CENTRUM DOPRAVNÍHO VÝZKUMU

HLOUBKOVÁ ANALÝZA DOPRAVNÍCH NEHOD
VYZKUMNEHOD.CZ
OD ROKU 2011

Research on seniors in traffic and e-bikes

TRANSPORT RESEARCH CENTRE

TRANSPORT FOR THE FUTURE

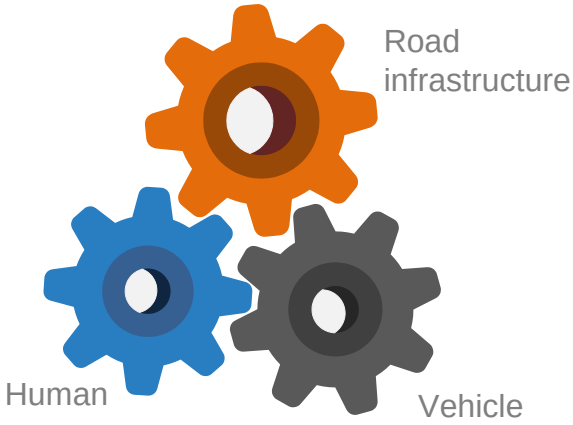
CDV – TRANSPORT RESEARCH CENTRE

CZECH IN-DEPTH CzIDAS ACCIDENT STUDY

Project Czech In-Depth Accident Study (CzIDAS)

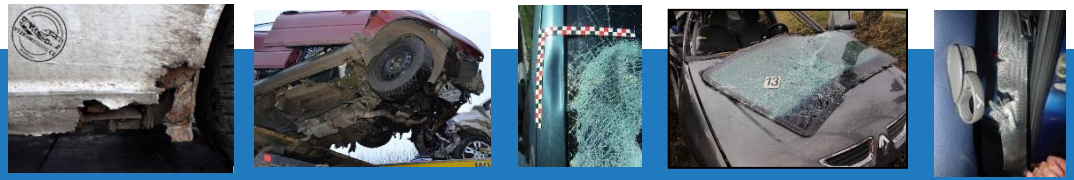
Data from In-depth Accident Analysis

- provide a comprehensive view of all the factors related to a particular accident,
- serve to identify the characteristics leading to the crash occurrence and affect its consequences.



The in – depth accident investigation teams document all relevant information on

- traffic environment
- vehicles
- human factor (human behavior, injury mechanism)

