I examined, 2016 and 2017, technical malfunction was indicated as the cause of the accident in only two cases. In one case, the wheel of a vehicle detached, and in the other case the accident was caused by a punctured old tire. However, this does not mean that the overall technical condition of the vehicle does not play a role in the occurrence of the accident, as well as in the severity of its outcome. During the on-site inspection of accidents and later in the forensic vehicle expert examination, the primary focus is to determine whether there was a technical malfunction of the vehicle. The quality of the vehicle's technical condition is not examined. Factors such as how aged or worn the suspension, braking system, or the vehicle's body, etc. are not evaluated. Yet, these could have played an important role in the occurrence of the accident, for instance, due to increased braking distance, or in how well the vehicle could protect its occupants through passive safety systems.

Regular maintenance and technical inspection of vehicles is crucial for maintaining road safety. In Hungary, mandatory technical inspections are taken regularly; however, for older vehicles, maintenance costs are higher, which may lead many owners to postpone or neglect necessary repairs.

"The deadline for periodic inspection for a new vehicle is calculated from the date of registration, and for a used vehicle, from the date of the inspection prior to registration: For passenger cars, in the case of a new vehicle, it is four years; for a used vehicle, within three calendar years following the year of first use, it is three years; beyond three calendar years, it is two years."[4] The police check these during traffic control, but the possibility of a technical inspection of the vehicle is limited.[5]

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[2] Mészáros 2017: 61.

[3] KSH s. a.

[4] 5/1990 (IV. 12.) KöHÉM rendelet a közúti járművek műszaki megvizsgálásáról [Regulation of the Ministry for Transport, Communications and Construction on the Technical Inspection of Road Vehicles], 11. § (3) b).

[5] Major–Mészáros 2015.

Hungarian and international research on the topic

Vehicle manufacturers placed increased emphasis on both active and passive safety features of vehicles in recent years. Safety systems that were previously only found in high-end vehicles now became mandatory equipment in the European Union. As a result, the safety level of newer vehicles is higher than that of vehicles manufactured 15–20 years ago. Therefore, it seems logical to assume that in fatal traffic accidents, where people die in vehicles, older vehicles are primarily involved.

This is justified by a Hungarian study that claims: "The result of the analysis also duly finds that vehicle age has an emphatic role in the occurrence of accidents."[6]

This statement was not only justified in Hungary. According to a study made in the United States of America: "In fatal crashes, the study shows that a driver in a vehicle of age 4–7 years was 10 percent more likely to be fatally injured than a driver in the baseline vehicle age category of 0–3. The model produced comparable estimates for drivers of vehicles age 4–7 (10%), 8–11 (19%), 12–14 (32%), 15–17 (50%), and 18+ (71%). Each of these estimates show the increased risk of being fatally injured in older vehicles, compared to the baseline 0–3 vehicle age category."[7]

The report also shows that "driver restraint use plays a large role in the relationship between vehicle age and the percentage of drivers fatally injured. The percentage killed among restrained drivers dropped fairly steadily from 46 percent among vehicles 19 years old, down to 26 percent among vehicles of age less than 1. This pattern was seen less among unrestrained drivers. Among vehicles of age 19 all the way down to vehicles of age 3, the percentage killed among unrestrained drivers varied little, remaining consistently between 76 and 78 percent."[8]

Vehicle age increases the expected proportion of injured occupants, with the greatest impact being found for cars that are 18 years or older.[9]

In Poland, the number of fatalities caused by passenger cars analysed by the age of a vehicle indicated that "the risk of being killed increases with the age of the vehicle. Chances of the loss of life of people involved in accident participants are three times more in the case of more than 21 year old cars compared to 5 years old cars".[10] The relationship between the age of vehicles and the severity of the outcome of their accidents was also examined in New Zealand. "The significant proportions of older vehicles being driven on the roads and the magnitude of the increased risk for these vehicles make this an important public health issue. Our study supports previous research in finding occupants of older vehicles to be at increased risk of car crash injury and provides important quantification of this risk. Given the trend for increasing age of vehicles being driven on the roads, this is likely to remain a road safety challenge."[11]

6 Török 2020: 794.
7 U.S. Department of Transportation 2013: 6–7.
8 U.S. Department of Transportation 2013: 7.
9 Santolino et al. 2022.
10 Sicińska 2019: 105.
11 Blows et al. 2003.

