Serious road injuries in the Netherlands

SWOV fact sheet, December 2023

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Summary

In 2022, the number of serious road injuries in the Netherlands was estimated at 8,300. That number is about 1,500 (over 20%) higher than the 2021 number and also slightly higher than was to be expected considering the upward trend through 2019. In 2020 and 2021, the number of serious road injuries was lower than expected, partly due to the COVID-19 social distancing measures, which meant less traffic on the roads.

In the Netherlands, serious road injuries are defined as persons admitted to hospital for road injuries with a maximum severity of 3 or more on the medical injury scale AIS (MAIS3+)[1]. The estimate of the number of serious road injuries in the Netherlands is based on a combination of the national road crash registration (BRON) and the national hospital discharge register (LBZ).

The number of serious road injuries in 2022 represents 22,500 years lived with disability (YLD). Seven out of ten (70%) seriously injured road users are cyclists. A large majority of them were injured in a crash that did not involve a motor vehicle. In 2022, almost six out of ten seriously injured road users were aged 60 or over, while one in six (16%) was aged 80 or over.

1 How many road users were seriously injured in the Netherlands in 2022?

In 2022, an estimated number of 8,300 road users were seriously injured in the Netherlands. That number is about 1,500 (over 20%) higher than the 2021 number. The 2022 number of serious road injuries is also slightly higher than was to be expected considering the upward trend through 2019 [1] [2].

In the Netherlands, serious road injuries are defined as persons admitted to hospital for road injuries with a maximum severity of 3 or more on the medical injury scale AIS (MAIS3+; for the complete definition, see the question *What is the official definition of a serious road injury?*). Through 2020, hospitalised road injuries with a moderate injury severity (MAIS2) were also included in the number of serious road injuries. The MAIS2 injury group amounted to 19,400 casualties in 2022, again more than 20% higher than the 2021 number, and a higher number than was to be expected considering the trend through 2019 [1] [2].

1. Through 2020, road injuries with an injury severity of MAIS2 were also included in the definition of serious road injuries.

Other sources also mention road injuries with an injury severity that could be considered serious, but for which different definitions are used. According to these sources, in 2022, 80,000 road injuries with an injury severity of MAIS2 or higher paid a visit to an accident & emergency (A&E) department [3] and 15,765 road injuries were acute clinical A&E admissions of which 2,304 had multiple injuries [4]. Most of the 8,300 serious and 19,400 moderate road injuries are part of these two major groups of A&E injuries.

2 What is the official definition of a serious road injury?

In the Netherlands, serious road injuries are defined as casualties admitted to hospital with serious injuries due to a road crash, not having died within 30 days after the crash [1] [5] [6] [7]. A road crash is internationally defined as a crash on a public road, in which at least one moving vehicle is involved. The injury severity of the casualty, expressed as the Maximum Abbreviated Injury Score (MAIS) which ranges from 1 (slight injury) to 6 (maximum injury severity) [8] [9], must at least be MAIS3 [1] [5] [6] [7]. MAIS is an international standard to indicate the severity of an injury. This score can be derived from the patient's various injuries. Examples of MAIS3 injuries are skull base fractures, hip or femur shaft fractures, or wrist or ankle amputations.

Through 2020, road casualties in the Netherlands were defined as 'serious injuries' if their injury severity was MAIS2 or higher (MAIS2+). Examples of MAIS2 injuries are bone fractures and concussions with brief loss of consciousness. After 2020, the Netherlands switched to a definition starting at MAIS3+ in order to match the international and medical definition of 'serious injury'.

Up to 2010, the term 'in-patients' was used in the Netherlands [10]. This term was abandoned because not all of the hospitalised patients were found to be seriously injured and a significant number of them were found to have been hospitalised for observation only.

3 How is the number of serious road injuries determined in the Netherlands?

In the Netherlands, SWOV annually assesses the number of serious road injuries [10] based on two sources:

- *Database of registered road crashes in the Netherlands (BRON).*
  In BRON, the Ministry of Infrastructure and Water Management collects and publishes road crash data based on police registration, notifications by road inspectors of the Dutch national road authority and information from media reports. This database contains information on crash characteristics such as road design features, vehicle characteristics and casualty information. BRON does not contain reliable information about injury severity, and a lot of casualties are missing, particularly those resulting from crashes not involving a motor vehicle.
- *The national hospital discharge register (LBZ).*
  LBZ is a database maintained by Dutch Hospital Data (DHD). It contains injury data of patients discharged after hospitalisation. Examples of data that are registered are crash type, injured body parts and injury types. LBZ contains little information about the crash itself; for example, the crash location is not recorded in LBZ. We assume that LBZ contains all road casualties admitted to hospital. Yet, in the database, not all casualties are identifiable as road casualties. Approximately 95% of serious road injuries can be found in LBZ [1].

