Annex 5: Data report cardiovascular diseases and diabetes
WP9 : Cardiovascular disease and diabetes
Report on data collection for cardiovascular disease and diabetes
and related relative risks

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Abstract

This DYNAMO-HIA report relates to work package (WP) 9, “WP9 – Cardiovascular disease and diabetes”. It summarises the methods used to obtain age- and gender-specific data on Ischaemic heart disease (IHD), stroke and diabetes in the 27 EU countries, as well as age- and sex-specific relative risks for the association of diabetes on cardiovascular disease. The main outputs of WP9 are a set of data on prevalence, incidence, and excess mortality data for IHD, stroke and diabetes, and for IHD and stroke 28-day case-fatality. In addition the relative risks for the association between diabetes and CVD are also provided.

List of abbreviations

The following abbreviations are used in this report:

CVD    Cardiovascular disease
IHD    Ischaemic heart disease
NIDDM  Non-insulin diabetes mellitus
DYNAMO-HIA Dynamic Model for Health Impact Assessment project
EU     European Union
EC     European Commission
HIS    Health Interview Survey
EUROCISS European Cardiovascular disease information surveillance
WP     Workpackage

Acknowledgements

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This report was prepared by Dr Kathleen Bennett.
Introduction

DYNAMO-HIA (DYNAmic MOdel for Health Impact Assessment – http://www.dynamo-hia.eu/root/o14.html) project is an EU funded project aiming to develop a web-based tool to assess the health impact of policies in the European Union (EU) through their influence on health determinants, including cardiovascular disease and diabetes. This document provides information on the Workpackage 9: “WP9 – Cardiovascular disease and diabetes. It focuses on the sources of data that were used to deliver the required age- and gender-specific data on prevalence, incidence and excess mortality of IHD, stroke and diabetes, and 28-day case fatality for IHD and stroke. In addition, data on relative risks associated with diabetes and cardiovascular disease are provided.

WP9 was led by the Haughton Institute, Dublin but it involved all associated partners and all 25 collaborating partners. The three main objectives of WP9 were:

1. To contribute to the discussion on specification of the model and specification of scenarios in WP9 (“Model specification and scenarios);
2. To deliver: age- and gender-specific data on prevalence and/or incidence and mortality of cardiovascular disease and diabetes in as many EU countries as possible, using existing data sources, to create an EU-wide dataset.
3. To apply the model using these data in an application and (this will contribute to WP2 – “Dissemination of the results”).

The main output of this WP are a set of data on incidence, prevalence and excess mortality of IHD, stroke and diabetes and 28-day case fatality for IHD and stroke in Europe. In addition the relative risks between diabetes and cardiovascular disease. Another output will be a paper on an application of the DYNAMO-HIA model for cardiovascular disease and diabetes.

The following sections discuss the data collection methods used to gather information on cardiovascular disease and diabetes and relative risks.

Part 1 Estimating data on cardiovascular disease and diabetes

1.1 Definition of Ischaemic heart disease (IHD)

The study used the definitions as given in the EUROCISS project (http://www.cuore.iss.it/eurociss/en/project/project.asp). The EUROCISS Project (European Cardiovascular Indicators Surveillance Set) was set up in 2000 by a partnership of European Union (EU) countries to develop health indicators and recommendations for monitoring the burden and distribution of cardiovascular disease (CVD). EUROCISS was set up to improve the quality and comparability of the data. The Project was financed by the European Commission within the Health Monitoring Programme (HMP).

The following gives the ICD codes used in defining IHD

- **Mortality rate**: annual deaths from IHS per 100,000 population. ICD codes: ICD-9 410 – 414 and ICD-10 I20 - I25.

MORBIDITY
• **Hospital discharge rate:** annual IHD hospitalizations per 100,000 population. ICD codes: ICD-9 410 – 414 and ICD-10 I20 - I25.

### 1.2 General approach for obtaining data on Ischaemic heart disease

Several different approaches were considered for obtaining data on IHD across the countries. Firstly, the EUROCISS project was used to obtain a link to possible sources of data for IHD. The EUROCISS lists the following databases available at the European level.

**Statistical databases of the World Health Organization (WHO)**

The WHO Mortality database (MDB) and the Health for All Statistical dataBase (HFA-DB, 1) contain data on about 600 health indicators, more specifically: basic demographic and socio-economic indicators; lifestyle and environment-related indicators; mortality, morbidity and disability indicators; hospitalization, health care resources, health care utilization and expenditure indicators.

The HFA-DB provides the following indicators in each country: number of hospitalizations for circulatory system diseases, ischaemic heart disease and cerebrovascular disease; incidence of ischaemic heart disease and cerebrovascular disease. In this database morbidity indicators are not available by ICD code, sex and age. Often, they are not even available for the same calendar year.

WHOSIS is another statistical database similar to the WHO HFA database above.

**EUROSTAT – Statistical Office of the European Communities**

- EUROSTAT is an important source of data at the European level: it provides statistical health data for all countries of the European Union as well as for Iceland, Switzerland and Norway. The database combines data from WHO, Food and Agriculture Organization (FAO) and OECD. Data on self-reported cardiovascular disease and diabetes are presented in the fourth chapter of the Report *Key data on health 2002 – data 1985-1995*(2).

