

Report

Country Survey

State of the art of
MAIS 3+ assessment in the
FERSI Member States and EU/EEA countries

**FERSI Working Group
“Injury Classification”**

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1. Innovations in reporting on serious road traffic injuries in Europe

In most European countries road traffic injuries are coded by the police. They collect the data at the scene of accident and during the succeeding investigation. It is the exception rather than the rule to find coordinated nationwide representative police and hospital data collection (e.g. Spain, Sweden).

According to the IRTAD-Report “Reporting on Serious Road Traffic Casualties” (2010, p. 25) criteria used in police records and official statistics to classify the severity of a crash vary from country to country. The definitions refer, for example, to length of stay in hospital, long term disability or inability to work.

Due to different definitions and measurement methods, accurate comparisons between countries are not possible and the magnitude of the problem cannot be fully understood and therefore not addressed adequately.

Facing these conditions the European Commission aims to harmonize the definition of a “seriously injured road user” in Europe. In recent years important milestones towards an injury strategy were set, resulting in a definition referring to injury severity.

- 2010 EU Commissions „Policy orientations“ addressed serious road injury
- 2011 EU High Level Group on Road Safety addressed serious road injury; EU Parliament called on Commission to focus on a common definition; Expert group and public consultation
- 2012 Injury strategy key topic at EU High Level Group Meeting
- 2013 Maximum Abbreviated Injury Score (MAIS) confirmed by EU High Level Group

MAIS is an injury severity score that is based on the Abbreviated Injury Scale (AIS). The AIS is an anatomical based coding system used by medical professionals to classify and describe specific individual injuries including the severity of these injuries. In this context, “severity” is categorised according to the probability of death and survival respectively. AIS is by far the most common anatomic scale for injuries. MAIS, the Maximum AIS Severity Score, is used to describe the most severe injury among a group of injuries (i.e. the most severe injury among all injuries of one patient). Each MAIS can range from 1 to 6, with levels 3 to 6 considered as “serious”, “severe”, “critical” and “maximum” injuries.

The EU High Level Group “Road Safety” agreed on injuries classified ≥ 3 according to the MAIS Severity Score (MAIS 3+) to be considered as most relevant for identifying serious road traffic injuries.

The EU High Level Group “Road Safety” describes collection of reliable data as a second step. Member States might choose from three ways to proceed:

- Police data: Continue to use police data but apply a correction coefficient;
- Hospital data: The number of injuries is reported on the base of hospital data using MAIS;
- Link of police and hospital data: The ideal way might be the linkage of police and hospital data, which leads to a more complete picture of serious injuries.

Each way has its advantages and disadvantages. Every Member State should use the method most appropriate for achieving the goal of assessing the total number of serious injuries in its country.

The EU Commission asks all Member States to report on the number of serious injuries in their country for the year 2014 in 2015. In the following years a target for reduction of serious road injury should be set. At the moment a discussion is held about the right time to set this target. The European Commission seems to prefer to postpone the realization of the task arguing that the data collection in the countries is much more difficult than assumed initially. Others (e.g. ETSC) urge to introduce an EU-wide strategic/aspirational target as soon as possible and pronounce that a target would provide a stimulus for EU actions in areas where it has exclusive responsibilities for road safety (e.g. vehicle safety standards) and that an EU target would also inspire competition and knowledge sharing between Member States.

Independently of this discussion the objectives of the EU Commission are ambitious and pose a challenge for all Member States. To address these challenges FERSI established the Working Group (WG) “Severely injured road users in crash statistics”. The main objective of the WG was to produce policy recommendations for the European Commission on the classification of injuries and to promote the introduction of uniform injuries classification in the EU Member States. In 2014 the results of the WG were summed up in a paper “Uniform approach to classification of injuries - Research and implementation measures” and presented to the DG MOVE.

One of the major recommendations of this paper was to support research aiming at:

- understanding how injury data is actually assessed, stored and manipulated in hospitals,
- collecting data on the current state and methods of MAIS assessment and
- identifying possibilities and hurdles for combining MAIS diagnoses and police accident data or other indicators.

2. Country survey on the state of the art of MAIS 3+ assessment

The European Commission (DG MOVE) followed these recommendations and requested FERSI to conduct a survey on the state of the art of MAIS 3+ assessment in the FERSI Member States and EU/EEA countries.

BASt (Federal Highway Research Institute, Germany) in cooperation with DGU/AUC (The German Trauma Society / German Academy of Trauma Surgery, Germany) was charged with the development, conduction, and analyses of the survey.

The aim of the survey is to collect up-to-date, comprehensive, valid and internationally comparable information on the relevant processes, methods, challenges, etc. that are associated with MAIS 3+ assessment in each country.

2.1 Development of the survey

In a first step a draft questionnaire was developed as a WORD document. The questionnaire was structured in six chapters:

1. General information on road traffic crashes (RTC): What has been done up to now?
2. General information on hospitals
3. ICD-coding in hospitals and other relevant data

4. Transformation of ICD-codes (or other hospital data) to AIS
5. AIS-coding in hospitals (no transformation)
6. Reporting on serious injuries regarding MAIS 3+

The draft document was reviewed by five FERSI-partners (SWOV, IFSTTAR, BIVV, KfV, KTI). Resulting from this review some questions were reformulated, supplementary and more detailed questions were added and it was decided to implement the questionnaire online.

Thus in a second step an online version of the questionnaire was produced by UZBONN (University of Bonn). A pretest was conducted and several adaptations were made. The online questionnaire was based on the six chapters named above and contains 68 items. Filter functions, plausibility checks, mouse-over-information, possibility to pause etc. facilitated filling in the questionnaire.

The survey was dedicated to experts of different fields (road safety, medicine, police work, and statistics), thus cooperation between different institutions was in some cases necessary to fill in the questionnaire adequately.

For logging in a password was needed. One password per country was allocated.

A pdf version of the whole questionnaire was offered (see appendix).

2.2 Conduction of the survey

The survey started in February 2015. FERSI representatives of 21 countries¹ were contacted and asked to fill in the online questionnaire. The login-password was sent in a separate e-mail. It was up to each representative to forward the request to other national experts or to fill in the questionnaire by themselves. It was intended to receive one filled in questionnaire per country.

Aiming to implement the survey in European countries not belonging to FERSI, FERSI representatives recommended contact persons from these countries to the BAST coordination team.

The deadline for data collection was set at the end of March 2015 and prolonged first to the April 20th, 2015 and later to the end of July 2015 aiming to increase responder rates.

2.3 Data analysis

The aim of the data analysis was to get an overview of the state of the art of MAIS 3+ assessment in the FERSI Member States and EU/EEA countries. Thus, the activities concentrated on descriptive and comparative analyses. As far as it was possible parallels between countries (e.g. all countries that transform ICD into AIS) are worked out.

¹ Without United Kingdom, as there was no FERSI-representative nominated by TRL at that time.

3. Results

The results are presented in the order of the six chapters of the questionnaire, preceded by the description of some general results.

3.1 General aspects

In February 2015 all 21 FERSI Member States (Austria (AT), Belgium (BE), Czech Republic (CZ), Denmark (DK), Finland (FI), France (FR), Germany (DE), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), the Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Russia (RU), Serbia (RS), Slovenia (SI), Spain (ES), Sweden (SE), and Switzerland (CH)) were invited to fill in the online questionnaire and asked to spread the survey in EU/EEA countries outside FERSI.

Resulting from this no further contacts to countries outside FERSI could be established. Thus the aim to cover all EU and EEA countries was not reached.

Response rate

The deadline for filling in the questionnaire was set until end of March 2015 at first. As just three countries (AT, FI, RU, i.e. 14% of 21 countries) had successfully completed the questionnaire at this point of time the deadline was prolonged until April 20th 2015. Thus the response rate improved to twelve countries (AT, BE, CZ, FR, FI, DE, GR, HU, NL, RU, ES, SE, i.e. 57%). Three countries (IE, IT, SI, i.e. 14%) had partly filled in the questionnaire respectively filling in was stopped by the respondent without sending it.

These interim results were presented at the FERSI General Assembly on April 28th 2015 and countries were invited again to participate in the survey and to contact relevant persons outside FERSI. Resulting from this a second prolongation of the deadline was agreed on (31.07.2015).

By the end of July 2015 15 countries had successfully completed the questionnaire (AT, BE, CZ, FR, FI, DE, GR, HU, IT, IE, NL, RU, ES, SE, SI, i.e. 71%). Six FERSI Member States (DK, NO, PL, PT, RS, CH¹ i.e. 29%) missed to respond. Referring to the total number of FERSI/EU/EEA countries (N=34) 44% of these countries could be reached.

Referring to the countries that completed the survey some chapters or questions could not be answered. In these cases the respective countries are omitted from the analyses.

Time needed to fill in the questionnaire

The online access automatically assesses date/time when the respondent started to fill in the questionnaire and when he/she finished. The time needed to fill in the questionnaire ranges between 35 minutes and 46 days. This big range might be explained by different factors: number of experts needed to answer all questions and corresponding coordination, possibility to pause filling in the questionnaire, different states of establishing MAIS 3+ assessment in the countries and thus different familiarity with the topic.

¹ Switzerland answered in October 2015; the results are not included yet.

3.2 General information on road traffic crashes (RTC): What has been done up to now?

The first chapter of the survey consists of eight items and asks for “General information on road traffic crashes (RTC): What has been done up to now?”. The first item asks which institutions are responsible for RTC data collection, data analysis and dissemination of official statistics.

All 15 countries state that **RTC data collection** (table 1) is in the responsibility of the police. Furthermore three countries state that hospitals (GR, RU, SE) respectively the ministries (BE, GR, NL) are responsible for RTC data collection as well. Agencies of statistics are involved in RTC data collection in five countries (CZ, HU, IT, NL, RU). “Other institutions” are named by five countries (CZ, FR, GR, NL, SE).

Table 1: Which institutions are responsible for RTC data collection?

Country	Police	Hospitals	Ministries	Agencies of statistics	Other institutions
AT	X				
BE	X		X		
CZ	X			X	Masaryk University Institute of Biostatistics and Analyses
ES	X				
FI	X				
FR	X				IFSTTAR and the Rhone road trauma registry
DE	X				
GR	X	X	X		CERTH/HIT
HU	X			X	
IT	X			X	
IE	X				
NL	X		X	X	SWOV Institute for Road Safety Research
RU	X	X		X	
SE	X	X			The Swedish Transport Agency
SI	X				

The answers referring to the question, which institutions are responsible for **RTC data analysis** (table 2), reveal that most often agencies of statistics are responsible for RTC data analysis (AT, CZ, FI, DE, GR, IT, RU, SI). In all countries except for Finland at least one other institution (police, hospitals, ministries, and other institutions) is responsible as well.

Table 2: Which institutions are responsible for RTC data analysis?

Country	Police	Hospitals	Ministries	Statistics Agencies	Other institutions
AT			X	X	KFV and others
BE			X		Belgian Road Safety institute
CZ	X			X	Masaryk University Institute of Biostatistics and Analyses
ES					DGT
FI				X	
FR			X		IFSTTAR and the Rhone road trauma registry
DE				X	BASt = Federal Highway Research Institute
GR		X		X	CERTH/HIT Academia
HU	X				KTI Institute for Transport Sciences Non-profit Ltd.
IT			X	X	
IE					Road Safety Authority
NL			X		SWOV
RU	X	X		X	
SE					The Swedish Transport Agency, Transport Analysis, the Swedish Transport Administration (and others)
SI	X			X	

Dissemination of official statistics (table 3) belongs in most countries (AT, CZ, FI, DE, GR, I, NL, RU, SE) to the responsibility of the agencies of statistics. In five of these countries (AT, CZ, FR, GR, I, NL) this task is also accomplished by the police, ministries and/or “other institutions”. In Hungary and Slovenia solely the police is responsible for dissemination and in Spain it is solely DGT.

