OECD RAPID R&D STUDY 2014
Coordinated by the ITALIAN MINISTRY OF HEALTH
with the support of the EUBIROD NETWORK

STANDARDIZED DEFINITIONS AND CALCULATION OF LOWER EXTREMITY AMPUTATION RATES IN DIABETES FOR THE OECD HEALTH CARE QUALITY INDICATORS PROJECT

FINAL REPORT

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This report is the product of a volunteer R&D Study agreed within the activities of the OECD "Health Care Quality Indicators" (HCQI) Project, Paris, 2014.

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1. Rationale

Throughout the years, the calculation of several diabetes indicators included in the OECD Health Care Quality Indicators (HCQI) Project showed problems regarding the feasibility and comparability of the results at the international level.

Following the data collection 2012-2013, the Expert Group agreed the following:

- to merge three indicators on Diabetes Hospital Admission into one summary indicator of uncontrolled/uncomplicated, short and long term complications
- to drop the indicator on Annual Retinal Examination, due to the limited availability at international level
- to conduct a specific evaluation of the application of OECD definitions for lower extremity amputations in diabetes (Annex 1) in support of potential modifications and/or retention/omission of the indicator by November 2014

Across a decade, a total of twenty-four OECD countries contributed data on Lower Extremity Amputations Rates in Diabetes (LEARD). The results highlight a high variation across time and space, which can be partially explained by the use of different sources and methods (Annex 2).

At the second HCQI annual meeting 2013, the expert group agreed that multidisciplinary expert advise was required to ascertain whether specific coding strategies and/or selection of a subset of clinical conditions can lead to more stable estimates, improving the international comparability of LEARD.

The present study aimed to evaluate the application of different methods e.g. the selection of different data sources and the adoption of specific clinical definitions and statistical algorithms, for the calculation of LEARD at the international level. The study is one of several rapid R&D projects approved by the HCQI expert group, to update methods in the calculation of indicators and plan the OECD data collection 2014-2015 accordingly. All studies were expected to deliver recommendations to the expert group for the second annual meeting 2014.

The project has been coordinated by the Italian Ministry of Health in collaboration with the OECD HCQI secretariat. Expert methodological support for the conduction of the study has been provided by the Italian-led EUBIROD Network (www.eubirod.eu), a EU collaboration of diabetes registers which agreed to participate on a voluntary basis.

The study was carried out in two different phases:

I. Understanding local methodology in the calculation of LEARD.
   a) review of algorithms and sources used by countries for the OECD data collection
   b) review of recent literature on the topic
   c) survey on the state of the art of practices in participating countries
II. Investigating the differences in indicator values when using alternative specifications on multiple data sources e.g. discharge data, diabetes registers or system-wide data linkage.
   a) selection of different algorithms for the calculation of amputation rates
   b) national data analysis using selected algorithms
   c) interpretation of the results from on field testing

The project has benefited from results obtained by the study conducted by the UK Department of Health, exploring the effect of different data systems and technical specifications on diabetes indicators.

2. Participants and Setting

The study was conducted as a collaboration between the Italian Ministry of Health and governmental institutions of Ireland, Israel, Latvia, Norway and the United Kingdom.

The following national officers volunteered to collaborate to the present study:

- Jana Lepiksone, Centre for Disease Control, Latvia
- Hanne Narbuvold, Directorate of Health, Norway
- Katherine Everard, Candida Ballantyne, NHS England and Veena Raleigh, The King's Fund, UK
- Flavia Carle, Silvia Donno, Paola Pisanti, Ministry of Health, Italy
- Ziona Haklai, Yael Applebaum, Ministry of Health, Israel
- Deirdre Mulholland, Grainne Cosgrove, Department of Health and Children, Ireland

The following experts from the EUBIROD Network accepted to support volunteer countries:

- Jana Lepiksone, Centre for Disease Control, Latvia
- Karianne Fjeld Loovas, Noklus, Norway
- Scott Cunningham, University of Dundee, Scotland, UK
- Zeliko Metelko, CrodiabNet, University of Zagreb, Croatia
- Tamara Poljicanin, National Institute of Public Health, Croatia
- Joseph Azzopardi, University of Malta, Malta
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- Fabrizio Carinci, HIRS, Italy
- Massimo Massi Benedetti, HIRS, Italy

Support from the EUBIROD network resulted also in additional information submitted for Slovenia.

The following experts also accepted to collaborate:

- Prof.Luigi Uccioli, Università degli Studi di Roma "Tor Vergata", Italy

The Italian coordinating team included: Flavia Carle, Silvia Donno and Paola Pisanti, Italian Ministry of Health; Massimo Massi Benedetti and Fabrizio Carinci, EUBIROD Network; and Luigi Uccioli, Università Tor Vergata.

3. Workplan

The workplan included the preparation of relevant background material for the conduction of the study. An initial review of the recent literature allowed structuring a short questionnaire for participating countries, including questions on national practices in the calculation of LEARD.

The questionnaire was circulated in July 2014, with a deadline for completion by September 2014. The examination of responses allowed the definition of a common standard to collect relevant data for the application of different algorithms across countries.

A structured format using aggregate data was specified for the scope (including counts for numerators, denominators and selected strata e.g. age, sex, etc). Ad hoc SAS software was developed to compute LEARD on hospital discharges and deliver the desired format. An analysis of Italian data was carried out for years 2002-2013.

The major results have been included in a short report delivered to the OECD on 30th October 2014. The validation of the proposed methodology extending the analysis to other countries and using diabetes registers as a gold standard has been postponed, pending agreement of countries to undertake further analysis. The timetable of operations is presented in detail in Annex 3.

4. Rapid Preliminary Literature Review

A rapid preliminary review of LEARD has been conducted to provide immediate input to the group of expert for the production of the questionnaire for participating countries and to underpin an initial discussion on the possible analyses that will be conducted. The initial review was carried out by the coordinating team in June and successfully completed on 1st July 2014.

The search strategy was aimed at selecting papers published between 2009-2014, using Pubmed for indexed international journals, as well as Google Scholar for the identification or the relevant grey literature. Keywords adopted for the search included "lower" "amputation" and "diabetes". Reports identified by the search were later screened through visual inspection of the abstracts, from which a total of nineteen were found to be eligible for the scope of the initial review.

The final list of extracted papers (see "References" below ordered by last added in the search engine) highlighted the relative scarcity of formal international comparative studies. Papers included only one international review [14] and eighteen national analyses, reporting experiences conducted in the United States [1,11,12], Italy [2], Finland [3,4,15], Ireland [5,10], UK [6,7,8,9,16,17,18], Spain [13] and France [19].

In general, regarding numerators, the OECD selection criteria, diagnoses and procedure codes are applied uniformly in most studies, with the following exceptions:

- the OECD definition includes both minor and major amputations. Several studies consider amputation rates separately for minor and major amputations. In general, all amputations through and proximal to the ankle are considered major, while those distal to the ankle are considered minor. A range of ICD10 codes and local classifications (e.g. NOMESCO or Finnish Hospital League procedure codes) appear to be better suited to handle such discrimination. The potential effect of such differences and the extent to which results can be made comparable deserve to be carefully examined by diabetes experts involved in the present study.
- transfers from other institutions and same day admissions are not used as exclusion criteria. In some cases, records with traumas for superficial lesions, complication of therapies and complications of amputation site have not been excluded [3].
- several studies use neoplasms-related admissions as exclusion criteria

Regarding denominators, the major difference with OECD definitions is the following:

- the OECD definition uses the general population aged 15 and over as denominator. Results incorporate the different prevalence rates observed across OECD countries and thus do not only relate to quality of care in diabetes, but even health promotion campaigns etc. On the other hand, recent studies predominantly express the indicator as the incidence of amputations among subjects with diagnosed diabetes, either estimated through national surveys, or identified via data linkage using a personal ID, or population based diabetes registers.

The fundamental methodological problems encountered in these studies relate to the following aspects:

- calculation of numerators (cases of amputations) separately for subjects tagged as having diabetes or not. In some cases, the identification is based on a personal ID that allows to retrospectively assign a diabetes diagnosis using previous records, for instance in the same year. In the majority of cases, diabetes status is assigned only taking into account the individual admission with amputation procedure, which obviously may lead to substantial undercount. The amount of the bias has been estimated to be 10% if all admissions from the last ten years are used, as opposed to using only hospital discharges from the same year [2]. In countries e.g. Ireland [5,10] or Spain [13] a unique patient ID was not available to extract diabetes status from multiple admissions. Therefore, in some cases amputation rates were patient-based, meaning that all amputations are taken into account, but rates are based on subjects, for instance by using the characteristics of the most proximal level amputation described [19].

- calculation of denominators (diabetes prevalence) to estimate the incidence rate for those with and without diabetes. These may be extracted from national vital statistics [2,19], targeted surveys e.g. the UK National Diabetes Audit or the US NHIS [1,7, 11], claims for selected populations e.g. US Medicare [12], pay for performance schemes e.g. the UK Quality and Outcomes Framework [8,17], computerized linked registries e.g. the Finnish registry linking exemptions, A10 codes for pharmaceutical drugs and hospital discharges [3] or population-based registries e.g. the DARTS in Scotland [9].

Almost all studies report a consistent decrease in the incidence of major and all LEAs, despite of a continuous rise in the prevalence of diabetes. Trends in minor amputations are less clear.

Studies conducted in Finland [3,4] showed that the incidence of any LEARD is less sensitive at detecting temporal or regional change than were indicators of major LEARD. Moreover, the incidence of any LEARD does not identify clearly those with several LEARD, nor it distinguishes those with minor amputations that may have improved outcomes compared to those with major LEARD. In contrast, the minor-major LEARD ratio may represent a useful indicator, even for a simple statistical reason: in its calculation, since denominators refer to the same population, they can be cancelled, thus reducing the computational burden related to standardization and disease prevalence. The ratio is then simply a comparison between absolute numbers extracted from the same population.

However, the Finnish studies recommend to use first LEARD in all cases, when these can be extracted through personal identifiers. This option shall be also considered for its convenient application in the OECD data collection. However, it relies on the possibility that minor and major amputations can be correctly classified using hospital records and the available classification criteria.

The systematic assessment of the literature conducted in 2011 [14] confirmed the high variation of results at the international level.

5. Survey of Amputation Rates in participating countries

The rapid review of the literature served to identify main themes for subject areas to be explored in collaboration with volunteer countries.

Following the review, a survey on local methods adopted for the calculation of LEARD was conducted with the aim of collecting preliminary information to assist with the definition of different algorithms, to be empirically tested on a small set of volunteer countries. A questionnaire was specifically developed for the scope, including a total of fourteen questions, divided into five sections on data linkage, standardized definitions, reporting, unique subject identifiers and diabetes registers.

The questionnaire was sent to volunteering experts on the 21st July. On 12nd September, completed questionnaires were received from Ireland, Israel, Italy, Latvia , Norway, Slovenia and the United Kingdom.

The results show that countries are slowly introducing data linkage and diabetes registers, but that in general the ascertainment of diabetes status, particularly for the OECD data collection, still relies on the quality of hospital coding during the hospitalization for amputation. LEARD are commonly used as an indicator, although with slightly different definitions, including denominators referred to people with diabetes only. In most cases, carrying out analyses using a person unique identifier (UID) is possible.

The structure of the questionnaire and details of the responses received from countries are shown in Annex 6.