SWOV estimates the number of serious road injuries in the Netherlands by linking and analysing the data from both data sources, and also estimates how many serious road injuries are missing in both databases or cannot be recognised as such [1].

The quality of both data sources is crucial for a reliable estimate of the number of serious road injuries. Since the year 2010, the quality of, most notably, BRON has greatly decreased [11]: still sufficient to determine the total number of serious road injuries and motor vehicle involvement, but insufficient to make reliable statements about the trends in serious road injuries with certain characteristics (such as types of road users, age groups, etc.) [1]. About 12% of serious road injuries from crashes without motor vehicles (e.g. cyclists crashing with a bollard or another cyclist) are found in BRON; and about 65% of serious road injuries from crashes with motor vehicles [1]. Based on hospital discharge register LBZ, a more reliable indication can be given of a number of characteristics of serious road injuries. Because LBZ does not contain information about crash location, it is not possible to distinguish between different types of locations on the basis of LBZ. It is hoped that in the future ambulance data can add more information about crash locations.

4 How has the number of serious road injuries in the Netherlands developed since 2000?

Figure 1 shows the trend in the number of serious road injuries from 2000 through 2022. The trend in serious road injuries is upward from 2006 onwards. In 2020 and 2021, the number of serious road injuries was lower than was to be expected considering the trend through 2019; in 2022, the number was slightly higher than this trend [1] [2]. The lower numbers in 2020 and 2021 were partly due to the COVID-19 social distancing measures, which resulted in less traffic on the roads.

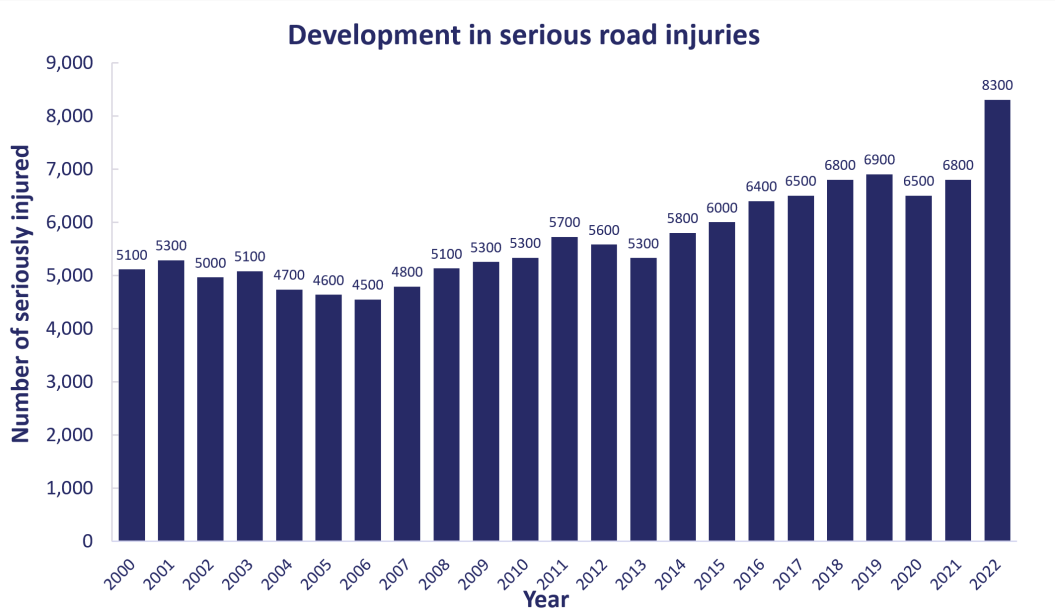

Figure 1. The number of serious road injuries in the Netherlands since 2000 according to the current definition. Source: SWOV, based on DHD and IenW.