Table 3: Which institutions are responsible for dissemination of RTC official statistics?

Country	Police	Hospitals	Ministries	Agencies of statistics	Other institutions
AT			X	X	KFV and others
BE			X		Belgian Road Safety institute
CZ	X			X	
ES					DGT
FI				X	
FR			X		
DE				X	
GR	X		X	X	CERTH/HIT Academia
HU	X				
I			X	X	
IE					Road Safety Authority
NL			X	X	SWOV: true number of serious injuries (MAIS2+)
RU				X	
SE				X	
SI	X				Statistical office

The respondents were further asked if their country reports annual RTC statistics. The answer was “Yes” for all 15 countries and in all countries these official statistics are based on police data (e.g. accident records). Further data sources are named by eight countries (table 4).

Table 4: What data source(s) are these official statistics based on?

Country*	Police data (e.g. accident records)	Hospital data (e.g. patient charts)	Death cause data	Other data	Not known
AT	X				
BE	X				
CZ	X	X	X		
ES	X				
FI	X		X		
FR	X			X ¹	
DE	X				
GR	X	X			
HU	X	X			
I	X				
IE	X				
NL	X	X	X	X ²	
RU	X	X			
SE	X	X	X	X ³	
SI	X				

¹ The Rhone road trauma registry, based on hospitals, emergency departments and forensic institute data, so that it includes patients, outpatients (from emergency departments), and deceased (on the scene or later)

² Court files of fatalities (as a part of death causes)

³ Please note that the official statistics is based on police data but other sources are used for quality assurance of the police reported accidents.

The next question asked, if the official statistics report on different injury severity categories. In most countries (AT, BE, CZ, ES, FR, DE, GR, HU, IE, NL, SE, SI) this is the case, but three countries (FI, IT, RU) do not report different injury severity categories.

All countries that report different injury severity categories distinguish between fatalities, serious and slight injuries.

The countries were asked to report the definitions of these injury severity categories. The answers reveal – as already summed up in the IRTAD report – similarities and differences between countries. The **definition of fatalities** is in eleven countries (AT, BE, ES, FR, DE, GR, HU, IE, NL, SE, SI) almost the same and indicates that a person who dies within 30 days as a result of the accident is defined as a RTC fatality. Four countries (DE, HU, NL, SE) specify that suicides are excluded. Only in the Czech Republic fatalities are defined by using the Abbreviated Injury Scale. Persons coded with AIS of 6 (maximum) are defined as fatalities.

All countries state that the **official report on RTC fatalities** is based on police data. In six countries (CZ, ES, GR, HU, NL, SE) death cause data and in two countries (GR, SE) hospital data is used as well. “Other data” (not further specified) is noted by the Netherlands and Sweden.

A more heterogeneous picture reveals regarding **definitions of serious and slight injuries**. Therefore the respective answers of the countries are quoted (table 5).

Table 5: How are serious and slight injuries defined?

Country ¹	Serious injuries	Slight injuries
AT	According to § 84 para. 1 of the Criminal Code, a serious injury leads to more than 24-day health damage or a disability (or sick leave in case of employment). In practice, the police at the scene of an accident decides on the severity of an injury (serious, slight, no injury).	All injuries which are not serious
BE	Road casualties admitted to hospital for more than 24 hours	All road victims that are not fatally or seriously injured
CZ	AIS = 3-5	AIS = 1-2
ES	Hospitalized for more than 24 hours, or MAIS3+	Not seriously injured.
FR	hospitalized more than 24h, since 2005	not hospitalized or less than 24h
DE	hospital care > 24h	ambulant care or hospital care < 24h
GR	According to the medical personnel professional opinion	Not hospitalized, treated and went home
HU	Any person, who, due to the accident, sustained serious injury, which a) necessitates hospitalization for more than 48 hours within seven days after occurrence or b) caused fracture, except for finger, toe, nose fractures or c) caused cut wounds, which resulted in serious bleeding or nerve, muscle or tendon injuries or d) caused injury of inner organs or e) caused burn of second or third degree or burn affecting more than 5% of body surface.	Any person, who suffered slight injury which does not need hospitalization, except for 24 hour-long observations.
IE	An injury for which the person is detained in hospital as an 'in-patient' or any of the following injuries whether or not detained in hospital: fractures, concussion, internal injuries, crushing, severe cuts and lacerations, severe general shock requiring medical treatment.	Where there are no deaths or serious injuries. A minor injury is an injury of a minor character such as a sprain or bruise.
NL	MAIS 2+, in hospital (not died within 30 days)	Not to hospital or MAIS=9 or 0 or 1 in hospital.
SE	A person who obtained fracture, crush injury, laceration, severe cutting injury, concussion or internal damage. If a person is affected by other damages that is expected to bring hospitalization this person is also considered seriously injured.	Injured but not seriously injured according to the definition above.
SI	Any injured persons who were involved in a road traffic accident and sustained injuries due to which their lives were in danger or due to which their health was temporarily or permanently damaged or due to which they were temporarily unable to perform any work or their ability to work was permanently reduced (Penal Code of the Republic of Slovenia).	Any persons injured excluding persons seriously injured.

¹ Filter: Just countries that answered the question "Do the official statistics report on different injury severity categories?" with "Yes" (n=12).

Official reports on serious RTC injuries are based in all countries – except for Greece – on police data. In Greece solely hospital data is used. In Spain, the Netherlands and Sweden hospital data is used additionally to police data.

Official reporting on slight injuries is based on police data alone in nine countries (AT, BE, CZ, ES, FR, DE, HU, IE, SI). Greece, the Netherlands and Sweden use hospital data as well. In Greece “other data” (not further specified) is also applied.

The countries had the possibility to comment their answers. Eleven countries made a statement:

BE: “Official data on RTC are based on police records, but national hospital data on the number of inpatients due to RTC are available (but these are not making part of "official RTC statistics").”

CZ: “Police and IHIS CR data about deaths caused by RTC differs due to distinct definitions of RTC death (Police data are lower than IHIS CR data).”

Spain: “In order to compile road traffic crashes statistics, official data on fatalities, hospitalized injured people for more than 24 hours and slightly injured people are gathered from police records. To quantify under-reporting we use hospital data and from them MAIS 3+ are estimated.”

FI: “Severity of injuries in 2014 data will be available Dec. 2015”

FR: “other data= from the Rhone road trauma Registry”

GR: “Underreporting by police is known for selected road user types, e.g. pedestrians, bicyclists and single-vehicle crashes (external validity is suboptimal). Internal validity of police data is high (national representativity; longitudinal analyses).”

IT: “In Italy, the national road accident database is maintained by the National Institute of Statistics (ISTAT). The accident database contains information about all traffic accidents that occurred in Italy and caused injuries to persons. The main purpose is to inform citizens of all aspects related to the phenomenon, for this reason ISTAT publishes an annual report on road accidents. Data collection is carried out mainly by the three police authorities: State Highway Police, "Carabinieri" (national military police) and Local Police inside urban area. Other public subjects involved in accident data collection are: ISTAT (coordinating the data collection at national level), chief cities Statistical Offices and in some cases Regional and Provincial administrations (generally their Statistical Offices) responsible for data collection in their administrative areas. Data collection is not standardized among the different Police groups. Police reports are drafted according to different protocols. This data is then used to fill in the “ISTAT accident form”, a national standardized form drawn up by ISTAT. It contains accident information such as type of road, weather condition, lighting, type of accident and so on. Once the ISTAT form has been completed, it is sent to the local office of the respective police authority, who forwards the data either directly to ISTAT (small cities) or to the Provincial Capital Statistical Office (for medium-large cities), who sends it to ISTAT. The quality of final statistical information is strongly related to the level of collaboration of these police authorities. ISTAT is responsible for the data input in the national road accident database.”

“The main problem of road accident data collected by means of the ISTAT module is that the data variables do not provide some important information like exact location and injury severity. Moreover, there are many different authorities in charge of data collection, there is no standardization of Police report forms, each investigation body has its own way of coding and the transmission to ISTAT involves at least two

intermediate steps. The standardization of the data collection system and the updating of the data collection form would clearly be beneficial for the overall data quality. Some improvements to the system have been done (e.g. since 2012 Carabinieri have their own digital data collection system at national level), however this is a slow on-going process.”

IE: “Numbers for fatalities are likely to be very reliable. We suspect that serious injuries are underreported.”

NL: “Serious injuries based on matched Hospital & Police data, including an estimate of missing data (Capture/recapture like).”

SE: “The Swedish Police forces have had problems with a new administrative tool which has led to an unfortunate greater loss of data during 2013 and 2014. This should not affect the quality of the statistics on fatalities. As for the reports on injuries, Sweden calculates risk of medical impairment on hospital data to capture the development towards the Vision Zero goal.”

SI: “National Institutes of Health also collect injuries from road accidents, but official data are based only on police data.”

Taking these comments into account the current heterogeneity between countries regarding assessment of and reporting on RTC injuries becomes obvious. Consequently the prerequisites, like a uniform national data collection systems by the police or the knowledge about underreporting, under which MAIS 3+ assessment will start are very different in each country.

3.3 General information on hospitals

The second chapter of the survey consists of three items and asks for general information on hospitals.

The first question asks for the number of hospitals in the country. It is distinguished between “all hospitals”, “hospitals that regularly treat RTC injuries” and “hospitals that treat serious RTC injuries”. Further on the respondents could mark if the reported number is an estimate or the exact number. The results are shown in table 6.

Table 6: How many hospitals exist in your country?

Country	Approximate total number of <u>all</u> hospitals (acute care hospitals)	Approximate number of hospitals that <u>regularly treat RTC injuries</u> (in-patients; slight and serious injuries)	Approximate number of hospitals <u>that treat serious</u> RTC injuries
AT	200 ¹	120 ¹	120 ¹
BE	141 ¹	141 ¹	141 ¹
CZ	156 ²	156 ²	11 ²
ES	789 ²	not known	not known
FI	not known	not known	not known
FR	2000 ^{1, 3}	800 ^{1, 3}	500 ^{1, 3}
DE	1668 ²	900 ¹	600 ¹
GR	314 ²	not known	not known
HU	91 ²	67 ²	not known
IT	634 ¹	not known	not known
IE	no answer	no answer	no answer
NL	131 ²	131 ¹	131 ¹
RU	5006 ²	no answer	46 ²
SE	71 ¹	not known	not known
SI	no answer	no answer	no answer

¹ Estimate² Exact number³ Public hospitals. In addition, some private hospitals can also support some RTC victims, but their number is not exactly known

The next question focuses on hospitals that regularly treat RTC injuries and asks if there are different hospital levels in the country. For each hospital level the national definition and the number of hospitals (estimate or exact number) should be stated. Just three countries could at least partly answer this question (DE, HU, NL). Germany and Hungary distinguish between four levels, the Netherlands between three levels.

DE: Level 1: Certified supra-regional trauma centers, *level 2:* Certified regional trauma centers, *level 3:* Certified local trauma centers, *level 4:* Uncertified basic and regular care hospitals. These hospital levels are defined in the “Whitebook Care of the Severely Injured” published by the DGU (<http://www.dgu-online.de>).