**OECD – Organisation for Economic Development and Cooperation**

It provides the *OECD-health data 2002* software package, which is an interactive database for comparative analyses of health systems in the thirty member countries. It is available for a fee on CD-ROM, purchasable on-line from OECD web pages. However, the OECD data are not presented by age, gender groups and therefore this data source was not considered any further.

**ECHI (European Community Health Indicators) and ECHIM European Community Health Indicators monitoring**

International public health comparisons can only be made in a meaningful manner if data are not only actually available, but also comparable and of sufficient quality. In practice, the data situation is often not ideal. The ECHI and ECHIM project examines indicators across a range of health status and diseases in Europe (3). Further details are available in Appendix I.
MONICA – WHO Project

The MONICA project – MONItoring of CArdiovascular diseases – was launched at the beginning of the 1980s with the aim of assessing whether the decline in CHD mortality registered in some countries was real and, if so, how much of it could be attributed to reduction in incidence and how much to reduction in case fatality. In order to answer this question, MONICA project monitored 37 populations from 21 countries for 10 years in order to measure attack rates and case fatality of coronary and cerebrovascular events, treatments during acute phase and the distribution of risk factors using a standardized methodology (4). Because the data are now relatively old (mid 1980s and mid 1990s) they were not considered further within the DYNAMO project.

EUROCISS

In addition the EUROCISS project provides further details on sources of data from 16 of the 27 EU countries. These include: United Kingdom, the Netherlands, Belgium, France, Spain, Portugal, Italy, Greece, Austria, Hungary, Czech Republic, Poland, Germany, Denmark, Sweden and Finland. The additional sources of data are given below. A paper comparing coronary and cerebrovascular population-based registries across Europe concluded that although population-based registers provide the best indicators for AMI and stroke this depends on the comparability of data across countries in terms of standardisation and validity (5).

Hospital discharge records

Hospital discharge records cover almost the entire population, both genders and all ages, in nearly all countries. However, the problem with using hospital discharge records in that they only represent the subset of patients who are admitted to hospital with the disease, and neither reflect the true incidence or prevalence. In some countries, the rate of hospital discharge for AMI was used as a measure for incident IHD (Denmark, Finland and Sweden), but when this data was applied to IPM modelling, it did not produce consistent estimates. In most cases the hospital discharge records are likely to be an under or over-estimate of the true incidence rates.

Surveys on CVD

Finland, Germany, Italy, The Netherlands, Portugal and Spain regularly carry out surveys on cardiovascular diseases using the LSHTM questionnaires for the evaluation of symptoms, medical examination and ECGs. In most cases the MONICA-OMS (4) project methodology is adopted. The data from surveys tends to be self-reported diagnosis, and will only provide an estimate of prevalence of IHD. There is a database of European surveys which was examined (6).

Longitudinal cohort studies

These studies have been carried out in Belgium, Denmark, Finland, France, Germany, Italy, The Netherlands, Sweden and UK. They are performed on relatively small samples of population.
GP networks

Data from GP networks were available for The Netherlands and UK. They were used in both countries and provided the best data for estimating prevalence, incidence, excess mortality and 28-day case fatality.

Registers

Registers based on administrative data: they are on a national basis, cover all ages and both genders. They are typical of Northern countries and are based on the linkage between hospital discharge and mortality records; this is possible thanks to the identification number available in all medical records. They are economical but not always reliable.

Population-based registers: they are formed through the linkage between various sources of information (morbidity, hospital discharge and GP records) and the validation of suspected events. They cover large samples of population; the accuracy of the data related to incidence/occurrence depends on their completeness and quality. Data are validated using standardized procedures: the most widespread are those of the MONICA-OMS (4) project.

Differences exist between registers. In particular, AMI and stroke registers from different countries use different procedures in the selection of events. More details about the registers of AMI and cerebrovascular accidents can be found on EUROCISS website (http://www.cuore.iss.it/eurociiss/en/data) and in a published paper (5).

Other sources were considered such as the SHARE questionnaires (7) and the ECHIS (8) project, the latter source not currently being available to use within the time frame of the DYNAMO-HIA project. Morbidity data are not available at the European level, partly because they are difficult to collect. A full list of literature extracted for IHD by country are presented in Appendix II.

For the purpose of comparable data across Europe an alternative approach was used. IHD mortality rates by age and gender were extracted for each country and a ratio calculated in relation to the UK. This ratio was then applied to the UK GPRD IHD incidence data for all the other countries to obtain adjusted incidence rates for the remaining EU countries (except the Netherlands which has registry data). All incidence data was subject to IPM modelling to obtain consistent estimate for prevalence and excess mortality (using RRs from GPRD). In addition, case fatality from the GPRD was used for all EU countries.

2.1 Definition of Stroke (Cerebrovascular disease)

The study used the definitions as given in the EUROCISS project (http://www.cuore.iss.it/eurociiss/en/project/project.asp) according to ICD codes.

MORTALITY

- Cerebrovascular mortality rate: annual deaths from cerebrovascular diseases per 100,000 population. ICD codes: ICD-9 430 – 438 ; ICD-10 I60 - I69, G45.

MORBIDITY
• **Cerebrovascular hospital discharge rate**: annual hospitalizations for cerebrovascular diseases per 100,000 population. ICD codes: ICD-9 430 – 438 ; ICD-10 I60 - I69, G45.