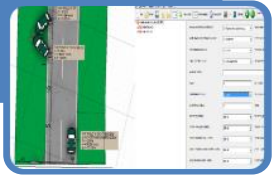


Project Czech In-Depth Accident Study

Crash notification

Investigation on spot

Case processing - database



Crash analysis

countermeasure

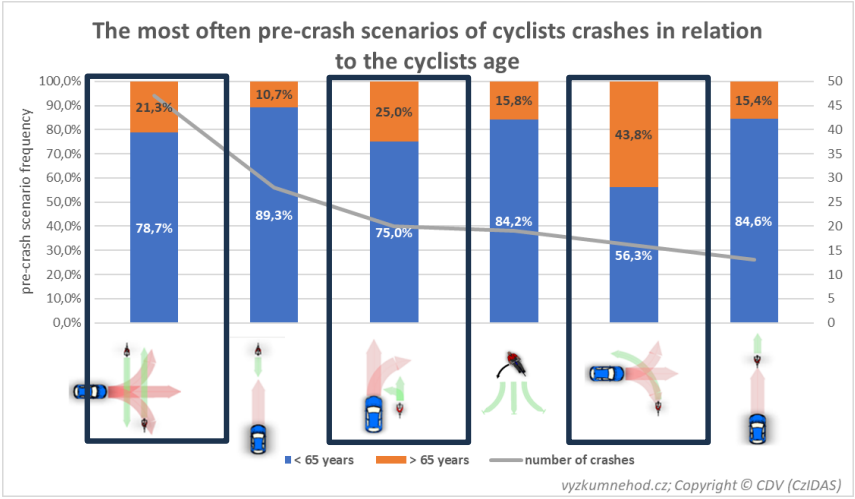
Seniors in road traffic

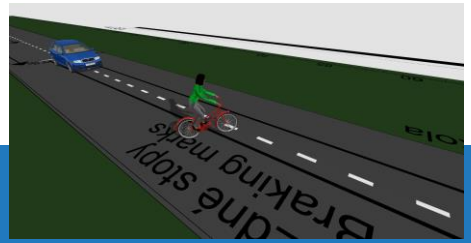
- Seniors are one of the most vulnerable groups in road traffic – they are predisposed to various diseases and take multiple medications, which is also reflected in the total treatment time or hospitalisation of the patient after a crash.
- **Human aging** - awareness and adaptability decrease, **difficulties with adjustment to the new situation** increase, **decline in their cognitive abilities**, changes in the intellectual sphere appear, **perceived sensations is lowered**, thinking processes change, and memory skills decrease
- The **deterioration of cognitive and motoric abilities is reflected in crash contributory factors, which are also related to the crash mechanism.**
- Understanding the crash patterns of senior drivers has become increasingly important as life expectancy increases
- The measures on road infrastructure, improvement of vehicle protection, educational activites and preventive campaigns should **reflect the specifics of senior crashes**

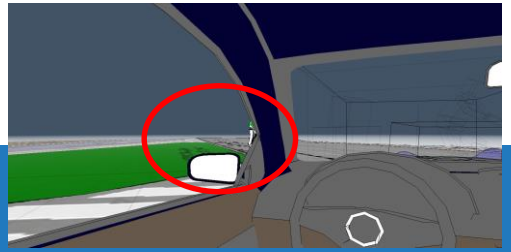
Cyclist Crash mechanism

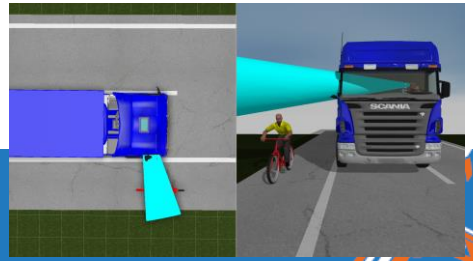
Higher proportion of elderly cyclists

- in crash scenarios at intersections, especially **seniors are significantly more often involved in pre-crash scenarios at intersection when bicyclists turn left.**
- when cyclist change direction during riding or vehicle change direction during driving and crash with cyclist riding in the same direction.





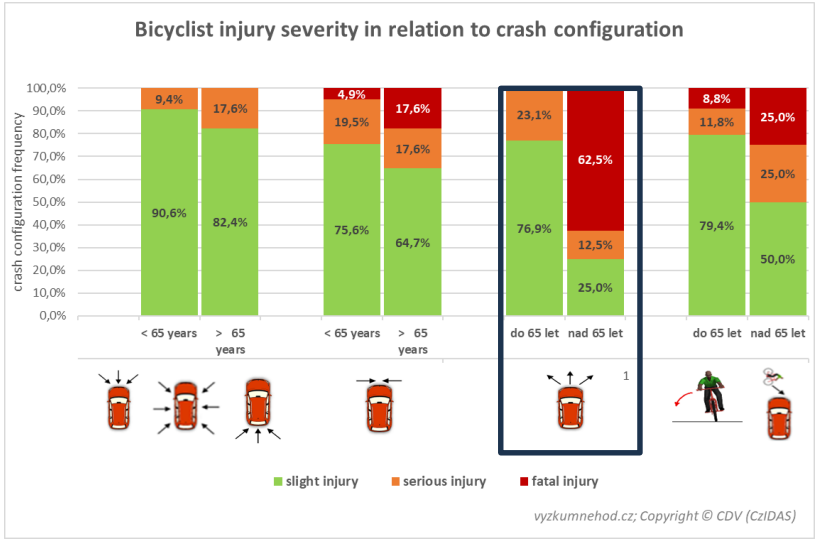


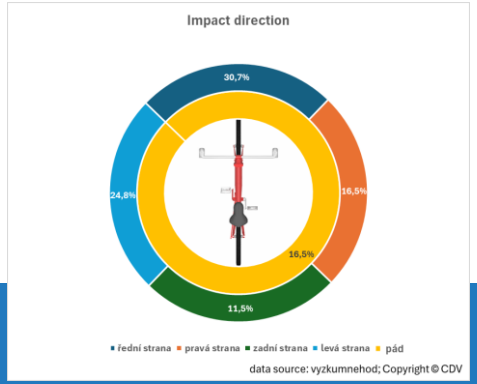


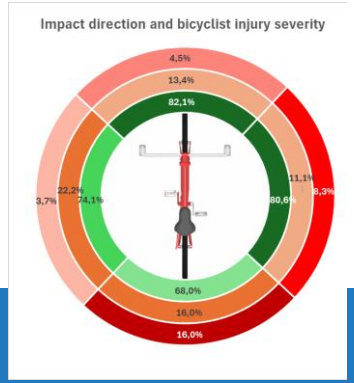
Cyclist crash mechanism and injury severity