HU: Level I: As a basic condition, in the acute care of an injured person the presence of 1 full-time specialist should be ensured permanently right through 24 hours. In addition, for the operation of traumatology the FTE presence of other 3 persons should be provided. For the care of an acute injured, continuously, 1 full-time anaesthesiologist and a specialist engaged in intensive therapy should be provided right through 24 hours. The presence of the whole operating theatre staff should be ensured right through 24 hours. Endoprotetical surgery activity can be performed just over 100 cases per year. *Level II/a:* This means such a county-level trauma centre, where they are not engaged in the supply of the injury of the central nervous system or of a spinal injury to be operated, where there is no poly-traumatic care, but there is a multi-traumatic supply. For the care of an acute injured the permanent presence right through 24 hours of 2 full-time traumatologist specialists should be ensured (at least 8 FTE persons/institution). In addition, for the operation of traumatology the FTE presence of other 6 persons should be provided. Supply of child traumatology needs a background ensuring inpatient children’s ward. The presence of the whole operating theatre staff is a 24 hours requirement. Continuous diagnostic background (excluding MRI) must be provided right through 24 hours.

Level II/b: This means such a county-level trauma centre, which supplies a full-scale polytrauma care. For the care of an acute injured, continuously, the presence of 2 full-time traumatologist specialists should be ensured right through 24 hours (at least 8 persons FTE/institute). In addition, for the operation of traumatology the FTE presence of other 6 persons should be provided. The presence of the whole operating theatre staff is a 24 hours requirement. Continuous diagnostic background must be provided right through 24 hours. At institutional level the background of holding a medical consultation necessary for providing the full-scale traumatological care must be available right through 24 hours, apart from some exceptions (spine surgery, facial, and jaw and oral surgery). Availability of specialists in thoracic and neurosurgery is necessary within 30 minutes.

Level III: For the acute care of an injured person the permanent presence of 3 full-time specialists in traumatology is ensured right through 24 hours (at least 12 persons FTE/institution). For the operation of the trauma department, the FTE presence of additional 12 persons should be ensured. The presence of the total staff of the operating room is required permanently, right through 24 hours. Availability of a full-scale medical consultation and a diagnostic background should be ensured permanently right through 24 hours. Availability of specialists in thoracic- and neurosurgery is necessary within 30 minutes.

NL: *Level 1:* extended trauma care, large scale facilities; *level 2:* Accident and Emergency 24*7 + wide range of specialities; *level 3:* Accident and Emergency 24*7

FR: Concerning the different levels of hospitals: we do not have the equivalent of trauma centers that exist in some countries. However there are only some hospitals (the big ones usually - public and associated with a medical university) that are able to treat people with multiple and severe injuries (severe= MAIS4+) (there are 2 such one in the Rhone county).

Numbers of hospitals corresponding to the stated hospital levels could just be given by Germany and the Netherlands (table 7).

Table 7: Regarding hospitals that regularly treat RTC injuries: Are there different hospital levels in your country and what is the number of hospitals?

Country	Level 1	Level 2	Level 3	Level 4
DE	99	214	311	276
NL	11	56	64	--

For the Netherlands it is guessed that 25% of seriously injured RTC victims are treated in level 1 hospitals.

The third question asks if there is any database in the country that integrates data from different hospitals and can be used for the analyses of RTC victims. Eleven countries (AT, BE, CZ, ES, FI, FR, DE, IT, NL, SE, SI) indicate that such a database exists and name it. Greece and Russia do not have such a database and the Hungarian and Irish respondent stated that he/she had no information about this.

The named databases that integrate data from hospitals and are suitable for the analyses of RTC victims are listed in table 8.

Table 8: Databases that integrate data from hospitals

Country	Name of database
AT	Hospital Discharge Register
BE	The Federal Public Service (FPS) Public Health maintains a centralized database on hospital discharge data. All road victims, hospitalized for at least one night, are registered in this database and can be retrieved. There is also a possibility to retrieve road victims that are only treated at the emergency unit. Injuries are coded through ICD9CM (but only for inpatients). The BRSI has no direct access to this database but can ask the FPS Public health to conduct some queries, cross tables etc. (without any financial remuneration).
CZ	National Register of Hospitalized Patients (NRHOSP): NRHOSP is a nationwide population register that builds on the information system Hospitalization maintained in IHIS CR since 1960. NRHOSP keeps evidence on persons that were hospitalized in bed departments and whose hospitalization was terminated in the monitored period. Data collection from all bed departments of bed care establishments was performed for the first time in 1981 and then in 1986. Data are regularly processed every year since 1992. Since 1994 registration of basic hospitalization diagnoses is performed according to the 10th revision of International classification of diseases (ICD-10) that replaced the previously used 9th revision. Up to 1997 data were collected from bed care establishments without establishments of central organs (sectors of transport, defense and justice) that until then did not provide data. A statistical units subject to mandatory reporting is a terminated hospitalization of patient (including foreigners) in one bed care department of a health establishment disregarding the kind of admission and termination (discharge, transfer, death). NRHOSP does not register day care (one day surgery) that belongs to out-patient care.
ES	The Minimum Basic Data Set regarding Hospital Discharge (CMBD, in Spanish) compiles all hospital discharges occurring at General Hospitals network within the National Health System (SNS). Its scope reaches the whole country and data will have one year as the reference period. Public hospitals, the network of hospitals of public use and the publicly administered hospitals or those with a special agreement (to provide health care activities to an area with population covered by the public system) are included. Among them we can also cite specialized hospitals that form a group with secondary or tertiary hospitals. Psychiatric hospitals and long-term care hospitals are not included.
FI	Hospital Discharge Register (HILMO).
FR	There is PMSI that registers hospitalized people, but the external causes are very often missing (80%), so it cannot be used to identify RTC victims. More precisely, it can be used to identify people based on their injuries (for example fracture of radius) as they have codes 800-999 in ICD9 and S or T codes in ICD10= injuries) but the injuries can be due to home and leisure accidents, occupational accidents, road accidents, or even intentional events (aggression, self-inflicted). It is estimated from the European Injury Database that road accidents are only about 10% of all these injured hospitalized persons); The 80% of missing external causes is calculated on this whole group of injured hospitalized persons.
DE	TraumaRegister DGU® and German In-Depth-Accident Study (GIDAS).
IT	From 1 January 1995 the Hospital Inpatient Discharge Data has become the ordinary means for the collection of information about each patient discharged (including deceased) from the public and private health institutions throughout the country.

Table 8: Databases that integrate data from hospitals (continued)

Country	Name of database
IE	<p>HIPE. HIPE is a health information system designed to collect demographic, clinical and administrative information on discharges and deaths from acute hospitals nationally. HIPE statistics are available through a number of channels. National statistics are available in aggregated form, thus ensuring patient confidentiality. For information on the variables collected please refer to the Data Collected section. HIPE statistics are used extensively in research and planning, for example:</p> <ul style="list-style-type: none"> Epidemiological studies - hospital activity statistics related to diseases/procedures Input to population health profiles at the Health Board/Health Region level Quality assurance studies Market research Drugs trials etc <p>HIPE information is used by the Department of Health and the Health Service Executive in the planning, provision and measurement of acute hospital services. HIPE is the only source of morbidity statistics available nationally for acute hospital services in Ireland. All acute public hospitals participate in HIPE reporting on over 1.5 million records annually.</p>
NL	LMR - national medical register " http://www.swov.nl/UK/Research/cijfers/Toelichting-gegevensbronnen/LMR-UK.html ".
SE	STRADA, PAR (Patientadministrativa registret)
SI	National Institutes of Health has data from different hospitals, but it cannot be used for analyses of RTC currently

3.4 ICD-coding in hospitals and other relevant data

The third chapter aims at gathering information on ICD-coding in hospitals as valid ICD-coding is an important prerequisite for the transformation of ICD-codes to AIS (see next chapter). Twelve items were formulated.

All 15 respondents indicated that nationwide almost 100% of the hospitals that regularly treat RTC injuries use ICD-coding.

The question if the ICD-codes are electronically stored was answered with “Yes” by 13 countries; Ireland and Slovenia could not answer this question. It was distinguished between national or international databases / trauma registries, multicenter or regional databases, hospital databases and other databases. The respondents were asked to give information on the relevant databases in their country (table 9).

Table 9: Databases used to electronically store ICD-codes

Country	national or international databases / trauma registries	multicenter or regional databases	hospital databases	other databases
AT	Hospital Discharge Data			
BE	Hospital Discharge Data administered by the FPS Public Health		Name of database not known	
CZ	National register of Hospitalized Patients			
ES			HDD	
FI	Hospital Discharge Register (HILMO)			
FR	PMSI	PMSI	PMSI + names + codes of treatments	
DE	Federal Statistical Office		Hospital IT systems	Databases of insurance companies
GR		Name of database not known	Name of database not known	
HU	OEP (Országos Egészségpénztár, National Health Insurance Found)			
IT	Banca dati ricoveri ospedalieri SDO			
NL			LMR - National Medical Register	
RU				
SE	The national patient register		Information from hospitals are gathered to the national patient register	Svenska traumaregistret www.swetrau.se

Seven countries note that one database (AT, CZ, ES, FI, HU, IT, NL), two countries (BE, GR) that two databases and three countries (FR, DE, SE) that three databases are in use. The majority of countries (AT, BE, CZ, FI, FR, DE, HU, IT, SE) stores ICD-codes in national or international databases / trauma registries. Multicenter or regional databases are used by France and Greece. Hospital databases are noted by BE, ES, FR, DE, GR, NL and SE. Ireland and Slovenia did not answer this question. Independently of the kind of database relevant in a country the respondents stated that all relevant hospitals (100%) participate; just Sweden mentions that the “Svenska traumaregistret” is just used by 80% of the relevant hospitals.

Comparing the named databases no overlaps between countries could be determined. Thus it can be assumed that ICD-Scores are stored on a national level in the best case, but not on an international level.

National differences in the storage of ICD-codes become aware when asking for the number of digits that is used (e.g. ICD-9: 851 or 851.8 or 851.84). Three countries (AT, FR, GR) state that four digits are common, seven countries (BE, CZ, ES, I, HU, NL, SE) respond five digits. The remaining countries use another systematic (DE), do not know (FI, IE) or gave no answer (RU, SI).

The main purpose of ICD-coding differs between countries as well. Nine countries (AT, BE, ES, FR, DE, GR, HU, IE, RU) indicate that billing is a main purpose of ICD-coding; from these countries five (AT, BE, FR, DE, HU) state that billing is the only purpose. Eight countries (CZ, ES, GR, I, IE, NL, RU, SE) describe research as a main purpose as well, but research is in no country the only objective. Other purposes like statistics and public information are mentioned by three countries (CZ, I, SE). The Finish and Slovenian respondents could not answer this question. The results of this question are shown in table 10.

Table 10: Purposes of ICD-coding

Country	Billing	Research	Other purposes
AT	X		
BE	X		
CZ		X	X
ES	X	X	
FR	X		
DE	X		
GR	X	X	
HU	X		
IT		X	X
IE	X	X	
NL		X	
RU	X	X	
SE		X	X

Also the ICD-editions used differ between countries (table 11). Most prominent is ICD-10 (AT, CZ, FI, FR, DE, HU, NL, RU, SE) followed by ICD-9-CM (BE, ES, I, NL). Other editions are listed by Ireland (ICD-10-AM). France claims that “the change between ICD 9 and ICD 10 has not been done at the same period of time in all hospitals”, but ICD-10 is already the most common. So not alone differences between countries are revealed but also concomitant use of different ICD-edition within one country (NL, FR, DE).

