Linking a road trauma registry and hospital discharge data to improve the ICD-AIS mapping

M. Yvrou, A. Ndiaye, J-L. Martin, E. Amoros, B. Gadegbeku
Introduction: different countries, different methods

- Starting research project: no results available yet, focus on methodology

- Number of serious road traffic casualties: difficult to estimate

- European Commission: serious road traffic casualties = at least an AIS 3+ injury score

- SafetyCube project\(^1\) recommends
  - Applying correction factors to police data
  - Using hospital data
  - Police and hospital data linkage

- Most European countries: hospital data

- France:
  - Correction method based on police data and the Rhône road trauma registry\(^2\)
    - Estimates produced from national hospitalization data\(^3\)

- Problem with hospital data: injuries coded with ICD \(\rightarrow\) No severity score

A conversion tool is necessary to obtain injury severity

\(^1\)Safetycube, Perez 2018
\(^2\)Amoros et al. 2008
\(^3\)Zullo et al. 2021
Introduction: ICD to AIS

• Several conversion maps: different versions of ICD and AIS classifications

• Association for the Advancement of Automotive Medicine (AAAM): ICD-AIS map

• From ICD-10-CM (clinical modification, US coding) to AIS 2005 update 2008 (AIS3+ yes/no/unknown)

• Different classifications structures → Important number of undetermined AIS scores

• Map limitations:
  • Unknown severity score if ICD code = several AIS post-dot codes with different severities
  • Significant proportion of undetermined scores: ~50%  
  • Not optimal for European data
  • Few studies with real world data, small samples

Agreement between translated AIS / directly coded AIS not well enough evaluated
Introduction: Rhône context

- Rhône road trauma registry: injury severity directly coded with AIS by an expert
  - 2015-2021 ~9,000 injured per year, including ~1,500 hospitalized

- Rhône county: 1.8 million inhabitants, urban (Lyon) and rural

- Hospital data (PMSI, medico-administrative database):
  - ICD codes for all hospitalized victims in France
  - AIS severity by mapping

Probabilistic linkage between the two
Direct AIS versus translated AIS

Objective: Evaluate validity of translated MAIS
Data (and methods)

Rhône road trauma Registry

- All road accident casualties, outpatients (ED) and hospitalized
- Rhône county
- Injuries: **AIS 2005 update 2008**
- Directly coded
- Expert physician
- Focus on
  - 2015-2021
  - ~1500/year hospitalized casualties
  - Rhône county = crash location

Hospital data (PMSI)

- Hospitalized patients
- France
- Injuries: **ICD-10**
- ICD-AIS map to obtain AIS severity
- Medical staff
- Focus on
  - 2015-2021
  - Admissions, ≥1 traumatic injury (ICD-10 codes S00-T88) ~3 300 patients/year
  - Rhône county = hospitalization place
Methods: probabilistic linkage

- Linkage variables
  - FINESS (hospital ID number)
  - Admission date (day, month, year)
  - Discharge date (day, month, year)
  - Age
  - Gender
  - Postal code of residence
  - Type of admission
  - Type of discharge
  - Length of hospital stay

- Linkage should be conducted by a hospital data expert team
- Rhône county
- 2015-2021
Methods

Linked sample

- Expected size: ~7000 casualties
- AIS severity directly coded
- AIS severity obtained from ICD-10 codes by the ICD-AIS map

→ Strength of agreement between both scores, using Cohen’s kappa\(^1\)
  - Global
  - By body region
  - By road user modes (pedestrian, car, bicycle, motorcycle ...)

→ Distribution of AIS scores for a given ICD-10 code: helps to resolve unknown AIS severity status

Conversion maps

- AAAM: From ICD-10-CM codes to AIS severity scores\(^2\)
- Significant injury map: From ICD-10 code to AIS severity 3+/<3/unknown
- ICD-ISS map: From ICD-10 code to AIS severity, AIS chapter (body region), ISS body region

\(^1\) Cohen 1960
\(^2\) Loftis et al. 2016
Limitations

• Several ICD-10 codes: **No AIS severity** with the conversion tool (~50% with AAAM ICD-AIS map\(^1\))

• Linkage = data loss

• External cause (ICD10 V codes) poorly coded in France: **difficult identification of road casualties**
  • Traumatic injuries (S00-T88) due to **different external causes** (road crash, home and leisure injuries, occupational accidents)

• One-to-one match Registry/PMSI difficult to obtain?

• Severe road crash casualties transferred in the Rhône county, from outside the area

\(^1\)Zullo et al. 2021
Strengths

- **Large sample size** expected
- **Reduction of unknown AIS severity** by assigning an AIS distribution

*Hypothetical example:*

<table>
<thead>
<tr>
<th>ICD code</th>
<th>Translated AIS severity</th>
<th>Directly coded</th>
<th>Observed distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>541699</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541610</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541612</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541620</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541622</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541640</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>541614</td>
<td></td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td>541624</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>541626</td>
<td></td>
<td>4</td>
<td>20%</td>
</tr>
<tr>
<td>541628</td>
<td></td>
<td>5</td>
<td>10%</td>
</tr>
</tbody>
</table>

**S37.0**
(Injury of kidney)

- Results expected in **2023**
Thank you for your attention

melanie.yvrou@univ-eiffel.fr
Additional slide

• What is AIS?
• **Abbreviated injury scale = injury classification**

![Diagram](attachment:image_url)

- Body region (R)
- Type of anatomic structure (T)
- Body area or anatomic structure specification (S)
- Specific type of lesion (N)

• Registry AIS expert is working on a one-to-several mapping ICD/AIS (RTSN) codes
• Conversion improvements for French data and probably European ones
• Possible extension to other AIS severity scores or study of sequelae (FCI)
• MAIS : overall severity score (if several injuries), = maximum of AIS