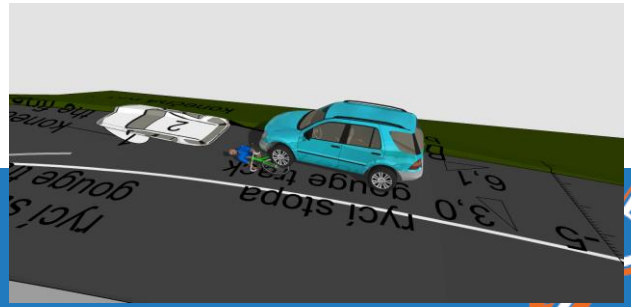
Elderly cyclists are more vulnerable to injury regardless of the crash mechanism.

- The riskiest scenario is rear-ended vehicle collision with a cyclist and also the fall off the bike, especially when including subsequent collision with a vehicle or road infrastructure.





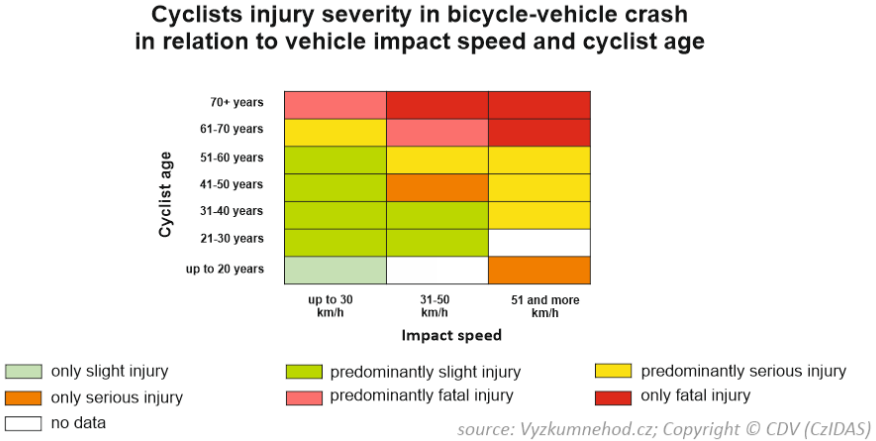




Cyclist crash mechanism and impact speed

Increased probability of severe bicyclist injury is associated with older bicyclists and higher motor-vehicle speeds.

- **the probability of cyclist severe and fatal injuries increase with higher age**
- **even lower-speed crashes could, with higher probability, result in severe injuries.**

