Determination of the number of serious road injuries

The Hague, 24 May 2016
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Method 2: use of hospital data
Aim

To obtain the best estimate of the number of road traffic serious injuries
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To obtain the best estimate of the number of road traffic serious injuries
How to derive the number of severe road traffic injuries (MAIS3+) using hospital data?

- How can hospital data be accessed?
- Which criteria should we use to select cases from hospital data?
- How can MAIS been derived from hospital Data?
Methods

- 2 case studies
  - 1. Inclusion / exclusion Criteria
    - Hospital data from Spain and The Netherlands
    - ICD9 / ICD10
  - 2. MAIS conversion tools
    - Data from The Netherlands, France, Slovenia, Spain, Austria, and Belgium
Criteria for case selection

- What to do with:
  - Hospital Fatalities
  - Readmissions
  - Scheduled
  - Outpatients & short admissions

- Which injury codes?
- Which external causes?
### In/exclusion criteria

#### How to treat deaths before and after 30 days

- If a person is admitted to hospital but finally **dies within 30 days** after the admission he/she should be accounted as a fatality.

- But if the person **dies after 30 days**, it should be counted as injured according to their severity.
In/exclusion criteria

Include or not readmissions & scheduled admissions

• Exclude **readmissions** to avoid duplicates within a full calendar year (or within a month if it is not possible to identify through the full year)

• and exclude **scheduled admissions** when they is a second episode of a previous emergency injury but they are not defined as readmissions.
How to treat hospitalizations of 1 day or less / day treatment

• Include all traffic injury hospitalizations in the definition because, although they have such a short hospitalization, they might be transferred to other hospitals. They will be registered then as readmission or as a scheduled admission and not as an emergency. That means that it is unlikely to be duplicated.
In/exclusion criteria

**Injury codes**

- Include all cases with any **injury diagnosis**
  - ICD9CM: 800-999
  - ICD10: S00-T88
In/exclusion criteria

External causes

- Include **external causes** for road traffic injuries:
  - **ICD9CM**: E810-E819, E826, E827, E829, E988.5
  - **ICD10**: V01-89
- for those codes for **traffic injuries**
  - and/or weighting -correcting for non-public road- for non-traffic injury codes

Traffic Injuries

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E810-819</td>
<td>Motor vehicle traffic accident</td>
</tr>
<tr>
<td>E826</td>
<td>Pedal cycle accident</td>
</tr>
<tr>
<td>E827</td>
<td>Animal-drawn vehicle accident</td>
</tr>
<tr>
<td>E828</td>
<td>Accident involving an animal being ridden</td>
</tr>
<tr>
<td>E829</td>
<td>Other road vehicle accident</td>
</tr>
<tr>
<td>E988.5</td>
<td>Injury by crashing of motor vehicle, undetermined whether accidentally or purposely inflicted</td>
</tr>
</tbody>
</table>
In/exclusion criteria

Additional information

• Missing Ecode

• Accident compensation payer (Vehicle insurance company)
Weighting factors

<table>
<thead>
<tr>
<th>Including</th>
<th>Spain</th>
<th>The Netherlands</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths within 30 days</td>
<td>0.95</td>
<td>0.96</td>
<td>0.95</td>
</tr>
<tr>
<td>Readmissions</td>
<td>0.98</td>
<td>0.96</td>
<td>0.97</td>
</tr>
<tr>
<td>E929 - Late effects</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>E828 - Accident involving an animal being ridden</td>
<td>0.98</td>
<td>0.97</td>
<td>0.97</td>
</tr>
<tr>
<td>E820-825 – Non traffic transport injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Include:
  • All injury diagnoses (ICD9CM: 800-999; ICD10: S00-T88)
  • External causes for road traffic injuries to include are:
    ICD9CM: E810-E819, E826, E827, E829, E988.5; ICD10: V01-89
    for those codes for traffic injuries (on public roads)