5 How are serious road injuries distributed by transport mode and crash opponent?

Since 2010, the *number* of serious road injuries by transport mode has been hard to determine due to poor registration in BRON (see *How is the number of serious road injuries in the Netherlands determined?).* The casualty characteristics based on LBZ appear to be a reasonable alternative. LBZ contains no information about the crash opponent, only whether the crash did or did not involve a motor vehicle.

In the hospital discharge register LBZ, cyclists are by far the largest group among serious road injuries (see *Figure 2*). In 2022, 70% (about 5,500) of the serious road injuries in the hospital registration were cyclists. In comparison: in 2022, about four out of ten road deaths were cyclists and the number of cyclists among road deaths has been the largest group for a number of years now (see SWOV fact sheet *Road deaths in the Netherlands*).

The share of cyclists among serious road injuries in the hospital registration has increased over time (not shown). In 2014, it was 66% (about 3,700), while by 2022, it is estimated that at least 19% of seriously injured cyclists were the result of a crash involving a pedelec; in 2015 (the first year for which we can currently determine pedelec involvement) it was at least 4%.

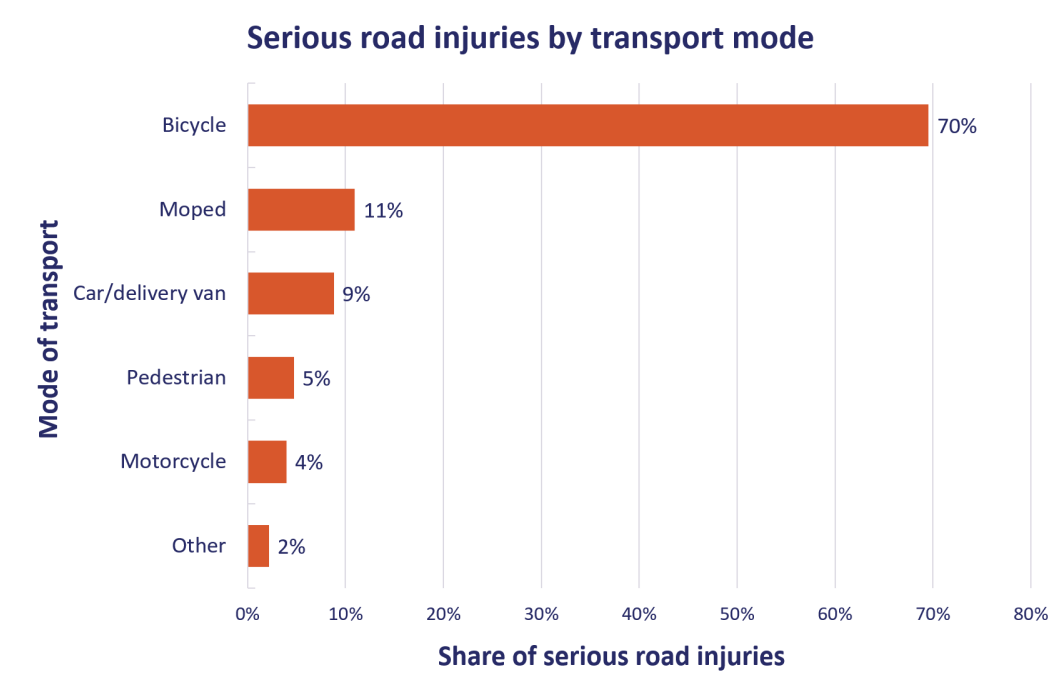

Figure 2. Distribution of serious road injuries in the Netherlands by transport mode in 2022, based on LBZ registration. Source: DHD and SWOV.

In 2022, 61% (about 5,100) of the serious road injuries were injured in a crash not involving a motor vehicle. Among hospital-registered seriously injured cyclists the share amounted to 82%. In particular, these are cyclists injured in a single-bicycle crash (with no crash opponent), a bicycle-bicycle crash, or a bicycle-pedestrian crash.

The *risk* of being seriously injured (serious road injuries per distance travelled) is highest for two-wheelers (motorised or non-motorised). For car occupants, the risk is lowest (*Figure 3*). *Figure 3* provides the average *biannual* risk, because risks calculated on an annual basis, particularly for motorised two-wheelers, fluctuate too much due to uncertainties in mobility data and casualty numbers.[2]

2. Because of a change in method between 2017 and 2018 and the mobility restrictions associated with the COVID-19 measures in the years 2020-2021, we keep using these two-year averages. Once the 2023 road deaths are known, we will add the years 2022 and 2023.