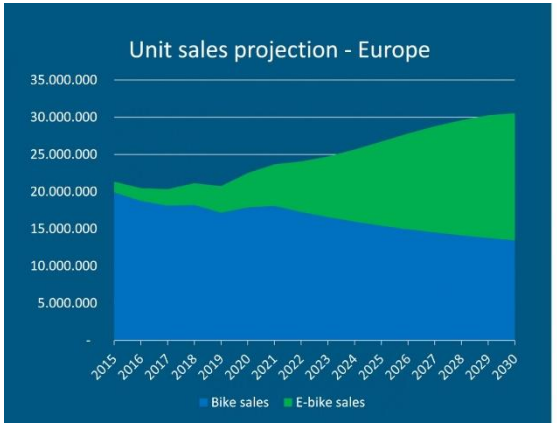


(e)bike sales projections

The rapid rise in e-bike use and sales in many countries

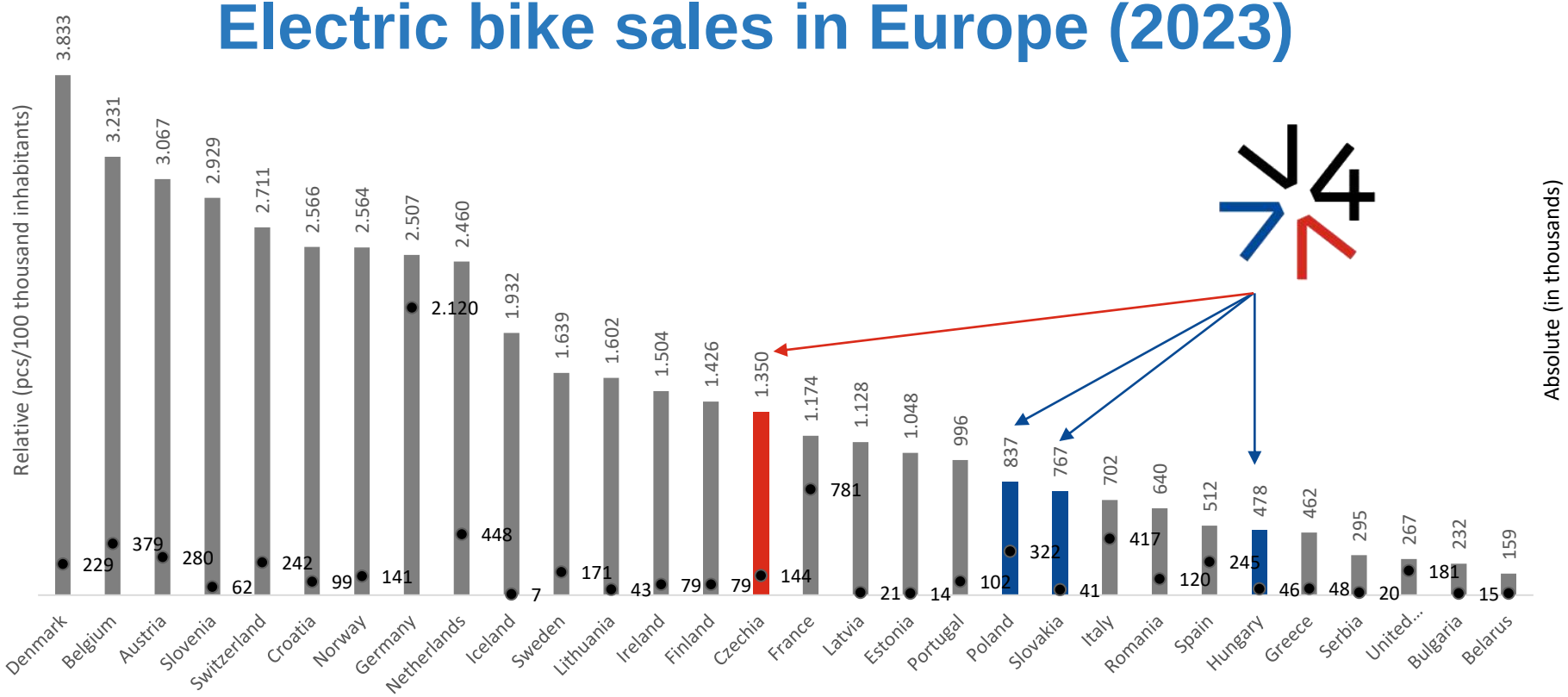
- In 2020, every fifth bicycle sold in EU countries was an e-bike
- it is predicted that by 2030 it will be every second bicycle
- the data about sales in EU countries are periodically updated, data about crashes are often not available and harmonized

The increased number of pedal e-bikes in road traffic raised discussion related to its risks and safety impacts.



Unit sales projections - CONEBI report [https://pro.eurovelo.com/news/2023-03-08_how-do-e-bikes-impact-cycling-tourism]

Electric bike sales in Europe (2023)