Table 11: ICD-editions used in the countries

Country	ICD-9-CM	ICD-10	Other editions
AT		X	
BE	X ¹		
CZ		X ²	
ES	X		
FI		X	
FR	X (not so common)	X	
DE		X	
GR		X	
HU		X	
I	X		
IE			X
NL	X	X (not so common)	
RU		X	
SE		X	
SI			

¹ In 2015, Belgium will switch from ICD-9-CM to ICD-10-CM

² The ICD-11 is planned to be started in 2017

In a further question it was asked if it is common in a country to code the **external cause** of an injury (ICD, chapter XX: external causes of morbidity and mortality). Eight countries (AT, BE, CZ, ES, HU, I, NL, SE) answered that almost all hospitals that regularly treat RTC victims code the external cause. Austria explains that ICD external causes are a specific rudimentary version of chap. XX. France states that at least a certain percentage of all relevant hospitals code the external cause, though no exact percentage is available. The French respondent gives revealing information about the existing challenges: "All hospitals in France are requested (but it is not mandatory) to fill the external causes, but the percentage of completion varies, with an average of 16%. With such a low percentage, we cannot identify those injured from road crashes by distinguishing them from those injured in home and leisure accidents, occupational accidents, or even intentional event (aggression or self-inflicted). Also, when the external cause is filled, sometimes it is vague: "transport accident, no other precision" (it could be rail, water, air although we know road is by far the most frequent)." In Germany external causes are not coded as a routine documentation. Three respondents (FI, GR, RU) had no information about this issue and two countries (IE, SI) did not answer.

Referring to the countries that stated to code external causes it was asked which external causes (ICD) are used to obtain RTC victims. Belgium, Spain, Italy, the Netherlands and Sweden use E-codes; the Czech Republic, France, Hungary as well as the Netherlands use V-codes. Other codes are mentioned by Austria ("Austrian-specific E-codes (only one code for all transport accidents (no distinction by mode of transport)") and Italy ("A 'Cause of injury' code exists. One of the possible values is 'Road accident'"). Having a closer look at the used E-codes differences between countries occur:

BE: "100% of all victims with an E-code between E810 and E819 (E810 and E819 included) 90% of all victims with E-codes 826, 827 and 829 (this is a random sample). We know that approx. 10% of patients with E-codes 826, 827 and 829 are traffic victims on private roads and NOT on public roads. This explains how it is done by the BRSI. There is no general rule in our country."

ES: "E810-E819 y E826"

IT: "E800-E819, E826"

NL: „E810-816+818-819+826-827+829. But if matched with a victim in the police registration, also other E-codes are accepted (mainly E828, others in the range E800-829 and E885 (falls)).“

The next question asks if the ICD-codes (external causes) are electronically stored (table 12). In most countries (AT, BE, CZ, FR, HU, I, SE) external causes are stored on a national level. Just Spain and the Netherlands name only databases on hospital level. The percentage of hospitals using these databases is indicated with 100% in all cases.

Table 12: Storage of ICD-codes (external causes)

Country	National database / trauma registries	Multicenter or regional databases	Hospital databases
AT	Hospital discharge Data		
BE ¹	Hospital Discharge Data administered by the Federal Public Service (FPS) of Public Health		Name of database not known
CZ	National Register of Hospitalized Patients		
ES			Hospital discharge data
FR	PMSI - Programme Médicalisé des Systèmes d'Information	PMSI	PMSI + name
HU	OEP - Országos Egészségpénztár (National Health Insurance Found)		
IT	SDO - Banca dati ricoveri ospedalieri (hospital discharge records)		
NL			LMR - National Medical Register
SE	The national patient register		

¹ BE: "The Federal Public Service (FPS) of Public Health maintains a centralized database on hospital discharge data. All road victims, hospitalized for at least one night, are registered in this database and can be retrieved. There is also a possibility to retrieve road victims that are only treated at the emergency unit. Injuries are coded through ICD9CM (but only for inpatients). The BRSI has no direct access to this database but can ask the FPS Public Health to conduct some queries, cross tables etc. (without any financial remuneration)."

The respondents were asked if there are alternative systems (to ICD external causes) to identify RTC victims in the hospital data. Six countries (AT, CZ, ES, FI, GR, HU) stated that this is not the case. Two countries (NL, RU) answer that RTC victims can be identified by linking hospital data to police data (RTC records). Belgium, Germany and Italy remark that hospital data contains an "RTC"-item:

BE: "In the Belgian Hospital Discharge Data there is another variable (apart from the E-code) specifying the cause of an injury (approx 10 answer options amongst them "a road accident") and there is also still another variable "road user type"."

DE: "TraumaRegister DGU® contains information on the cause of injury (i.e. RTC, fall >3 meters etc.) and user type (i.e. car occupant, cyclist etc.), but collects data on the most seriously injured patients only."

IT: "National SDO database includes a variable named "Cause of injury". One of the possible values is "Road accident"."

France and Sweden inform about other systems to identify RTC victims:

FR: "Link police data with the Rhone road trauma registry + apply capture-recapture (to correct for underreporting AND biases) + apply projection of Rhone police under-registration correction coefficients to the national police data (assuming homogeneity of police registration practice across France) and hence obtain national estimates of RTC victims. These national estimates have been validated with other external sources: national travel survey (number of self-reporting road injuries) and national public health insurance (number of sick leaves due to road injuries)."

SE: "Hospitals reporting to STRADA."

The Slovenian respondent indicates that he/she has no information on this issue and Ireland gave no answer.

The following question aimed at getting an idea of the percentage of RTC victims (in the hospital data) that is missed (e.g. due to invalid or missing data) by the existing systems. The majority of countries (BE, CZ, FI, FR, DE, GR, I, IE, RU, SI) cannot number an exact percentage. Austria and Spain say it is 0%, Sweden 1%, Hungary 5% and the Netherlands 10%. Having a closer look at the comments made, valuable information on this issue can be extracted:

AT: "0% for ICD diagnoses; for ICD external causes: 20%."

BE: "We estimate that around 5% is missing. Approx. 16% of all patients with a ICD-9-CM main diagnosis between 800.00 and 959.9 do not have an E-code. But we think that road victims lacking an E-code can most of the time be identified via two other variables in the hospital discharge data (see previous question)."

CZ: "The system of National register of Hospitalized Patients doesn't allow the user to left external cause of injury blank. Estimated percentage of invalid data is very low but it's difficult to quantify it."

ES: "The variable funding scheme is a high quality variable; it shows those admissions in which the external cause has not been coded."

FI: "Please see research results VAAKKU – Estimating the number of seriously injured road users in Finland."

FR: "84% if we think the 84% missing values on external causes are "at random". Probably they are not, but we do not know if the external causes are more often filled for one/some type of injury or one/ some type of accident ... (yes, they are almost always filled for people with (serious) burn injuries and/or in health units that receive severely burnt people)."

DE: "There is no established documentation system that allows for identification of all RTC victims."

HU: "Inaccuracy in coding" and "1-5% of the RTC injured cannot be registered since they will be transported to other countries immediately or 1-2 days after the crash."

IT: "At present a very preliminary estimation of serious injuries has been undertaken by the Health Ministry. Data need to be further examined in order to quantify the exact percentage of unknown RTC victims."

NL: "83% of TRC victims can be identified directly in LMR (E-code range). 7% is added by matching police data with LMR resulting in additional victims with other E-codes. Another 10% is estimated to be present in LMR, but not possible to identify because of missing police data. Apart from that, since 2005, LMR is not 100% complete, but consists of 3 to 15% of generated patients (which are assumed to be representative of the ones not recorded)."

SE: "We know that about 1 % of all patients who have an injury as the principal diagnosis don't have a code for external causes. But we do not know how big is the part of the RTC victims that is missing from the register."

3.5 Transformation of ICD-codes (or other hospital data) to AIS

Chapter 4 of the survey applies to countries that address transformation of ICD-codes (or other hospital data) to AIS. In the majority of countries (AT, CZ, DE, GR, HU, IE, SE, SI) transformation of hospital data to AIS is unusual. Only two countries (ES, NL) state that data of almost all hospitals relevant for the treatment of crash victims is transformed. Four respondents (BE, FI, FR, I) use the option “other” and specify:

BE: “Transformation is done neither by the hospitals nor by the FPS Public Health. But the BRSI has already made a transformation of 2004-2011 hospital discharge data by means of the ICDPIC conversion table.”

FI: “We will start conversion from ICD-10 to AIS year 2015.”

FR: “It is unusual in the hospitals. However, in the Rhone road trauma registry, two physicians, [...], have made the correspondence between AIS version 90 and ICD version 10 (they have established it and they have used it).”

IT: “In Italy there is no distinction between slight and serious injuries in official accident statistics. It is the first time that an estimation of serious road injuries has been provided.”

The Russian respondent has no information on this topic.

Based on these answers the respondents were asked what hospital data (i.e. ICD edition or other data) is used for the transformation. Belgium, Spain, Italy and the Netherlands use ICD-9-CM, whereby the Dutch colleague specifies: “Currently ICD-10 codes (from 2012 onwards) are transferred back to ICD-9-CM before transformation to AIS is carried out.”. In Finland and France ICD-10 is used.

Accordingly the AIS-edition into which the ICD-codes are transformed should be stated. In France and the Netherlands AIS 1990 is most common; in Spain AIS 1998 is used. The Belgian, Finish and Italian respondents did not know which edition is applied.

The institutions being responsible for the transformation of ICD-codes to AIS are listed in table 13.

Table 13: Institutions responsible for the transformation of ICD-codes to AIS

Country	Institution
BE	There is no responsible institution and no regulation that makes transformation of hospital data to AIS obligatory. BRSI deals with transformation.
ES	DGT – Dirección General de Tráfico
FI	Not known
FR	The Rhone road trauma registry
IT	A central public institution
NL	SWOV – Institute for Road Safety Research

The next question asks what transformation method and /or tool is used. The six relevant countries give the following explanations:

BE: “The BRSI is using ICDPIC for the transformation, but will soon also try out the conversion table that is provided by the European Commission. The Harvard Injury Control Research Center is responsible for the ICDPIC conversion tool that is available in STATA. Also very simple conversion tables are available (without using STATA). ICDPIC

was developed by using the largest U.U. database in which both AIS as ICD-9-CM are reported. <http://fmwww.bc.edu/repec/bocode/t/trauma.html>; <http://fmwww.bc.edu/repec/bocode/i/icdpic.html>.”

ES: “Conversion algorithm which transforms ICD-9-CM codes to AIS codes - They are updated - Contact: [...]”

FR: “This has been done "manually" by two physicians. In the road trauma registry, injuries are directly coded [...] into AIS codes (6 digits + AIS score) (and into IIS as well, but not in ICD).”

IT: “SAS codes have been used. These SAS codes are valid for data years 1998 and forward.”

NL: “ICDmap90 (Johns Hopkins, 1998)”

The responses to the question “What information is received from the transformation?” reveal that the reception of MAIS 3+ is in no country the main objective (table 14). All six countries (BE, ES, FI, FR, I, NL) receive MAIS 1, 2, 3, 4, 5, 6 and – except for Italy – even more detailed information (AIS, ISS, body region AIS predot codes) are available. Thus to derive the intended information on MAIS 3+ (yes/no) should be no problem in these countries.

Table 14: Information received from the transformation

Country	AIS	MAIS (1-6)	MAIS 3+ (yes/no)	ISS	Body region	AIS predot codes	other
BE ¹	X	X		X	X		
ES	X	X				X	
FI		X					Probably only MAIS 3+ (yes/no) information will be used
FR	X	X	X	X	X	X	the full AIS code: 6 digits + AIS severity score
IT		X					
NL	X	X		X	X	X	AIS 0 (unknown) and 9 (not scorable) as well. NISS and MAIS 3+(Y/N) can be derived.

¹ Information about AIS and ISS is not used in Belgium, except for BRSI activities.

The respondents were asked regarding the normal usage of the received AIS information. It reveals – though more detailed information is gathered (see above) – the main intention of AIS-coding is to obtain the number of serious injuries (MAIS 3+). Only the Dutch respondent notes explicitly national interests: “Monitoring serious injuries to the 2020 target by the Ministry of Infrastructure and the Environment”, but here the definition of a serious injury refers to MAIS 2+.