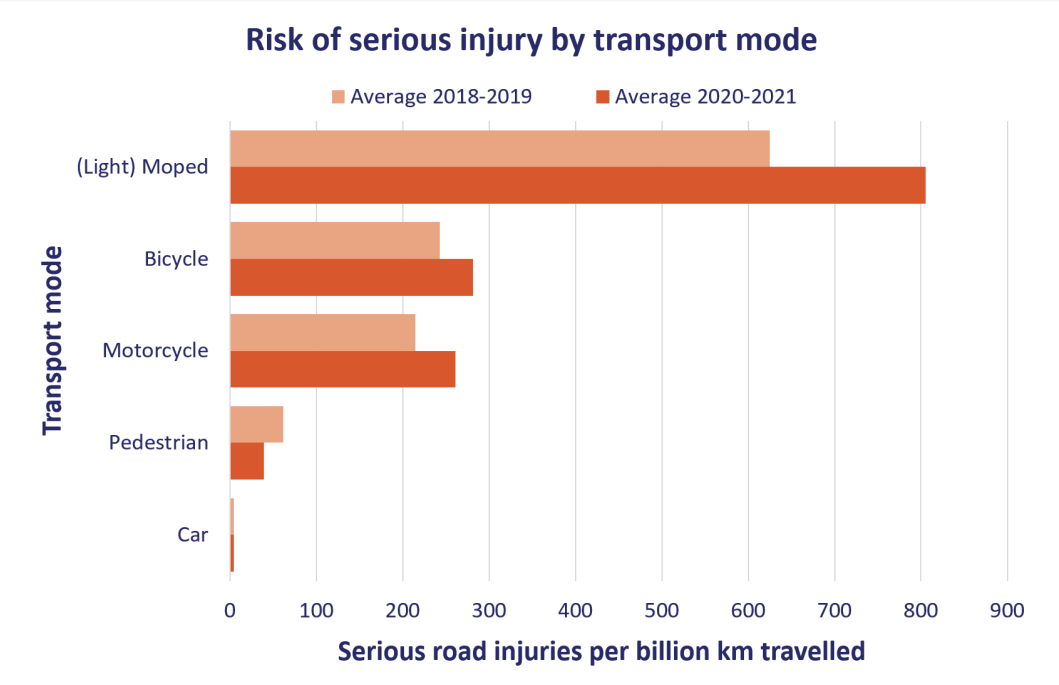

Figure 3. The risk of being seriously injured (number of serious road injuries per distance travelled) in the Netherlands for different transport modes, averaged over 2018-2019 and 2020-2021 based on LBZ. Sources: Statistics Netherlands, DHD and SWOV.

6 How are serious road injuries distributed by age and gender?

Figure 4 shows the 2022 age distribution for serious road injuries, based on the hospital discharge register LBZ. An ever-growing share of serious injuries is sustained by older road users. In 2022, 58% (about 4,500) of the hospital-registered seriously injured road users were aged 60 or over, while in 2014 this had amounted to 51% (about 2,800). The growing share is related to demographic developments, but the share of older road users sustaining serious injuries grows faster than their share of the population. Older people are physically more vulnerable, also see SWOV fact sheet *Older road users*. Among older seriously injured road users, the share of (pedelec) cyclists exceeds that of other age groups.

In 2022, children made up around 3% (about 200) of the hospital-registered serious road injuries; in 2014 this was about 6% (about 300). Also see SWOV fact sheet *Children aged 0 to 14.* Most children are injured while cycling or walking.