Research methodology

Since I could not find data on the ages of vehicles in which travellers died during traffic accidents, I included data on the make, model and age of vehicles in my research on fatal traffic accidents that occurred in 2016 and 2017 in all the regions of Hungary. My assumption was that the proportions of vehicles of different ages involved in fatal accidents would mirror the average age of the vehicle fleet in Hungary. Considering that the average age of vehicles is continuously increasing, I found it important to investigate the age of vehicles involved in accidents, primarily those in which travellers in passenger cars lost their lives.

During the data collection, I aimed to obtain data on all fatal accidents in the examined years. The years under review were 2016 and 2017. In order to understand the results of the investigation and the causes of accidents determined at the end of the procedure, it is necessary to wait for the completion of the procedures, which often takes a long time. However, data collection was only partially successful, as some counties (e.g. Békés, Heves, Komárom-Esztergom and Zala) did not provide data for 2016, citing the destruction of records. Nevertheless, I obtained data on nearly 90% of the accidents, which already provides a clear picture of the age of vehicles involved in fatal road traffic accidents in Hungary. The research exclusively pertains to fatalities occurring in passenger cars.

The average age of vehicles in Hungary

The average age of passenger cars in Hungary showed a decreasing trend until 2007, with an average age of 10.3 years. In 2008, the trend reversed, and since then, the average age of vehicles has been continuously increasing, reaching 15.8 years in 2023. Compared to 2007, the average age of passenger cars has increased by one and a half times by 2023 (Figure 1).

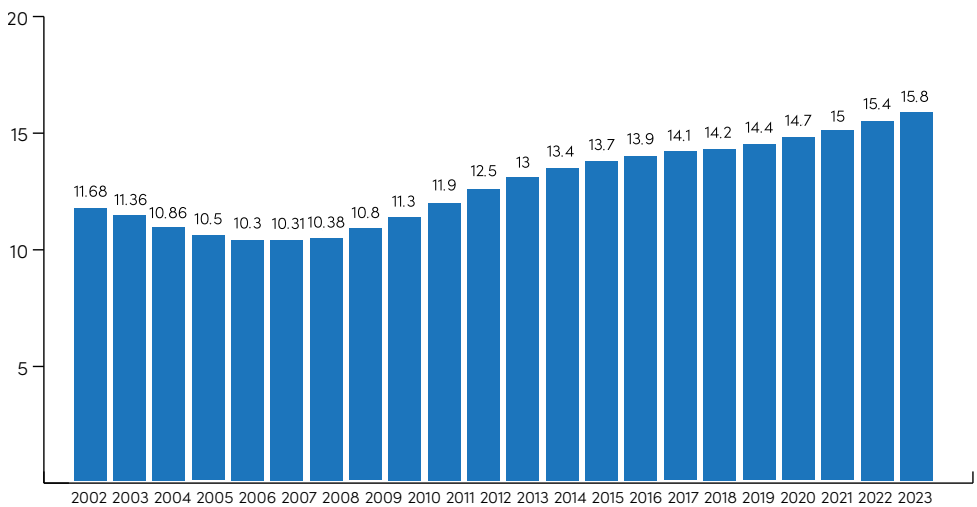

Figure 1: Average age of passenger cars in Hungary 2002–2023
Source: compiled by the author based on KSH 2023

The European Automobile Manufacturers' Association (ACEA) states that according to statistics on road traffic safety in the European Union, the average age of vehicles in the EU was 12.3 years in 2022, which is 3 years lower than Hungary's average of 15.4 years. Between 2017 and 2022, similarly to the car fleet in Hungary, the average age of cars in the EU also showed a continuous aging trend, at a similar rate to that in Hungary. There are significant differences between EU countries. Luxembourg is in the most favourable situation with an average car age of 7.9 years, while Greece is in the worst situation with an average of 17.3 years. Hungary, along with other former socialist countries except for Slovenia and Croatia, is located in the lower third of the EU ranking (Figure 2). This data is noteworthy on its own, but it becomes even more interesting when compared to statistics on fatal road accidents.