2.2 **General approach for obtaining data on stroke (cerebrovascular disease)**

Several different approaches were considered for obtaining data on stroke across the countries. Firstly, the EUROCISS project was used to obtain a link to possible sources of data for stroke (5). The list of available data sources are described above in section 1.2.

Data from GP networks were available for The Netherlands and UK. They were used in both countries and provided the best data for estimating prevalence, incidence, excess mortality and 28-day case fatality of stroke. A full list of literature extracted for stroke by country are presented in Appendix III.

In addition, a review of available stroke incidence and prevalence data in Europe by Truelson et al (9) provided estimates of incidence and prevalence of stroke in 25 of the 27 countries. In this study the authors reviewed the published data from EU countries, Iceland, Norway, and Switzerland, and provided WHO estimates for stroke incidence and prevalence in these countries, and applied these to other countries.

3.1 **Definition of non-insulin diabetes mellitus (NIDDM or type 2 diabetes)**

Diabetes mellitus is a chronic disease, characterised by hyperglycaemia, resulting from defects in insulin secretion, insulin action or both. Diabetes mellitus is diagnosed, according to the WHO, by the classic symptoms of polyuria, polydipsia and unexplained weight loss, and/or a hyperglycaemia H 11.1 mmol/l (200 mg/dl) in a random sample or fasting (no caloric intake for 8 hrs), plasma glucose 7.0 mmol/l (126 mg/dl) and/or postprandial value 11.1 mmol/l (200 mg/dl) (2 hrs plasma glucose level during an oral glucose tolerance test). This test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 h anhydrous glucose dissolved in water). In the absence of unequivocal hyperglycaemia with acute metabolic decompensation, these criteria should be confirmed by repeat testing on a different day (EUDIP Definition).

In 1997, the WHO issued a new recommendation for the diagnosis and classification of Diabetes Mellitus (DM), according to which the following types of DM are distinguished (10):

• Type 1 encompasses diabetes cases with absolute insulin deficiency, triggered by a destruction of beta cells (pancreas islet cells which normally produce insulin). Type 1 is classified as type 1a (immune-mediated diabetes), in which DM is stimulated by a resistance reaction of the immune system, e.g. to viral infections, and type 1b (idiopathic diabetes), which occurs by itself and is not a consequence of other diseases.
• Type 2 diabetes (T2D) denotes all forms of diabetes with relative insulin deficiency, which can be caused by insulin resistance or secretory defects. The former classification of type 2a (normal weight) and 2b (overweight) is no longer valid. Type 2 diabetes occurs far more often than type 1 diabetes: between 85 and 95% of diabetics suffer from T2D (10).

For the purpose of the DYNAMO-HIA project the following ICD codes were used for diabetes: ICD10 E10-E14, and ICD9 250.

2.2 General approach for obtaining data on NIDDM

Different data sources were considered for European data on type 2 diabetes. Some of the available data sources are described above in section 1.2. In addition, there were some data sources that are specific to diabetes and each of these is described briefly below. A full list of literature extracted for diabetes by country are presented in Appendix IV.

The aim of the European Core Indicators in Diabetes (EUCID) project is to collect and compare data about risk factors for diabetes, complications and quality of care indicators in EU countries or future member states. 19 countries provided data for a list of indicators by age band which were representative at a regional or a national level for 2004, 2005 or 2006. The indicators for this project were designed during the EUropean Diabetes Indicators Project - EUDIP. Data were age-standardized for comparisons performed in the general population. Recently EUCID's final report was published at the DG SANCO website (11).

Another data source that was considered was the EU public health indicators project EUPHIX (12). EUPHIX is a web-based knowledge system for health professionals, policy makers and others. It presents structured European public health information, giving a special insight into similarities and differences between EU Member States. It provides some information on prevalence of diabetes but only diabetes in 2007 and estimates for 2025, in Iceland, Norway, Switzerland and the EU 27. Age-standardised diabetes prevalence are also provided but the data are considerably dated.

Diabetes Atlas (13) is a comprehensive publication from the International diabetes federation on diabetes prevalence across the world. Although it provides some references for data across Europe the publications were quite dated and data were not provided by specific age-groups.

The DECODE (the Diabetes Epidemiology: Collaborative Analysis of Diagnostic Criteria in Europe) study was conducted initially in 13 centres around Europe (14). The study is based on using epidemiological data on close to 30,000 subjects from twenty European epidemiological studies. The prevalence of diabetes, using fasting rather than the 2-hour glucose concentrations (as had previously been recommended for epidemiological studies) resulted in changes in the prevalence of diabetes.

The global burden disease study on diabetes provided some information on diabetes prevalence worldwide (13). However, only a small number of European studies were included, Malta, Netherlands, Poland and Spain, and the data for these countries were quite dated. Relative risks of mortality for diabetes mellitus are also provided.

Figure from GBD publication.
3 Data collection and estimation methods

3.1 Data collection and estimation methods for individual level data

3.1.1 Criteria for selecting sources of individual level data

The main criteria used for including sources of individual level data on cardiovascular disease or diabetes were as follows:

Time frame
- The data was recorded relatively recently; we gave preference to data collected since 2000. Where several years data were available (e.g. from UK GPRD) we retrieved data from 2000-2007 or 2003-2007, and averaged the data over these years. For total mortality the years from 2003-2006 were combined and averaged for each country.