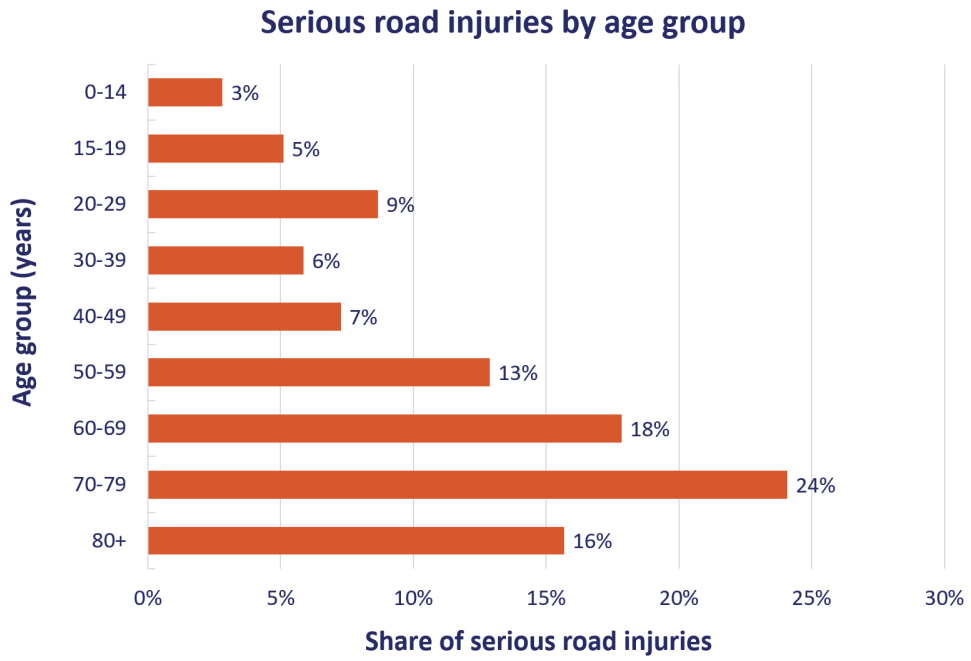

Figure 4. Distribution of serious road injuries in the Netherlands by age group in 2022, based on hospital discharge register LBZ. Sources: DHD, SWOV.

In 2022, 61% (about 4,800) of the LBZ-registered serious road injuries were male and 39% (about 3,100) were female. In general, women are more often injured in crashes not involving a motor vehicle than men are. This partly relates to mobility differences between men and women: men drive more, women more often walk [12].

7 What is the distribution of the number of serious road injuries across different road types?

In addition to casualty characteristics, the crash characteristics themselves (type, location) are also important for road safety research and policy making in this field. Currently, hardly any data are available about crash locations of serious road injuries. This is because location information is only available in BRON (and thus not in LBZ), which only includes part of the serious road injuries (see the question *How is the number of serious road injuries determined in the Netherlands?*). Particularly for serious road injuries sustained in crashes without involvement of a motor vehicle, hardly any crash location information is available.

Through 2009, crashes that did involve motor vehicles were better recorded in BRON. Therefore, we know that up to 2010 about 60% of the registered serious road injuries (definition based on MAIS2+, see the question *What is the official definition of a serious road injury?*) occurred in urban areas. No reliable data are available for the years following 2009. It is expected that, in the

future, the link with ambulance data will provide more insight into the locations where serious injury crashes occur [13].

8 What causes serious injury crashes?

Crashes are usually caused by a combination of factors and thus often have multiple causes [14]. For example, speeding, drink and/or drug driving, and fatigue are known to be factors in the occurrence and/or outcome of crashes. Road design, vehicle characteristics and conditions can also contribute to the occurrence of a crash. However, crash causes are not (reliably) registered in BRON and LBZ. Therefore, it cannot be unequivocally determined in how many crashes the various factors played a role.

However, there is evidence of factors that often play a role in crash causation, for example, from European research on characteristics of serious road injuries among pedestrians, cyclists, motorcyclists and car occupants [15]. This study found the following common crash causes:

- observation or judgment errors;
- inappropriate speed or reckless driving;
- use of psychoactive substances;
- loss of control of the vehicle.

Other contributing factors can be found in various SWOV fact sheets under the topic of Risks.

9 What is the risk of being seriously injured in traffic?

The *risk* of being seriously injured in traffic can be expressed as the number of serious road injuries per kilometre travelled. The risk is highest for two-wheelers (motorised and non-motorised) and has increased for these groups in recent years. The risk is lowest for car occupants (*Figure 5*).