• Exclude:
  • Fatalities after 30 days
  • Readmissions/duplicate records
  • Crashes on non-public roads / Non traffic injuries
Discussion
Including / excluding criteria

- Criteria? Missing criteria?
- Ecode underreporting?
- Road traffic Injuries in non public roads?
- Weighting factors?
How to derive MAIS\(_3^+\)

- Direct coding vs conversion tools
- Versions AIS\(1990 / 1998\) - AIS\(2005 / 2008\)
- Number of injuries per casualty
- Truncated injury codes
How to derive MAIS₃⁺

- AIS 2005/2008

Conversion tools
- ICDmap90
- AGU
- DGT
- ICDpic
- ECIP
- AAAM9
- AAAM10
## How to derive MAIS$_3^+$

### Versions AIS - Direct coding

- The difference between AIS1990 and AIS1998 can be neglected
- The difference between AIS2005 and AIS2008 can be neglected
- If injuries are coded in AIS1990-98 instead of AIS2005-08, the number of MAIS3$^+$ casualties should be multiplied by a factor 0.9
How to derive MAIS3+

Conversion tools

- For **ICD9cm** the 4 tools investigated to derive the AIS or MAIS3+ do not make any significant change to the number of MAIS3+ casualties.
- For **ICD10** there seems to be only one tool available, as the AAAM10 mapping does not actually fit to the European coding practice (no clinical modification):
  - AAAM10 algorithm appears to
    - result in a clearly lower number of MAIS3+ casualties compared to direct coding
    - results in clearly lower numbers of MAIS3+ casualties compared to ECIP (30% to 40% lower)
How to derive MAIS3+

Consequence of using a limited number of injuries per casualty

- Apply the following weighted factors in cases where less than 4 injuries are taken into account for the determination of the number of MAIS3+ casualties
  - 1.3 in cases of 1 injury
  - 1.1 in cases of 2 injuries
  - 1.05 in cases of 3 injuries

<table>
<thead>
<tr>
<th></th>
<th>BE</th>
<th>NL</th>
<th>NL (ICD10 converted to ICD9cm)</th>
<th>ES</th>
<th>SUM</th>
<th>Average ICD9cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICD9cm</td>
<td>ICD9cm</td>
<td>ICD9cm ICDmap90</td>
<td>ICD9cm</td>
<td>ICD9cm</td>
<td>(BE+NL+ES)/3</td>
</tr>
<tr>
<td>All</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>94%</td>
<td>98%</td>
<td>98%</td>
<td>94%</td>
<td>97%</td>
<td>95%</td>
</tr>
<tr>
<td>2</td>
<td>87%</td>
<td>95%</td>
<td>95%</td>
<td>88%</td>
<td>93%</td>
<td>90%</td>
</tr>
<tr>
<td>1</td>
<td>71%</td>
<td>85%</td>
<td>83%</td>
<td>77%</td>
<td>82%</td>
<td>78%</td>
</tr>
</tbody>
</table>
How to derive MAIS3+

Consequence of truncated injury codes

• Do not use the ICDpic tool in combination with truncated codes

• Use the following factors to correct for truncated codes:
  • 1.06 in case of ICDmap90 or DGT
  • 1.03 in case of ECIP
  • 1.11 in case of AAAM9

Estimated number of MAIS3+ casualties when using truncated codes compared to using full codes

