

# Practical guidelines for determining the number of serious road injuries (MAIS<sub>3+</sub>)

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Within the EU project SafetyCube<sup>1</sup>, guidelines have been developed for determining the number of serious road injuries. This leaflet summarizes these guidelines. For the full guidelines, please see Perez et al. (2016) Deliverable 7.1: Practical guidelines for the registration and monitoring of serious road injuries (<http://www.safetycube-project.eu/publications/>).

Serious traffic injuries have recently been adopted as an additional indicator of road safety. Reducing the number of serious traffic injuries is one of the key priorities in the Policy Orientations for Road Safety 2011-2020 of the European Commission (EC, 2010). In January 2013, the High Level Group on Road Safety, in which all EU Member States are represented, established the definition of serious traffic injuries as road casualties with an injury level of MAIS<sub>3+</sub>. The Maximum AIS represents the most severe injury obtained by a casualty according to the Abbreviated Injury Scale (AIS®).

The High Level Group identified three main ways Member States can arrive at data on serious traffic injuries (MAIS  $\geq$  3):

- 1) by applying a correction on police data,
- 2) by using hospital data, and
- 3) by using linked police and hospital data.

Within SafetyCube, for each of these three ways, practical guidelines have been developed to help countries determining the number of MAIS<sub>3+</sub> road casualties. Moreover, it was examined how comparable data from different methods are and how differences in data availability influence on the results.

The estimated number of MAIS<sub>3+</sub> casualties is highly influenced by the method applied. Linking of police and hospital data leads to the most reliable estimate, followed by the use of hospital data. However, also between countries that apply the same method, differences might occur because of differences in the data and/or differences in the operationalization of the method applied. For the time being, one should be careful drawing conclusions when comparing MAIS<sub>3+</sub> counts between countries. Further harmonisation is certainly desirable over the next years.

## Getting access to hospital data

Hospital data is essential for determining the number of MAIS<sub>3+</sub> casualties with any of the three ways to identify serious injuries; even when applying correction to police data, it is necessary at some point to have hospital data to derive the correction factors. Anonymised hospital data should therefore be available for research or statistical purposes in all Member States. To this end, there should be more inter-sectorial collaboration between the health and the transport actors at national and international level.

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<sup>1</sup> SafetyCube (Safety CaUsation, Benefits and Efficiency) is a European Commission supported Horizon 2020 project. The project's main objective is the development of an innovative road safety Decision Support System (DSS) that will enable policy-makers and stakeholders to select and implement the most appropriate and cost-effective strategies, measures and approaches to reduce casualties of all road user types and of all severities. One of the Work Packages is dedicated to serious road injuries, their health impacts and their costs.

## Recommendations

### Method 1: Applying correction on police data

#### WHEN:

- In case you don't have hospital data for the entire country and/or every year
- In case hospital data become available at a too late stage

#### HOW:

- Use a **sample of hospital data** (previous years and/or part of the country) to derive correction factors that can subsequently be applied to recent police data from the entire country (see *Use of Hospital data* for how to make the right selection within the sample)
- As police and hospital registration differs between different groups of casualties, **multiple correction factors should be derived**. As a first step, one could **model the effects of various variables** (such as year, type of road user, age, gender...) on the ratios of police/hospital registrations. This allows the determination of the variables that significantly affect these ratios and consequently the correction factors.
- **Update correction factors on a regular basis**. Correction factors are likely to vary over time and place. When applying correction factors estimated for one-time period to another one, it is necessary to check first that police registration methods have not changed from one time point to the other.

### Method 2: Use of hospital data

#### WHEN:

- In case hospital data of good enough quality are available and record linkage with police data is not available

#### HOW:

Select all **road traffic casualties** with **MAIS<sub>3+</sub> injuries** in the hospital discharge data:

- Select patients with **external causes for road traffic injuries** (public road): ICD9CM: E810-E819, E826, E827, E829, E988.5; ICD10: V01-89 for those codes for traffic injuries and/or weighting -correcting for non-public road- for non-traffic injury codes
- **Exclude fatalities within 30 days**
- **Exclude readmissions** (as well as scheduled admissions when they are a second episode of a previous emergency injury)
- Select all cases with any **injury diagnosis** (ICD9CM: 800-999; ICD10: S00-T88; AIS injury)
- In case of ICD coded injuries, **assess the severity (AIS)** of each injury using a ICD to AIS recoding tool (e.g. ICDpic, ICDmap90, AAAM, ECIP/Navarra)
- **Determine the Maximum AIS** of each casualty and select all MAIS<sub>3+</sub> (including MAIS<sub>6</sub>) casualties

#### ISSUES TO CONSIDER:

- **External causes** (E/V-codes) may be **missing or misspecified** for many casualties. This makes it difficult to select road traffic injuries. Try to compensate for these missing E-codes by using information from additional sources.
- Only traffic crashes on public roads should be selected, i.e. non-traffic crashes or crashes on non-public roads or terrain should be excluded.