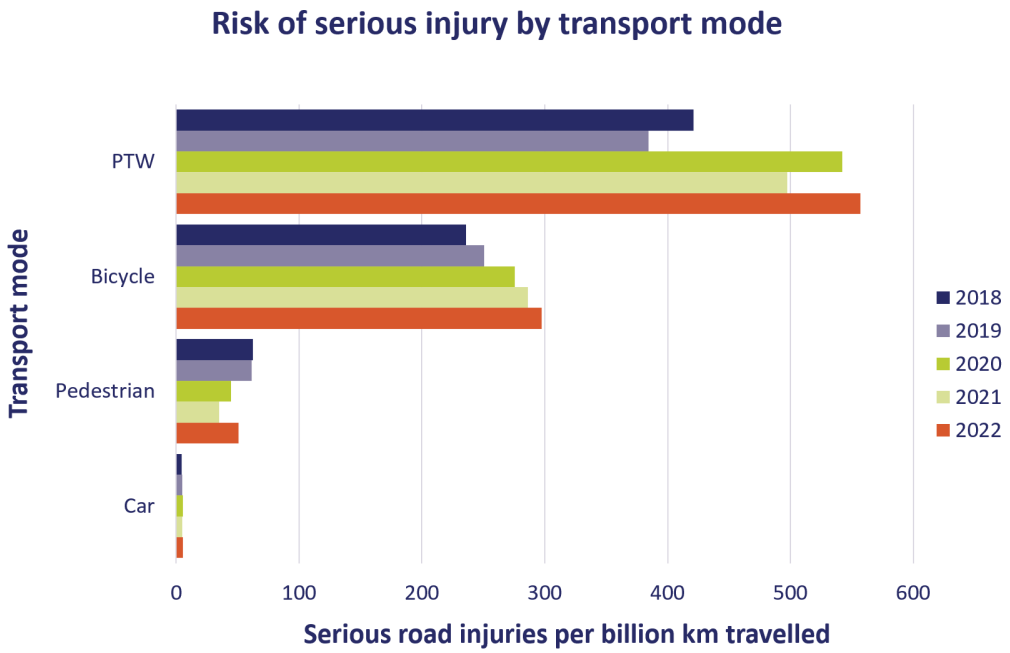

Figure 5. The risk of serious injuries (number of serious road injuries per distance travelled) in the Netherlands for different transport modes, for the years 2018-2022, based on LBZ. PTW = powered two-wheelers. Sources: Statistics Netherlands, DHD and SWOV.

Comparing different age groups, the risk of being seriously injured appears to be highest for older road users and has also continued to increase for this group (*Figure 6*). Teenagers aged 15-19 also have a slightly higher risk than other age groups. This is due to them being novice motor vehicle users; see also SWOV fact sheets *Young drivers* and *Young road users (teenagers and adolescents)*.

