Definition and calculation of Lower Extremity Amputation Rates in Diabetes

OECD R&D Study coordinated by the Italian Ministry of Health

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OECD R&D on Lower Extremity Amputations in Diabetes

The problem

- Across a decade, a total of twenty-four OECD countries contributed data on Diabetes Lower Extremity Amputations.
- Results highlighted a high variation across time and space, which could be partially explained by the use of different sources and methods.
- Multidisciplinary expert advise is required to ascertain whether specific coding strategies and/or selection of a subset of clinical conditions could lead to more stable estimates, improving the international comparability for this indicator.
- At the HCQI Meeting in May 2014, the expert group agreed about the general scope and specific objectives of the present study.
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Study team

**Coordinator:** Italian Ministry of Health

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- Przemka Jarosz-Chobot, Medical University of Silesia (Poland)
- Natasa Bratina, Iztok Stotl, University of Ljubliana, (Slovenia)
OECD R&D on Lower Extremity Amputations in Diabetes Study Workplan (July-November 2014)

Step 1 (June)
- Rapid Literature Review

Step 2 (July-September)
- Questionnaire on local approaches, data sources and experiences in the calculation of Lower Extremity Amputation Rates in Diabetes (LEARD)

Step 3 (September)
- Specification of test algorithms for different options in the calculation of amputation rates
- Data sheet(s) for data collection

Step 4 (October-November)
- Development of SAS source code
- Analysis of national hospital discharges
- Final report to the HCQI
Current OECD definition

Coverage:
Population aged 15 and older.

Numerator:
All non-maternal/non-neonatal admissions with procedure code of lower extremity amputation excluding toe in any field and diagnosis code of diabetes in any field in a specified year.

Exclude cases:
- transferring from another institution
- MDC 14 (Pregnancy, childbirth, and puerperium)
- MDC 15 (Newborn and other neonates)
- with trauma diagnosis code in any field
- same day/day only admissions (admissions with a length of stay less than 24 hours). In those countries where a timestamp of admission or discharge is not available cases with a length of stay of 0 days shall be excluded.

Denominator:
Population count.

No restriction on ages
Distinction between minor, major, unspecified, total
Diabetes diagnoses tracked from previous discharges (using person ID)
Not needed when using personal ID
Exclude also tumour-related amputations

- Use people with diabetes
- Use Minor/Major ratio (no need to estimate denominator)
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Step 2. Questionnaire on local practices

✔ Total of 14 questions organized in 5 sections (data linkage, standardized definitions, reporting, unique subject identifiers and diabetes registers)

✔ Completed by 7 countries: Ireland, Israel, Italy, Latvia, Norway, Slovenia, UK

✔ Main results:

✔ Indicator is commonly used, although with slightly different definitions e.g. denominators including people with diabetes only

✔ Ascertainment of diabetes status still relying on the quality of hospital coding during the hospitalization for amputation

✔ In most cases, carrying out analyses using a person unique identifier (UID) is possible.

✔ Countries are slowly introducing diabetes registers and data linkage across multiple sources to improve estimates
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Step 3. Test algorithms

**Numerator:**
Reference population:
- People with diabetes; People without diabetes (for comparison)
Classification of ICD amputation codes into three different sub-categories:
- Minor amputations (ICD9CM: 84.11-84.12); Major amputations (ICD9CM: 84.13-84.19); Total: Minor+Major+Unspecified (ICD9CM: 84.10)
Use of unique person identifier:
**Yes,** retain only one subject per amputation episode
- count each patient only once, recording only the most severe amputation
- recover diabetes diagnoses from previous discharges
- Exclusion criteria: MDC 14, 15; Trauma diagnosis code; Tumour-related peripheral amputations

**Denominator:**
- Estimated total number of people with and without diabetes
OECD Analysis of Lower Extremity Amputations in Diabetes