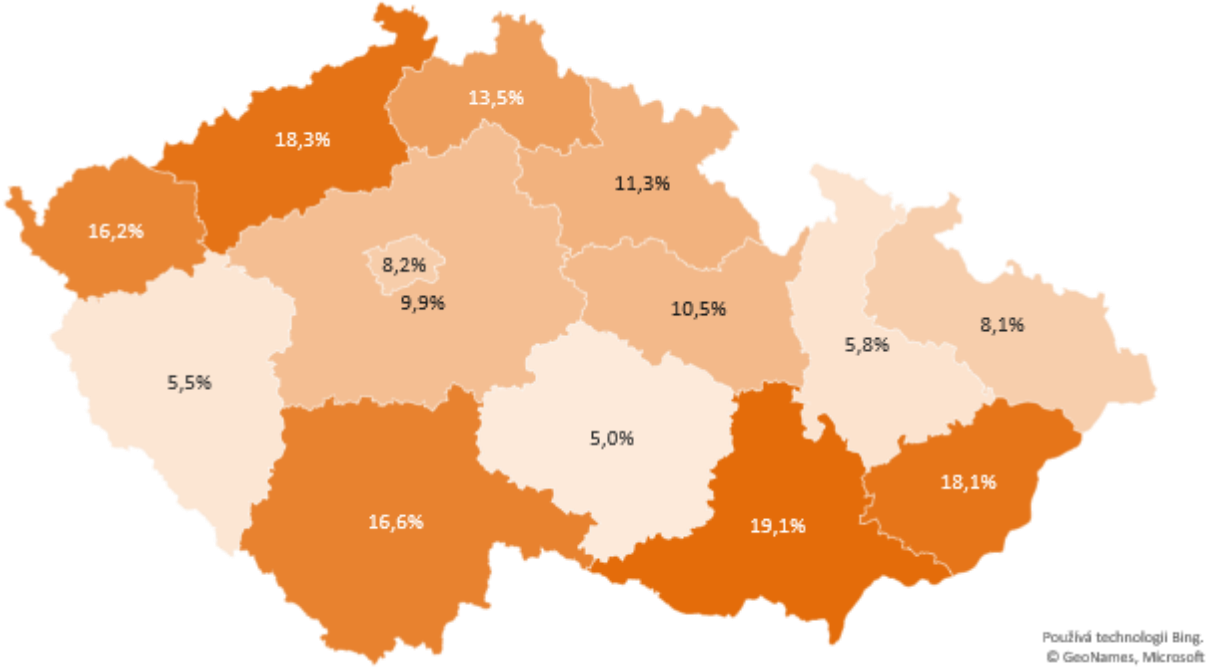
Source of input data: Statista, Eurostat; Graphics by the Transport Research Centre

E-bike crashes risk factors

- **lack of familiarity with pedelecs** and their function and **worse stability of pedelec** in comparison with traditional bikes
- Higher age of pedelecs users (**e-bikes remove a number of barriers to pedal cycling** including fitness and demanding terrain and age characteristic and physical disabilities)
- gender aspects and related **risky behaviour**
- rider attitudes, risk underestimation
- higher speed or speeding
- **underestimation of their speed** by drivers, especially at the intersections

Accidents of cyclists on e-bikes in the Czechia

- In the Czech Republic, the e-bikes accident rate are recorded in detail from January 2023
- Between January 2023 and July 2024, 786 accidents involving e-bikes were recorded
- 689 cyclists on e-bikes were injured, i.e. 11.9% of all injured cyclists (on bicycles)
- the shares in 14 regions are different - see attached cartogram (max. 19.1% in the South Moravian Region)