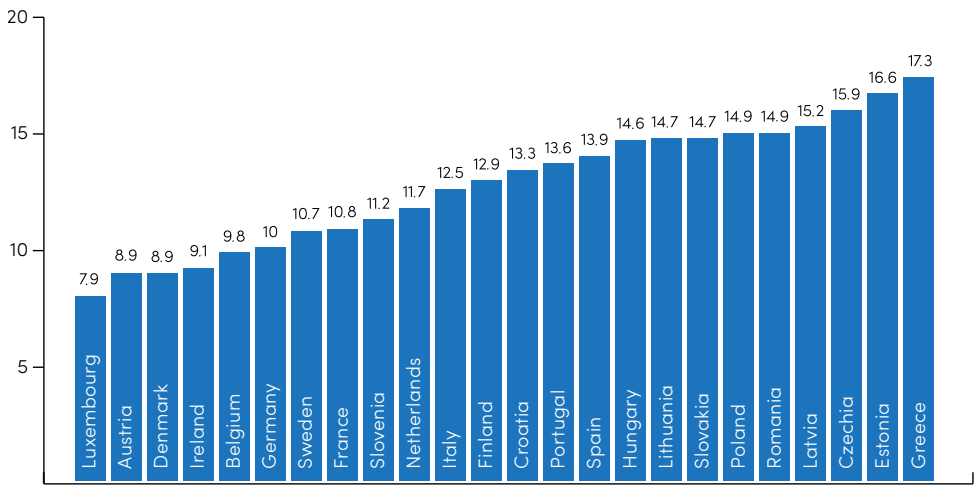

Figure 2: Average age of the EU vehicle fleet, by country
Source: compiled by the author based on ACEA 2024

Examining the trends, the average age of vehicles shows a similar change in both the European Union average and the Hungarian average. Only the starting values are differing. In 2017, the EU average age was 11.1 years, while in 2022 it was 12.3 years. In Hungary, the average age was 14.1 years in 2017 and 15.4 years in 2022. The increasing trend of the average age of passenger cars is practically the same in the Union and Hungary. However, this also means that Hungary is unable to get closer to the EU average age (Figure 3).

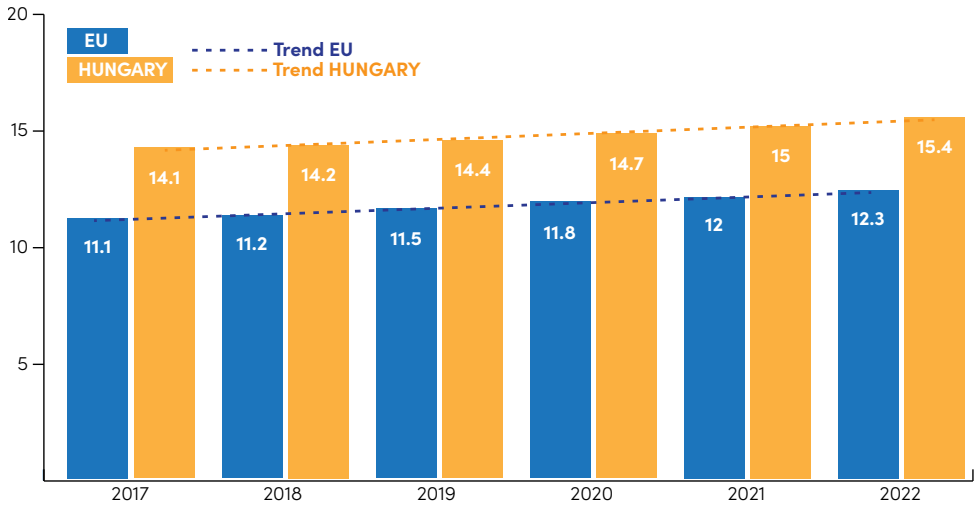

Figure 3: Average age of passenger cars in the EU and Hungary 2017–2022
Source: compiled by the author based on KSH 2023; ACEA 2024