Study sample
- The reference population was described and corresponded as closely as possible to the national population.
- The sampling strategy was as close as possible to random sampling.
- The sample was representative of the reference population.
- The sample size was large (sample size calculation ideally included).
- As wide an age range as possible (from 15 years onwards) was included.
- Data were available by age and gender.
- The level of non-response was ideally documented.

Validity of the methods
- The methods used to collect data were as free of bias as possible.
- Data were collected at the level of the individual.
• The statistical analysis of the data was appropriate.

Type of information

The following hierarchy of data quality was used to select one source of data for a given country where more than one data source was available:

• Population-based registry
• Large sample survey of good quality
• Small sample survey of good quality
• Survey data on a large sample.

3.1.2 Search strategy for the identification of individual level data

Data on incidence, prevalence of the three diseases, IHD, stroke and NIDDM and 28-day case fatality for IHD and stroke were also identified using a comprehensive search which included computerised databases of published articles, internet search of possible sources of data, and contact with experts in some of the individual countries for their own data.

Computerised databases, library and internet searches

The PubMed database (http://www.ncbi.nlm.nih.gov/sites/entrez) was searched using the free search terms “coronary heart disease [country name]”, or “IHD or ischaemic heart disease [country name]” or “stroke” or “diabetes” “type 2 diabetes” “NIDDM” in order to identify relevant surveys and researchers who could be contacted to obtain data or further information about the studies described.

Internet searches (using the Google search engine - http://www.google.com and Google Scholar - http://scholar.google.com/) were also used. The WHO Global health indicators (http://www.who.int/whosis/en/) were also examined for additional sources of information.

The European Health Interview & Health Examination Surveys Database (https://hishes.iph.fgov.be/index.php?hishes=home) developed within the framework of the European Health Survey Information Database (EUHSID) project (4) was also searched by country and type of questions. However, the database did not contain the level of detail required and in addition self-reported data was not considered a reliable source of disease data.

Contacts with experts

Direct contacts were made with experts in the area of cardiovascular disease or diabetes within each country for sources of published or unpublished data on cardiovascular disease and diabetes. Experts were working in either governmental agencies or academic institutions and their contact details available through the EUROCISS website, collaborators in DYNAMO or contacts known by the workpackage leaders.

Contacts were also made with other EU funded projects.
3.1.3 Characteristics of included and excluded individual-level data

Included data

This section describes the general availability and quality of the individual-level data for DYNAMO-HIA. Details of all sources of information reviewed for each country are provided in Annex 1.

Ischaemic heart disease

Individual-level estimates of prevalence, incidence, excess mortality and 28-day case fatality for IHD were obtained for 11 EU countries. Details of the sources of data obtained for each country are described in Table 2. The UK GP research database (GPRD, 16) and the Netherlands GP registry data (17) were the most complete and reliable source of data. Because excess mortality data were not available in all countries except the UK and the Netherlands, the age-sex specific relative risks for mortality from having versus not having the disease were obtained from the UK GPRD and these were applied.

As described above, when data were not available for a given country, data from a neighbouring country with similar risk of disease were used.

Excluded data

Details of the reasons for the exclusion of studies are provided in appendix I. In summary, these included the following:

- Another source of data was used for the country (e.g. more representative sample, better method of data collection, more recent, larger sample size, higher response rate, etc);
- Data were not representative of the population of the country (e.g. only sub-groups or sub-regions of the population were studied);
- Data were not sufficiently recent. All studies used were since year 2000 (e.g. MONICA studies which were from mid 1980s and 1990s).

3.1.4 Characteristics of identified individual level data
<table>
<thead>
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<th>Country</th>
<th>Data sources</th>
<th>Name of Source (year)</th>
<th>Data collection method for Incidence and prevalence</th>
<th>Definition used</th>
<th>Overall sample size</th>
<th>Sex</th>
<th>Overall age range</th>
<th>Assessment of quality of the data</th>
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<td>UK GPRD adjusted for CS mortality</td>
<td>UK GPRD adjusted for CS mortality (incidence) IPM prevalence</td>
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<td>M/F</td>
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<td>GP Registries</td>
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<td>CMR=12,000 RNH=78,000</td>
<td>MF</td>
<td>0-85+</td>
<td>Good</td>
</tr>
<tr>
<td>Poland</td>
<td>UK GPRD</td>
<td>UK GPRD adjusted for CS mortality</td>
<td>UK GPRD adjusted for CS mortality(incidence) IPM prevalence</td>
<td>Using READ/OXMIS codes for IHD</td>
<td>N=2.8million per year</td>
<td>M/F</td>
<td>16+ years</td>
<td>Good</td>
</tr>
<tr>
<td>Portugal</td>
<td>Personal communication, Ana Avedos, University of Porto</td>
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<tr>
<td>Country</td>
<td>Data sources</td>
<td>Name of Source (year)</td>
<td>Data collection method for Incidence and prevalence</td>
<td>Definition used</td>
<td>Overall sample size</td>
<td>Sex</td>
<td>Overall age range</td>
<td>Assessment of quality of the data</td>
</tr>
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<tr>
<td>Spain</td>
<td>UK GPRD</td>
<td>UK GPRD adjusted for CS mortality</td>
<td>UK GPRD adjusted for CS mortality (incidence) IPM prevalence</td>
<td>Using READ/OXMIS codes for IHD</td>
<td>N=2.8million per year</td>
<td>M/F</td>
<td>16+ years</td>
<td>Good</td>
</tr>
<tr>
<td>Sweden</td>
<td>UK GPRD</td>
<td>UK GPRD adjusted for CS mortality</td>
<td>UK GPRD adjusted for CS mortality (incidence) IPM prevalence</td>
<td>Using READ/OXMIS codes for IHD</td>
<td>N=2.8million per year</td>
<td>M/F</td>
<td>16+ years</td>
<td>Good</td>
</tr>
<tr>
<td>UK</td>
<td>UK GPRD</td>
<td>UK GPRD 2000-2008 National GP registers</td>
<td>Using READ/OXMIS codes for IHD</td>
<td>N=2.8million per year</td>
<td>M/F</td>
<td>16+ years</td>
<td>Good</td>
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</tbody>
</table>