6. On field test of selected algorithms for lower extremity amputations in diabetes

6.1 Guiding criteria

The literature review amd survey of practices in volunteering countries provided the basis for guiding criteria in the definition of different options in the calculation of LEARD:

3. Reference population
   - Using the general population in the denominator dilutes the results on a wider pool, where people with diabetes are a very small portion. Rates would be also directly associated with a higher prevalence of diabetes, i.e. countries with a higher prevalence also show higher rates of amputations: the two aspects of quality of care and primary prevention are mixed together. Moreover, restricting the analysis to specific age classes may be not justified and would not even allow to clearly isolate type 1 from type 2. Therefore, all people with diabetes may seem a better reference population.
4. Severity of amputations
   - The scientific literature agrees that only major amputations shall be considered to be indicative of quality of care and should be included in this indicator. In the current definition, minor amputations are overweighted, because multiple episodes can be included in the numerator, and less severe episodes are more likely to occur and be counted repeatedly.
5. Person-based approach
   - Research studies make an increasing use of computerized data linkage from multiple sources to reconstruct the best person-based estimate of LEARD. In its current definition, the indicator does not support the use of a unique person identifier and thus is expressed as the total number of amputations on subjects with a diabetes diagnosis in the general population. Although advantageous in the current state for countries unable to use a unique identifier, improving this indicator may solicit strengthening the overall information infrastructure.
   - Data linkage can ascertain diabetes status much more precisely, adding amputations that otherwise would not be counted, through using the overall database of discharges as well as other sources. This would result into an increased precision of estimated rates.
   - The analysis of multiple admissions makes possible to select the most severe episode in the history of a patient, increasing the focus on major complications and counting a series of events only once, modifying the indicator in the sense of "percentage of people with diabetes experiencing a lower extremity amputation".
   - As all information from multiple admissions would be condensed into one record, conditions e.g. transfer from other institution and same day admission/discharge may be safely omitted from the algorithm.
6. Exclusion criteria
   - Several papers agree on considering tumour-related peripheral amputations as a relevant exclusion criterion.

6.2 Test algorithms

Based on the above considerations, we conducted an on field analysis of LEARD to test the following options:

Numerator:

1. Reference population:
   a) People with diabetes
   b) People without diabetes (for comparison)

2. Classification of ICD amputation codes into three different sub-categories:
   a) Minor amputations (ICD9CM: 84.11-84.12)
   b) Major amputations (ICD9CM: 84.13-84.19)
   c) Total: Minor+Major+Unspecified (ICD9CM: 84.10)

3. Use of unique person identifier:
   a) Yes, retain only one subject per amputation episode
      - count each patient only once, recording only the most severe episode of amputation occurred in the reference year
      - recover diabetes diagnoses for amputations that do not carry a diagnosis of diabetes in any field during the same hospitalization: automated search of a match from diabetes discharges within the same and previous years (up to a time zero)
      - Exclusion criteria:
        - MDC 14 (pregnancy, childbirth and puerperium)
        - MDC 15 (newborn and other neonates)
        - Trauma diagnosis code
        - Tumour-related peripheral amputations

   b) No, count all amputation episodes
      - count patients as many times as many amputations occurred in the reference year
      - unable to recover diabetes diagnoses for amputations that do not carry a diagnosis of diabetes in any field during the same hospitalization
      - Exclusion criteria:
        - Transferring from another institution
        - MDC 14 (pregnancy, childbirth and puerperium)
        - MDC 15 (newborn and other neonates)
        - Same dates of admission and discharge
        - Trauma diagnosis code
        - Tumour-related peripheral amputations

Denominator:

1. Estimated total number of people with diabetes
2. Estimated total number of people without diabetes (for comparison)

The differences of revised definitions with the current ones adopted by the OECD can be so summarized:

- Numerator:
  - Age coverage is complete. This is consistent with several relevant papers on lower extremity amputations in diabetes. The absence of this selection criterion also facilitates access to estimates of diabetes prevalence now referred to the entire population.
  - Transferring from another institution is not an exclusion criterion any more when using the unique person identifier. The subject-oriented approach make sure that all hospitalizations are screened and only the most severe episode of amputation for each subject is counted in the numerator. As the aim is to maximise information in the reference year and count subjects only once, leaving out any admission would be actually counter-productive for amputation screening and irrelevant in terms of total counts in the numerator.
  - Admission and discharge on the same day is not an exclusion criterion any more when using the unique person identifier. Same as above.
  - Tumour related peripheral amputations added to the exclusion criteria. This is consistent with several relevant papers on lower extremity amputations in diabetes.
- Denominator:
  - Restricted to the estimated number of subjects with diabetes, as opposed to the total population in the previous specification.

6.3 Data sheet for data collection

Two separate data sheets have been designed to collect data generated by the application of the above options for the calculation of LEARD.

Table 6.1 includes a data sheet designed to compare the effect of inclusion and exclusion criteria on frequencies for each ICD code of amputation procedures.

Table 6.1. Structure of the table for the extraction of amputations from hospital discharges

Year	**Diabetes Status (0=No,1=Yes)**		**Procedure**	**N**
	Diagnosis present with intervention	**Diagnosis extracted from ALL discharges for the same subject (current+previous years)**		
2013	0	0	84.10	x,xxx
2013	0	1	84.10	x,xxx
2013	1	1	84.10	x,xxx
2013	0	0	84.11	x,xxx
2013	0	1	84.11	x,xxx
...	...	...	...	...

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

The sheet is a cross tabulation between diabetes status and amputation procedure, where diabetes is ascertained in the same hospitalization of the amputation and/or from other discharges (optional column in grey).

Table 6.2 presents a second data sheet, showing the overall results that would be obtained using categories of minor, major and all type of amputations.

Both tables can be calculated using the different options outlined here, particularly by taking or not into account the use of a unique patient identifier (also implying patient-based estimation and most severe episode).

Table 6.2. Structure of the table for the on field analysis of amputations in diabetes

Year	People with diabetes						People without diabetes					
	Minor		Major		Total		Minor		Major		Total	
	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*
2008	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
2009	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
2010	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
2011	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
2012	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
2013	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x	x,xxx	x.x
...	...	...	...	...								

* x 100,000 popolation with and without diabetes

6.4 Software

Specific SAS software has been developed for the scope to implement and apply the above described test algorithms and automatically print results in compliance with designed data sheets.

All the source code used for the analysis of Italian hospital discharges is included in Annex 6.

The program has been written to operate efficiently on a very large national database, including well over 112 million records for all Italian hospitals in the time frame 2001-2013. The software, designed to run on a single dataset including all records, can be easily customized to recursively process different datasets for different years.

Briefly, the program recursively runs across all years in a time frame specified at the outset (e.g. 2002-2013). If a unique person identifier is used, a loop processes all records from the first day of the start year (2002) to the last day of the year in the current loop (e.g. 2006), and extracts records with a diagnosis of diabetes, producing an "annual" list including people with diabetes ascertained at the specific year.

For the same year, all amputations are extracted in a separate dataset, including also the diabetes status recorded in the hospitalization. If the unique person identifier is used, the dataset saves only the most severe amputation, along with the person code. The list of amputated subjects is merged with the list of people with diabetes from previous years, so that a comparison of diabetes status detected from amputation episodes and other discharges can be performed. Rates are computed and results are printed in a format compliant with the above described data sheets.

The software runs as a macro, where the following parameters shall be specified:

- Directory of the discharge database

- Start year of the time interval
- End year of the time interval
- Names of the variables for MDC class, transfer from other institution, date of admission/discharge, unique person identifier (if empty not used), ICD diagnoses and procedures (up to any maximum number allowed)

The above parameters can be changed in accordance with different conditions in specific countries. The macro is run twice, to simulate results that would be obtained from the definition with and without the unique person identifier.

The program also requires the specification of a dataset including the denominators (total estimated number of people with diabetes and total population) for each year in the time interval.

The software is open source, so that changes can be done by any user with national data available for use. The total time of execution for over 100 million records on a high end workstation running SAS 9.3 on MS Windows 8 has been of 2 hours, 46 minutes and 57 seconds.

Despite being developed to be applied on the Italian database, the source code is fairly general and can be rapidly customized for use with other national databases. For any specific requests related the use of the software, please refer to the author (F.Carinci, research@fabcarinci.net).

6.5 Results from Italian data

The test was run on the complete National Italian Discharge Database at Ufficio VI, Ministry of Health in Rome, including discharges from any Italian hospital (public and private for all hospital services covered by the National Health Service). All records for the time frame 2002-2013 were analysed.

Table 6.3 shows the total number of discharges for each year and the total number of discharges attributable to diabetes for those with a reliable UID. For each year, between 6.8% and 7.4% hospital records included a diabetes code of 250.xx in any diagnosis field. The rate for year 2013 has been equal to 7.2%.

Table 6.3. Number of Discharges for Diabetes in the Italian Discharge Database

Year	Diabetes Discharges*	All Discharges*	% Discharges for diabetes
2002	605,775	8,943,591	6.8
2003	619,726	8,864,489	7.0
2004	627,630	8,783,533	7.1
2005	637,960	8,668,281	7.4
2006	640,308	8,737,122	7.3
2007	627,082	8,517,201	7.4
2008	622,451	8,391,591	7.4
2009	601,393	8,245,819	7.3
2010	588,424	8,030,621	7.3
2011	564,047	7,699,785	7.3
2012	546,256	7,494,994	7.3
2013	522,335	7,272,173	7.2

* including only records with a valid unique person identifier

The use of a UID allowed counting the exact number of persons, with diabetes ascertained in any discharge over the entire time frame (Table 6.4).

Between 2002-2013, a total of 2,987,156 people with diabetes were hospitalized, corresponding to nearly the 5.0% of the Italian population for 2013 (the percentage does not take into account the overall population for the selected time frame). Nearly 58.5% of hospitalizations carrying a diabetes diagnoses were identified as readmissions.

As far as amputations are concerned, the analysis produced a series of tables modelled on the data sheet presented before for each year in the time frame.

Table 6.4. Cumulative Number of Persons with Diabetes in the Italian Discharge Database

Year	People with diabetes	Diabetes Discharges*	% Readmissions	All Discharges*
2002	436,476	605,775	27.9	8,943,591
2002-2003	775,953	1,225,501	36.7	17,808,080
2002-2004	1,071,204	1,853,131	42.2	26,591,613
2002-2005	1,343,324	2,491,091	46.1	35,259,894
2002-2006	1,595,732	3,131,399	49.0	43,997,016
2002-2007	1,827,793	3,758,481	51.4	52,514,217
2002-2008	2,048,475	4,380,932	53.2	60,905,808
2002-2009	2,255,979	4,982,325	54.7	69,151,627
2002-2010	2,454,261	5,570,749	55.9	77,182,248
2002-2011	2,640,853	6,134,796	57.0	84,882,033
2002-2012	2,819,033	6,681,052	57.8	92,377,027
2002-2013	2,987,156	7,203,387	58.5	99,649,200

* including only records with a valid unique person identifier

The results for year 2013, with the search for diabetes status extended as explained above over 2002-2013, are presented in Tables 6.5, 6.6.

The distribution of amputations among those concordantly identified as with or without diabetes at different hospitalizations (if any) showed to be fairly similar, with the code 84.17 for major amputations being most frequent, followed by 84.11 for minor amputations.

However, the distribution showed to be very different among those with a diabetes diagnosis not present at amputation, but present in other discharges in the same or previous years (Table 6.6). In this case, the percentages of procedures of major amputations is substantially higher, particularly for 84.17 being more than double (37.7% vs 15.2%) compared to the rate calculated among amputations with a diagnosis of diabetes (data not shown in table). The result seems particularly concerning, as it seems to highlight an attitude towards underscoring the relevance of diabetes for major amputations within the same hospitalization. Such hypothesis deserves to be investigated further in other national databases, considering the relevance of data quality on variation at international level.

In year 2013, a total of 1,676 patients out of 7,700 (21.8%) discharged for an amputation attributable to diabetes, were found to have a diabetes diagnosis not assigned with amputation, but present in any discharge between 2002-2013 (Table 6.6).