In the following the survey asked “What are/were the greatest challenges in establishing transformation routines?”. Four countries answered (Finland and Italy ticked “not known”):

BE: “It was difficult to find a good transformation tool. The eventually chosen transformation tool, ICDPIC, is rather easy in use. There are no big challenges.”

ES: “To link health and police records. At present, we are carrying a pilot test with the Autonomous Region of Valencia.”

FR: “It is not set up as a routine. About 15% of ICD-codes could not be transposed.”

NL: “Introduction of ICD-10 (a conversion to ICD-9 is available) and transformation to AIS2005/2008.”

Additional information on the transformation of ICD-codes to AIS was provided by six countries (table 15).

Table 15: What else?

Country	
AT	Pilot project by KfV/BMVIT on establishing a common factor between Police-reported serious injuries and MAIS3+-injuries has been carried out
BE	In our country there is no regulation that imposes the transformation to AIS. Transformation by the BRSI is done on a voluntary basis.
CZ	Transformation of ICD-codes to AIS is not performed in hospitals in Czech Rep. The new National Register of Injuries includes AIS coding.
DE	Transformation of ICD-codes to AIS is not performed in Germany.
HU	In Hungary ICD-codes are only required.
SI	In Slovenia we do not transform ICD-codes to AIS. Hospital data are based only on ICD-codes.

3.6 AIS-coding in hospitals (no transformation)

AIS-coding in hospitals is an alternative to transformation of ICD-codes to AIS. It was asked if AIS-coding is practiced in hospitals that regularly care for RTC victims. Most countries (AT, BE, ES, FI, FR, GR, IE, NL, RU) state that AIS-coding is unusual in their countries. Three countries (DE, HU, SE) inform that AIS-coding is practiced by a certain percentage of hospitals that regularly care for RTC victims; in Germany this is up to 50% of these hospitals in Hungary and Sweden it is up to 10%. Only in the Czech Republic AIS-coding seems to be practiced in almost all relevant hospitals. The Italian respondent had no information on this topic and the Slovenian respondent did not answer this question.

The four countries (CZ, DE, HU, SE) that answered the previous questions with “Yes” were asked to provide information on the purpose of AIS-coding in their country (table 16). In Germany, Hungary and Sweden research projects are a main purpose. Quality management is named by the Czech Republic, Germany and Sweden. Triage, i.e. prioritizing patients regarding the severity of their injuries, is indicated by the Czech Republic and Hungary. The use of AIS-coding in official statistics is just practiced in the Czech Republic.

Table 16: Purposes of AIS-coding

Country	Research projects	Quality management	Triage (prioritizing)	Official accident statistics
CZ		X	X	X
DE	X	X		
HU	X		X	
SE	X	X		

The question what percentage of hospitals that regularly care for RTC victims contribute to these purposes could just be answered by the Czech Republic and Germany. The Czech participant states that all hospitals (100%) are assigned with the responded tasks; in Germany it is guessed that this is about 40%.

The next question asked whether the AIS-codes are electronically stored. In the Czech Republic (National register of injuries) and Germany (TraumaRegister DGU®) AIS-codes are electronically stored on a national level; the percentage of participating hospitals is again 100% in the Czech Republic and 40% in Germany. In Sweden the relevant database is SweTrau, which covers about 10% of the hospitals. This item was not answered by Hungary.

Corresponding to the above answers only the Czech database on AIS-codes is statistically representative for the country. In Germany national representativity is limited as the TraumaRegister DGU® collects data of the most seriously injured patients only and not all hospitals participate in the database. For Hungary it is stated that the AIS-data is not representative, since AIS-coding is not a nationwide practice. The Swedish respondent had no information on this issue.

In Germany and Sweden the AIS-edition 2005 update 2008 is used; for the Czech Republic and Hungary the respondents marked “not known”.

Dedicated to all 15 countries again it was asked if there are any attempts or efforts to spread/improve AIS-coding in hospitals. This was answered with “Yes” by the Czech Republic, Germany and Sweden:

CZ: “Until 2015 only Traumacentres used the AIS coding. Since 2015 all hospitals use new National register of Injuries that includes AIS coding (2015 - severe injuries, since 2016 all injuries).”

DE: “It is planned to instruct hospital coding staff in cooperation with AAAM.”

SE: “The purpose of SweTrau is to be a national database.”

“No” was marked by Belgium, Finland, France, the Netherlands and Russia. The Belgian, French and Dutch respondents gave explanatory remarks:

BE: “AIS-coding is not well known by the hospital administrations and by the FPS Public Health. Moreover the training of AIS-coding, the implementation of new software etc. require substantial investments.”

FR: “Probably because it would need great financial and human resources.”

NL: “In hospitals there is DBC and ICD-9/ICD-10. There is no intention of AIS-coding.”

The other respondents (AT, GR, HU, I, SI) did not know if there are any attempts in their country to improve AIS-coding or gave no answer (ES, IE).

In the following question it was asked what resources would be needed to spread/improve AIS-coding in the hospitals (table 17). Five resources (political support; legal/law modifications; financing; training of medical staff; IT and electronic coding system) were preset and “others” could be specified. Respondents were asked to rank the need of resources on a scale of 1 “almost no resources needed” to 10 “huge resources needed”. In the case AIS-coding in hospitals is no goal in a country (see item before) “not applicable” could be marked. Actually six countries (AT, BE, FI, FR, I, NL) marked the letter option, anyhow Finland and France ranked the preset resources. Four countries (ES, IE, RU, SI) did not answer this item at all. The remaining countries (CZ, DE, GR, HU) together with France and Finland reveal a heterogeneous picture of needed resources. All countries rank the needed resources for financing and training of medical staff higher than the needed resources for legal modification or political support. Resources for IT and an electronic coding system are ranked rather high as well.

Table 17: Need of resources to spread/improve AIS-coding in the hospitals

	Political support	Legal/law modifications	Financing	Training of medical staff	IT and electronic coding system
FI	7	2	9	9	7
FR	10	not known	10	10	not known
CZ	not known	not known	3	3	3
DE	8	1	5	7	8
GR	3	5	8	8	8
HU	3	3	4	4	4
mean	6,2	2,8	6,5	6,8	6,0

Rating scale: 1 = "almost no resources needed" to 10 = "huge resources needed".

Beyond it was asked what are/were the greatest challenges in establishing AIS-coding in the hospitals. Three countries (CZ, DE, HU) responded:

CZ: "The training of users of the National Register of Injuries (medical doctors, another hospital staff) is planned. The AIS coding is new for most of them."

DE: "Controlling high data quality, training of staff."

HU: "Lack of staff. Doctors and resources would be necessary for the coding."

Lastly countries were invited to give further information, comments etc. that could help to understand the situation regarding AIS-coding in their country. Four countries (BE, CZ, DE, NL) answered:

BE: "The ICD-9-CM coding already requires time and effort from the medical staff. It will be difficult to motivate the medical staff to learn yet another new coding system. Moreover, Belgium will switch from ICD-9-CM to ICD-10-CM in 2015, which demands already an extra effort from the hospital staff."

CZ: "Since 2015 there is new National Register of Injuries on nationwide level. In 2003-2014 period there was pilot project of Injury register including only Trauma centres. Only injury registers include AIS coding."

DE: "AIS-coding is performed for > 90% of the most seriously injured RTC victims and registered in the TraumaRegister DGU®. Procedures are standardized."

NL: "AIS-coding to 1990 version is tricky because the software runs on an XP-machine (in a windows98 shell) which is not much longer supported. We intend to migrate to AIS2005 as soon as feasible."

3.7 Reporting on serious injuries regarding MAIS 3+

The last chapter of the survey focuses on the reporting on serious injuries regarding MAIS 3+. In 2015 all European Member States shall report on the number of serious injuries (MAIS 3+) for the year 2014. It was asked if the countries will be able to report this number. It is distinguished between reporting for the year 2014 and reporting in the long run (i.e. in the next ten years). Six countries (CZ, GR, HU, IE, RU, SI) state, that they will not be able to report the number of serious injuries in 2015; Greece also doubts that reporting in the long run will be possible and Russia cannot judge if they will be able to assess MAIS 3+ in the future (no answer). Some countries give explaining information on the reasons why reporting is not possible:

CZ: “Nationwide data (AIS coding) are not available for 2014”

GR: “Injuries are not recorded by the Police so detailed”

HU: “Problems in the field of financing, staff, etc.”

IE: “2014 data is unlikely to be available. It will be for a different year, but we should be in a position to report one year of data.”

SI: “In Slovenia we don’t link data from hospitals with data from Police. I think that data from 2014 won’t be reported based on MAIS 3+.”

Regarding the institutions that will be in charge of reporting MAIS 3+ data it becomes obvious that in many countries special (research) institutes and agencies are entrusted with this task (table 18). The ministries – as described by Belgium and Germany – are officially designated by the EC to report the number, but the research institutions (BRSI, BAST) are responsible for the calculations.

Table 18: Will the countries be able to report on the number of serious injuries (MAIS 3+) for the year 2014 respectively in the long run?

Institution in charge of reporting...	Yes										No	
	Ministry of Health		Ministry of Transport		Ministry for Internal Affairs		National Statistical Agency		Other institution		2014	In the long run
	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run		
AT			X	X						X ¹		
BE				X					X ²	X ²		
CZ		X								X ³	X	
ES					X	X						
FI							X	X				
FR					X	X			X ⁴	X ⁴		
DE			X	X					X ⁵	X ⁵		
GR											X	X ⁶
HU		X				X		X			X	
IT	X	X										
IE										X ⁷	X	
NL			X	X					X ⁸	X ⁸		
RU											X	no answer
SE									X ⁹	X ⁹		
SI		X								X ¹⁰	X	
Σ	1	4	3	4	2	3	1	2	5	9	6	1

¹ KfV

² The BRSI will calculate the number of MAIS3+ road victims. The Ministry of Transport is officially designated by the EC to report the number.

³ Institute of Health Information and Statistics of the Czech Republic

⁴ IFSTTAR and the Rhone road trauma registry

⁵ BASt will calculate the number of MAIS 3+ RTC victims. The Ministry of Transport is officially designated by the EC to report the number.

⁶ Greece will not report in the long run but works on the assessment of MAIS 3+

⁷ Road Safety Authority

⁸ SWOV

⁹ Swedish Transport Agency

¹⁰ Slovenian Traffic Safety Agency

In the next item the respondents were asked to describe how the number of serious injuries (MAIS 3+) will be assessed for the year 2014 and in the long run (table 19).

Table 19: Assessment of MAIS 3+ in 2014 and in the long run

Country	2014	In the long run
AT	The proportion of MAIS3+ patients from hospital discharge data is applied to RTC number from the police (EU-Option 1: "continue to use the police data but apply a correction coefficient")	Same as 2014 until direct link between Police and Hospital data will be established.
BE	Hospital discharge data for the year 2014 will probably not be available in 2015. We will use a correct coefficient based on the relation of "seriously injured" encoded by the police and the number of MAIS3+ victims retrieved from hospital data, for the years for which both figures are available	In the long run we aim to link hospital and police data, but there is still a legal problem to overcome.
CZ		National register of Injuries includes AIS coding. It runs since April 2015.
ES	Use of a conversion algorithm	Same as 2014
FI	By combining hospital and police data. Conversion from ICD-10 to MAIS is used.	Same as 2014
FR	There are two main steps. (i) We use linkage of police data and road trauma registry on the Rhone County, and capture-recapture. This method is used to correct for underreporting and biases of police data. It provides the total number of road injured people in the Rhone County, and we hence estimate correction coefficients between the police and the estimated total. We apply these coefficients to the national police data. (ii) We then construct a model of prediction of the proportion of MAIS3+ among police data, casualties all severity. This model is constructed on linked police and registry data in the Rhone County. We apply this model to the national police corrected data. See text p33 for more details.	Same as 2014
DE	Use extrapolation from a small representative database (GIDAS, i.e. police data plus hospital data) in combination with a large but not representative trauma registry (TraumaRegister DGU®, i.e. hospital data for the most seriously injured). Both data sources will lead to independent results and show the range of the 'real' number of serious injuries.	not known yet
HU		It is necessary to organize it in the whole country.
IT	AIS codes are derived from ICD codes thanks to tables provided to all EU countries by the European Commission.	Same as 2014
IE		We propose to apply the MAIS algorithm to the hospital data to report on MAIS3+ using medical information in the first instance. In the coming years we plan on statistically matching police and hospital data to estimate the level of underreporting.