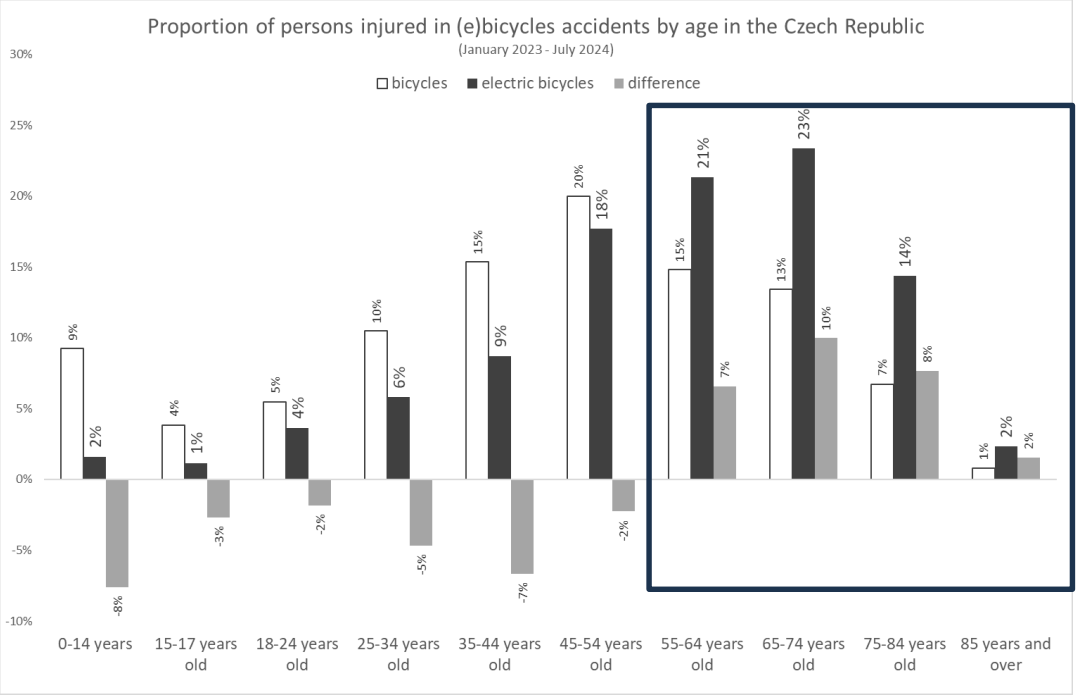


And couple of numbers…….

Injured cyclists by age

higher proportion of elderly in e-bike crashes

- **while on bicycles the proportion of injured seniors (65+) was 21%, on e-bikes it was 39%**
- 6 out of 10 cyclists injured on e-bikes were over 55 years old



Consequences of accidents of seniors (65+) on e-bikes

In the period January 2023-July 2024, 298 accidents involving senior cyclists on e-bikes were registered in the Czech Republic (20% share of all senior cyclist accidents).

These accidents involved:

- 13 persons were killed **(41% of all senior cyclists killed)**
- 22 persons seriously injured (22% of all seriously injured senior cyclists)
- 241 persons slightly injured (20% of all slightly injured senior cyclists)

Note: For the age category up to 64 years, proportions of 9% for accidents, 8% for fatalities, 14% for seriously injured, 9% for slightly injured persons were recorded.

Eight of the ten cyclists killed on e-bikes were seniors (65+)

If these are exclusively e-bike accidents, then seniors (65+) were involved:

- 38% of accidents
- **81% of fatalities**
- 39% of the seriously injured
- 39% of slightly injured

Note: For bicycles (excluding assisted motorcycles), the proportions of seniors (65+) were recorded as 20% for crashes, 37% for fatalities, 27% for serious injuries, and 20% for slight injuries.

Cyclist and e-cyclist injury severity

The overall severity of cyclist crashes is determined by the sum of fatalities and serious injuries in thousands of crashes.

Crashes on e-bikes are about 42% more severe for the elderly than crashes on bicycles (without a motorcycle assist)

The single-vehicle crashes including e-bikes have higher severity in comparison to the single bicycle crashes (2times higher probability of severe injuries of single e-bike crash – 10% for conventional bike and 20 % for e-bikes)

Crash rates for senior cyclists (65+): 41% of crashes

- 69 % of fatalities
- 77 % of seriously injured
- 41% of slightly injured

Senior women (65+) on e-bikes are involved in about 30% of accidents

In the period January 2023-July 2024, 91 accidents involving female senior cyclists (65+) were recorded. Their proportion in terms of gender was thus:

- 30.5% for accidents
- 15.4% for fatalities
- 31.8% seriously injured
- 32.0% slightly injured

Note: For bicycles (without auxiliary motorcycle), the proportion of women was 32.7% for accidents, 10.5% for fatalities, 39.2% for serious injuries and 32.7% for slight injuries.

Causes of accidents involving cyclists on e-bikes

The most common causes of traffic accidents:

- **Incorrect driving style - - - - e-bicyclist‘s fault**
- **Failure to give way ---- e-bicyclist collision opponent‘s fault**

Causes of traffic accidents (guilty cyclist on electric bike)	65+ years		up to 64 years	
excessive speed	36	19%	65	22%
incorrect overtaking	1	1%	4	1%
not giving way	24	13%	34	11%
driving on the wrong side of the road (driving in the opposite direction)	5	3%	5	2%
the driver was not fully engaged in driving the vehicle	44	23%	50	17%
incorrect driving style	**82**	**43%**	**140**	**47%**

Causes of traffic accidents (culprit-collision opponent)	65+ years		up to 64 years	
excessive speed	2	2%	7	6%
incorrect overtaking	6	7%	12	10%
not giving way	**35**	**42%**	**55**	**48%**
driving on the wrong side of the road (driving in the opposite direction)	1	1%	6	5%
the driver was not fully engaged in driving the vehicle	15	18%	10	9%
incorrect driving style	21	25%	17	15%
not the fault of the driver	4	5%	8	7%