Italics indicate where data from UK GPRD were substituted for the countries data, as the data provided was not consistent with regard to IPM modelling; CS is cause-specific mortality.
Stroke

Individual-level estimates of prevalence, incidence, excess mortality and 28-day case fatality for stroke were obtained for 24 EU countries. Details of the sources of data obtained for each country are described in Table 3. The main source of data is provided by a systematic review of stroke prevalence and incidence in Europe (9) based on WHO estimates. As this was available for almost all of the 27 countries (the exception were Romania, Estonia and Bulgaria). In addition, the UK GP research database (GPRD, 16) and the Netherlands GP registry data (17) were the most complete and reliable source of data. Because excess mortality data were not available in all countries except the UK and the Netherlands, the age-sex specific relative risks for mortality from having versus not having the disease were obtained from the UK GPRD and these were applied. For consistency of data sources the same source (WHO estimates from the systematic review) of incidence data was used for all countries. IPM was used to calculate the prevalence from incidence, and RRs from the UK GPRD were used in computing excess mortality. Case fatality from the UK GPRD was used for all countries.

Excluded data

Details of the reasons for the exclusion of studies are provided in Appendix II. In summary, these included the following:

- Another source of data was used for the country (e.g. more representative sample, better method of data collection, more recent, larger sample size, higher response rate, etc);
- Data were not representative of the population of the country (e.g. only sub-groups or sub-regions of the population were studied);
- Data were not sufficiently recent. All studies used were since year 2000.
<table>
<thead>
<tr>
<th>Country</th>
<th>Data sources</th>
<th>Name of Source (year)</th>
<th>Data collection method for Incidence and prevalence</th>
<th>Definition used</th>
<th>Overall sample size</th>
<th>Sex</th>
<th>Overall age range</th>
<th>Assessment of quality of the data</th>
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<td>WHO estimates</td>
<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
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<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
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<td>MF</td>
<td>25-85+</td>
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<td>WHO estimates</td>
<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
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<td>MF</td>
<td>25-85+</td>
<td>Good</td>
</tr>
<tr>
<td>Country</td>
<td>Data sources</td>
<td>Name of Source (year)</td>
<td>Data collection method for Incidence and prevalence</td>
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<td>Sex</td>
<td>Overall age range</td>
<td>Assessment of quality of the data</td>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
</tr>
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<td>WHO estimates</td>
<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
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<td>Truelson et al review(2002)</td>
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<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
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<td>Data sources</td>
<td>Name of Source (year)</td>
<td>Data collection method for Incidence and prevalence</td>
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<td>Sex</td>
<td>Overall age range</td>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
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<td>25-85+</td>
<td>Good</td>
</tr>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
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<td>25-85+</td>
<td>Good</td>
</tr>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
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<td>25-85+</td>
<td>Good</td>
</tr>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
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<td>25-85+</td>
<td>Good</td>
</tr>
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<td>Name of Source (year)</td>
<td>Data collection method for Incidence and prevalence</td>
<td>Definition used</td>
<td>Overall sample size</td>
<td>Sex</td>
<td>Overall age range</td>
<td>Assessment of quality of the data</td>
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<td>WHO stroke definition</td>
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<td>25-85+</td>
<td>Good</td>
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<td>Truelson et al review(2002)</td>
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<td>WHO stroke definition</td>
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<td>25-85+</td>
<td>Good</td>
</tr>
<tr>
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<td>WHO estimates</td>
<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
</tr>
<tr>
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<td>Truelson et al review(2002)</td>
<td>Review for incidence, IPM for prevalence using GPRD RR</td>
<td>WHO stroke definition</td>
<td>44 population based studies from 14 countries</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
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</table>
Diabetes

Individual-level estimates of prevalence, incidence, and excess mortality for diabetes were obtained for 11 EU countries. Details of the sources of data obtained for each country are described in Table 4 below. In most cases prevalence was obtained and incidence and excess mortality calculated by IPM modelling using the UK GPRD RRs. The UK GP research database (GPRD, 16) and the Netherlands GP registry data (17) were the most complete and reliable source of data. Because excess mortality data were not available in all countries except the UK and the Netherlands, the age-sex specific relative risks for mortality from having versus not having the disease were obtained from the UK GPRD and these were applied. The RRs obtained from the GPRD were adjusted by increasing the value by 50% to obtain internally consistent IPM estimates. It is likely that the true RR may have been underestimated because mortality due to diabetes can be under-reported (18).