NL	Linking police registration with medical register and estimate errors. Filter on MAIS2+ with an option of separating MAIS3+ ¹	Same as 2014
SE	Another definition of serious injury is used in Sweden (medical impairment), it is also based on AIS why assessing MAIS 3+ is also possible. Data comes from STRADA. ²	Same as 2014
SI		In the next years we will try to link police and hospital data and transform ICD to AIS.

¹ NL: "Theory: Reurings, M.C.B. & Stipdonk, H.L. (2011). Estimating the number of serious road injuries in the Netherlands. In: Annals of Epidemiology, vol. 21, p. 648-653. Practical results (in Dutch, English summary): www.swov.nl/rapport/R-2009-12.pdf (1993-2008) [R-2011-05.pdf](http://www.swov.nl/rapport/R-2011-05.pdf) (2009) [R-2012-07.pdf](http://www.swov.nl/rapport/R-2012-07.pdf) (2010) [R-2014-31.pdf](http://www.swov.nl/rapport/R-2014-31.pdf) (2011-2013)"

² SE: "STRADA includes information from the police (STRADA Police) and from medical centers (STRADA hospital). The database matches accidents known both by the police and the healthcare. To calculate risk of medical impairment a risk matrix developed by insurance company Folksam is used. Depending on the parts of the body that have been injured and the AIS values the person has been assigned in the case of injury a risk is given, and this risk is applied on the STRADA data to calculate a risk of medical impairment."

The European Commission distinguishes between **three ways to proceed with MAIS 3+ assessment**: Linkage of hospital data and police data; use of hospital data alone; use of police data plus application of a correction coefficient. The respondents were asked if the method used in their country can be classified accordingly (table 20). It was differentiated between reporting in "2014" and "in the long run". **For the year 2014** just three countries (FI, NL and FR) will report on the basis of the ideal way proposed by the European Commission, this is linkage of hospital and police data. Three countries (ES, IT, SE) will use hospital data alone and two countries (AT, BE) use police data plus application of a correction coefficient. Germany uses "another method" (see below). In line with the results above six countries (CZ, GR, HU, IE, RU, SI) did not respond to this item. The Hungarian respondent remarks in a later item that for the year 2014 hospital data alone will be used.

In the long run the number of countries that will use linkage of hospital and police data rises to seven countries. In addition to the Netherlands and Finland, Austria, Belgium, Hungary and Slovenia will use this assessment method as well. Hospital data alone (without linkage to police data) will be newly introduced by the Czech Republic, Greece and Ireland; thus together with Spain, Italy and Sweden six countries will follow the second way of MAIS 3+ assessment proposed by the EC. The use of police data plus application of a correction coefficient in the long run is reported by no country. Germany cannot state what method will be used in future. Russia did not answer.

Table 20: Ways to proceed with MAIS 3+ assessment

Country	2014	In the long run
AT	Use of police data plus application of a correction coefficient	Linkage of hospital data and police data
BE	Use of police data plus application of a correction coefficient	Linkage of hospital data and police data
CZ		Use of hospital data alone (without linkage to police data)
ES	Use of hospital data alone (without linkage to police data)	Same as 2014
FI	Linkage of hospital data and police data	Same as 2014
FR	Another method is used largely based on a linkage of health data and police data	Same as 2014
DE	Another method is used ²	Not known

GR		Use of hospital data alone (without linkage to police data)
HU	Use of hospital data alone (without linkage to police data) ³	Linkage of hospital data and police data
IT	Use of hospital data alone (without linkage to police data)	Same as 2014
IE		Use of hospital data alone (without linkage to police data)
NL	Linkage of hospital data and police data	Same as 2014
RU		
SE	Use of hospital data alone (without linkage to police data) ⁴	Same as 2014
SI		Linkage of hospital data and police data

² *DE*: “Two different methods will be used to show the range within the ‘real’ number of serious injuries lies. The first method is based on GIDAS (German In-Depth Accident Study; <http://www.bast.de/EN/FB-F/Subjects/e-gidas/e-gidas.html>) data. The data is gathered in two regions (Hannover, Dresden) and refers to crashes reported by the police. The database contains up to 3.000 variables per case, including AIS-scores. On the basis of decision trees sub-groups are identified differing in injury severity (MAIS 3+: yes/no) and police variables (e.g. road user type, road class, sex). It is aimed at receiving disjoint risk groups (police variables) with homogenous MAIS-score-distribution within these groups. The percentage of RTC victims with MAIS 3+ is determined in relation to all injuries (> 24h in hospital). The characteristic values of each sub-group (e.g. male driver of a motorized two-wheeler involved in a crash on a rural road: number respectively percentage of MAIS 3+ in relation to all hospitalized injuries in this sub-group) are taken into account and summed up when extrapolating for the national value (number of MAIS 3+ victims and percentage of MAIS victims in relation to all hospitalized injuries in Germany). The second method is based on hospital data (TraumaRegister DGU®; <http://www.traumaregister.de/index.php?lang=en>). The data contains AIS-scores, but is dedicated to the most severely injured only (i.e. need for intensive care). For this and some other biases correction coefficients are estimated. It is assumed that the first method ends up with a national estimate that rather underestimates the real number of MAIS 3+ RTC victims, whereas the second method is closer to the “real”, but not in line with the official road accident statistics which are based on police data.

³ *HU*: This information is derived from the Hungarian answer to another item of the survey.

⁴ *SE*: “Since not all acute care hospitals have been connected to STRADA earlier than 2015, a correction coefficient is used to correct for the loss of data. Please note that the hospital data with AIS is linked to the police data when the accident is also known and reported by the police.”

Countries using **linkage of hospital data and police data** (2014 or in the long run: AT, BE, FI, HU, NL, SI) were asked to further specify their methods. France uses specific method based on a linkage between medical and police data. In three countries (BE, FI, HU) the link is based on the ID of the injured. The Belgian respondent explains in detail:

BE: “We will link on the basis of ID and some other variables that are common in the hospital and police database, such as date of the accident (only encoded in the police database), date of the hospital admission (only encoded in hospital data), age and gender.”

In three countries (NL, SI and FR) the link is based on probabilistic link method. Respondents give explanatory information on the used variables:

NL: Distance based linking on date of birth, gender, date, time of accident, intake severity (police), external cause (hospital). The same method is used in 2014 and the next years. Possibly verification of probabilistic linking (or replacement if there is reason to).

SI: “We don’t have any method yet. There is one option to link databases based on 3 or 4 different variables: date of birth, sex, administrative unit of birth and accident.”

FR: We estimate police correction coefficients in the Rhone County: using the police data, the Rhone road trauma registry, a linkage of the two, and capture-recapture. The linkage between police data and the road trauma registry in the Rhone County is based on a clerical and semi-automated probabilistic method (we allow for some errors). Variables used for linking are date and time of the crash, place of crash (town/village and possibly street/road name), road user type, year and month of birth, gender. Capture-recapture corrects for under-reporting AND more importantly for biases. For this purpose, we use a multivariate model, including variables that play a role in the probability of police reporting, such as severity (hospitalized or not), severity of the crash (fatal or non-fatal), road user type (pedestrian, cyclist/M2W, car, other), whether the crash was single or multiple-vehicle, type of police (3 types in France with different reporting rates), type of road, and year. Capture-recapture provides the total number of road injured people in the Rhone County, and we hence estimate correction coefficients between the police and the estimated total. There are about 300 coefficients as they depend on all the characteristics included in the model. We then apply the correction coefficients to the national police data, with the assumption that police reporting practices are homogeneous over France within each type of police force (3 types in France). There are some external elements of validation of our results: within France with other sources (National Transport Survey on 23,000 people who reported their road traffic injuries => same total number, and with the general health insurance on the number of sick leaves due to road accidents) and with other countries with the ratio of injured (all severities/killed) which is about 60-70 in UK and Germany, and we reach this value in France with our correction coefficients. To estimate the number of MAIS 3+ among the injured of all severities, we constructed a model in the Rhone County, on the injured people identified in both the police data and the registry: on this sub-group we have information on MAIS 3+ (from the registry) and on police variables. We model in a multivariate way the probability of MAIS 3+ according to: hospitalized (yes/no) according to police, police type, severity of the crash (fatal or non-fatal), road user type (pedestrian/cyclist/ M2W/car/other) * type of antagonist, impact point (near or far from the person), age and sex. We do not predict MAIS 3+ at an individual level but at an aggregated level, i.e. we predict counts. We apply this model on the national police corrected data (corrected for under-reporting and bias). External validation: when we work in the same way to predict the number of people with paraplegia (from spine injury), we obtain the same number as another source: the national health insurance on people with paraplegia from all causes and we restrict it to road accidents (applying some proportion estimated from yet another source).

The Austrian respondent had no information to specify their linking method.

Further on these seven countries should state what data is used to estimate the number of MAIS 3+. The question aimed at detecting methodological differences that affect the resulting number of MAIS 3+ victims. It revealed that Austria, Hungary and Slovenia plan to use the whole group of police and hospital data (union of both). The Dutch respondent specifies their proceeding:

NL: "Police records that are not linked are believed to concern slightly injured (MAIS 1), as the hospital is complete (but not all traffic casualties have the proper external cause). Therefore an estimate of improperly coded casualties is added."

FR: see text above.

In Finland for the year 2014 only successfully linked cases are used; the method that will be applied in the long run is not known yet. In Belgium a final decision is not made on this issue either.

Countries using **hospital data alone** (2014 or in the long run: CZ, ES, GR, IT, IE, SE) to report on the number of MAIS 3+ were also asked to specify their methodology. The Czech Republic, Spain, Greece and Italy state that the used hospital data is based on inpatients only. Just Sweden considers inpatients and outpatients. The Irish respondent had no information on this issue yet; work on the report on MAIS 3+ will probably start in the coming months.

Countries basing their estimation of the number of MAIS 3+ injuries **on police data plus application of a correction coefficient** (for the year 2014: AT, BE) were invited to give information on their estimation procedures.

AT: "The proportion of (ICD-10 based) MAIS 3+ RTC patients from hospital discharge data."

BE: "1) The average ratio per road user type in the years 2008-2011 is calculated by dividing the number of "MAIS 3+ victims" through the number of seriously injured registered by the police. 2) The average ratio per road user type is multiplied by the number of seriously injured road users per road user type registered by the police for the years 2012 to 2014 to obtain the estimated number of "MAIS 3+ victims". 3) The total number of estimated "MAIS 3+ victims" in 2012 until 2014 is the sum of the number of estimated "MAIS 3+ victims" per road user type."

The next question was again dedicated to all fourteen countries planning to report on serious injuries (MAIS 3+) for the year 2014 (AT, BE, ES, FI, FR, DE, IT, NL, SE) or in the long run (plus CZ, GR, HU, IE, SI) and asks if their country report will be **nationwide representative**. All nine countries that will report for the year 2014, rate their reports as nationwide representative and assume that this will also be the case in the long run. Germany remarks that it is not decided yet what method will be used in future, but it is assumed that only a methodology that guarantees nationwide representativeness will be chosen. The Czech Republic, Hungary and Ireland also pronounce their future reports to be nationwide representative. Solely Greece will not be able to submit a representative report. Slovenia did not answer this item.