<table>
<thead>
<tr>
<th></th>
<th>Using full codes</th>
<th>Using truncated codes</th>
<th>%</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ES</td>
<td>ICDpic</td>
<td>8,274</td>
<td>2,108</td>
<td>25%</td>
</tr>
<tr>
<td>BE</td>
<td>ICDpic</td>
<td>19,143</td>
<td>3,949</td>
<td>21%</td>
</tr>
<tr>
<td>NL</td>
<td>ICDmap90</td>
<td>107,735</td>
<td>101,549</td>
<td>94%</td>
</tr>
<tr>
<td>DGT</td>
<td></td>
<td>115,380</td>
<td>109,039</td>
<td>95%</td>
</tr>
<tr>
<td>NL</td>
<td>ICDpic</td>
<td>109,373</td>
<td>17,454</td>
<td>16%</td>
</tr>
<tr>
<td>NL</td>
<td>AAAM9</td>
<td>108,509</td>
<td>97,660</td>
<td>90%</td>
</tr>
<tr>
<td>NL</td>
<td>ECIP</td>
<td>14,519</td>
<td>14,071</td>
<td>97%</td>
</tr>
<tr>
<td>NL</td>
<td>AAAM10</td>
<td>8,480</td>
<td>12,123</td>
<td>143%</td>
</tr>
</tbody>
</table>
Deriving MAIS3+

- Multiply the number of MAIS3+ casualties by a factor 0.9 when injuries are coded in AIS1990 or AIS1998 instead of AIS2005 or AIS2008

- Adapt the conversion tables for the AAAM10 tool to better fit European needs. In the current state the AAAM10 tool results in a clear underestimation of the number of MAIS3+ casualties. Moreover, truncation results in an increase in the number of MAIS3+ casualties.

- Apply the following weighted factors in cases where less than 4 injuries are taken into account for the determination of the number of MAIS3+ casualties
  - 1.3 in cases of 1 injury
  - 1.1 in cases of 2 injuries
  - 1.05 in cases of 3 injuries

- Do not use the ICDpic tool in combination with truncated codes.
- Use the following factors to correct for truncated codes:
  - 1.06 in case of ICDmap90 or DGT
  - 1.03 in case of ECIP
  - 1.11 in case of AAAM9
Discussion
Deriving MAIS$_3^+$

- Recommending standard conversion tool?
- Weighting factors?
- Specific weighting factors by road user / age group?
Discussion
Including / excluding criteria

- Criteria? Missing criteria?
- Ecode underreporting?
- Road traffic Injuries in non public roads?
- Weighting factors?
<table>
<thead>
<tr>
<th>Traffic Injuries</th>
<th>MAIS0-2</th>
<th>MAIS3+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Ecode</td>
<td>5,241 (24.0%)</td>
<td>811 (9.1%)</td>
<td>6,054 (19.6%)</td>
</tr>
<tr>
<td>E810-819 Motor vehicle traffic accident</td>
<td>11,620 (53.2%)</td>
<td>6,438 (72.1%)</td>
<td>18,075 (58.7%)</td>
</tr>
<tr>
<td>E826 Pedal cycle accident</td>
<td>2,716 (12.4%)</td>
<td>1,018 (11.4%)</td>
<td>3,734 (12.1%)</td>
</tr>
<tr>
<td>E827 Animal-drawn vehicle accident</td>
<td>18 (0.1%)</td>
<td>7 (0.1%)</td>
<td>25 (0.1%)</td>
</tr>
<tr>
<td>E828 Accident involving an animal being ridden</td>
<td>450 (2.1%)</td>
<td>193 (2.2%)</td>
<td>644 (2.1%)</td>
</tr>
<tr>
<td>E829 Other road vehicle accident</td>
<td>80 (0.4%)</td>
<td>28 (0.3%)</td>
<td>108 (0.4%)</td>
</tr>
<tr>
<td>E929.0 Late effects</td>
<td>228 (1%)</td>
<td>8 (0.1%)</td>
<td>238 (0.8%)</td>
</tr>
<tr>
<td>E988.5 Injury by crashing of motor vehicle, undetermined whether accidentally or purposely inflicted</td>
<td>1 (0%)</td>
<td>3 (0%)</td>
<td>4 (0%)</td>
</tr>
<tr>
<td>Other Ecode</td>
<td>1,499 (6.9%)</td>
<td>421 (4.7%)</td>
<td>1,931 (6.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>21,853</td>
<td>8,927</td>
<td>30,813</td>
</tr>
</tbody>
</table>