Excluded data

Details of the reasons for the exclusion of studies are provided in Appendix IV. In summary, these included the following:

- Another source of data was used for the country (e.g. more representative sample, better method of data collection, more recent, larger sample size, higher response rate, etc);
- Data were not representative of the population of the country (e.g. only sub-groups or sub-regions of the population were studied);
- Data were not sufficiently recent. Most studies used were since 2000
Table 4. Details of the studies used to estimate incidence and prevalence data for NIDDM in the DYNAMO-HIA project.

<table>
<thead>
<tr>
<th>Country</th>
<th>Data sources</th>
<th>Name of Source (year)</th>
<th>Data collection method for Incidence and prevalence</th>
<th>Definition used</th>
<th>Overall sample size</th>
<th>Sex</th>
<th>Overall age range</th>
<th>Assessment of quality of the data</th>
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<tr>
<td>Denmark</td>
<td>National diabetes register</td>
<td>Carstensen et al 2006</td>
<td>National diabetes register for prev and IPM incidence</td>
<td>Diagnosis of diabetes in the NPR, defined as ICD10: DE10-14, DH36.0, DO24 (excluding DO24.4), or ICD8 (prior to 1999): 249, 250 or blood glucose, treatments</td>
<td>N=358,729 in registry</td>
<td>MF</td>
<td>0-110</td>
<td>Good</td>
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<tr>
<td>Finland</td>
<td>Danish National diabetes registry</td>
<td>Carstensen et al 2006</td>
<td>National diabetes register for prev and IPM incidence (using GPRD RR)</td>
<td>AS above</td>
<td>N=358,729 in registry</td>
<td>MF</td>
<td>0-110</td>
<td>Good</td>
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<tr>
<td>France</td>
<td>CNAMTS – projected to 2005</td>
<td>Diabetes &amp; Metabolism 34 (2008) 266–272. Data from 2005</td>
<td>Projected treated diabetes from permanent sample (prev) and IPM (GPRD)</td>
<td>Treated diabetes at least twice per yr</td>
<td>N=70,000</td>
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<td>Definition used</td>
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<td>Robert Koch Institute, Bundes-Gesundheits survey (heft 24)</td>
<td>Thefeld W Prävalenz des Diabetes mellitus Gesundheitswesen 61 (Sonderheft 2): S85–S89 (1998)</td>
<td>Survey (prevalence). IPM (GPRD)</td>
<td>Plasma glucose, treatments (prev); N=7124 (prev); MF-assume same rates</td>
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<td>Ireland</td>
<td>Department of Health and Children, HSE-PCRS</td>
<td>Survey Ireland (SLAN) 2007</td>
<td>Face to face interviews, IPM (GPRD)</td>
<td>Self-reported diabetes (prevalence), N= 10,364 for prevalence</td>
<td>MF 25+years</td>
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<td>Italy</td>
<td>Testointegral survey 2008 (prev)</td>
<td>Testointegral survey (prev 2008)</td>
<td>Survey for prevalence. IPM (GPRD)</td>
<td>Self-reported diabetes and incident cases from random sample</td>
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<td>Sex</td>
<td>Overall age range</td>
<td>Assessment of quality of the data</td>
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<td>GP Registers</td>
<td>RIVM, 2003</td>
<td>GP registry for prevalence. IPM for incidence (GPRD)</td>
<td>E-code 0919 (NIDDM). From the other registrations: ICPC-code T90.</td>
<td>CMR=12000</td>
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<td>Encuesta Nacional De Salud De Espana 2006 (prev).</td>
<td>Survey and IPM for incidence (GPRD)</td>
<td>Survey question.</td>
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<td>30-75yr</td>
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<td>UK</td>
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<td>UK GPRD (2000-2008)</td>
<td>National GP registries</td>
<td>Read and OX MIS codes, plus prescribing of anti-diabetic meds</td>
<td>N=2.2mill for each yr.</td>
<td>MF</td>
<td>25-85+</td>
<td>Good</td>
</tr>
</tbody>
</table>
3.2 Data collection and estimation methods for prevalence and incidence of IHD, stroke and NIDDM and 28-day case fatality for IHD and stroke.

Estimates of total mortality were obtained from the EHM database (19) for each country for years 2003-2007. The average age-sex specific mortality rate over this period was used. For stroke prevalence and incidence the WHO estimates from the published study by Truelson et al (4) were used in most countries. The only countries not having data provided were Romania, Estonia and Bulgaria. For IHD data from GP registries were available from some countries, for example, the UK and Netherlands. In other cases, data on prevalence were available from Surveys and national cardiovascular registries e.g. in Italy. For diabetes, prevalence data were available from surveys in some countries e.g. Italy, Ireland although the data were self-reported. For incidence data GP registries were used for diabetes e.g. UK and the Netherlands.

3.3 Approach for estimating age and sex specific incidence, prevalence, excess mortality for all diseases

The major limitation to obtaining estimates of disease prevalence is the lack of country-specific data, and the need to extrapolate from existing data. Even when data is available in some countries, it may not be representative of the whole country. Also, data for older age groups are often not available and so assumptions about this age group are required to produce data for this age.