All twelve countries (AT, BE, CZ, ES, FI, FR, DE, HU, I, IE, NL, SE) that indicated their reports as representative (now or in future) were asked to specify **what method of data collection is/will be applied to receive nationwide representativeness**. It is distinguished between "nationwide data collection/complete (exhaustive) collection", "representative sample and statistical projection/extrapolation/inference" and "biased sample, but auxiliary information and/or statistical projection/extrapolation/inference enabling correction for these biases". Ten countries (AT, BE, CZ, ES, FI, HU, I, IE, NL, SE) use a nationwide data collection. Seven of these countries name the relevant databases:

AT: "Hospital discharge data"

BE: "Hospital Discharge Data, administered by the FPS Public Health. The most principal problem of the database is a delay of 3-4 years. At this moment the most recent data are from 2011."

CZ: "All hospitals will use National Register of Injuries to report injury data."

ES: "HDD"

HU: "Nationwide linkage of police and hospital data."

NL: "Police: national road crash registration BRON:

<http://www.swov.nl/UK/Research/cijfers/Toelichting-gegevensbronnen/BRON-UK.html>;

National Medical register LMR: <http://www.swov.nl/UK/Research/cijfers/Toelichting-gegevensbronnen/LMR-UK.html>;

New name of LMR is LBZ (starting in 2013)."

SE: "Data collection made at all acute care hospitals in Sweden but one. Internal loss of data exists due to different reasons (data collection is based on patient consent) and a work on quantifying these losses is being carried out." "The registration of the acute care hospitals in STRADA is based on agreements and is not regulated by law which could create a more complete collection in the future."

Germany uses a representative sample and statistical extrapolation to reach nationwide representativeness:

DE: "GIDAS: 2,000 (slight and serious) injuries per year; TraumaRegister DGU®: 20,000 RTC victims per year. Statistical methods are not finalized yet."

France indicates the use of a biased sample, but auxiliary information and/or statistical extrapolation enabling correction for these biases. The French respondent describes explicitly:

FR: "The sample corresponds to the Rhone County; it is not representative of France in terms of accidents but we expect it to be representative in terms of police reporting. We estimate police correction coefficients in the Rhone County: using the police data, the Rhone Road Trauma Registry, a linkage of the two, and capture-recapture." "[...], maybe adding the Ain County (smaller but more rural)". (For further remarks see above.)

Greece that stated not to be able to submit a representative report now or in future, gives information on their future plans indicating that nationwide representativeness might be a reachable aim anyway:

GR: "Only hospitals from large cities might provide MAIS information, the sample might correspond to approx 65% of the population."; "Sample (mainly from large cities) with possibility of correcting for the biases."

The next question aimed at receiving information on how a country deals with incompleteness of data files and underreporting. Austria and Finland state, that no procedure has been developed yet respectively that a procedure is under construction. The Czech respondent has no information on this topic. The item was not answered by Spain, Greece, Ireland and Slovenia (Russia was barred from this question due to the answers given before). Seven countries (BE, FR, DE, HU, IT, NL, SE) commented:

BE: "We estimate that approx. 95% of all inpatients that are road victims can be identified in the hospital data by their external code (= the E-code) and the other variables in the national hospital discharges database. Because we are not sure how many road victims exactly remain undiscovered and we think underreporting is relatively small in the hospital data, we prefer not to adjust for underreporting in 2014. As soon as we can link hospital and police data we will consider the use of capture-recapture."

FR: "There is police under-reporting, and more importantly biases, as in many countries. To correct for this and for biases (example: cyclists are less often registered), we use capture-recapture between the police data and the road trauma registry and in a multivariate modeling, including 6 variables that highly affect the police reporting rate: crash severity (whether there is at least one person killed), injury severity (hospitalized or not), road user type (pedestrian, cyclist, M2W, car occupant, other), whether there

was an opponent or not, severity of the crash (fatal or injury only), type of road, and type of police (3 types in France). The police-reporting correction coefficients hence depend on these 6 variables (about 300 coefficients).”

DE: “Extrapolation on the basis of the TraumaRegister DGU®: We use correction coefficients (e.g. estimation of the number of MAIS 3+ victims without intensive care; patients treated in hospitals not taking part in the Trauma Registry DGU®) to deal with incompleteness of data. These assumptions are based on research projects and data of trauma registries of other countries (GB: TARN). Extrapolation on the basis of GIDAS: GIDAS data is extrapolated using the national crash statistics. Under-reporting and biases in these statistics are not controlled. It is assumed that the extrapolations based on the TraumaRegister DGU® respectively GIDAS reveal different results, thus showing the range within the ‘real’ number of MAIS 3+ victims lies. What will be done in the long run has not been decided yet.”

HU: “In 2014 we had only non-representative samples. In the long run the linkage of both data sources (hospital and police) will be the solution.”

IT: “The present estimation is subject to some issues mainly due to the absence of the linking with police data and to ICD external causes missing data.”

NL: “see earlier.”

SE: “[...] there is an internal loss of data and a work on quantifying this loss is being made to be able to address these losses and taking them into consideration in the work on RTC.”

Further on it was asked if there is a **need to change/optimize the reporting on serious injuries (MAIS 3+) in the following years**. The majority of countries (BE, FI, FR, DE, HU, IT, IE, NL, SE) answers “Yes” and sums up relevant aspects:

BE: “In 2015 hospitals will switch from ICD-9-CM coding to ICD-10-CM coding. The ICD-PIC conversion table is only suitable for ICD-9-CM coding. We will need in the future another conversion table. This will probably be the conversion table provided by the EC. Until now, we didn't take into account all injuries of the victims to find the MAIS score. This will be changed in the future. Until now, we calculated the number of road victims solely on the basis of the external E-code while two other variables in the hospital discharge database permit to identify road victims. This will also be changed in the future.”

FI: “We will decide possible changes after the first reporting.”

FR: “The French inter-ministries committee for road safety decided in October 2015 to extend the Rhône Road Trauma Registry to a larger area, the new Auvergne-Rhône-Alpes Region that included the Rhône County. This region counts for 7.8 million inhabitants, i.e. 12% of the entire French population. Just before, from 2013 to 2014, an experiment of data collection was conducted in the Ain County (also included in the same area)”

DE: “TraumaRegister DGU®: Training of hospital staff to code AIS; extension of inclusion criteria in the TraumaRegister DGU® (all MAIS 3+ victims) in order to increase representativeness; adaptation of the ‘RTC-item’ in order to identify RTC victims in line with definition of the official crash statistics.”

HU: “Usage of conversion algorithm.”

IT: “[...] this is the first year in Italy that an estimate of serious injuries has been provided and the estimation is subject to some problems. In order to improve this estimate it s

needed to cope with the absence of a link to police crash data and with the treatment of cases with missing ICD external causes.”

IE: “We would like to statistically match police and hospital data.”

NL: “There is a transition ongoing from ICD9-cm to ICD10; this will enable the transfer top AIS2005 (update 2008) replacing AIS1990.”

SE: “Please see earlier comments on internal loss of data in data collection.”

No need to optimize reporting on serious injuries in the following years is seen by Austria and Spain; Greece also states that there is no need to change reporting routines, but adds a note “Not exist yet”. “Not known” was marked by the Czech Republic, Russia and Slovenia.

To get a deeper insight into the **greatest challenges in the context of MAIS 3+ reporting** (2014/9n the long run) the countries were given a list of possible challenges and asked to mark all relevant challenges in their country and/or specify other challenges (table21). It reveals that “communication/ cooperation between institutions” as well as “data protection and corresponding restrictions to use hospital data” are stated most often referring to current challenges as well as to challenges anticipated in the future. Financing is also a problem countries are concerned about now and in the long run. Concerns about legal regulations are more likely dedicated to the future respectively are described as an ongoing problem. “Other Challenges” are named by four countries (CZ, FR, DE, NL):

CZ: “Implementation AIS coding to hospitals (hospital information systems).”

FR: “Implication of the Ministry of Health.”

DE: “Development of statistical models.”

NL: “The quality of the police reporting is an issue. The external cause is no longer a required element in the medical register. We need that to select patients after traffic crashes. The 4th digit in the V-code often specifies the patient as not resulting from a road traffic crash, but from a more generic transport accident, i.e. not a traffic crash. We have to see if that is true.”

“No challenges” are seen by the Czech Republic for the current reporting period, by Spain for the current and future periods and by Finland for the reporting in the long run. No information on this item was given by Russia and Sweden.

Table 21: Greatest challenges in the context of MAIS 3+ reporting

Country	Data protection and corresponding restrictions to use hospital data		Legal regulations (e.g. necessity of amendments)		Financing		Communication/cooperation between institutions (e.g. police, hospitals, public agencies)		Other		There are/will be no challenges	
	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run
AT	X	X	X	X								
BE		X		X			X	X				
CZ										X ¹	X	
ES											X	X
FI							X					X
FR		X		X	X	X		X		X ²		
DE		X		X		X		X	X ³			
GR	X	X			X	X	X	X				
HU	X	X		X	X	X		X				
IT					X	X	X	X				
IE	X	X	X	X			X	X				
NL									X ⁴	X ⁴		
RU												
SE												
SI	X	X					X	X				
Σ	5	7	2	5	4	5	6	7	2	3	2	2

¹CZ: Implementation AIS coding to hospitals (hospital information systems)

²FR: Implication of the ministry of health

³DE: Development of statistical models

⁴NL: The quality of the police reporting is an issue. The external cause is no longer a required element in the medical register. We need that to select patients after traffic crashes. The 4th digit in the V-code often specifies the patient as not resulting from a road traffic crash, but from a more generic transport accident, i.e. not a traffic crash. We have to see if that is true.

The country reports asked by the European Commission solely aim at assessing the total number of serious injuries (MAIS 3+) in a country. Numbers differentiating between different groups (e.g. by age or gender) are not claimed until now. However it is quite likely that at least some countries could provide more detailed analyses. Therefore it was asked, if the **countries will report numbers for different groups** (table 22). Sweden is the only country that will not report numbers for different groups neither for the year 2014 nor in the long run. The same holds true for Greece and Russia as both countries will not report at all. Hungary and Slovenia (no report for the year 2014) do not know yet if numbers for different groups can be reported in the long run. The Czech Republic and Ireland (no report for the year 2014 as well) will be able to report numbers for different groups in the long run. The Italian respondent has no information on this issue, neither for the year 2014 nor for the future years. Germany will be able to report numbers for different groups (at least by age, gender and road user type) for the year 2014, but states that the future proceeding is not determined yet. All other countries (AT, BE, ES, FI, FR, NL) are able to provide analyses for different groups for the year 2014 and in the long run. Most common are analyses regarding age and gender and road user type.

Table 22: Will your country report numbers for different groups (2014/in the long run)?