According to Eurostat data, in Hungary, during the years examined in the research, in 2016, 6.1% of the passenger car fleet was 0–2 years old (204,007 pieces), 6.0% was 2–5 years old (201,034 pieces), 20.7% was 5–10 years old (686,154 pieces), 54.1% was 10–20 years old (1,793,815 pieces) and 12.9% was older than 20 years (428,196 pieces). In 2017, 7.0% of the vehicles were 0–2 years old (244,719 pieces), 6.2% were 2–5 years old (215,458 pieces), 16.8% were 5–10 years old (585,118 pieces), 56.3% were 10–20 years old (1,957,207 pieces) and 13.5% were older than 20 years (468,495 pieces). The situation has not improved since then; in 2022, 6.1% of passenger cars were 0–2 years old (249,140 pieces), 9.3% were 2–5 years old (381,469 pieces), 13.0% were 5–10 years old (533,877 pieces), 50.9% were 10–20 years old (2,086,727 pieces) and 20.7% were older than 20 years (842,916 pieces).

The situation in Poland is the same as in Hungary: "The number of passenger cars fleet driven in Poland showed that: more than 60% of passenger cars is between 11 and 20-year-old, the rate of oldest (more than 21 years old and more) vehicles of this type is very low, estimated to be 9.9% of all passenger cars, and the rate of newest vehicle (up to 5-year-old cars) is also at low level, 10.3%."[12]

The result of the research

During the research, I examined the cases in which individuals traveling in passenger cars died, either as drivers or passengers, during accidents. According to Eurostat data, in 2016, there were 565 traffic accidents resulting in 607 fatalities, of which 270 were in passenger

[12] Sicińska 2019: 113.

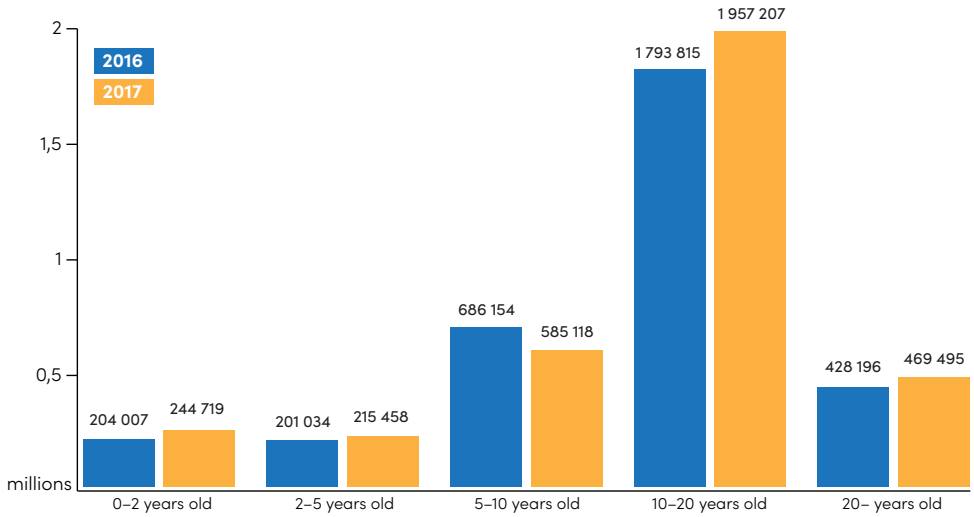

Figure 4: Age composition of passenger cars in Hungary 2016–2017
Source: Eurostat 2023

cars. In 2017, there were 575 traffic accidents resulting in 623 fatalities, of which 277 were in passenger cars (Figure 5).