Where data were not available or did not appear consistent (IPM) data from a neighbouring or similar country were assumed. In most cases the data used was from the UK GPRD data which was based on GP registries.

For estimating excess mortality, the age-sex specific relative risk estimates for CVD and diabetes from the UK GPRD were used for most countries, except the Netherlands. This assumes the same relative risk would apply as in the UK, which in some low risk countries e.g. Italy may not be appropriate. However, because few data on excess mortality were available from other countries, this was considered the best way to estimating excess mortality in this case.

3.3.1. Smoothing

All estimates of prevalence, incidence and excess mortality for CVD and diabetes and 28-day case fatality for CVD were based on smoothed value. This allowed for (i) individual age-sex specific estimates of these parameters for each country and (ii) any extrapolation of data beyond the confines of those supplied by the studies etc. In many cases the data were provided by 10-year age bands, and some studies within a narrow age range. Data on the highest age groups (i.e. 65 years and over) tends to be less frequently reported. The smoothing of the estimates was performed using a variety of different models depending on the type of data. For prevalence data, logistic regression analysis was performed, and a linear, quadratic and in some cases cubic age term fitted. For incidence, total mortality, and case fatality data a Poisson regression model was used with linear, quadratic and cubic age terms, according to the best fitting model. Separate smoothing models were provided for males and females separately.
3.3.2. Incidence-Prevalence-Mortality (IPM) modelling: DISMOD

In order to ensure consistent estimates for incidence, prevalence and Excess mortality the IPM model was used. (20) A publication by Hoogeveen provided further details on the methods that had previously been applied to IHD, stroke and diabetes in the Netherlands (21).

Initially the WHO DISMOD (disease model) software was implemented to examine the internally consistent IPM estimates (22). However, after discussions with the co-ordinators of the project and following a meeting 19-21st January 2009 in Rotterdam, it was decided that IPM modelling would be implemented using SAS software (SAS Institute Inc, Cary USA). The equations and methods were written into SAS code (available on request).

The IPM model was used in different ways. Firstly, it was used to estimate excess mortality from age-sex specific incidence and prevalence when excess mortality was not available. The formula used in this instance is as follows:

\[
\text{ExcMort} = \frac{\text{Total mortality} \times (\text{RR} - 1)}{(\text{Prevalence} - \text{Incidence}) \times (\text{RR} - 1) + 1}
\]

Age-sex specific relative risks (RR) were provided by the UK GPRD or the Netherlands.

In some cases prevalence was available but not incidence and IPM modelling was used to estimate incidence from prevalence, and excess mortality. Also, prevalence may not have been available but it was possible to estimate prevalence from total mortality, and assuming the excess mortality from the UK GPRD applied.

4 Discussion of the data provided on IHD, Stroke and NIDDM

4.1 Potential sources of uncertainty related to the choice of data sources used

A major source of uncertainty in the final estimates of prevalence, incidence and excess mortality data obtained for DYNAMO-HIA relates to the choice of data sources used, i.e. surveys versus GP registry data, and the assumptions where data are not available i.e. using the UK GPRD estimates of RR for mortality in disease vs non-diseased individuals for calculating excess mortality.

Sources of data on disease prevalence, incidence and case-fatality.

Due the variability in the sources of data available for disease prevalence and incidence etc. the quality of the information on disease will vary across the different countries (Tables 2-4 above). Generally, those estimates based on GP or disease-specific registries will tend to provide more reliable estimates of incidence and prevalence, based on (i) the improved case ascertainment, (ii) large numbers, and (iii) more objective assessments of disease. Prevalence estimates based on self-reported disease from health surveys will lack the external validity and objectivity and may over or under-estimate the true value. They will also depend on the choice and responses provided to the questions on disease.

Some of the data used in the estimates are based on one region of the country, which may not be truly representative of the whole country due to regional, and socio-
econom
dic
er. We have made no adjustments to take these factors into
cideration in the present estimates, and assume the same value apply throughout.

4.2 Other potential sources of uncertainty
Although we aimed to obtain individual level prevalence, incidence, case fatality and excess mortality data for every EU country, this was not possible. It may be possible to make extrapolations from some countries to others but this is not provided. This may have been an important source of uncertainty, especially in the presence of inter-country heterogeneity. In particular, where data for some countries did not ‘fit’ with what would be expected or where it was not possible to obtain internally consistent estimates, data from a country that was considered similar in terms of the prevalence of the disease was used. For example, data for IHD from Sweden and Finland were obtained from hospital registers, but the data were not consistent with other similar countries and it was not possible to obtain internally consistent estimates for prevalence and incidence (see figure 1). In this instance, it was decided to substitute the data from the UK GPRD instead. IHD is similar between the UK and these scandinavian countries, particularly Finland, which has ranked in the top 3 countries for IHD mortality alongside the UK and Ireland.

Part 2 Estimating diabetes - CVD relationships

1. General approach for obtaining data on relative risks
The associations provided in this report were based on a comprehensive review of the literature including individual studies and any meta-analysis. This provided evidence for the direction and size of the relationship between diabetes and IHD or stroke separately. Due to the limited time and resources available for this Workpackage, it was not possible to conduct new meta-analyses.