	By age		By gender		By road user type		By opponent		By injury severity (e.g. MAIS 1, 2, 3, 4, 5, 6)		By body region		By injury type		other	
	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run	2014	In the long run
AT	X	X	X	X												
BE	X	X	X	X	X	X			X	X	X	X	X	X		X
CZ	n.r.	X	n.r.	X	n.r.	X	n.r.		n.r.	X	n.r.	X	n.r.	X	n.r.	
ES	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FI	X	X	X	X	X	X	X	X							X	X
FR	X	X	X	X	X	X	X	X	X	X					X	X
DE	X	X	X	X	X	X		n.k.		n.k.		n.k.		n.k.	X	n.k.
HU	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.
IT	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.	n.k.
IE	n.r.	X	n.r.		n.r.	X	n.r.		n.r.		n.r.		n.r.		n.r.	
NL	X	X	X	X	X	X			X	X	X	X	X	X	X	X
SE																
SI	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.	n.r.	n.k.
Σ	7	9	7	8	6	8	3	3	4	5	3	4	3	4	4	5

n.k. = not known

n.r. = no report

Countries that will report numbers for different groups were asked further on if some of these **groups will be crossed**. Six countries (AT, ES, FI, FR, DE, NL) will report cross tables for the year 2014; in the long run Belgium will be able to provide cross tables as well. Though France and Germany have not decided yet what groups will be crossed and Austria limits cross tables to gender by age it seems that in most countries all kind of cross tables will be possible. The Netherlands provide a link (https://www.swov.nl/ibmcognos/cgi-bin/cognos.cgi?b_action=powerPlayService&m_encoding=UTF-8&BZ=1AAACCxHrASV42n1OTVPCMBD9M0nRGYdJ0iJy6KFNwLAHi1JmPAe6rYWSOmnAv28ClgcHN9ns25e3H0GxGBarxVJmlu5tZyATd5ixho4f05RPEy6SJAoFTylxmZTTcRSmkeROcx%7E4Wpks_e w1Wc1izKabTlvQ1qGqa0sweJTiiGi1BxyKQQ6OapUu_wEeiRuiolWbD9tVFZj_ATOyht4eDsbpepeBdk_naziqtgX9T593MDtom_3OFSilrWp%7ExJ9qs1M13FCD778%7EKI37aUb3tvHo6P%7EdCjv8db oEPXRcajqNw8ShDPTLZTkxE35QIAo_5Is8l3yVuZC8yFj_tru0cTCfB_lbXBGCKCGEUoIQImhEzu4PQ nOAYjbbEpPJs1LGBYTZE2YhwQwoZmvMJmeCXgn0x_jpenCedvKrfQMdbpGG) which shows the series 1993-2009 where all variables were crossed. The Dutch hope to continue this series.

The next question was dedicated again to all countries that will report for the year 2014 or in the long run on the number of serious injuries. It was asked if their country would be able to **report different MAIS-levels** (that means the exact severity score, e.g. MAIS 2 or MAIS 5). Six countries (BE, ES, FR, I, NL, SE) would be able to report exact severity scores for the year 2014, eight countries (CZ, ES, FR, HU, IT, NL, SE, SI) in the long run. In Finland and Germany exact MAIS-levels are not assessed for the 2014; for the following years no statement can be made yet. Belgium has no information about exact MAIS assessment in the long run as well and Austria has neither information on this topic regarding 2014 nor the next years. Ireland (no report for the year 2014) negates the assessment of exact severity scores in the long run.

Until now “serious injuries” are defined as MAIS 3+ (i.e. MAIS 3, 4, 5, 6). As the inclusion of MAIS 6 might lead to an overlap with “fatalities”, some countries prefer to define serious injuries as MAIS 3-5. Thus the next question asked was what **interpretation of MAIS 3+** will be used in the respective countries. Two countries (AT, HU) declare MAIS 3-5 as their countries interpretation of MAIS 3+, four countries (ES, IT, IE, SI) MAIS 3-6. Five countries (BE, CZ, GR, RU, SE) marked “not known”, whereby Greece comments “Not known yet, however MAIS 3-5 seems more reasonable.”. Four countries (FI, FR, DE, NL) indicate to use another interpretation of MAIS 3+, all with the intention to exclude an overlap with fatalities:

FI: “Fatalities are defined based on death causation register and overlap is removed.”

FR: “It will probably be MAIS 3-6, but excluding those who died within 30 days of the crash (in order not to overlap with fatalities figures).”

DE: “We use MAIS 3-6 minus fatalities (dead within 30 days).”

NL: “Serious Injuries = admitted traffic casualties, not dying within 30 days as a result of the crash, having MAIS in (2, 3, 4, 5, 6).”

The last question of this chapter offered a free text field to give further information, comments etc. that could help to understand the situation regarding MAIS 3+ reporting in the countries. Eight countries (CZ, FR, DE, HU, IE) took advantage of this opportunity:

CZ: “Some MAIS 6 patients do not die. If MAIS 3+ is interpreted as MAIS 3-5 some very seriously injured will not be included in the total figure of MAIS 3+.”

FR: “In the Rhone Road Trauma Registry, we have all fatalities from road accidents: those who died at the scene (as the registry includes the forensic medicine institute), those who died shortly afterwards and those who died later.”

DE: “The Federal Ministry of Transport and Digital Infrastructure, BAST and representatives of the research community intended to integrate MAIS 3+ coding into the police records. However, this process was stopped now by other ministries. The procedure for 2014 (based on data of GIDAS and the TraumaRegister DGU®) is not the final solution.”

HU: “MAIS 6 is the group of fatalities.”

IE: “Data protection and governance are huge barriers to conducting statistical matching of sensitive information. Assistance or advice at an EU level would be appreciated. Note the European Commission has advised us to use 3-6 as a definition of MAIS 3+.”

NL: “Linked fatalities (according to the police) are excluded. Other fatalities (within or after 30 days) are included as serious injuries (MAIS 2+) if they have MAIS in (2, 3, 4, 5, 6). In our medical file about 50% of patients with MAIS=6 dies, the other half survives.

Filter on MAIS=6 OR die (LMR-traffic 2007-2009):

MAIS	Survive	Die(<30d)	Die(>30d)	Sum
6	9	10	2	21
5	-	139	10	149
4	-	207	19	226
3	-	135	10	145
2	-	34	7	41
1	-	14	2	16
0	-	34	0	34
9	-	23	2	25
Sum	9	596	52	657

So we even observe fatalities with MAIS=1. Description of MAIS=6 is also ‘untreatable’, that does not imply that chances of survival are none. That can be caused by the fact that we derive AIS from ICD.”

The very last question of the survey offered the respondents to describe the situation in their country more detailed, to ask questions or to give feedback. Comments were made by France, Germany and Sweden. The respective texts passages (e.g. links to websites) are – as far as possible – already integrated in the preceding chapters.

4. Discussion

A country survey on the state of the art of MAIS 3+ assessment was conducted between February and July 2015. Altogether 15 countries participated in the survey. It was aimed at covering all FERSI Member States and EU/EEA countries. This aim could not be reached. The main reason for failure was difficulties in finding relevant contact persons, especially outside FERSI. To succeed it would have been necessary to invest more resources (time, staff, and budget), which was unfortunately not possible. Referring to the total number of FERSI Member States, EU Member States and EEA countries (n=34) about 44% of these countries participated in the survey.

Especially the inclusion of countries outside FERSI is unsatisfying. It might be worth investing some more resources to initiate contacts to these countries to end up with a more complete picture of the state of the art of MAIS 3+ assessment in whole Europe. A “second round” of the survey could be set up to reach this aim.

Referring to all FERSI countries (n=21) a response rate of 71% could be achieved. There is no information available why six countries did not respond. Reasons related to the questionnaire itself (e.g. complexity of items, time needed to fill in, necessity to cooperate with other institutions etc.) might be an explanation. Ireland might be an example that clarifies the challenges that arise when cooperation between different institutions is needed. Though the Irish respondent tried hard to find colleagues in the health service to assist, this task could not be managed in the available time. In our understanding the establishment of communication structures and cooperative relationships between institutions of different fields (e.g. police - hospital) is one of the major and most difficult tasks the countries have to face – not just to fill in the survey but in the whole process of establishing MAIS 3+ assessment. This interpretation is supported by the answers given by the countries when asked for current and future challenges in the context of MAIS 3+ reporting: “communication/ cooperation between institutions” (and “data protection and corresponding restrictions to use hospital data”) are stated most often.

The online survey was divided into six chapters:

1. General information on RTC: What has been done up to now?
2. General information on hospitals,
3. ICD-coding in hospitals and other relevant data,
4. Transformation of ICD-codes (or other hospital data) to AIS),

5. AIS-coding in hospitals (no transformation),
6. Reporting on serious injuries regarding MAIS 3+.

The chapters 1-5 aimed at gathering background information to outline the respective “starting position” of each country in the process of establishing the assessment of and reporting on MAIS 3+. The last chapter had the objective to assess the situation of MAIS 3+ reporting for the year 2014 and in the long run. The survey intended to make national proceedings in the whole context of MAIS 3+ assessment more transparent. Therefore on the one hand many free text fields were provided to describe the national situation (e.g. each chapter ended with the question ‘What else?’ to give additional information and/or to clarify national exceptions) and on the other hand standardized items were presented to reveal differences and similarities between countries more easily.

Taking this aspiration into account two general conclusions might be drawn:

- Each country has its unique “starting position”. Any kind of data management (definitions, collection, storage, analysis, and dissemination of data) that is in the responsibility of any of the involved institutions (police, hospitals, ministries, etc.) seems to be influenced by national and historical circumstances.
- The current efforts of MAIS 3+ assessment are affected by these national exceptions. Each country works on its own way of assessing the number of serious injuries. The European Commission distinguishes between three ways to proceed with MAIS 3+ assessment; for the report for the year 2014 all three ways and other solutions will be used by the countries. Countries using the same methodological approach (e.g. linkage of hospital and police data) have different study designs. The interpretation of MAIS 3+ (e.g. MAIS 3-5 or MAIS 3-6 minus fatalities) differs between countries as well. Thus a synopsis regarding the number of serious injuries on a European level is hardly possible now.

What is the meaning of this?

On the one hand the methodological heterogeneity makes international comparisons difficult and limits the calculation of a European total number of serious injuries. It should be avoided to compare “apples and oranges”. Any interpretation of national numbers of serious injuries has to take carefully into account the respective methodological particularities (and limitations). A simple example is the difference in injury numbers based on hospital data alone versus injury numbers derived by police records. The first proceeding could tend to overestimate the real number of serious injuries, since the definition of a RTC in a medical sense is in most cases less strict (e.g. inclusion of crashes on non-public roads) than in terms of the official RTC statistics. However, a use of hospital data could also result in underestimations of MAIS3+ cases, e.g. due to missing or miscoding of external causes or in case of impossibility of trans-coding from ICD to AIS. The other way round it is well known that police data tends to underestimate RTC numbers especially regarding pedestrians and cyclists.

On the other hand the different national solutions indicate that the countries work hard to succeed in assessing the number of serious injuries. Some countries (e.g. NL, SE) are concerned with this topic for many years and still invest a lot to optimize their systems (e.g. ways to reach national representativeness, adaptations like change from ICD-9 to ICD-10). In some cases these efforts result in injury data and statistics that are over and above the expectations of the European Commission. Others (e.g. GR, IT) are rather at the beginning of MAIS 3+ assessment

and have to cope with more fundamental problems. The difference between countries with already elaborated assessment systems and countries just starting to establish relevant infrastructure, methods etc. suggests the assumption that the description of best practice (by the more experienced countries) might be helpful to meet current challenges of the less experienced countries. In our understanding it would be worth working on such an approach, though it must be stressed that a solution worked out for one country can never be transferred to another country one by one as national exceptions are too big. But the adaptation of solutions or at least single aspects might be assistance.

Summing up the results regarding prospects three aspects might be important:

- The process of establishing MAIS 3+ assessment will take time, in some countries probably some years.
- It is not very likely that methodological differences between countries in assessing the number of serious injuries can be settled easily to obtain a “unique” European number. On this way it should at least be agreed on the interpretation of MAIS 3+.
- The overall objective is to reduce the number of serious injuries in Europe. The assessment of numbers of serious injuries is only the first step on the path to this aim. The identification of injury prevention measures (e.g. training, education, infrastructural developments, vehicle and road users protection systems, etc) for all groups of road users is a second step. Therefore datasets containing information on MAIS 3+ and the accident occurrence is necessary. Up to now only a few countries seem to be ready to address this task.

The bottom line of this survey is that European countries started well with assessing the number of serious injuries, but we have still got a long way to go.