Step 3. Data sheets for data collection

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Diabetes Status (0=No,1=Yes)</th>
<th>ICD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diagnosis present with intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diagnosis extracted from ALL discharges for the same subject (current+previous years)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>84.10</td>
<td>x,xxx</td>
</tr>
<tr>
<td>2013</td>
<td>1</td>
<td>84.10</td>
<td>x,xxx</td>
</tr>
<tr>
<td>2013</td>
<td>1</td>
<td>84.10</td>
<td>x,xxx</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>84.11</td>
<td>x,xxx</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>84.11</td>
<td>x,xxx</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

*Data for this column are only available if a unique identifier is in the hospital discharge database

Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>People with Diabetes</th>
<th>Total population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>XXX,XXX</td>
<td>XXX,XXX</td>
</tr>
<tr>
<td>2013</td>
<td>XXX,XXX</td>
<td>XXX,XXX</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

...
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Step 4. Analysis of hospital discharges

Italy 2002-2013 (N=99,649,200)
Total 2013: N=7,272,173; N 250xx=522,335 (7.2%)

[SAS Source code deployed to produce results from hospital discharges]

<table>
<thead>
<tr>
<th>Distribution of Amputated Subjects by Procedure ICD Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD 250.xx + amputation in 2013</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>with diabetes</td>
</tr>
<tr>
<td>N=7,700</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>without diabetes</td>
</tr>
<tr>
<td>N=4,149</td>
</tr>
</tbody>
</table>
Step 4. Analysis of hospital discharges
Italy 2002-2013 (N=99,649,200)

<table>
<thead>
<tr>
<th>Year</th>
<th>People with diabetes</th>
<th></th>
<th>People without diabetes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minor N</td>
<td>Rate*</td>
<td>Major N</td>
<td>Rate*</td>
</tr>
<tr>
<td>2002</td>
<td>3,225</td>
<td>145.1</td>
<td>2,539</td>
<td>114.2</td>
</tr>
<tr>
<td>2003</td>
<td>3,486</td>
<td>152.0</td>
<td>2,611</td>
<td>113.9</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2012</td>
<td>4,956</td>
<td>151.7</td>
<td>2,678</td>
<td>82.0</td>
</tr>
<tr>
<td>2013</td>
<td>4,852</td>
<td>150.5</td>
<td>2,623</td>
<td>81.4</td>
</tr>
</tbody>
</table>

|      | CV**    | 13.4  | 4.1    | 2.9   | 11.8  | 8.4   | 5.5    | 3.0   | 2.3    | 7.0   | 8.5    | 4.6   | 6.0    |

<table>
<thead>
<tr>
<th>Not using patient unique identifier</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>3,944</td>
<td>177.4</td>
<td>2,398</td>
<td>107.9</td>
<td>6,655</td>
<td>299.4</td>
</tr>
<tr>
<td>2003</td>
<td>4,079</td>
<td>177.9</td>
<td>2,351</td>
<td>102.5</td>
<td>6,724</td>
<td>293.3</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>2012</td>
<td>5,349</td>
<td>163.7</td>
<td>2,070</td>
<td>63.4</td>
<td>7,644</td>
<td>234.0</td>
</tr>
<tr>
<td>2013</td>
<td>5,163</td>
<td>160.2</td>
<td>1,982</td>
<td>61.5</td>
<td>7,358</td>
<td>228.3</td>
</tr>
</tbody>
</table>

| CV** | 9.7   | 5.9    | 6.1   | 18.7  | 4.7   | 9.7    | 9.7    | 8.4    | 3.0    | 4.2    | 3.3    | 2.6    |

* x 100,000 population with and without diabetes; **coefficient of variation x100
## Trends in LEA Rates (x100,000) in People with Diabetes

<table>
<thead>
<tr>
<th></th>
<th>Person-based (using patient Identifier)</th>
<th>Episode-based (not using patient Identifier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV</td>
<td>CV=5.5</td>
<td>CV=9.7</td>
</tr>
<tr>
<td></td>
<td>CV=4.1</td>
<td>CV=5.9</td>
</tr>
<tr>
<td></td>
<td>CV=11.8</td>
<td>CV=18.7</td>
</tr>
</tbody>
</table>