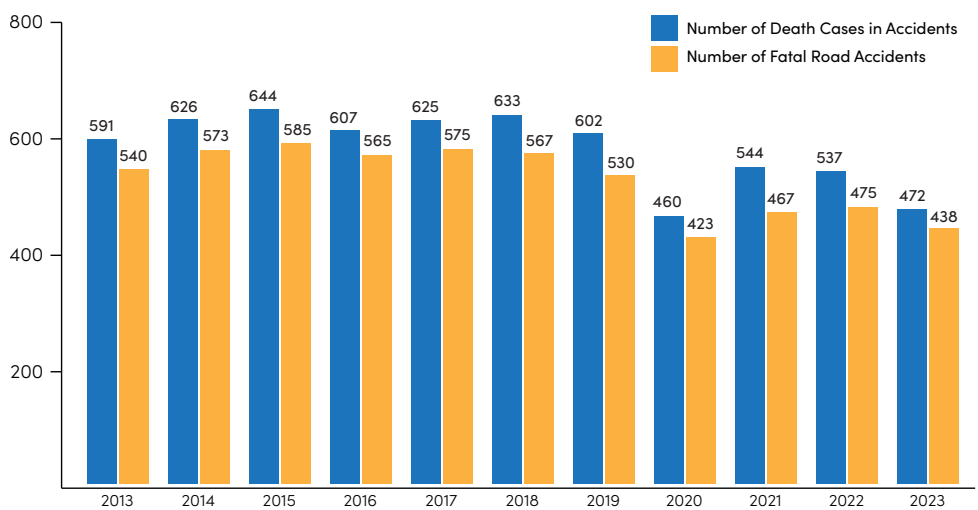

Figure 5: Number of fatal road accidents and number of death cases in road accidents
Source: compiled by the author based on Eurostat 2022

In 2016, the counties reported data on 200 fatal road traffic accidents, totalling 245 individuals. This means I received data on 90% of the fatalities in accidents that occurred in 2016. For 173 of these accidents, I also received data about the age of the vehicle, meaning that I was able to analyse nearly 80% of the accidents that were the subject of the research in that year.

In 2017, I received data on 215 such cases, in which a total of 260 people died. This means I received data on 93.4% of the accidents that occurred in that year. I received information about the age of the vehicle in 198 accidents, allowing me to analyse nearly 86% of the accidents studied that year.

In 2016, the average age of passenger cars was 13.9 years according to the Hungarian Central Statistical Office. Data revealed during the research period indicated that the average age of passenger cars involved in fatal accidents was 16.13 years. In cases where a passenger car collided with another passenger car (considering only passenger cars in the range of accidents) the average age of the vehicles in which no one died was 12.92 years in 2016.

In 2017, the average age of passenger cars was 14.1 years, while the average age of passenger cars involved in accidents was 15.52 years. In cases where another vehicle was involved in the accident and no one was killed, the average age of passenger cars was 12.46 years in 2017.

In both years, it was evident that the passenger cars in which fatalities occurred were significantly older than those they collided with, and in which no fatalities occurred. In both years, it was observable that the average age of the vehicles in which deaths occurred was higher than the average age of the vehicles in circulation, while the average age of the vehicles in which no deaths occurred was lower. The difference between the two categories was more than 3 years in both years.