Table 6.5. Amputations for year 2011 among people identified without diabetes*

Year	Diabetes Status (0=No,1=Yes)		Procedure	N	%
	Diagnosis present with intervention	Diagnosis extracted from other discharges for the same subject*			
2013	0	0	84.10	224	5.4
2013	0	0	84.11	1,275	30.7
2013	0	0	84.12	338	8.1
2013	0	0	84.13	2	0.0
2013	0	0	84.14	21	0.5
2013	0	0	84.15	386	9.3
2013	0	0	84.16	6	0.1
2013	0	0	84.17	1,760	42.4
2013	0	0	84.18	25	0.6
2013	0	0	84.19	112	2.7

*Search for other discharges applied on the time interval 2002-2013

Table 6.6. Amputations for year 2013 among people identified with diabetes*

Year	Diabetes Status (0=No,1=Yes)		Procedure	N	%
	Diagnosis present with intervention	Diagnosis extracted from other discharges for the same subject*			
2013	0	1	84.10	67	0.9
2013	0	1	84.11	529	6.9
2013	0	1	84.12	265	3.4
2013	0	1	84.13	1	0.0
2013	0	1	84.14	4	0.1
2013	0	1	84.15	162	2.1
2013	0	1	84.16	2	0.0
2013	0	1	84.17	632	8.2
2013	0	1	84.18	6	0.1
2013	0	1	84.19	8	0.1
2013	1	1	84.10	158	2.1
2013	1	1	84.11	2,670	34.7
2013	1	1	84.12	1,388	18.0
2013	1	1	84.13	2	0.0
2013	1	1	84.14	23	0.3
2013	1	1	84.15	581	7.5
2013	1	1	84.16	9	0.1
2013	1	1	84.17	1,176	15.3
2013	1	1	84.18	8	0.1
2013	1	1	84.19	9	0.1

Among these, a total of 815, slightly less than half (10.6% of all amputations) relate to major amputations. Therefore, the impact of undetected diagnoses of diabetes at amputation seems far from being negligible regardless of the severity of amputation, at least in the Italian case.

Results for the chosen algorithms over the entire time interval are shown in Tables 6.7 (using unique identifier) and 6.8 (not using a unique identifier).

The difference between the results obtained from different methods are relevant for the purpose of the study. In general, the variation observed for rates of major amputations is higher than among minor and overall amputations.

This is true for all selected algorithms and apply to both people with and without diabetes, with the exception of minor amputations for people without diabetes, whose coefficient of variation is exactly double to the one observed for major amputations (8.4% vs 4.2%).

According to the algorithm taking into account the UID, between 2002-2013, Italian hospital data show a 28.7% reduction in the portion of subjects undergoing major amputations among people with diabetes (114.2 to 81.4 x 100,000). Noticeably, a 19.6% reduction has also been observed among people with diabetes (5.1 to 4.1 x 100,000).

From the point of view of diabetes care in Italy, the results are very positive, as they show not only that the amputation rates are sharply decreasing, but also that the ratio of minor/major amputations increased from 1.27 to 1.84.

This means that among subjects with diabetes undergoing a specific amputation, almost two out of three experienced only a minor one in 2013. The same number was four out of seven in 2002. This result is likely to be substantially more positive than what can be ascertained from hospital data, as an increasing number of minor amputations, as opposed to major, take place in outpatient settings.

The algorithm not taking into account the UID leads to a much higher estimate of the reduction, equal to over 43% (107.9 to 61.5 x 100,000).

However, in this case amputations incorrectly attributed to a subject without diabetes, would not be recovered from previous years. As a result, rates for people without diabetes are much higher than those one obtained when using the UID (6.1 vs 4.1 x 100,000 in 2013).

Compared to the one using the UID, the algorithm not using the UID shows higher rates of minor amputations and lower rates of major and overall amputations among people with diabetes, as well as higher rates for all categories among people without diabetes.

The coefficient of variation is almost double among people with diabetes (5.9% vs 4.1% in minor, 18.7% vs 11.8% in major, 9.7% vs 5.5% in total amputations) and about four times for minor amputations among people without diabetes (8.4% vs 2.3%).

However, the pattern is reversed for major (4.2% vs 8.5%) and overall (2.6% vs 6.0%).

This might suggest that counting multiple amputations in the algorithm currently adopted by the OECD might explain part of the variability found in the recent results.

Using a person UID, whenever possible, could possibly translate into a reduced variation in the results observed among countries particularly if using a definition using major complications.

Although results based on only one country shall be used with caution, the longitudinal variation observed in this case may help signal trends of selected algorithms at a global level.

Table 6.7. Lower extremity amputations using patient unique identifier – Italy 2002-2013

Year	People with diabetes						People without diabetes					
	Minor		Major		Total		Minor		Major		Total	
	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*
2002	3,225	145.1	2,539	114.2	6,059	272.6	1,632	3.0	2,803	5.1	4,855	8.9
2003	3,486	152.0	2,611	113.9	6,400	279.1	1,570	2.9	2,747	5.0	4,599	8.4
2004	3,834	161.5	2,581	108.7	6,697	282.2	1,580	2.8	2,639	4.8	4,499	8.1
2005	4,007	163.2	2,639	107.5	6,927	282.1	1,653	3.0	2,468	4.4	4,439	7.9
2006	4,139	156.6	2,656	100.5	7,104	268.7	1,686	3.0	2,456	4.4	4,416	7.9
2007	4,093	150.5	2,495	91.7	6,852	251.9	1,630	2.9	2,488	4.4	4,391	7.8
2008	4,349	152.0	2,795	97.7	7,423	259.4	1,717	3.0	2,524	4.4	4,523	8.0
2009	4,737	164.4	2,671	92.7	7,692	266.9	1,696	3.0	2,391	4.2	4,363	7.6
2010	4,790	162.0	2,678	90.6	7,743	261.9	1,709	3.0	2,304	4.0	4,244	7.4
2011	4,814	162.0	2,644	89.0	7,722	259.9	1,678	2.9	2,349	4.1	4,256	7.4
2012	4,956	151.7	2,678	82.0	7,893	241.6	1,683	3.0	2,263	4.0	4,146	7.4
2013	4,852	150.5	2,623	81.4	7,700	238.9	1,613	2.9	2,312	4.1	4,149	7.3
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**

* x 100,000 popolation with and without diabetes; **coefficient of variation x100

Table 6.8. Lower extremity amputations not using patient unique identifier – Italy 2002-2013

Year	People with diabetes						People without diabetes					
	Minor		Major		Total		Minor		Major		Total	
	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*	N	Rate*
2002	3,944	177.4	2,398	107.9	6,655	299.4	2,470	4.5	3,688	6.7	6,734	12.3
2003	4,079	177.9	2,351	102.5	6,724	293.3	2,471	4.5	3,561	6.5	6,469	11.8
2004	4,475	188.5	2,224	93.7	6,972	293.8	2,465	4.4	3,514	6.3	6,400	11.5
2005	4,563	185.8	2,247	91.5	7,080	288.3	2,624	4.7	3,388	6.0	6,474	11.6
2006	4,363	165.0	2,201	83.3	6,849	259.1	2,973	5.3	3,415	6.1	6,816	12.1
2007	4,287	157.6	2,034	74.8	6,577	241.8	2,910	5.2	3,411	6.0	6,718	11.9
2008	4,622	161.5	2,251	78.7	7,125	249.0	3,046	5.4	3,611	6.4	7,090	12.5
2009	4,915	170.5	2,103	73.0	7,278	252.5	3,111	5.4	3,452	6.0	6,982	12.2
2010	4,969	168.1	2,053	69.4	7,261	245.6	3,241	5.6	3,411	5.9	7,024	12.2
2011	5,120	172.4	2,090	70.4	7,444	250.6	2,945	5.1	3,373	5.9	6,690	11.6
2012	5,349	163.7	2,070	63.4	7,644	234.0	3,036	5.4	3,349	6.0	6,721	12.0
2013	5,163	160.2	1,982	61.5	7,358	228.3	3,059	5.4	3,435	6.1	6,830	12.1
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

Discussion

The present study offered an opportunity to investigate a specific indicator of diabetes care that has received substantial attention throughout the last decade at the global level.

Volunteer countries and field experts showed a remarkable interest in the execution of the study, providing tangible support for the design and realization of our on field data analysis. They can be both improved by further collaboration and subsequent refinements.

In general, the results seem very promising and worth to be replicated in other countries. In particular, the approach and source code provided to support of the application elsewhere seems helpful as a sustainable means for further application at the OECD level.

A word of caution has been expressed with respect to the following:

- the use of people with diabetes as denominator for amputation rates. The level of accuracy of national estimates of diabetes prevalence may vary across countries. For instance, the European Task Force on Morbidity Statistics noted that some countries underestimate diabetes cases, due to undiagnosed, untreated or unregistered cases (http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-TC-14-003/EN/KS-TC-14-003-EN.PDF).
- the use of common criteria for privacy protection hamper the possibility to apply data linkage homogeneously across countries. Common approaches that can practically circumvent this problem e.g. the use of aggregate data in EUBIROD, need to be identified to overcome the existing barriers and make indicators e.g. amputation rates more comparable at the international level.
- the application of strict criteria e.g. major revision may create a divide between countries with limited the information infrastructure - e.g. those without a personal ID - and others that can continue to improve estimates through data linkage across different sources e.g. diabetes registers.

The extent of these limitations and the identification of proper solutions deserve to be carefully discussed at the broader level within the HCQI expert group.

Further comments provide scope for future improvement.

A fundamental request has been to provide specific coding guidelines for all major classification systems e.g. ICD10 and NOMESCO. The present study reflects the practical experience of the coordinating country and if the general lines will be approved, the report shall be extended to cover other coding systems, in collaboration with countries with specific experience.

Regarding the validation of estimates from hospital discharges with diabetes registers, some countries have signalled the possibility that this could be also carried out, although the data linkage might be particularly challenging and resource demanding.

The report allowed drawing initial recommendations for the HCQI expert group that are here included in the following conclusions.

Conclusions

Our short R&D study on the HCQI indicator "lower extremity amputation rates in diabetes" recommends the OECD Expert Group to choose between two possible revisions of the former definition, presented as "minor" and "major" in Box 1.

The "minor revision" would leave most issues on double counting of episodes and under counting of diabetes episodes still open. However, with few relevant changes, it would allow solving the problem of minor vs major complications, by selecting only the latter, as well as the heterogeneity of diabetes prevalence, by using the whole population with diabetes both in the numerator and denominator.

The "major revision" would further improve comparability, as it would recover a substantial portion of diabetes cases in all countries, albeit cutting out all those unable to use a unique person identifier. This way, subjects would be counted only once, and only the most severe episode would be recorded, with a more precise measurement of quality of care at person-level.

We believe that the choice of the "major revision" would be consistent with the current HCQI trend towards more robust data quality standards, as demonstrated by the adoption of mortality indicators in-and-out hospital, requiring data linkage across multiple sources.

The team encourages the OECD to continue refining and testing different options for LEARD in the future, including characteristics e.g. age, sex, in the data collection, that would allow standardization and using confidence intervals for international comparisons.

To this aim, we invite volunteering countries to continue work on tasks e.g.:

1. application of "major revision" (if not chosen for the OECD 2014-15 data collection)
2. extension of data linkage
3. comparison with rates calculated in diabetes registers.

The authors of the present study express their interest to continue collaboration with the OECD along these lines.

Box 1. Proposed revision of the OECD indicator "Lower extremity amputations in Diabetes"

<table>
<tr><th>Current definition</th><th>Minor Revision</th></tr>
<tr><td rowspan="3">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) - Refer to Appendix B of the technical guidelines
• with trauma diagnosis code (see ICD codes below) 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.</td>
<td>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</td></tr>
<tr><th>Major Revision</th></tr>
<tr><td>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.
• Exclusion criteria:
    • 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)
Denominator:
Estimated total number of people with diabetes</td></tr>
</table>

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ANNEX 1. Timetable of execution of the project

Date	Activity	Notes
MAY	Collection of Expressions of interest from HCQI Expert Group and EUBIROD Network	OECD proposal "delsa-heal-hcq(2014)4.pdf"
Deliverable: Study Team		
JUNE JULY	Rapid revision of the recent literature	papers in "biblio_amputations_1.zip"
	Coordination Team Meeting (Carinci, Massi Benedetti, Carle)	30th June. Aims: Revision of draft questionnaire and organization of EUBIROD support
	Questionnaire sent to participating countries	21st July
Deliverable: Questionnaire on local approaches, data sources and experiences with the calculation of diabetes amputation rates		
AUGUST SEPTEMBER	Questionnaire collection	19th September
Deliverable: Identification of different protocol definitions (candidate algorithms) for the calculation of amputation rates		
OCTOBER	Conduction of national data analyses and aggregate data collection	28th October
	Draft of final report	30th October
	Submission of abstract of the final report to the OECD	30th October (OECD_R&D_LEAR_281014_compact.pdf)
	Transmission of the report to all study participants (EUBIROD+ countries)	31st October (OECD_R&D_LEAR_311014.pdf)
Deliverable: Extraction of aggregate data using the Italian National Database of Hospital Discharges (frequency tables of combination of procedures).		
NOVEMBER	Delivery of final global report	10th November
Deliverable: Final Report to the HCQI		

ANNEX 2. OECD Definitions for Data Collection 2013–2014

Diabetes lower extremity amputation

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) - Refer to Appendix B of the technical guidelines
- with trauma diagnosis code (see ICD codes below) 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.