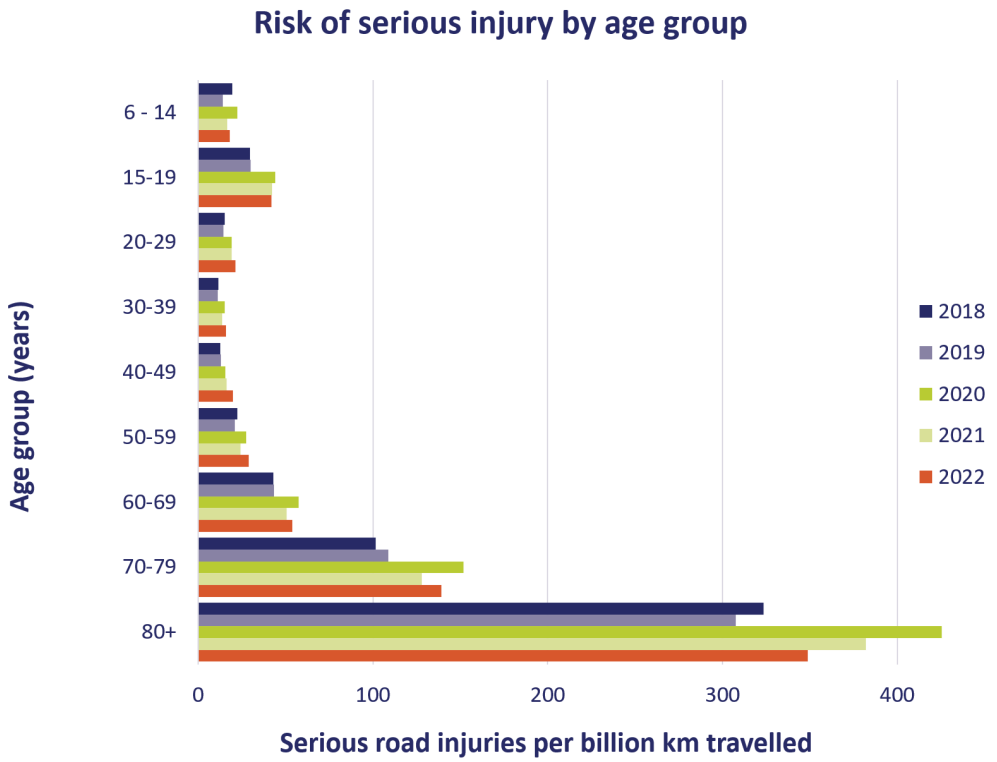

Figure 6. The risk of sustaining serious injuries (serious road injuries per distance travelled) in the Netherlands, for different age groups, averaged over 2018-2022, based on hospital discharge register LBZ. Note: the risk for age group 6-14 is a slight overestimate. Sources: Statistics Netherlands, DHD and SWOV.

10 Which types of injury do road casualties sustain and what is the injury severity?

Figure 7 illustrates which body parts sustain serious injury and to what extent the consequences are acute or permanent (the burden of injury, expressed in the number of years lived with disability (YLD)). Remarkable are the large proportions of hip and leg trauma, followed by head injuries. Lasting effects mainly result from injuries to the head and torso, but also from injuries to the hip and upper leg. Casualties who suffer lasting impairment mainly experience pain and problems with their daily activities. About 33% of the casualties experience lingering effects. The injuries and burden of injury vary between traffic modes, between different age groups and between males and females. For more information, see the report *The road injury burden dissected* [16].

The injury burden of the serious road injuries in 2022 was estimated at 22,500 YLD [1]. The group of hospitalised MAIS2 road injuries – which also used to come under the definition of serious road injuries - was twice as large and had an injury burden of approximately 28,500 YLD in 2022 [1].

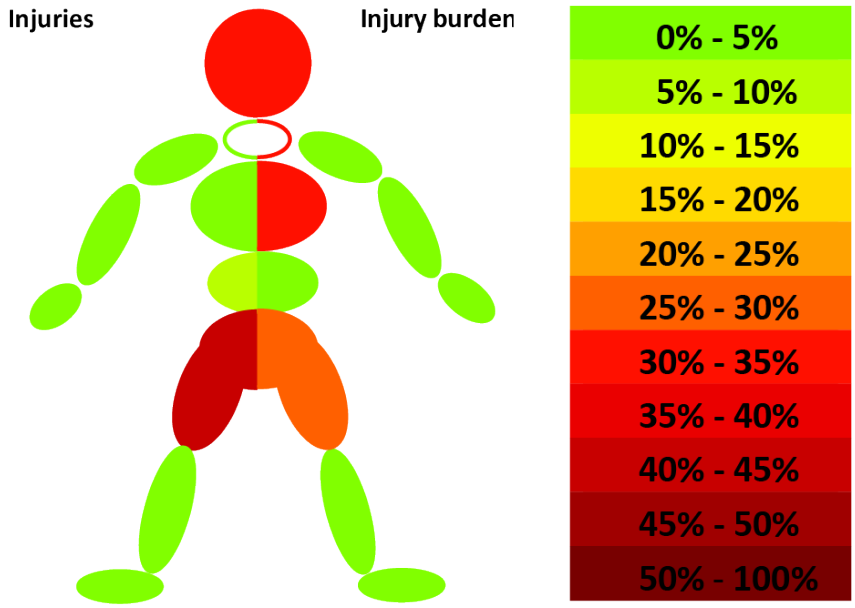

Figure 7. Distribution of injuries and injury burden by body part. The distribution is based on the serious road injuries registered in LBZ in 2014 [16].

11 Which societal costs are caused by a serious road injury?

More than half of the total societal costs of road crashes (about 52%) can be attributed to serious road injuries (situation in 2020, on the basis of the definition current at that time), while the share of road death costs is relatively low (an estimated 15%), see *Figure 8*. Casualties with slight injuries (treated at an A&E department) have a share of about 17% and other casualties a share of about 3% in societal costs.