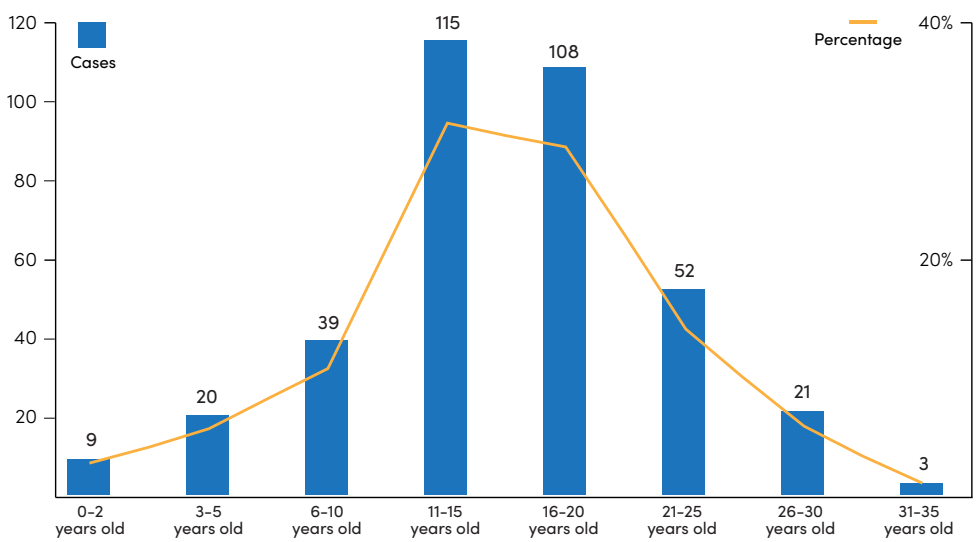

Figure 6: Age groups of vehicles
Source: compiled by the author based on his own research

Figure 6 shows the average age of vehicles sorted by group, in which fatalities occurred in car accidents. In 60.76% of the accidents, the age of the cars falls within the range of 10 to 20 years, while 18.53% of the vehicles are younger than 10 years, and the proportion of vehicles older than 20 years is 20.71%.

I examined the age distribution between counties; however, it was not possible to establish a trend based on the two years studied. In some counties, the average age decreased over the two years, while in others it increased, sometimes being below and other times above the average. Only in Budapest was it noticeable that in both years, the average age of the passenger cars involved in fatal accidents was lower than that of the vehicles in circulation.

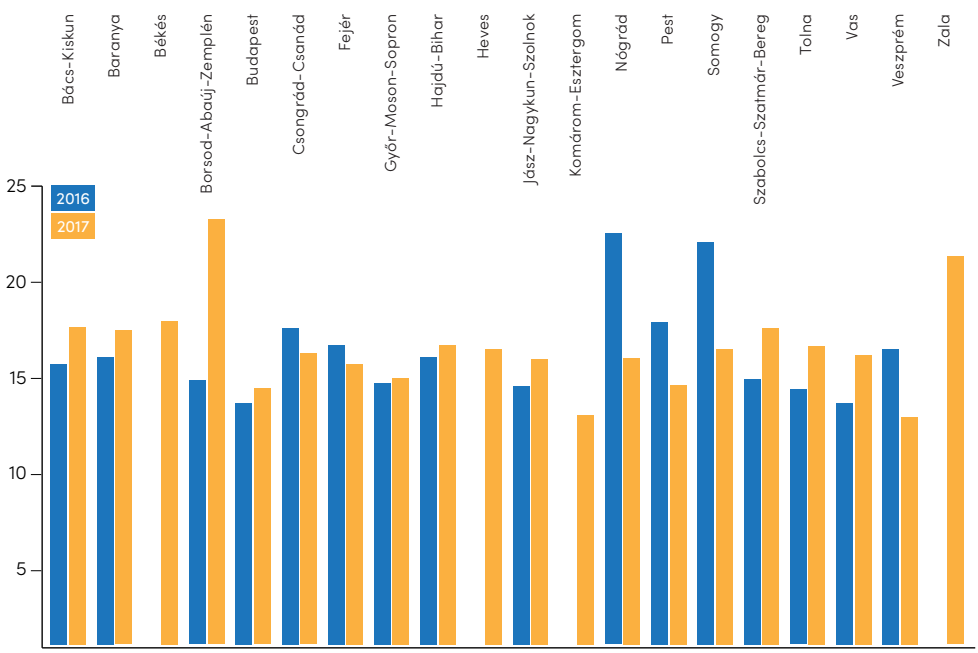

Figure 7: Age distribution of the vehicles involved in fatal accidents between counties 2016–2017
Source: compiled by the author based on his own research

Analysis of the 2016 data

In 2016, in 27 cases, no other vehicle was involved in the accidents. Passenger cars collided with objects and trees during the accident and overturned. In 8 cases, the vehicle collided with a railway vehicle, and in 44 cases, it collided with much larger vehicles, such as buses and trucks.