Diabetes lower extremity amputation and diabetes diagnosis codes:

ICD-9-CM	ICD-10-WHO
Procedure codes for lower-extremity amputation excluding toe 8410 LOWER LIMB AMPUTATIONS 8412 AMPUTATION THROUGH FOOT 8413 DISARTICULATION OF ANKLE 8414 AMPUTAT THROUGH MALLEOLI 8415 BELOW KNEE AMPUTAT NEC 8416 DISARTICULATION OF KNEE 8417 ABOVE KNEE AMPUTATION 8418 DISARTICULATION OF HIP 8419 HINDQUARTER AMPUTATION Diagnosis Codes For Diabetes: 25000 DMII WO CMP NT ST UNCNTR 25001 DMI WO CMP NT ST UNCNTRL 25002 DMII WO CMP UNCNTRLD 25003 DMI WO CMP UNCNTRLD 25010 DMII KETO NT ST UNCNTRLD 25011 DMI KETO NT ST UNCNTRLD 25012 DMII KETOACD UNCONTROLD 25013 DMI KETOACD UNCONTROLD 25020 DMII HPRSM NT ST UNCNTRL 25021 DMI HPRSM NT ST UNCNTRLD 25022 DMII HPROSMLR UNCONTROLD 25023 DMI HPROSMLR UNCONTROLD 25030 DMII O CM NT ST UNCNTRLD 25031 DMI O CM NT ST UNCNTRL 25032 DMII OTH COMA UNCONTROLD 25033 DMI OTH COMA UNCONTROLD 25040 DMII RENL NT ST UNCNTRLD 25041 DMI RENL NT ST UNCNTRLD 25042 DMII RENAL UNCNTRLD 25043 DMI RENAL UNCNTRLD 25050 DMII OPHTH NT ST UNCNTRL 25051 DMI OPHTH NT ST UNCNTRLD 25052 DMII OPHTH UNCNTRLD 25053 DMI OPHTH UNCNTRLD 25060 DMII NEURO NT ST UNCNTRL 25061 DMI NEURO NT ST UNCNTRLD 25062 DMII NEURO UNCNTRLD 25063 DMI NEURO UNCNTRLD 25070 DMII CIRC NT ST UNCNTRLD 25071 DMI CIRC NT ST UNCNTRLD 25072 DMII CIRC UNCNTRLD 25073 DMI CIRC UNCNTRLD 25080 DMII OTH NT ST UNCNTRLD 25081 DMI OTH NT ST UNCNTRLD 25082 DMII OTH UNCNTRLD 25083 DMI OTH UNCNTRLD 25090 DMII UNSPF NT ST UNCNTRL 25091 DMI UNSPF NT ST UNCNTRLD 25092 DMII UNSPF UNCNTRLD 25093 DMI UNSPF UNCNTRLD	Procedure codes for lower-extremity amputation excluding toe NOT SPECIFIED Diagnosis codes for diabetes: E10.0 INSULIN-DEPENDENT DM WITH COMA E10.1 INSULIN-DEPENDENT DM WITH KETOACIDOSIS E10.2 INSULIN-DEPENDENT DM WITH RENAL COMPLICATIONS E10.3 INSULIN-DEPENDENT DM WITH OPHTHALMIC COMPLICATIONS E10.4 INSULIN-DEPENDENT DM WITH NEUROLOGICAL COMPLICATIONS E10.5 INSULIN-DEPENDENT DM WITH PERIPHERAL CIRCULATORY COMPLICATIONS E10.6 INSULIN-DEPENDENT DM WITH OTHER SPECIFIED COMPLICATIONS E10.7 INSULIN-DEPENDENT DM WITH MULTIPLE COMPLICATIONS E10.8 INSULIN-DEPENDENT DM WITH UNSPECIFIED COMPLICATIONS E10.9 INSULIN-DEPENDENT DM WITHOUT COMPLICATIONS E11.0 NON-INSULIN-DEPENDENT DM WITH COMA E11.1 NON-INSULIN-DEPENDENT DM WITH KETOACIDOSIS E11.2 NON-INSULIN-DEPENDENT DM WITH RENAL COMPLICATIONS E11.3 NON-INSULIN-DEPENDENT DMWITH OPHTHALMIC COMPLICATIONS E11.4 NON-INSULIN-DEPENDENT DM WITH NEUROLOGICAL COMPLICATIONS E11.5 NON-INSULIN-DEPENDENT DM WITH PERIPHERAL CIRCULATORY COMPLICATIONS E11.6 NON-INSULIN-DEPENDENT DM WITH OTHER SPECIFIED COMPLICATIONS E11.7 NON-INSULIN-DEPENDENT DIABETES MELLITUS WITH MULTIPLE COMPLICATIONS E11.8 NON-INSULIN-DEPENDENT DM WITH UNSPECIFIED COMPLICATIONS E11.9 NON-INSULIN-DEPENDENT DM WITHOUT COMPLICATIONS E13.0 OTHER SPECIFIED DM WITH COMA E13.1 OTHER SPECIFIED DM WITH KETOACIDOSIS E13.2 OTHER SPECIFIED DIABETES MELLITUS WITH RENAL COMPLICATIONS E13.3 OTHER SPECIFIED DM WITH OPHTHALMIC COMPLICATIONS E13.4 OTHER SPECIFIED DM WITH NEUROLOGICAL COMPLICATIONS E13.5 OTHER SPECIFIED DM WITH PERIPHERAL CIRCULATORY COMPLICATIONS E13.6 OTHER SPECIFIED DM WITH OTHER SPECIFIED COMPLICATIONS E13.7 OTHER SPECIFIED DM WITH MULTIPLE COMPLICATIONS E13.8 OTHER SPECIFIED DM WITH UNSPECIFIED COMPLICATIONS E13.9 OTHER SPECIFIED DM WITHOUT COMPLICATIONS E14.0 UNSPECIFIED DM WITH COMA E14.1 UNSPECIFIED DM WITH KETOACIDOSIS E14.2 UNSPECIFIED DM WITH RENAL COMPLICATIONS E14.3 UNSPECIFIED DM WITH OPHTHALMIC COMPLICATIONS E14.4 UNSPECIFIED DM WITH NEUROLOGICAL COMPLICATIONS E14.5 UNSPECIFIED DM WITH PERIPHERAL CIRCULATORY COMPLICATIONS E14.6 UNSPECIFIED DM WITH OTHER SPECIFIED COMPLICATIONS E14.7 UNSPECIFIED DM WITH MULTIPLE COMPLICATIONS E14.8 UNSPECIFIED DM WITH UNSPECIFIED COMPLICATIONS E14.9 UNSPECIFIED DM WITHOUT COMPLICATIONS

Exclude trauma diagnosis codes:

ICD–9–CM	ICD–10–WHO
8950 AMPUTATION TOE 8951 AMPUTATION TOE-COMPLICAT 8960 AMPUTATION FOOT, UNILAT 8961 AMPUT FOOT, UNILAT-COMPL 8962 AMPUTATION FOOT, BILAT 8963 AMPUTAT FOOT, BILAT-COMP 8970 AMPUT BELOW KNEE, UNILAT 8971 AMPUTAT BK, UNILAT-COMPL 8972 AMPUT ABOVE KNEE, UNILAT 8973 AMPUT ABV KN, UNIL-COMPL 8974 AMPUTAT LEG, UNILAT NOS 8975 AMPUT LEG, UNIL NOS-COMP 8976 AMPUTATION LEG, BILAT 8977 AMPUTAT LEG, BILAT-COMPL	S78.0 TRAUMATIC AMPUTATION AT HIP JOINT S78.1 TRAUMATIC AMPUTATION AT LEVEL BETWEEN HIP AND KNEE S78.9 TRAUMATIC AMPUTATION OF HIP AND THIGH, LEVEL UNSPECIFIED S88.0 TRAUMATIC AMPUTATION AT KNEE LEVEL S88.1 TRAUMATIC AMPUTATION AT LEVEL BETWEEN KNEE AND ANKLE S88.9 TRAUMATIC AMPUTATION OF LOWER LEG, LEVEL UNSPECIFIED S98.0 TRAUMATIC AMPUTATION OF FOOT AT ANKLE LEVEL S98.1 TRAUMATIC AMPUTATION OF ONE TOE S98.2 TRAUMATIC AMPUTATION OF TWO OR MORE TOES S98.3 TRAUMATIC AMPUTATION OF OTHER PARTS OF FOOT S98.4 TRAUMATIC AMPUTATION OF FOOT, LEVEL UNSPECIFIED T05.3 TRAUMATIC AMPUTATION OF BOTH FEET T05.4 TRAUMATIC AMPUTATION OF 1 FOOT AND OTHER LEG [ANY LEVEL, EXCEPT FOOT] T05.5 TRAUMATIC AMPUTATION OF BOTH LEGS [ANY LEVEL] T13.6 TRAUMATIC AMPUTATION OF LOWER LIMB, LEVEL UNSPECIFIED

ANNEX 3. OECD Data Collection Results 2001-2011

Diabetes lower extremity amputation

Gender	Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Male	Australia									11.1	10.2	8.8	8.2
	Belgium	25.6	27.6	30.4	30.7	31.7	31.4	34.3	30.9	23.7	24.7		
	Canada								18.9		16.3	15.1	16.2
	Denmark								32.7		31.5		
	Finland								10.3	9.1	10.3	9.7	8.3
	France								22.1			12.2	11.9
	Germany								53.8		32.5		29.1
	Hungary					0.9	1.1	1.1	1.6	2.3	1.1	1.7	1.8
	Iceland	9.3	3.9	5.6	7.8	2.3	1.0	2.6	0.0	1.0	0.0		
	Ireland	9.0	7.7	6.1	9.1	7.4	9.0	7.5	9.7	7.9	8.4	9.3	6.8
	Israel	37.3	38.4	36.6	39.4	36.9	37.6	35.5	35.8	30.3	26.3	28.8	
	Italy		8.4	9.7	9.6	9.4	9.2	8.4	8.4	9.0	8.9	9.1	8.8
	Korea								14.3	15.5	16.2	15.1	16.2
	Luxembourg			6.3	12.0	6.6	9.1	6.3	16.1	11.9	8.9	10.5	5.4
	Mexico										10.7	12.6	12.2
	Netherlands						18.5		19.5	18.1	18.3	20.2	
	New Zealand						13.4	9.8	9.1	11.3	12.0	10.3	9.1
	Norway								18.8		14.2	12.5	13.4
	Poland						20.6	22.7	18.5	19.3	19.9	20.8	
	Portugal												18.1
	Slovenia										17.2	17.5	20.2
	Spain	13.0	14.3	14.6	15.6	15.5	15.8	16.3	16.5	16.3	16.6	15.4	15.5
	Sweden								4.5	4.8	5.4	4.9	5.0
	Switzerland							28.7		13.0		12.5	
	United Kingdom							8.4	8.6	8.7	8.7	8.6	8.2
	United States							53.2		49.1		25.0	
Female	Australia									3.6	3.3	2.9	2.5
	Belgium	10.8	10.9	11.4	11.0	11.8	12.0	12.1	11.3	9.6	8.7		
	Canada								6.2		4.8	4.9	4.9
	Denmark								12.8		9.4		
	Finland								3.8	4.1	3.3	3.8	3.6
	France								6.5			3.5	3.4
	Germany								21.9		10.9		9.7
	Hungary					0.4	0.3	0.4	0.6	0.8	0.4	0.4	0.5
	Iceland	3.7	2.9	0.0	2.1	3.4	0.9	0.8	0.0	0.0	0.0		
	Ireland	1.9	2.6	1.8	2.2	1.8	2.3	2.0	2.3	2.6	2.2	2.0	1.4
	Israel	20.7	17.9	18.9	17.8	17.4	17.0	17.6	16.3	12.8	12.4	11.8	
	Italy		3.9	4.3	4.1	3.9	4.1	3.6	3.2	3.4	3.2	3.3	3.2
	Korea								4.3	4.2	4.4	4.8	4.6
	Luxembourg			3.5	3.9	2.9	2.9	1.3	1.7	0.8	1.4	4.4	1.1
	Mexico										6.0	6.8	6.5
	Netherlands						7.5		7.5	6.3	6.2	8.0	
	New Zealand						4.9	4.0	5.4	5.4	4.3	4.5	4.7
	Norway								5.2		5.6	4.1	5.1
	Poland						8.2	8.9	7.4	7.2	7.7	7.9	
	Portugal												8.4
	Slovenia										10.8	8.8	10.5
	Spain	6.4	6.3	6.3	6.6	6.4	6.1	6.3	5.6	5.6	5.5	5.0	4.8
	Sweden								2.1	2.1	2.1	1.9	2.0
	Switzerland							7.3		3.9		2.8	
	United Kingdom							2.6	2.6	2.6	2.6	2.6	2.6