E-cyclist fatalities in Czechia

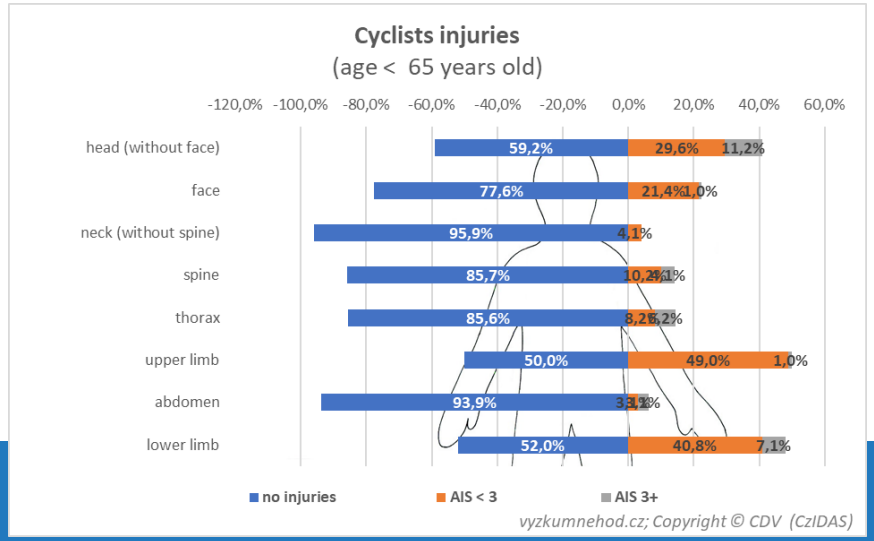
- **92%** of e-cyclists fatal crashes – the **cyclist fault**
  - x 85% of all e-bike crashes, 52 % of all conventional bike crashes
- **58%** of e-cyclists fatal crashes were result of **a single-vehicle crash**
  - x 55 % of all e-bike crashes, 26 % of all conventional bike crashes
- **54%** of fatally injured e-cyclists were **65+**
  - x 45 % of all e-bike crashes, 37 % of all conventional bike crashes
- 31% of e-bike fatal crashes were caused by **inappropriate speed**

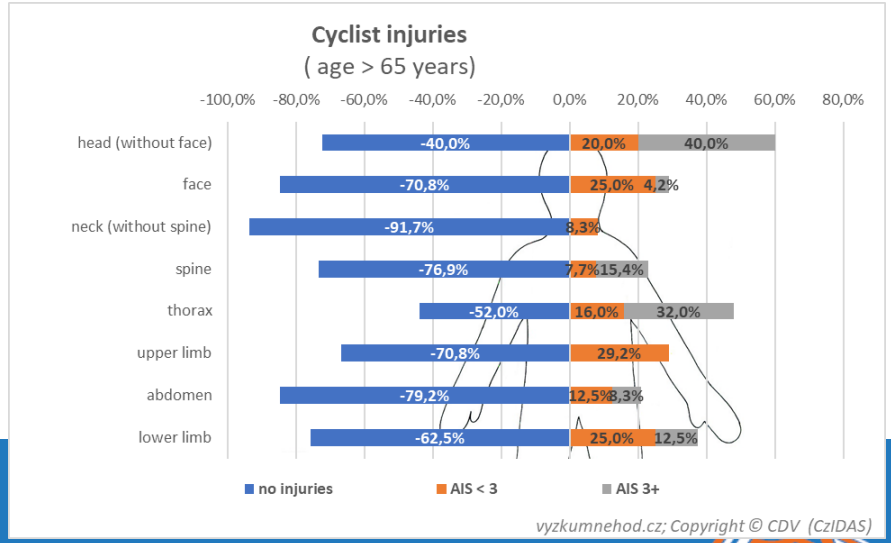
  19% were caused by **inattention**
  - X 24 % caused by inapproriate speed of all e-bike crashes, 11 % of all convenional bike crashes
  - X 21 % caused by inattention of all e-bike crashes, 4 % of all conventional bike crashes

Cyclist injury mechanism

The **most frequently injured cyclist body regions are the lower extremities, the head and the upper extremities**. These locations of injuries are major regardless of age – senior and also non-senior.