In 2016, I obtained data on the collision speed in 116 accidents. In each case, I considered the speed of the vehicle that collided with the other vehicle or object at a higher speed. Taking this into account, the average collision speed in 2016 was 75.5 km/h.

While examining collisions with lower-than-average speeds (53 cases), it was found that in 18 cases the vehicle collided with a stationary object, with the lowest collision speed of 45 km/h. The passenger car collided with much larger vehicles in 24 cases, such as buses, trucks and agricultural tractors. In these cases, the lowest collision speed was 34 km/h. Passenger cars collided with other passenger cars in 11 cases, where in 6 cases people died in the vehicle that was hit from the side during the collision of cross-moving vehicles, and in five cases, vehicles collided head-on.

The collision speed was greater than 100 km/h in 18 cases, of which 10 were single-vehicle accidents involving a collision with a stationary object. The highest collision speed was 135 km/h on a road section where the maximum allowed speed was 60 km/h. In 8 cases, the passenger car collided with another vehicle. The highest value was when a passenger car traveling at a speed of 170–190 km/h and collided at 140 km/h with a turning bus traveling on a road section where the maximum speed allowed was 90 km/h.

In 2016, in the 200 accidents examined, I received data on speed in 116 cases, of which the expert determined an absolute speed violation in 70 cases, resulting in the deaths of 80 people. This means that when the speeds of the vehicles were examined, a speed violation was established in 60.3% of the cases. The average age of the speeding vehicles was 15.64 years.

The seatbelt was not used in 70 cases, of which 35 vehicles were also speeding. Among those who did not use seatbelts, the average age of the vehicles was 16.31 years.

Analysis of the 2017 data

In 2017, I received data on 129 cases, and the average collision speed was 77.4 km/h. Examining the lower-speed collisions (61 cases), it was found that in 15 cases, the vehicle collided with a stationary object, with the lowest collision speed being 28 km/h. In 32 cases, the passenger car collided with significantly larger vehicles, such as buses, trucks, or agricultural tractors. In these cases, the lowest collision speed was 66 km/h. In 14 cases, passenger cars collided with other passenger cars, with one case resulting in a fatality during a collision between crossing vehicles, where a person died in the vehicle that was hit from the side. In 11 cases, vehicles collided head-on.

In 19 cases, the collision speed was greater than 100 km/h, of which 5 were single-vehicle accidents involving a collision with a stationary object. The highest collision speed was 130 km/h (the speed before the accident was 140 km/h) on a stretch of road where the maximum permitted speed was 90 km/h, and in all 5 cases, there was a speed violation. In 6 cases, the passenger car collided with another vehicle of significantly greater weight. The highest value was when a passenger car traveling at a speed of 130–140 km/h before its accident collided with a truck at 130 km/h on a stretch of road with a maximum permitted speed of 130 km/h. In 8 cases, a passenger car collided with another passenger car, and in 7 cases, there was a speed violation. The

highest value was when a passenger car traveling at 150–160 km/h before the accident collided with an oncoming passenger car at 135 km/h on a stretch of road where the maximum permitted speed was 90 km/h.

In 2017, out of the 215 accidents examined, I received speed data in 129 cases. In 87 cases, the expert determined that there was a speeding violation, resulting in the deaths of 110 people. This means that when the speed of the vehicles was examined, speeding was established in 67.4% of the cases. The average age of the speeding vehicles was 10.54 years.

The seatbelt was not used in 86 cases. Out of these cases, 34 vehicles were also speeding. In the case of those who did not use a seatbelt, the average age of the vehicles was 16.67 years.