Gender	Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	United States							24.1		22.0		10.4	
Total	Australia									6.9	6.4	5.5	5.0
	Belgium	17.5	18.5	20.0	19.9	20.6	20.6	22.1	20.1	15.9	15.9		
	Canada								11.9		10.0	9.6	10.0
	Denmark								22.3		19.2		
	Finland								6.8	6.4	6.5	6.5	5.8
	France								13.4			7.4	7.1
	Germany								36.4		20.6		18.4
	Hungary					0.6	0.7	0.8	1.1	1.5	0.7	1.0	1.1
	Iceland	5.7	3.1	2.5	4.6	2.8	1.1	1.6	0.0	0.4	0.0		
	Ireland	5.1	4.8	3.6	5.2	4.3	5.3	4.4	5.6	5.0	4.9	5.2	3.8
	Israel	28.1	27.3	26.8	27.4	26.2	26.3	25.7	25.1	20.7	18.6	19.5	
	Italy		5.9	6.7	6.6	6.4	6.4	5.8	5.6	5.9	5.7	5.9	5.7
	Korea								8.8	9.4	9.6	9.5	9.8
	Luxembourg			4.9	7.7	4.8	5.5	3.6	7.7	6.0	4.6	7.0	2.8
	Mexico										8.3	9.5	9.2
	Netherlands						12.5		12.8	11.6	11.6	13.5	
	New Zealand						8.5	6.7	7.0	7.9	7.6	7.1	6.7
	Norway								11.0		9.3	7.8	8.7
	Poland						14.0	15.3	12.6	12.8	13.3	13.9	
	Portugal												12.8
	Slovenia										14.0	12.5	15.1
	Spain	9.4	9.9	10.1	10.6	10.5	10.5	10.8	10.5	10.4	10.6	9.7	9.6
	Sweden								3.2	3.2	3.6	3.2	3.3
	Switzerland							16.8		7.9		7.1	
	United Kingdom							5.2	5.3	5.4	5.3	5.3	5.1
	United States							37.5		34.5		17.1	

Dataset: Health Care Quality Indicators
Value: Age(-sex) standardised rate per 100 000 population
Age Group: 15 years old and over

ANNEX 4. OECD HCQI Sources and methods for data collection

Diabetes lower extremity amputation

Country	Data custodian / Organisation	Name of the information system	Source type	Compliance with OECD requirements on data source quality and additional information	Classification used	Compliance with the OECD definition for the indicator	Break in time series
Australia	Australian Institute of Health and Welfare(AIHW) and Australian Bureau of Statistics (ABS)	National Hospital Morbidity Database 2008-09 to 2011-12 and Australian Demographic Statistics, June 2012	Administrative database	Yes	ICD-10-AM 7th edition, 1 July 2010	The National Hospital Morbidity Database NHMD does not hold information on time of admission or separation. Length of stay less than24 hours was captured using a derived data element called same day flag. Same day flag captures separations where a patient was discharged from hospital on the same calendar day during which he she was admitted. Same day flag does not perfectly capture the concept of LOS less than 24 hours, but was the best available option in the database. Population used for denominator was estimated resident population, age 15 plus as at 30 June 2008.	No
Belgium	Federal Public Service (FPS), Health DG1	Minimal Clinical Data	Administrative database	Yes	ICD-9CM	Yes	No
Canada	Canadian Institute for Health Information (CIHI), Ministry of Health and Social Services, Quebec and Statistics Canada	Discharge Abstract Database, File of hospitalisations MED-ÉCHO and CANSIM	Administrative database	Starting in 2009, Quebec is included in this indicator calculation.	ICD-10 CA	Yes. Major Clinical Categories (MCC) 13 (Pregnancy and Childbirth) and MCC 14 (newborn and neonates) were used as equivalents for MDC14 and MDC15, respectively.	No
Denmark	Statens Serum Institut (SSI) and Statistics Denmark	National Patient Registry and Population Statistics	Registry (mandatory or volontary)	2008 registration not completed yet - completeness estimated at 90+ %	ICD-10	Yes	No
Finland	National Institute for Health and Welfare (THL) and Statistics	Hospital Discharge Register combined with	Registry (mandatory or	Yes	NOMESCO Classification for	Yes	No

Country	Data custodian / Organisation	Name of the information system	Source type	Compliance with OECD requirements on data source quality and additional information	Classification used	Compliance with the OECD definition for the indicator	Break in time series
	Finland	Cause-of-Death Register	volontary)		Surgical Procedures (NCSP)		
France	Technical Agency for Information on Hospitalisation (ATIH) and National Institute of Statistics and Economic Studies (INSEE)	National hospital discharge Database (PMSI MCO) and Population Statistics	Administrative database	Yes	Classification Commune des Actes Médicaux (CCAM)	Toe amputation were not excluded for the year 2007.	No
Germany	Federal Office of Statistics (Destatis)	DRG-Statistics and Population Statistics	Administrative database	Before 2011 the indicator was calculated on base of a 10% sample. Since 2011, the indicator is calculated on base of the full data set.	ICD-10-GM	Yes	No
Hungary	National Institute for Quality and Organizational Development in Healthcare and Medicines (GYEMSZI) and Hungarian Central Statistical Office (KSH)	National Health Insurance Fund Inpatient Database and Population Pyramid	Administrative database	Yes	ICD-10	Yes	No
Iceland	The Directorate of Health in Iceland and Statistics Iceland	National Patient Register and National Register of Persons	Registry (mandatory or voluntary)	Yes	Nordic Classification for Surgical Procedures (NCSP)	Cases transferring from another institution, maternal and neonatal cases as well as cases with trauma diagnosis code in any field were not excluded.	No
Ireland	Economic and Social Research Institute (ESRI) and Central Statistical Office (CSO)	Hospital Inpatient Enquiry (HIPE) and Population Data	Administrative database	Data refer to discharges from publicly funded acute hospitals only; private hospitals are not included. Activity data for private hospitals is not available, however based on a household survey carried out by the Central Statistics Office in 2010 it	ICD-9-CM for 2000 - 2004; ICD-10-AM for 2005 - 2011	Yes	No

Country	Data custodian / Organisation	Name of the information system	Source type	Compliance with OECD requirements on data source quality and additional information	Classification used	Compliance with the OECD definition for the indicator	Break in time series
				is estimated that approximately 15% of all hospital inpatient activity in Ireland is undertaken in private hospitals. It should be emphasized that this is an estimate only and so should be interpreted with caution.			
Israel	Ministry of Health and Central Bureau of Statistics (CBS)	National Hospital Discharge Database and Population by age and gender	Administrative database	Yes	ICD-9CM	Cases transferring from another institutionwere not excluded.	No
Italy	Ministry of Health and National Institute of Statistics (ISTAT)	National Hospital Discharge Database and Population Data	Administrative database	Yes	ICD-9-CM, 9th Revision, 2007	Yes	No
Korea	Health Insurance Review & Assessment Service	National Health Insurance Claims data	Administrative database	Yes	Health Insurance Procedure Code of HIRA	Yes	No
Luxembour g	Caisse Nationale de Santé and Centre Commun de la Sécurité Sociale	Hospital discharge database and Social Security Database	Administrative database	Yes	National classification "Nomenclature des actes et services des médecins et médecins-dentistes"	Insured resident population	No
Mexico	Ministry of Health and National Population Council (CONAPO)	National System for Health Information (SINAIS) - Hospital Discharge Automated System (SAEH) and 2009: Basic Demographic Indicators 1990-2009: Census 2010 version, 2010 and 2011: National	Administrative database	Only information from public services (hospitals managed by the Ministry of Health, State Health Services, Ministry of Marine (SEMAR), PEMEX and institutions of social security, such as IMSS and ISSSTE) were available. Information from private	ICD-10	Cases transferring from another hospital could not be excluded.	No

Country	Data custodian / Organisation	Name of the information system	Source type	Compliance with OECD requirements on data source quality and additional information	Classification used	Compliance with the OECD definition for the indicator	Break in time series
		Population Projections 2010-2050.		hospitals and from hospitals managed by the Ministry of Defense (SEDENA) could not be included. However, an ajdustment was performed.			
Netherlands	Dutch Hospital Data (Utrecht) and Statistics Netherlands (the Hague)	National Medical Registry and Population register	Registry (mandatory or voluntary)	Several hospitals stopped to participe in the National Medical Registry.	Dutch Classification of Medical Specialty Procedures (CMSV 2.6)	Yes	No
New Zealand	Ministry of Health and Statistics New Zealand	National Minimum Dataset and Population data	Administrative database	Yes	ICD-10-AM-III (Australian modification, 3rd edition)	Yes	No
Norway	Norwegian Directorate of Health and Statistics Norway	Norwegian Patient Register and Norwegian Population Registry	Registry (mandatory or voluntary)	Yes	NCMP, Norwegian version 2010,2011	Yes	No
Poland	National Institue of Public Health - National Institute of Hygiene and Central Statistical Office	General Hospital Morbidity Study and Population Data Base	Administrative database	Completeness about 90% - hospitals reporting level	ICD-10	Cases transferring from another hospital could not be excluded.	No
Portugal	Administração Central do Sistema de Saúde (ACSS) and Instituto Nacional de Estatistica (INE)	Annual hospital discharges database and Censos 2011 - Estimativas Junho 2012	Administrative database	Yes	ICD-9CM	Yes	No
Slovenia	National Institute of Public Health	National Hospital Health Care Statistics Database; e-DRG database	Administrative database	Yes	ICD-10-AM / ACHI 2nd Edition classification	Yes	No
Spain	Ministero de sanidad de servicios sociales e igualdad and National Institute of Statistics	Registro de Altas - CMBD and Population projections and	Administrative database	Only National Health System Hospitals (public and publicly financed -	ICD-9CM	Cases transferring from another institution were not excluded.	No

Country	Data custodian / Organisation	Name of the information system	Source type	Compliance with OECD requirements on data source quality and additional information	Classification used	Compliance with the OECD definition for the indicator	Break in time series
	(INE)	estimations		80-85% of total Country discharges). Coverage of the private sector progressively is increasing since 2005.			
Sweden	The National Board of Health and Welfare and Statistics Sweden	The National Patient Register and Registret över totalbefolkningen - RTB	Registry (mandatory or voluntary)	Yes	diabetes: icd10, amputations: the nordic classification of procedures	nordic classification, all but toes:'NHQ09', 'NHQ11', 'NHQ12', 'NHQ13', 'NHQ14', 'NGQ09', 'NGQ11', 'NGQ99', 'NFQ09', 'NFQ19', 'NFQ99', 'NEQ19','NEQ99'	No
Switzerland	Federal Statistical Office (SFSO)	Medical Statistics of Hospitals	Survey (population or patient)	Yes	Swiss classification of interventions (CHOP), based on ICD-9-CM, Volume 3, Version 11.0, 2008	Yes	No
United Kingdom	NHS Information Centre (England), NHS National Services Scotland, Information Services Division (Scotland), NHS Wales Informatics Service (Wales) and Hospital Information Branch (Northern Ireland)	Hospital Episode Statistics (England), Scottish Morbidity Record Scheme (Scotland), Patient Episode Database (Wales) and Hospital Inpatient System (Northern Ireland)	Administrative database	Data covers NHS funded patients treated in both public and private hospitals.	OPCS	Financial Year data rather than Calendar Year.	No
United States	Center for Organization and Delivery Studies (CODS), Agency for Healthcare Research and Quality (AHRQ), US Department of Health and Human Services (DHHS) and Nielsen Company (a vendor that compiles and adds value to the U.S. Bureau of Census data)	Healthcare Cost and Utilization Project, Nationwide Inpatient Sample (HCUP NIS) and Total US population counts	Administrative database	Yes	ICD-9-CM	Toe amputations could not be excluded prior 2010.	Yes. Counts prior to 2010 did not exclude toe amputation procedures. Counts for 2010 did exclude toe amputations.

