SafetyCube

ICD to AIS for Road injuries
Current practices & problems
Discussion on possible solutions

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Severity by Police and Hospital

AIS (AAAM)

ICD9, ICD10, CM (WHO)

Mappings ICD → AIS

Problems

Other issues – SafetyCube Guidelines

- Inclusion criteria
- External causes
- Combine HDR and Police

Discussion on solutions

How to assess injury severity?

- by the **police** at the scene
  (serious & slight, correct in ≈ 60% of cases)
- by **direct assessment** in hospital or ambulance
  e. g. through the Abbreviated Injury Scale **AIS** ©
- by **indirect assessment** through the injury diagnoses, e.g. through **ICD to AIS** mapping

DG Move: focus on serious injuries

- Next to reducing road fatalities,
  reducing the number of serious traffic injuries is a key priority in the road safety programme 2011-2020 of the European Commission (EC, 2010)
- A harmonised definition is required
- In January 2013, the High Level Group on Road Safety, representing all EU Member States, established the definition of serious traffic injuries as road casualties with an injury level of MAIS ≥ 3

SafetyCube survey results
Current practice in the EU (june 2016)

- 17 of the 26 countries: MAIS ≥ 3 estimates to DG-MOVE
- Difficulties to get access to hospital discharge data
- 9 hospital data, 2 corrections to police data, and 4 record linkage of police and hospital data. France and Germany apply a combination
- The ratio of MAIS ≥ 3 casualties / fatalities differs considerably between these countries, from **0.6** MAIS ≥ 3 in Poland to **13** MAIS ≥ 3 in the Netherlands

FERSI Road Safety Research

SafetyCube

irtad International Traffic Safety Data and Analysis Group

Care Experts

Source: State of data collection on serious traffic injuries across Europe (June 2016). http://www.safetycube-project.eu

Severity Indicators

- Police can determine
  - killed on the spot (fatal)
  - transported to hospital (fatal, serious, slight)
  - treated on the spot (slight)

  underreporting when casualties or witnesses call for medical care and do not inform police

  Follow up after transport to hospital:
  - Privacy – no detailed info from hospitals
  - Hospitalised
  - MAIS3+ cannot determined from police data
- Alternative sources: ambulance data?

Severity Indicators

- Hospital
  - *Treated at Accident & Emergency, Admitted (in-patient)*
  - *Admissions: detailed info is recorded however not always available for research, selection of traffic casualties can be difficult*
  - *A&E: detailed data is lacking, sometimes a sample of hospitals can be used (IDB)*

  Hospital Discharge Registers
  - *Even admitted casualties are often slightly injured*
  - *Increase in number of admittances for observation*
  - *Increase in day-treatment/short stay*
  - *Length of stay is decreasing (average from 15 to 5 days over last 20 years in many countries)*
  - *Detailed injury diagnosis codes can be used*

What is MAIS3+?

AIS: Abbreviated Injury Scale **BTSSLL.s**

B = Body Region
T = Type of Anatomical Structure
SS = Specific Anatomical Structure
LL = Level
S = Severity Score

Example: 419200.2 “inhalation injury NFS (heat, particulate matter, noxious agents)

Severity Score (AIS©)		distr in HDB	
		fatal	survive
	unknown	7%	7%
1.	Minor	2%	16%
2.	Moderate	8%	51%
3.	Serious	20%	17%
4.	Severe	34%	7%
5.	Critical	26%	1%
6.	Maximum	2%	<0.1%

Severity Score Examples

1 superficial laceration

2 fractured sternum

3 open fracture of humerus

4 perforated trachea

5 ruptured liver with tissue loss

6 total severance of aorta

MAIS = Maximum AIS for a casualty; MAIS>2 = **MAIS3+**

Questionaire on current practice

Information of health/hospital data

- Data sources
- Inclusion criteria (e.g. outpatients, day care patients, re-admissions, scheduled admissions, fatalities within 30 days)
- ICD version
- Nr. of diagnoses & nr. of digits
- Conversion algorithm
- Proportion of failed transformations (ICD > MAIS)
- ICD injury codes
- External causes
- …

AIS versions

Association for the Advancement of Automotive Medicine
http://www.aaam.org/

Versions of AIS

1985		
1990, 1998	*1200 codes*	*Direct coding in FR, DE (Rhône, Gidas)*
2005, 2008	*2000 codes*	*Direct coding in DE*
2015?		