Summary

Based on the data from the two years 2016 and 2017, the overall picture is withering. In 2016 and 2017, I received data on a total of 415 cases where passengers in a car died. In both years, I found that the average age of the cars in which the fatalities occurred (16.13 and 15.52 years) is higher than the average age of cars in traffic (13.5 and 14.1 years). This number is clearly higher than the average age of the colliding vehicles that were involved in fatal traffic accidents with cars, but where passengers did not die (12.92 and 12.46 years).

I received data on the speeds of vehicles in motion and collision speeds in 245 cases. Out of these cases the expert determined absolute speeding in 157 cases. In accidents involving aging vehicles, where individuals died in passenger cars, speed violations were identified in 60% of the cases that were examined. When looking at all accidents in which individuals died in passenger cars, speed violations were also found in 37.8% of these accidents. This is significantly higher than the rate I found in a previous research regarding the speed violation rate in all fatal road accidents, which was around 30%.

The usage rate of seat belt, which is a passive safety device, is not better either. Over the two years, I found 156 accidents (37.5%) where seat belts were not used, and in half of these cases, speeding was also present. The research also revealed that the average age of passenger cars in which occupants died without using seat belts is the highest (16.31 and 16.67).

The rejuvenation of the vehicle fleet would improve traffic safety. "The influence of new-car safety on the fleet's average safety is not immediate. Of course, if all vehicles were replaced instantaneously with new vehicles, there would be a significant benefit, but the reality is that a benefit of that sort of magnitude takes many years to realize."[13] Unfortunately, the sales figures for new vehicles do not indicate that the vehicle stock will become younger. According to the data of the Central Statistical Office, fewer new passenger cars are being registered in Hungary (Figure 8).

[13] Anderson et al. 2009.

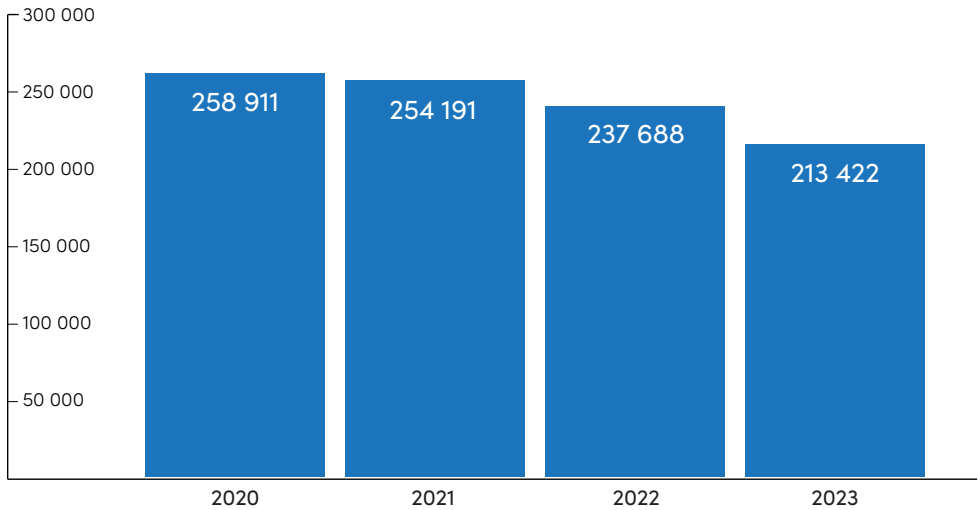

Figure 8: New passenger cars in Hungary
Source: compiled by the author based on KSH 2024

The aging vehicle fleet is further compounded by a lack of responsible driving behaviour. Driving at speeds greater than the speed limits increases the risk of accidents and worsens the outcomes of such accidents.[14] The inconsistent use of passive safety devices, such as seat belts, further exacerbates the severity of accidents. Therefore, it is necessary not only to refresh the vehicle fleet but also to promote responsible driver behaviour.

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