ANNEX 5. Survey on the calculation of amputation rates in selected countries

1. DATA LINKAGE. This section addresses the data infrastructure used to capture diabetes diagnoses and amputations in the reference population

1.1 Which are the most complete sources of personal data that can be used to capture a diagnosis of diabetes mellitus?	**Ireland:** Hospital Inpatients Enquiry (HIPE), based on discharge data long term illness, a scheme that provides medicines and appliances for specified illness including diabetes **Israel:** The most complete source would be from the four sick funds that insure and treat the whole Israeli population. **Italy:** no unique reliable system to capture diabetes diagnoses at national level. Several regions use computerized data linkage of hospital, pharmaceutical data and exemption that ensure full coverage for diabetes related services. The availability of a unique person identifier throughout the country ensures fairly complete capture if validated algorithms are used on top of these databases. However, type of diabetes and date of diagnoses cannot be ascertained this way. **Latvia:** Register of Patients with Particular Diseases, Patients with Diabetes Mellitus (Diabetes register) **Norway:** Norwegian Patient Register + Norwegian Prescription Database (NorPD) **Slovenia:** National Hospital Health Care Statistics Database; **UK:** Quality and Outcomes Framework (QOF); National Diabetes Audit (NDA); Hospital Episodes Statistics (HES)	**Latvia:** Diabetes register is population based. We collect new cases and update the information for each diabetic patient in register once a year (70-75 % of all registered patients have updated information each year). Diabetes register doesn't possess full coverage of all diabetic patients in Latvia (diabetes prevalence in Latvia is 4% of population according register date), but we are trying to improve data quality by comparing it with National Health Service's data from Payment system for the remuneration of medicines to obtain information for patients with diagnosis of diabetes mellitus which we don't have in Diabetes register. **Norway:** Diabetes register is available but has poor completeness, and is not used in calculations for amputations **UK:** QOF data comes from General Practice registers, but is only reported at aggregate level, therefore not currently linkable; it only relates to patients with diabetes aged 17+; the NDA integrates data from both primary and secondary care sources, but is also reported at aggregate level. NDA covers 88.4% of people in England and 82.2% with diagnosed diabetes (all ages), but would provide an accurate amputation rate which could be applied accross the whole country; HES is a database of all hospital admissions, is available at individual level and is linkable, but doesn't include all people with a diagnosis of diabetes. More information on: NDA: http://www.hscic.gov.uk/nda QOF: http://www.hscic.gov.uk/qof HES: http://www.hscic.gov.uk/hes

1.2 Which are the most complete sources of personal data that can be used to capture amputation procedures?	**Ireland:** HIPE **Israel:** As amputations are always performed within hospitals, we capture all the cases in the National Hospital Discharge Database **Italy:** National Discharge Database (SDO). However, the challenge is to link these procedures to diabetes diagnoses effectively. **Latvia:** National Health Service (NHS) database of State Paid in-patient services (NHS in-patient database) **Norway:** Norwegian Patient Register + Norwegian Prescription Database (NorPD) **UK:** HES, NDA	
1.3 Which sources have been used in previous rounds of the OECD data collection? Have several alternatives been considered/compared in the calculation of lower extremity amputations in diabetes?	**Ireland:** HIPE used for OECD. No alternatives available **Israel:** for the OECD reports regarding amputations, we have been using the National Hospital Discharge Database **Italy:** National Hospital Discharge Database (SDO, managed by Office VI, Ministry of Health). OECD algorithm used for amputation rates. However, academic studies have been conducted in the past using different algorithms on top o the SDO database (Lombardo et al 2014). **Latvia:** We used data from Diabetes register for OECD data collection (lower extremities amputations rate for patients with diabetes in Latvia in 2007 and 2009). We didn't compared these data with NHS in-patient database **Norway:** Quality indicator based on Norwegian Patient Register and Norwegian Prescription Database. Norwegian Population register has been used in previous rounds to OECD **Slovenia:** National Hospital Health Care Statistics Database; e-DRG database **UK:** HES; Yes, but HES was the only source considered for the OECD HCQI data collection	
1.4 To what extent the data sources used for the calculation of amputation rates can link a procedure to the presence or absence of diabetes (validated diagnosis)?	**Ireland:** same source: data coded according to ICD-10-AM coding standards. Therefore, diagnosis should be valid **Israel:** We search for the appropriate procedure code within a hospitalization and then look for a disease code of diabetes, and rule out a code of trauma. **Italy:** on a national level, this can only be approximated by	**Norway:** There is a discussion about whether amputation rates in general should be taken into account when comparing amputation rates in diabetics, since the access to high quality vascular surgery may also decrease amputation rates in diabetics, not only the quality of the diabetic care overall.

	retrospective analysis of previous discharges with diabetes diagnosis. In some regions, data linkage is used to capture diabetes from different sources. **Latvia:** There are primary, secondary and complication codes (ICD-10) and procedure code (NOMESCO - since 2014) in NHS in-patient database, so it is possible to select patients who have had lower extremity amputation and have diabetes diagnosis (E10-E14). If the primary diagnosis code for diabetic patient with amputation is oncology or trauma/injury we exclude these cases from data collection. It is possible to validate diabetes diagnosis for patients with amputation by linking NHS in-patient database with Diabetes register. **Norway:** There is high awareness among hospital doctors about the relation between diabetes and amputation When coding for amputation in hospitals,orthopaedic surgeons and vascular surgeons tell us that diabetes is always coded if present, but we do not have any validation study to underpin these statements. However, the reimbursement system honours economically the coding of diabetes with complications, which probably increases accuracy of this particular code with the procedure. In the interpretation of the results must be taken into account variations in age and gender. Amputations in diabetics are frequently in elderly men. Number of people with diabetes in a region is measured via NorPD by counting the use of glucose-lowering drugs. With this method it is assumed that you lose 25% of the diabetic population, ie those only treated with lifestyle measures. **Slovenia:** The diagnosis of diabetes is derived from ICD-10-AM diagnosis. This method can import a substantial bias. **UK:** The NDA links to HES for all people in the dataset. This therefore provides a reliable cohort of people with diagnosed diabetes and therefore HES is used to identify amputations using OPCS procedure codes.	

1.5 Can the accuracy of amputation rates be improved by specific actions to strengthen the information infrastructure, e.g. adopting new classification systems or accessing other data sources? Which actions are needed and how long would it take to implement them?	**Ireland:** audit of diabetes amputations. New coding guidelines **Israel:** We haven't developed alternative systems as we believe that our data regarding amputations is good.(Using the systems to identify every case of diabetes is much more complicated.) **Italy:** certainly data linkage applied by specific regions can be used extensively to ensure complete coverage at national level. This can be done in different ways, either centrally, or by linking at regional level and then pooling aggregate results obtained separately from all regions (as experimented in the EUBIROD project at EU level and the Matrice project at National level). That would require targeted action by the central authorities. The adoption of ICD-10 in the not too distant future would also ensure better monitoring of risk factors and further stratification. The creation of a national diabetes register, or linking regional diabetes registries across the country would lead certainly to most complete coverage, particularly of clinical measurements to better capture the type of amputation, but is a long term scenario that might be difficult to pursue in the fragmented Italian framework. **Latvia:** The only one manipulation code was used for all upper and lower extremities amputations in NHS in-patient database till 2014. NOMESCO classification for procedures is used in this database from 2014 (in 2014 as a pilot project, from 2015 the data should be usable). That means that it is possible to separate the amputations for upper and lower extremities for patients from 2014. **Norway:** Existing classifications system is adequate, but the use of several sources of data for the calculation of the rate of amputations for diabetics increases sources of error. In general there is insufficient data to provide systematic information about the quality of Norwegian diabetes care. This applies both with regard to blood glucose control, prevention of complications, cardiovascular risk factors and complication rate. **Slovenia:** 1. Data linkage with different sources for validation of diagnosis of diabetes would be useful to improve accuracy of amputation incidence estimation; 2. There is a ongoing initiative to	**Norway:** Diabetic foot ulcers and amputations are associated with increased mortality. Amputation is the result of missing / delayed preventive care in primary care and / or delayed referral to a specialist. Quality indicator describes the proportion of lower-limb amputations (respectively upper and lower ankle joint) in patients 15 years or older with diabetes as a primary or secondary diagnosis. **UK:** The capacity of the NDA team to respond to DARs has hitherto been very limited but we are promised resolution to this and this is not a complex or IG challenging request

	create a database of amputations. The database would be populated by mandatory data-set/form, filed out by surgeons after performing an amputation. Both possibilities are in early planing phase. **UK:** Yes by using NDA as source of prevalent population with diagnosed diabetes. The action required would be to submit a Data Access Request to HSCIC or HQIP (the data owners).	
1.6 What are the barriers to such improvements? What would be the foreseeable differences in amputation rates that would be seen if such barriers are removed?	**Italy:** enhanced collaboration among regions and between the regions and the Italian Ministry is certainly needed for the scope. Privacy legislation may certainly pose challenges to linking diagnoses data to procedures at a population level. However, that would be paramount to obtain unbiased estimators. More strict application of the legislation for data linkage at national level to monitor efficiency, and implementation of primary care information systems would be key to develop better indicators. Very likely, diabetes prevalence would increase. The impact of better information on amputation rates in diabetes is difficult to foresee. **Latvia:** Until now we were not able to use NHS in-patient database to validate the lower extremities amputation data in Diabetes register. Since there is NOMESCO classification in NHS database from 2014 and it is possible to select lower extremities amputations, we are planning to improve data quality in Diabetes register by linking it with NHS database, thus checking that all diabetic patients who have had amputations are indicated in register. **Norway:** The amputation rate among diabetics will differ according to the number of diabetics that is recorded. A better definition regarding inclusion in the clinical diabetes registry, easier registration in the diabetes clinical registry and maybe some incentives to register patients in the clinical registry would improve accuracy - and the rate of amputation would decrease due to an increase in the number of diabetics in the calculation. We believe that the number of amputation procedures is accurate due to the reimbursement linke to the coding. **Slovenia:** We are currently debating national registry/analytic	

	infrastructure, that would enable improved statistic queries into health system **UK:** Barriers: resources. It can technically be done for England and Wales.	