Differences: New codes (more specific), revised severity due to better data or medical improvements.

SafetyCube result: in AIS2005 the number of MAIS3+ casualties is about 10% lower than in AIS1998 or AIS1990

Recent development: Crosswalk converting AIS1998 to AIS2005 v.v.

ICD9 Interational Classification of Diseases

- ICD9 or ICD9cm – Clinical Modification
- 800.xx – 999.xx approx 2.880 codes
- Countries: BE, EL, IT, NL, PT, ES
  all use the clinical modification
- Tools: 800-959
  - *AAAM9 (3x)* *to AIS2005 in AIS3+=Yes, No, Unknown*
  - *ICDpic (1x)* *to AIS1985 in AIS, BR*
  - *DGT (-)* *to AIS1998 in predot.AIS*
  - *ICDmap90 (1x)* *to AIS1990 in predot.AIS*

  In SafetyCube some countries applied more tools; here the official tool is shown in (*x*)

ICD10

- ICD10 or ICD10cm – Clinical Modification
- S00.00 – T99.99 or S00.xxx – T99.xxx
  approx 3.900 and 17.500 codes, enabling Left and Right, and first encounter
- Countries: AT, DK, FI, HU, NL, PO, SI, UK, CH
  all ICD10, CH uses German modification, IE uses Australian modification, no country uses Clinical modification
- Tools:
  - *AAAM10 (6x)* *cm to AIS2005 in AIS3+=Yes, No, Unknown*
  - *ECIP navarra (-)* *to AIS1998 in predot.AIS*
  - *AGU (1x)* *swiss, combines other variables e.g. LoS*
  - *ICDmap90 (1x)* *after conversion to ICD9cm*

  T00-T19 (multiple injuries) are not mapped by these tools

  In SafetyCube some countries applied more tools; here the official tool is shown in (*x*)

AIS to MAIS and ISS

- If any injury is AIS in (3,4,5,6) then MAIS3+
  - *So ignoring any AIS in (1,2) or 9 (unknown)*
- ISS Injury Severity Score
  - *ISS = sum of 3 severest body regions AIS^2*
  - *E.g. ISS = $2^2 + 3^2 + 4^2 = 29$*
  - *Ranging from 1 .. 75 (any AIS=6 results in ISS=75)*
  - *Medically ISS >= 16 is considered Severe (AIS=4 or 3+3 or 3+2+2)*
  - *Only possible if you have AIS severity score by body region*