In ICD9 this is arranged by excluding E820-E825 from the selection (crashes where a motor vehicle is involved), but for the range E826-E829 (crashes without involvement of a motor vehicle) there is no way to exclude specific cases. Therefore, a fraction of the cases should be excluded, by sampling or by use of a weighting factor.

In ICD10 the indication of traffic on public road is principally arranged by the 4th digit of the V-code, however this is not always reliable. A country specific weighting factor or sampling should be applied.

- Countries use **different versions of AIS**. To make data from different countries more comparable to each other, the number of MAIS<sub>3+</sub> casualties should be multiplied by a factor 0.89 when injuries are coded in AIS1990 or AIS1998 instead of AIS2005 or AIS2008.
- The estimated number of MAIS<sub>3+</sub> casualties is also influenced by **the ICD to AIS recoding tool** applied. We were not able to produce weighting factors for all tools. We did find that the current version of the AAAM<sub>10</sub> (2016) tool results in a clear underestimation of the number of MAIS<sub>3+</sub> casualties and the tool is not able to deal with truncated codes. Therefore, we recommend adapting the conversion tables for the AAAM<sub>10</sub> tool to better fit European needs.
- In some countries, only a **limited number of diagnoses** is recorded per casualty. This results in an underestimation of the number of MAIS<sub>3+</sub> casualties, as the second or third recorded injury can be more severe than the first diagnosis. The following weighting factors should be applied:
  - 1.28 in case of 1 diagnoses recorded
  - 1.11 in case of 2 diagnoses
  - 1.05 in case of 3 diagnoses
- **ICD codes are truncated** in some countries. Use of truncated codes leads to a less reliable selection of MAIS<sub>3+</sub> casualties. In cases of truncated ICD codes, we currently advise not to use the ICDpic and AAAM<sub>10</sub> tools. The following weighting factors should be used to correct for truncated ICD codes in combination with other ICD to AIS recoding tools:
  - 1.06 in case of ICDmap90
  - 1.03 in case of ECIP/Navarra
  - 1.11 in case of AAAM9

### Method 3: Using linked police and hospital data

#### WHEN:

- In case the selection of MAIS<sub>3+</sub> road traffic casualties is problematic in the hospital data (e.g. in case of many missing External causes (E/V-codes))
- In case one aims for the best possible estimate of the number of serious road injuries

#### HOW:

- **Link hospital and police data** (and possibly data from other sources) on the basis of variables that are common in both data sources.
  - Ideally, linkage is based on a unique personal identification number (**deterministic linkage**), but this is rarely available for privacy reasons
  - When deterministic linkage is not possible, **probabilistic** or distance based linkage is recommend. Commonly used linking variables are date and time of the crash/hospital admittance, location of the crash and hospital, gender and date of birth of the casualty, mode of transport, etc.
- Once the linkage is completed, the number of serious traffic casualties recorded in hospital

data but not identified as such can be estimated using the *capture-recapture* method.

- The capture-recapture approach is based on six conditions, among them the three most important to keep in mind are:
  - The definition of the road casualty in the two data sources should be the same or included into one another.
  - Independence between the registrations: estimation is biased downwards in case of positive dependence, upwards otherwise.
  - Homogeneity of capture by a given registration: homogeneity is usually only valid within subgroups (e.g. mode of transport). These subgroups should hence be taken into account by stratification or modelling methods.

## Further information

This work has been carried out within the EU-project SafetyCube . This project is co-funded by the by the Horizon 2020 Framework Programme of the European Union.

The leaflet summarizes the main recommendations from Deliverable 7.1: Practical guidelines for the registration and monitoring of serious road injuries. The full guidelines can be found on (<http://www.safetycube-project.eu/publications/>). The following authors contributed to the guidelines:

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