2. STANDARDIZED DEFINITIONS. This section addresses to what extent the OECD definitions are consistent with current practices

2.1 Are any approaches/methods different from OECD definitions routinely applied for the calculation of lower extremity amputation rates in diabetes?	**Ireland:** reporting into OECD using standard OECD definitions **Israel:** The OECD definitions exclude amputation of toes. Often we include these in our local calculations and publications, as a complication of diabetes. **Italy:** slightly different (see Lombardo et al). **Latvia:** There is no routinely calculation of lower extremity amputation rates in Latvia. For OECD data collection we used OECD definitions **Norway:** Yes, Norwegian Quality Indicator System calculates amputations per 1000 diabetics **Slovenia:** Indicator for Slovenia is in compliance with OECD requirements on data source quality. **UK:** Yes incidence or prevalence of amputations in people with diabetes is a commonly used indicator, eg by NDA	**Italy:** algorithm selecting LEAs as ICD9 84.10–84.19 in primary or in one of the five secondary procedures. Exclusion criteria: duplicated records (same admission and discharge date for the same patient) or age>100 or trauma codes (ICD-9-CM 895–897; DRG 442–443) or tumour-related peripheral amputations (ICD-9-CM 170.7, 170.8; DRG 213, 408). Rates computed separately for subjects with diabetes and general population.
2.2 How are cases selected (e.g. major vs minor amputations)? Which limitations have been highlighted, and how are results interpreted taking them into account?	**Israel:** I think the answer to this question is what you are looking for. Accordingly you will aggragate cases or not. **Italy:** see publications **Latvia:** In Diabetes register we collect data about amputations above the knee, below the knee and amputations of toes separately. In NHS in-patient database there is only one code for all extremities amputations. **Norway:** Varying degrees of Annual Foot Exam and screening for neuropathy in primary care. Quality of and access to diabetes "fotsårteam" (foot ulcers team) in the health authorities. Regional availability of interventional radiology and vascular surgery. The rate of serious diabetes complications depends on many factors outside the direct control of the health service, including individual monitoring of their disease, education and lifestyle. The complications are also a result of individual factors and quality of care over a long period of time. The patient's age, sex, duration of diabetes and smoking are important.There has not	**Norway:** NCMP-NCSP + ICD-10 (E10-E14) is used to select cases. ICD-10 (Z91.6, T14.7, T24 , T25.0, T30, T93, T94, T95.3, 8, 9, S70 - S79, S80-S99, C40.2,3,4,9.) is excluded from the population. **UK:** Need to obtain further input on specific procedure (OPCS) codes used

	been much public interest or discussions about amputation rates, except for the vascular surgical input about amputation rates in relation to access to vascular surgical services **UK:** Major Amputation – surgical removal of the leg above the ankle (usually below, through or above the knee). Minor Amputation – surgical removal of toes or a part of the foot below the ankle.	

3. REPORTING. This section addresses how lower amputations in diabetes are computed and requests links that can be used to reference relevant experiences

3.1 How are denominators computed in amputation rates in diabetes (subjects with diabetes or general population)? Which source has been used to report diabetes prevalence? Which age bands have been applied for standardization?	**Ireland:** denominators / age bands computed according to OECD definitions **Israel:** We usually use the general population (age adjusted) for our calculations. Calculating subjects with diabetes is more difficult and is based on outpatient data.Outpatient data is based on various IT systems and may lack standardization. It also is based on other clinical input that may or may not be standardized. However we are in the process of examining this possibility and hopefully soon we will be calculating the rates of amputations in the diabetic population too. **Italy:** Lombardo et al 2014 calculate incidence rates of LEA on top of estimated prevalence of diabetes (ISTAT) as well as the general population. **Latvia:** To OECD data collection we computed amputation rates as definition provided. But we prefer to compute lower extremity amputation rates for diabetes patients on diabetes population, as we have a Diabetes register which we used to report diabetes prevalence in Latvia. **Norway:** National quality indicators Norway uses subjects with diabetes from NorPD. **Slovenia:** Diabetes prevalence is calculated with the help from data available in national drug database. Total prevalence is calculated with the estimation from the number of persons with diabetes medications. **UK:** The amputation rates calculated by the NDA use the prevalence population from the NDA and the rates are adjusted for age and sex.	
3.2 Are there documented experiences e.g. papers, technical reports, etc, applying methods for the calculation of Diabetes Amputation Rates that are worth to be considered for this rapid R&D study?	**Israel:** I will attach some data when I return this questionnaire. I can notify you also of our results if we have findings in our upcoming study. **Italy:** publications (in particular, Lombardo et al. 2014) **Latvia:** No, we don't have such experience **Norway:** Lower limb amputations: registration of all lower limb amputations performed at the University Hospital of Trondheim, Norway, 1994-1997. Witsø E, Rønningen H. Prosthet Orthot Int. 2001 Dec;25(3):181-5. Kapelrud H. Tidsskr Nor Laegeforen. Lower-limb amputations and diabetes]. 2006 Sep 7; 126(17):2261-3. Acta Orthop. 2010 Dec;81(6):737-44. doi: 10.3109/17453674.2010.519164.	

	Epub 2010 Sep 22. Witsø E1, Lium A, Lydersen S. Lower limb amputations in Trondheim, Norway. Tidsskr Nor Laegeforen. 1992 Jan 30;112(3):328-30. Uhlving S1, Bergrem H, Gabrielsen K [Prevalence of diabetes in a 5-year material of amputations in Sør-Rogaland]. [Article in Norwegian, abstract in English] **Slovenia:** A multinational, multi-centre, observational, cross-sectional survey assessing diabetes secondary care in Central and Eastern Europe (DEPAC Survey) http://onlinelibrary.wiley.com/doi/10.1111/j.1464-5491.2008.02570.x/abstract;jsessionid=3527B9CDF7D8F5720CDF0F75539873F3.f02t02 Diabet Med. 2008 Oct;25(10):1195-203. doi: 10.1111/j.1464-5491.2008.02570.x. Incidence of diabetic patients is calculated from simple equation: - people taking diabetes medications 85% - people with diagnosed diabetes without treatment with drugs - additional 15% (to 100%) - estimated number of diabetic patients that are not discovered yet - additional 20% This is published on the web page of our national diabetes program: http://sladkorna.ezdrav.si **UK:** See http://www.hscic.gov.uk/catalogue/PUB12738/nati-diab-audi-11-12-mort-comp-rep.pdf. For further information contact either diabetes@hscic.gov.uk or catherine.sylvester@hscic.gov.uk	

4. UNIQUE SUBJECT IDENTIFIERS. This section is aimed at checking the feasibility of comparative data analysis of amputation rates in diabetes

4.1 Would it be possible to conduct a retrospective analysis of hospital discharge records that would identify a cohort of subjects with diabetes through using a unique patient identifier?	**Israel:** It would be possible, but there is a bias in this denominator, as hospitalized patients are by definition sicker that their counterparts at home, so they cannot represent the cohort of diabetics for the denominator. **Italy:** Yes. The national discharge database has a unique person identifier (pseudonym) that has been already used for the scope (Lombardo et al. 2014) **Latvia:** It is possible to conduct retrospective analysis of patients with diabetes from NHS in-patients database **Norway:** Yes **UK:** Yes **Ireland:** No – no unique patient identifier	
4.2 How consistent has been diagnostic coding and patient ID across the last ten years?	**Israel:** Our unique patient identifier is a national number given at birth. This system has been in place since the birth of the state. Diagnostic coding is consistent since we still haven't changed over to ICD 10. As to the quality of the coding process, we have reservations on the disease codes, however major procedures are usually well coded because they are linked to billing. **Italy:** ICD9CM, quite consistently used throughout the last 15 years, although much more stable data and classifications have been used (also for international comparisons) from 2007 on. **Latvia:** In NHS in-patient database the information is collected from 2004. As we mentioned, there has been changes in classification of amputations in NHS in-patient database – up to 2014 there has been used one code for all upper and lower extremities amputations, NOMESCO classification is used for procedure coding from 2014. **Norway:** Norwegian patient register has registered patient ID since 2008. The ICD-10 coding system has not changed for diabetes during this time. **UK:** Patient ID - consistent Diagnostic coding - see Notes/Comments **Ireland:** changed from ICD-9-CM to ICD-10-AM in 2005 –	**UK:** In terms of using HES (hospital admissions) data: under pressure from 'Payment by Results' coding in the primary position has improved tremendously [over the last 10 years] and where co-morbidity coding affects the HRG (as it often does for diabetes) other position coding has improved as well. Using the NDA data to identify the cohort of people with diabetes however removes the need to rely on diabetes being coded as a co-morbidity in the HES data. There are likely to have been some improvements in the quality of diabetes recording over the past 10 years as the result of an initiative by NHS Diabetes. The other thing to consider is that the identification of Type 2 diabetes has improved significantly over the past 10 years. This means that there will be more people with a diagnosis of Type 2 diabetes and they are likely to have been diagnosed at an earlier stage of the disease. Although this does not relate specifically to the diagnostic coding it is likely to have changed the case-mix of those with Type 2 diabetes slightly. As people in the earlier stages of Type 2 diabetes have a lower risk of foot disease and therefore amputation this improvement in the diagnosis rate is likely to reduce the amputation rate slightly irrespective of changes in outcomes for those with foot disease.

	significant impact on coding of diabetes. Diagnostic coding consistent since then.	

5. DIABETES REGISTERS. This section addresses the potential use of a diabetes register to validate results obtained from national discharge databases

5.1 Is there a diabetes register with substantial coverage/completeness at the national level, that could be used to validate results obtained from discharge abstracts?	**Ireland:** NO **Israel:** The Israeli National Program for Quality Indicators in Community Healthcare has an ongoing monitoring system of all the diabetics that are known within the framework. Latvia: There is Diabetes register in Latvia and register data are validated by NHS in-patient and out-patient databases, also with data from Payment system for the remuneration of medicines once a year **Italy:** does not exist and has not even been planned for the near future at national level, although there is a national diabetes plan. However, the national institutions are involved with the EU initiatives PARENT for disease registries and the Joint Action on Chronic Diseases, where the National Institute of Health leads a specific workpackage on diabetes, including targeted monitoring of diabetes plans. **Norway:** Yes. A national diabetes register with >92% coverage 0-18 years exist and may be used to validate discharge abstracts. We also have a national prescription database (NorPD) covering all use of drugs for diabetes. **Slovenia:** It would be possible to calculate amputation prevalence from a limited population of diabetic patientsvfrom some major diabetes centers, that have screening/diabetic foot information databases in their diabetes foot clinics. **UK:** Yes (QOF)	**Norway:** A complementary diabetes register for adults also exist but with low coverage (http://www.noklus.no/Diabetesregisterforvoksne/Diabetesregisterforvoksne.aspx)
5.2 Can a diabetes register be used to provide an accurate estimate of diabetes prevalence? How is diabetes prevalence normally calculated?	**Ireland:** No **Israel:** There is now a national registry being set up. There always is a question regarding the definition of Diabetes and how you can extract the population from a major database. For a while the definition was : whoever purchased hypoglycemic medications. This definition is becoming problemtatic as the current policy is to prescribe medication also in the pre-diabetic period.In addition, it excludes those who are non compliant and are not purchasing prescribed medication or are treated with	**Norway:** Note that prevalence data published are for known diabetes. No. of undiagnosed may be estimated with uncertainity. **UK:** http://www.yhpho.org.uk/default.aspx?RID=81090

	dietary restrictions alone. Using lab results might be inaccurate as well, as you cannot identify who was fasting or not. Trusting the physicians entry might not be free from erorr either.Currently the system is either purchasing medication or lab tests with glucose and HbA1C >6.5%. The registry will include both diabetes and pre-diabetes. It is a new system that eventually will help define the cohort of diabetics. **Italy:** not possible. The survey conducted by the National Institute of Statistics (ISTAT) on self declared health can be used for the scope (Lombardo et al. 2014). **Latvia:** Yes, Diabetes register is used for providing of diabetes prevalence which is calculated as all the registered diabetes patients at the end of the year on all population at the end of the same year **Slovenia:** Not at this moment. Diabetes prevalence is estimated from the national drug database (from number of patients receiving antidiabetic medication). **Norway:** Yes, it can in the age group 0-18 years. Prevalence has normallly been calculated based on NorPD (se above). **UK:** Studies have shown that prevalence reported through QOF (GP registers) is around 75% of actual prevalence (including those undiagnosed) estimated through clinical measurement of a random sample of the population (Health Survey for England). The QOF data is considered to be a reliable measure of the prevalence of diagnosed diabetes. The National Diabetes Audit can also provide information on the prevalence of diabetes. Cross referencing the QOF data with the NDA shows similar rates.	