- **Older cyclists most often suffered fatal thorax and head injuries.**

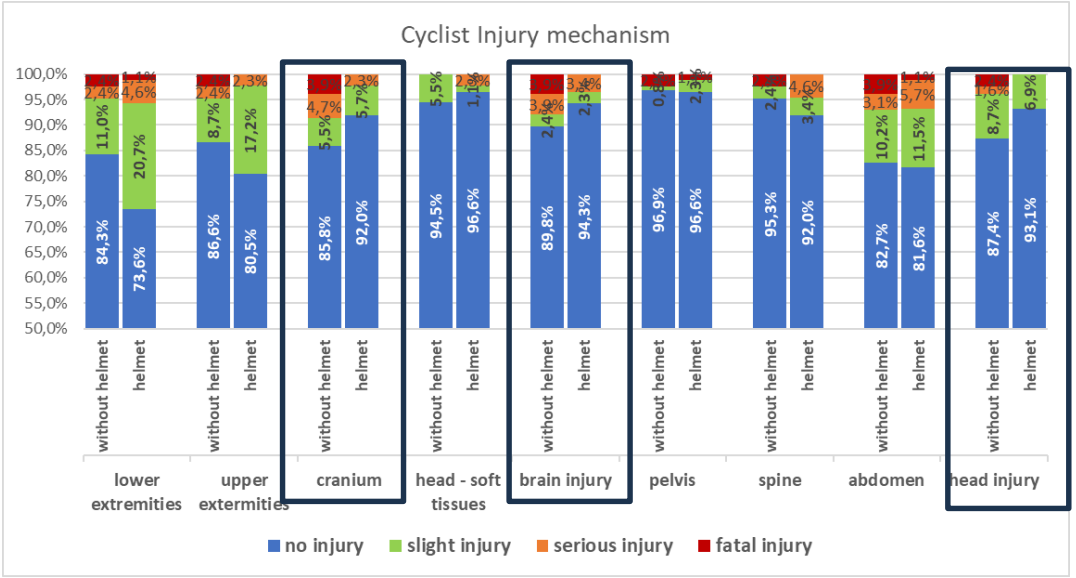




Cyclist injury mechanism and helmet usage

Older cyclists

- main risk group for traumatic brain injuries
- More frequent severe head injuries of elderly cyclists are also related to the less share of helmet use among seniors.



Helmet usage

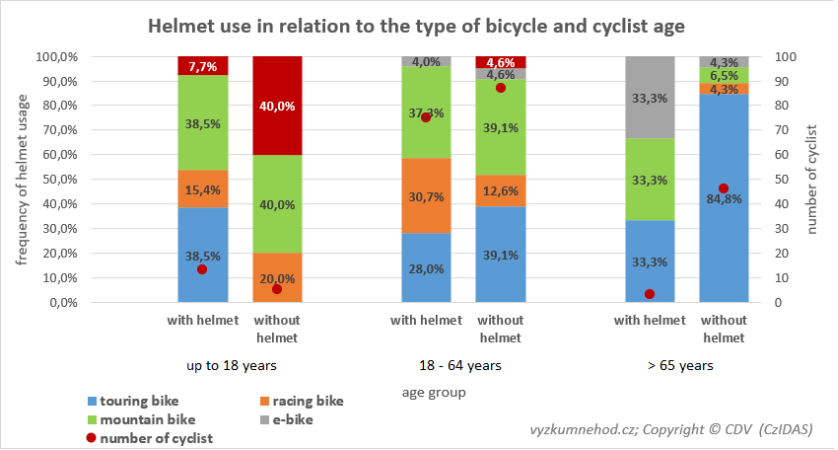
- 37% of fatally injured cyclists could have survived if they had been wearing helmets.
- The most promising contribution of helmets would be with single-vehicle crashes.
- helmet could help more often in the case of side collisions than rear-end collisions.

ESRA3

- 71 % of Czech cyclist do not use helmet (60 % of EU cyclist)

Older cyclists

- risk group regarding head injuries and related helmet usage
- only a minority of senior cyclists (including e-bike cyclists) used helmets during crashes.



Absence of bicycle helmets on electric bicycles

Did not use a bicycle helmet when riding e-bike

between January 2023 and June 2024:

- 56.3% of those killed
- 57.9% seriously injured
- 57.3% slightly injured

For seniors (65+):

- 61.5% of those killed

- 50.0% seriously injured
- 56.8% slightly injured

What can I meet on road?

- Tuned e-bikes
  - E-bikes/Pedelecs support the rider to a speed limit of 25 km/h, considering Czech legislation, pedelecs are approved for use on public roads
  - the use of illegal tuning that allows even higher speeds of their electric bikes
  - presence of road users, whose physical condition would not allow them to cycle without support

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