How to determine MAIS3+

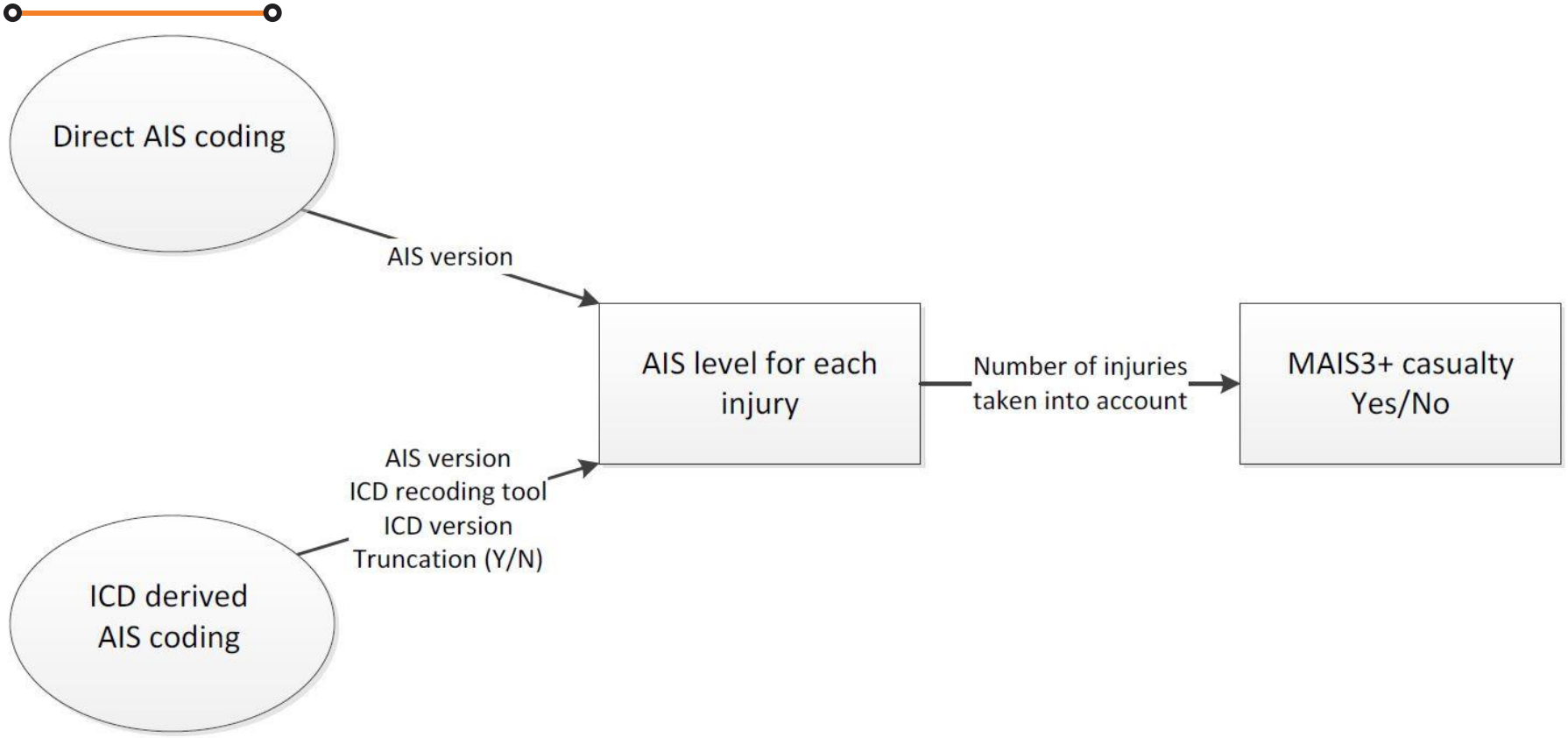


Figure 6-2 Issues related to deriving MAIS ≥ 3 that may influence the number of MAIS ≥ 3 casualties

Problems

- Principle *from many codes to a more limited set*: could work
- ICD9cm → AIS2005 is ok.
  AAAM9 works well, limited info on Body regions and impossible to derive ISS for multiple injury
- ICD10 – AIS2005 is difficult
  - *Missing codes in the AAAM-list*
    - *many countries trunk*
    - *AAAM10 was build for CM*
    - *Some countries use Australian or German modification*
  - *The number of injuries available is limited in many countries*
  - *ECIP maps to AIS1998 and is not officially accepted by AAAM*

To check, work arounds

- Check the mapping/join
  - *Avoid misjudgement because of leading or trailing spaces*
- Apply ECIP + Crosswalk AIS1998 → AIS2005
  - *Conversion after conversion, # of codes*
- Multiple injury (T00-T18):
  - *check that the detailed single injuries are present*
  - *If you only have a limited nr of injury codes or principal diagnosis only, check that this is not a code for multiple injury*

Solutions?

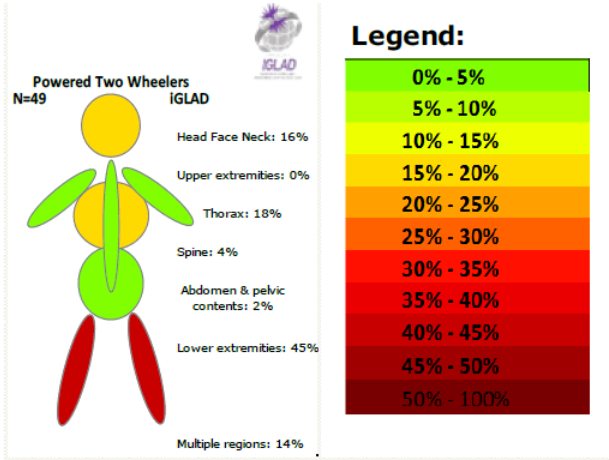
- AAAM asks to report missing codes
  https://www.aaam.org/get-updates-missed-code
  So maybe this gives an opportunity to have them added?
  - *truncated codes*
  - *(older) European ICD10-codes (i.e. not clinical modification)*
- AAAM developed an additional mapping which includes the AIS-level and Body region, enabling the ISS calculation and also other severity cut-offs such as MAIS2+. Conditions for use are yet unclear.
- Ask hospitals to map the AIS severity before they trunk the ICD-codes or limit the number of injuries delivered to you
- Develop our own indication of the severity
- If the codes are not detailed enough to specify one AIS or MAIS3+, we can opt to return a distribution over AIS instead.
  - *(so from observed detailed counts, it appears that for example 10% of the cases is AIS=4, 70% is AIS=3 and 20% is AIS=2).*
  - *In order to estimate the number of MAIS3+ cases (statistically, not at the casualty record level) this may work well.*
- .....