ANNEX 6. SAS Source code for the calculation of LEARD

```
/***********************************************************************
 SAS_AMPUT_OECD.SAS
 OECD HCQI Amputation Rates Utility Macros
 ------------------------
 Author:  Fabrizio Carinci <research@fabcarinci.net>
 Created: 2014-23-10;Version: 2014-23-10
 OS: Windows;Programming Language: SAS
 ------------------------
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 This file is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by
 the Free Software Foundation; either version 2, or (at your option) any later version.
 This file is distributed in the hope that it will be useful,but WITHOUT ANY WARRANTY; without even the implied warranty of
 MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the GNU General Public License for more details.
 You should have received a copy of the GNU General Public License along with this file; see the file COPYING.  If not, write to
 the Free Software Foundation, 675 Mass Ave, Cambridge, MA 02139, USA.
 In short: you may use this file any way you like, as long as you don't charge money for it, remove this notice, or hold anyone liable
 for its results.
 ***********************************************************************/

OPTIONS PS=5000 SOURCE MPRINT SYMBOLGEN ERRORABEND VALIDVARNAME=V6;

%macro amput(libname,start,end,mdcvar,tranvar,dateadm,datedis,uidvar,diagvar,procvar);

 LIBNAME OECDDATA "&libname";

 /* Extract list of diabetic patients */

 %let _f=0;

 %do cur_year=&start %to &end;

  %let _f=%eval(&_f+1);
  %let _i=0;

  %if %bquote(&uidvar)^= %then %do anno=&start %to &cur_year;

   %let _i=%eval(&_i+1);

   DATA AMPUT (KEEP=&uidvar);
   SET OECDDATA.OECD0113 (KEEP=&uidvar &diagvar &datedis);
   WHERE YEAR(&datedis)=&anno AND SUBSTR(TRIM(LEFT(&uidvar)),1,1) in ("A","B","C");
   LENGTH DIAB 3;
   DIAB=0;
   ARRAY DIAG [*] &diagvar;
   DO I=1 TO DIM(DIAG);
    IF SUBSTR(DIAG[I],1,3)="250" THEN DIAB=1;
   END;
   IF DIAB;
   RUN;

   %if &_i=1 %then %do;
    DATA AMPUT_COD;SET AMPUT;RUN;
   %end;
   %else %do;
    DATA AMPUT_COD;SET AMPUT_COD AMPUT;RUN;
   %end;
```

```
 PROC DATASETS NOLIST NOWARN;DELETE AMPUT /MEMTYPE=DATA;QUIT;

%end;

/* Pick unique subject IDs */
%if %bquote(&uidvar)^= %then %do;
 PROC SORT DATA=AMPUT_COD OUT=AMPUT_COD;BY &uidvar;RUN;
 DATA AMPUT_COD;
 SET AMPUT_COD;
 BY &uidvar;
 IF FIRST.&uidvar; /* Take only once as diabetic in the previous year */
 RUN;
%end;

DATA AMPUT_PRO (KEEP=&uidvar DIAB_CUR AMPUT);
SET OECDDATA.OECD0113 (KEEP=&mdcvar &tranvar &dateadm &datedis &uidvar &diagvar &procvar); /* Last Year */
WHERE YEAR(&datedis)=&cur_year AND
 &mdcvar NOT IN ("14","15")                          /* no pregnancy or newborn [CHANGE CODES AS NEEDED] */
 %if %bquote(&uidvar)^= %then %do;
  AND SUBSTR(TRIM(LEFT(&uidvar)),1,1) in ("A","B","C") /* quality score for code [CHANGE CODES AS NEEDED] */
  AND &tranvar NOT IN ('4','5','6') AND               /* no transfers from other institution [CHANGE CODES AS NEEDED] */
  &dateadm^=&datedis                                  /* same day */
 %end;
;

LENGTH DIAB_CUR AMPUT TUMOUR TRAUMA 3;
ARRAY DIAG [*] &diagvar;
ARRAY PROC [*] &procvar;
AMPUT=.;DIAB_CUR=0;TRAUMA=0;TUMOUR=0;

DO I=1 TO DIM(DIAG);
 IF SUBSTR(DIAG[I],1,3)="250" THEN DIAB_CUR=1;
 IF SUBSTR(DIAG[I],1,4) IN ("1707","1708") THEN TUMOUR=1;
 IF SUBSTR(DIAG[I],1,4) IN ("8950","8951","8960","8961","8962","8963","8970","8971","8972","8973","8974","8975","8976","8977") THEN TRAUMA=1;
END;

DO I=1 TO DIM(PROC);
 IF SUBSTR(PROC[I],1,3)="841" THEN AMPUT=MAX(AMPUT,INPUT(SUBSTR(PROC[I],4,1),2.)); /* Take Highest on one discharge */
END;

IF TRAUMA=0 AND TUMOUR=0 AND AMPUT>=0;
RUN;

%if %bquote(&uidvar)^= %then %do;

 PROC SORT DATA=AMPUT_PRO OUT=AMPUT_PRO;BY &uidvar AMPUT;RUN;
 DATA AMPUT_PRO;
 SET AMPUT_PRO;
 BY &uidvar AMPUT;
 IF LAST.&uidvar; /* Take highest amputation within the year */
 RUN;

 DATA ALL (KEEP=AMPUT DIAB_CUR DIAB_PRE);
 MERGE AMPUT_COD (IN=IN1) AMPUT_PRO (IN=IN2);
 BY &uidvar;
 IF IN2; /* Must be an amputation */
 LENGTH DIAB_PRE 3;
 IF IN1 THEN DIAB_PRE=1;ELSE DIAB_PRE=0;
 RUN;
```

```
 %end;
 %else %do;
  DATA ALL;SET AMPUT_PRO;RUN;
 %end;

 DATA ALL;
 SET ALL;
 PROC="84.1"||LEFT(TRIM(AMPUT));
 %if %bquote(&uidvar)= %then %do;
  LENGTH DIAB_PRE 3;
  DIAB_PRE=0;
 %end;
 RUN;
 PROC SORT DATA=ALL OUT=ALL;BY DIAB_CUR DIAB_PRE;RUN;

 PROC FREQ NOPRINT;
 TABLES PROC / OUT = AMPFREQ (DROP=PERCENT);
 BY DIAB_CUR DIAB_PRE;
 RUN;

 DATA AMPFREQ;SET AMPFREQ;YEAR=&cur_year;RUN;
 PROC SORT DATA=AMPFREQ OUT=AMPFREQ;BY YEAR DIAB_CUR DIAB_PRE;RUN;

 DATA ALLYEARS;
 %if &_f=1 %then %do;
  SET AMPFREQ;
 %end;
 %else %do;
  SET ALLYEARS AMPFREQ;
 %end;
 RUN;

 PROC DATASETS NOLIST NOWARN;DELETE AMPUT_COD AMPUT_PRO ALL AMPFREQ /MEMTYPE=DATA;QUIT;

%end;

DATA ALLYEARS;SET ALLYEARS;
LABEL YEAR="Year" DIAB_PRE="Diabetes ICD" DIAB_CUR="Procedure+Diabetes ICD" PROC="Procedure" COUNT="N";
RUN;

PROC PRINT DATA=ALLYEARS NOOBS LABEL;VAR YEAR DIAB_CUR DIAB_PRE PROC COUNT;RUN;

DATA AMPTAB;
SET ALLYEARS;
PROC_1=0;PROC_2=0;PROC_3=0;
IF TRIM(LEFT(PROC)) IN ("84.11","84.12") THEN PROC_1=COUNT;  /* Minor */
IF TRIM(LEFT(PROC)) IN ("84.13","84.14","84.15","84.16","84.17","84.18","84.19") THEN PROC_2=COUNT; /* Major */
PROC_3=COUNT;                                                /* Total */
RUN;
PROC SORT DATA=STATS OUT=STATS;BY YEAR;RUN;

DATA AMPTAB;
MERGE AMPTAB STATS (IN=IN2);
BY YEAR;
LENGTH DIAB 3;
IF IN2 THEN DIAB=0;
TOTNODIA=TOTPOP-TOTDIAB;
IF DIAB_CUR+DIAB_PRE>0 THEN DIAB=1;
RUN;
PROC SORT DATA=AMPTAB OUT=AMPTAB;BY YEAR DIAB;RUN;
```

```
 DATA AMPTAB (DROP=PROC_1 PROC_2 PROC_3 RENAME=(TPROC_1=PROC_1 TPROC_2=PROC_2 TPROC_3=PROC_3));
 SET AMPTAB;
 BY YEAR DIAB;
 LENGTH TPROC_1 TPROC_2 TPROC_3 3;
 IF FIRST.DIAB THEN DO;
  TPROC_1=0;TPROC_2=0;TPROC_3=0;
 END;
 TPROC_1+PROC_1;TPROC_2+PROC_2;TPROC_3+PROC_3;
 IF LAST.DIAB;
 RUN;

 DATA AMPTAB;
 SET AMPTAB;
 IF DIAB=0 THEN DO;
  RATE_1=ROUND((PROC_1/TOTNODIA)*100000,.1);RATE_2=ROUND((PROC_2/TOTNODIA)*100000,.1);RATE_3=ROUND((PROC_3/TOTNODIA)*100000,.1);
 END;
 ELSE DO;
  RATE_1=ROUND((PROC_1/TOTDIAB)*100000,.1);RATE_2=ROUND((PROC_2/TOTDIAB)*100000,.1);RATE_3=ROUND((PROC_3/TOTDIAB)*100000,.1);
 END;
 RUN;

 DATA AMPDIAB;
 SET AMPTAB (RENAME=(PROC_1=PROC_D1 RATE_1=RATE_D1 PROC_2=PROC_D2 RATE_2=RATE_D2 PROC_3=PROC_D3 RATE_3=RATE_D3));
 IF DIAB=1;
 LABEL YEAR="Year" PROC_D1="D.Minor N" PROC_D2="D.Major N" PROC_D3="D.Total N" RATE_D1="D.Minor %" RATE_D2="D.Major %" RATE_D3="D.Total %";
 RUN;

 DATA AMPNODIA;SET AMPTAB;IF DIAB=0;
 LABEL YEAR="Year" PROC_1="Minor N" PROC_2="Major N" PROC_3="Total N" RATE_1="Minor %" RATE_2="Major %" RATE_3="Total %";
 RUN;

 DATA AMPAMP;MERGE AMPDIAB AMPNODIA;BY YEAR;RUN;

 PROC PRINT DATA=AMPAMP NOOBS LABEL;
 VAR YEAR PROC_D1 RATE_D1 PROC_D2 RATE_D2 PROC_D3 RATE_D3 PROC_1 RATE_1 PROC_2 RATE_2 PROC_3 RATE_3;
 RUN;

%mend amput;

/* ****************************************************************** */
/* CHANGE AS REQUIRED                                                 */
/* ****************************************************************** */
/* These stats are related to Italy */
/* Shall be revised accordingly     */
DATA STATS;
INPUT YEAR TOTDIAB TOTPOP PREV;
CARDS;
2002 2222756 56993742 3.9
2003 2292843 57321070 4.0
2004 2373418 57888245 4.1
2005 2455420 58462375 4.2
2006 2643827 58751711 4.5
2007 2720039 59131287 4.6
2008 2861726 59619290 4.8
2009 2882163 60045068 4.8
2010 2956676 60340328 4.9
2011 2970696 60626442 4.9
2012 3266681 59394207 5.5
2013 3223002 59685227 5.4
RUN;
```

```
%amput(libname=C:\data\sdo,                  /* Location of the dataset (shall be unique) */
       start=2002,                           /* Start Year */
       end=2013,                             /* End Year */
       mdcvar=MDC,                           /* MDC variable name */
       tranvar=PROVEN,                       /* Transfer variable name */
       dateadm=DATA_RIC,                     /* Date admission variable name */
       datedis=DATA_DIM,                     /* Date discharge variable name */
       uidvar=CODICE,                        /* YES Unique person identifier */
       diagvar=DPR DSEC1-DSEC5,              /* Diagnoses variable names */
       procvar=INTPR INTS1-INTS5);           /* Procedures variable names */

%amput(libname=C:\data\sdo,                  /* Location of the dataset (shall be unique) */
       start=2002,                           /* Start Year */
       end=2013,                             /* End Year */
       mdcvar=MDC,                           /* MDC variable name */
       tranvar=PROVEN,                       /* Transfer variable name */
       dateadm=DATA_RIC,                     /* Date admission variable name */
       datedis=DATA_DIM,                     /* Date discharge variable name */
       uidvar=,                              /* NO Unique person identifier */
       diagvar=DPR DSEC1-DSEC5,              /* Diagnoses variable names */
       procvar=INTPR INTS1-INTS5);           /* Procedures variable names */
```