The total societal costs of road crashes in 2020 are estimated at €27 billion (€15 to €36 billion [17]). This equals over 3% of the gross domestic product. The costs per serious road injury in the current definition are about €1,000,000 million. For more information see SWOV fact sheet *Road crash costs.*

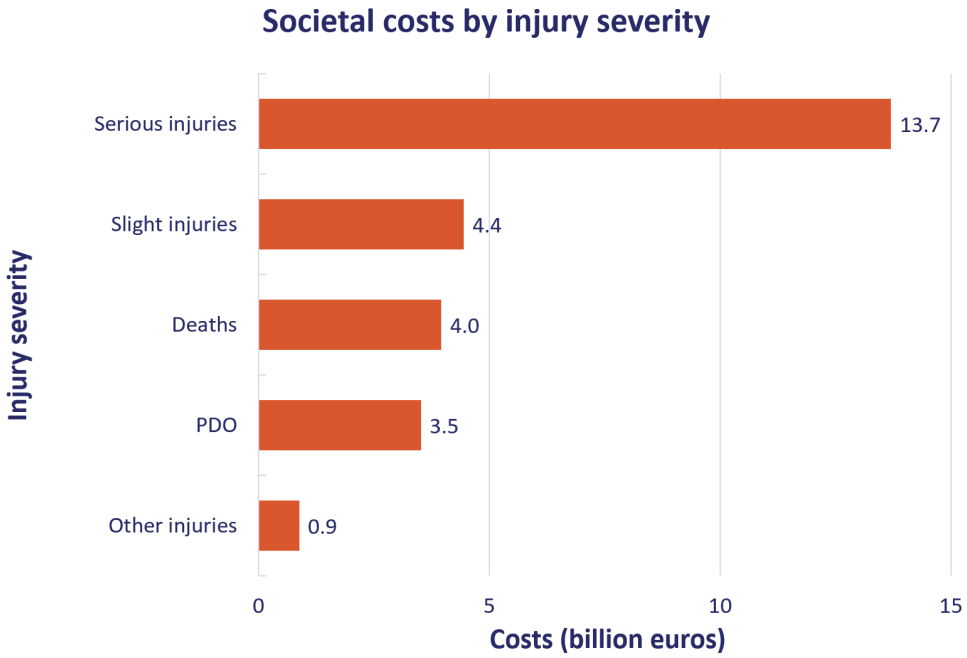

Figure 8. Proportions of road crash costs by damage type (here still according to the 2020 definition: serious road injuries based on injury severity MAIS2+. PDO = crashes with property damage only (17).

12 What is the target for the number of road casualties?

The Netherlands aims for zero road casualties in 2050 [18]. Mid 2021, a parliamentary motion was carried to apply an intermediate target of a 50% reduction in the number of road casualties in 2030 [19]. Quantification of measures that could contribute to this reduction showed that considerable casualty reductions are possible, but that a 50% reduction is probably too ambitious [20], particularly relating to the number of serious road injuries. This number is, as yet, not decreasing but – disregarding COVID years 2020 and 2021 - even shows an upward trend. Through 2020, a national road safety target for serious road injuries applied [21]. This target was not met [22].

International road safety targets have also been determined. Mid-2020, the United Nations extended the previous 2010 target, which implies a 50% reduction of road injuries by 2030 compared to 2021 [23]. The European Union also set targets for the number of road injuries [24]: a 50% reduction of the number of serious road injuries by 2030 compared to 2020. In addition, the objective was that in 2018 as many Member States as possible would know how many MAIS3+ injuries they had. However, the process of gathering information about MAIS3+ injuries in all Member States has not been finalised yet.

13 How does the number of serious road injuries in the Netherlands compare to that in other countries?

Casualties are reported in many different ways in different countries. Definitions and report rates vary, which makes international comparison difficult [25]. For years, the European Commission has been striving for a harmonised definition, based on road crash casualties with MAIS3+ injuries. Quite a number of countries encounter problems in collecting the necessary data (police and hospital data) and performing the required data editing to determine the number of serious road injuries (MAIS3+). In 2014, the European Commission did give a first-time estimate of the number of serious road injuries in Europe: 135,000 [26], for 2019, this estimate was 120,000 [27].

Publications and sources

Below you will find the list of references that are used in this fact sheet; all sources can be consulted or retrieved. Via Publications you can find more literature on the subject of road safety.

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