What do we expect?

→ The MAIS3+ new methodology should yield more reliable and comparable data than the old reporting system

→ In the longer term, the Commission will be able to monitor and benchmark Member State performance

→ Also, the new data (*) shows that fatal crashes and crashes resulting in serious injury have different characteristics. This will help to see where more work is needed, such as on safety for vulnerable road users or safety in urban areas



* SUSTAIN project:
ec.europa.eu/transport/road_safety/sites/roadsafety/files/injuries_study_2016.pdf

What still needs to be done?

→ Further harmonisation of methods (HLG 1,2,3) over the next years is desirable in order to ensure that the estimated numbers of MAIS ≥ 3 road traffic injuries are comparable across Europe

→Improve on mapping tools from ICD10 to AIS2005

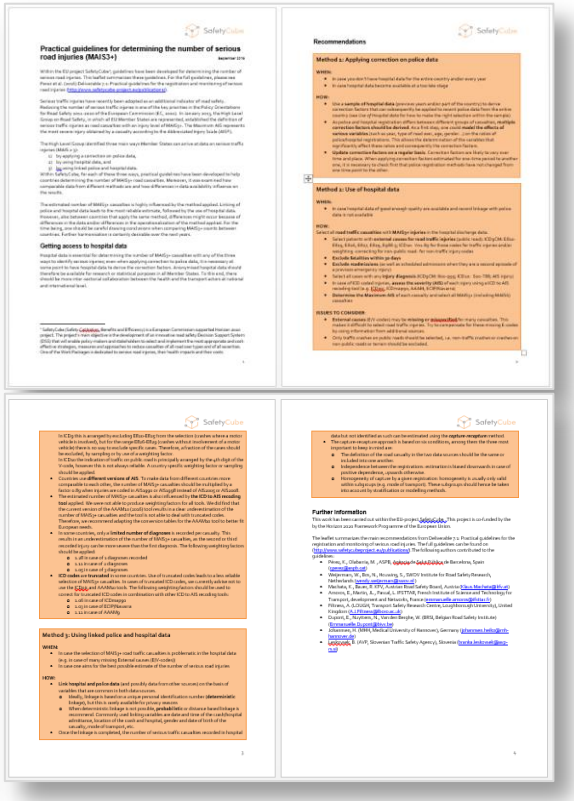
→ Complete ongoing research on MAIS3+ Guidelines by the EU Horizon 2020 project SafetyCube: www.safetycube-project.eu

MAIS3+ data availability: 17!

	MAIS3+ estimationscurrently or soon available?	For which years are MAIS3+ data available?
Austria	**yes** (2016)	2014
Belgium	**yes** (2015)	2011-2014
Bulgaria	No	-
Croatia	No	-
Cyprus	**yes** (soon)	-
Czech Republic*	**Yes**	2014
Denmark	No	-
Estonia	No	-
Finland	**yes** (2015)	2010 & 2011, 2014
France	**yes** (preliminary figures)	2006-2014
Germany	**yes** (2015)	2014
Greece	No	-
Hungary	No	-
Ireland*	**Yes**	2014
Italy	**yes** (2015)	2012-2014
Latvia	No	-
Lithuania	No	-
Luxembourg	No	-
Malta	No	-
Netherlands	**yes** (2015)	1993-2014
Poland	**yes** (2015)	2013
Portugal	**yes** (2015)	2010-2014
Romania	No	-
Slovakia	No	-
Slovenia	**yes** (2015)	2012-2014
Spain	**yes** (2016)	2000-2014
Sweden*	**Yes**	2014
United Kingdom	**yes** (2016)	1999-2011 (soon up to 2015)
Iceland	No	-
Norway	No	-
Switzerland	**yes** (2016)	2011-2014

The report

The leaflet



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http://www.safetycube-project.eu/

Thank you!