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**Step 4. Analysis of hospital discharges**

**Italy 2002-2013 (N=99,649,200)**
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Conclusions

✔ Pilot analysis conducted on Italian hospital discharges suggests that using a personal identifier may reduce variation in amputation rates, particularly for major complications

✔ Splitting the analysis of amputation rates by severity of amputation may lead to substantially different results

✔ Using a personal identifier retrospectively may recover a substantial portion of diabetes cases not identified within the episode of amputation. Preliminary analyses run by Israel also confirm such result

✔ The frequency of major amputations among cases with diabetes (presumably) incorrectly not recorded at amputation is substantially higher, compared to the group with diabetes attributed at amputation

✔ Countries and researchers are greatly interested in improving the calculation of amputation rates through continued collaboration. Empiric results and following discussions helped recommending new OECD definitions
### Current definition

**Coverage:** Population aged 15 and older.

**Numerator:** All non-maternal/non-neonatal admissions with procedure code of lower extremity amputation excluding toe in any field and diagnosis code of diabetes in any field in a specified year.

**Exclude cases:**
- transferring from another institution
- MDC 14 (pregnancy, childbirth and puerperium) - Refer to Appendix A of the technical guidelines
- MDC 15 (newborn and other neonates)
- Trauma diagnosis codes (ICD9CM: 89.50, 89.51, 89.60, 89.61, 89.62, 89.63, 89.70, 89.71, 89.72, 89.73, 89.74, 89.75, 89.76, 89.77)
- Tumour-related peripheral amputations (ICD9CM: 170.7,170.8)
- Same day/day only admissions

**Denominator:** Population count.

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### Minor Revision

**Coverage:** Population with diabetes at all ages

**Numerator:** All non-maternal/non-neonatal admissions with procedure code of major lower extremity amputation (ICD9CM: 84.13-84.19) in any field and diagnosis code of diabetes in a specified year

**Exclude cases:**
- Transferring from another institution
- MDC 14 (pregnancy, childbirth and puerperium)
- MDC 15 (newborn and other neonates)
- Trauma diagnosis codes (ICD9CM: 89.50, 89.51, 89.60, 89.61, 89.62, 89.63, 89.70, 89.71, 89.72, 89.73, 89.74, 89.75, 89.76, 89.77)
- Tumour-related peripheral amputations (ICD9CM: 170.7,170.8)
- Same day/day only admissions

**Denominator:** Estimated total number of people with diabetes

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### Major Revision

**Coverage:** Population with diabetes at all ages

**Numerator:** Major amputations (ICD9CM: 84.13-84.19)

Use of unique person identifier:
- count each patient only once, recording only the most severe episode of amputation occurred in the reference year
- automated search of diabetes diagnoses (ICD9CM: 250.xx) for all subjects amputated in the reference year, among discharges occurred within the same and previous years (up to the first year with reliable and consistent unique person identifier), and/or records indicating diabetes status in any other relevant database e.g. pharmaceuticals, specialist visits and laboratory data.

**Exclude cases:**
- MDC 14 (pregnancy, childbirth and puerperium)
- MDC 15 (newborn and other neonates)
- Trauma diagnosis codes (ICD9CM: 89.50, 89.51, 89.60, 89.61, 89.70, 89.71, 89.72, 89.73, 89.74, 89.75, 89.76, 89.77)
- Tumour-related peripheral amputations (ICD9CM: 170.7,170.8)

**Denominator:** Estimated total number of people with diabetes
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Step 4+. Analysis of hospital discharges

Further work required to consolidate and disseminate results

- Computation of standardized rates and confidence intervals
- Specs for different classification systems (ICD10, NOMESCO)
- Extension of data collection to (a limited set of) collaborating countries (using the data sheet specifications provided) and meta-analysis of variation in amputation rates
- Validation/comparison of amputation rates obtained from hospital discharges vs diabetes registers (where available)
- Production of a collaborative scientific paper
Questions, suggestions, support for further work???

Thanks for your attention!