2. Data collection and estimation methods

2.1 Criteria for selecting sources of RRs
There are many studies and meta-analyses of studies which have examined the association between differing levels of glucose levels (e.g. fasting glucose at various cut-offs 1, 2) and CVD outcomes. The selection of RRs for DYNAMO-HIA was based on having vs not having diagnosis of NIDDM and IHD or stroke mortality outcomes.

2.2 Search strategy

Computerised databases, library and internet searches
The PubMed database (http://www.ncbi.nlm.nih.gov/sites/entrez) was searched using the free search terms [diabetes, RR CVD mortality, CHD mortality, IHD mortality, stroke mortality] in order to identify relevant studies and researchers who could be contacted to obtain data or further information about the studies described.
Contacts with experts

Contacts were made with experts in the field for references to published or unpublished data sources or for the identification of appropriate contact persons. Experts were defined as contact authors for large epidemiological studies that examined the association between diabetes and the selected outcomes, or authors of meta-analyses in the same field of research. (DECODE authors, UKPDS study, and Prof Simon Capewell and Dr Martin O’Flaherty, Liverpool University, UK and Prof Nigel Unwin and Prof Julia Critchley, Newcastle University, UK).

Studies or meta-analyses were excluded is any one of the following criteria was satisfied:

- The measurement of exposure differed from that used for this project e.g. levels of HbA1c (fasting or otherwise);
- The outcome measures were not CVD mortality;
- The statistical analyses of the study were not adjusted for major confounding factors such as age, sex and smoking.

2.3 Characteristics of included & excluded studies of relative risks

IHD mortality

Several studies have examined the association between diabetes and CVD mortality outcomes. More recently a large meta-analysis was conducted by Huxley et al (3). This meta-analysis was based on 37 prospective studies with multiple adjusted coefficients. However, the data in the published paper was not presented in age groups and only provided gender specific RRs (F RR=3.12, 95% CI 2.34, 4.17; M RR= 1.99, 95% CI 1.69, 2.35). The authors were written to in order to obtain the age-specific RR, but no response was received. An earlier study by Kanaya et al (4) was based on 8 studies with multivariate adjustment, and showed similar results to that by Huxley, but no age-specific data provided (F RR=2.9 , 95% CI 2.2, 3.8 ;M RR= 2.3, 95% CI 1.9,2.8).

Due to the lack of age-specific RR from these meta-analyses and in consultation with Prof Simon Capewell and colleagues at Liverpool University, UK, we decided to use the RR from the INTERHEART study (5) which are based on a large number of case-control studies performed in 52 different countries. Gender-age specific RR are provided in Table 5 below.

Studies considered but not included

The DECODE (the Diabetes Epidemiology: Collaborative Analysis of Diagnostic Criteria in Europe ) study, initially from 13 centres around Europe (6). One of the authors of the study was contacted directly and RRs were obtained. However, the RRs appeared to considerably higher than other published studies above, and so were not considered further. (thank Dr Qiao et al for supplying these data)

Another study considered was a large study by Vibergsson et al (7), with multivariate adjustment for age, many CVD risk factors and calendar year. The results were found...
to be similar to those described above but this was an older study. The study by Manson et al (8) only provided data for women 30-55 yrs and another by Almdal T et al (9) was based on the Copenhagen Heart study, but outcome was total mortality.

<table>
<thead>
<tr>
<th>Age-gender group</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men &lt;=55 years</td>
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<tr>
<td>Men &gt; 55 years</td>
<td>1.93</td>
</tr>
<tr>
<td>Women &lt;=65 years</td>
<td>3.53</td>
</tr>
<tr>
<td>Women &gt;65 years</td>
<td>2.59</td>
</tr>
</tbody>
</table>

**Table 5: RR for diabetes association with IHD mortality**

**Stroke mortality**

Two studies were considered for inclusion in the RR for stroke mortality and diabetes, because they provided the range of ages required. The first by Barrett-Connor E et al (10) was used for those under 50 yrs and the second by Gu K, et al (11) for those aged over 50 year. The results are provided in table 6 below.

*Studies considered but not included*

As above the DECODE study was considered (6) and the author Dr Qiao provided the necessary data on RRs by gender and age groups adjusted for Cholesterol, SBP, smoking and BMI (personal communication Dr Qiao.) . Although the data were more detailed than those provided they were not considered further as the RRs appeared much higher than other published studies.

Two further studies by Stegmayr B et al (12) and Jaakko Tuomilehto et al (13) were small studies with large RRs and were not considered further.

<table>
<thead>
<tr>
<th>Age-gender group</th>
<th>RR</th>
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</thead>
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<td>Men &lt;=50 years</td>
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<td>Men &gt; 50 years</td>
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<tr>
<td>Women &lt;=50 years</td>
<td>2.90</td>
</tr>
<tr>
<td>Women &gt;50 years</td>
<td>2.20</td>
</tr>
</tbody>
</table>

**Table 6: RR for diabetes association with stroke mortality**

The same RR were used for all countries, hence comparability is not an issue here.
References

Part 1
1. http://www.euro.who.int/HFADB
6. http://www.euhsid.org/ (Health Surveys in the EU: HIS and HIS/HES evaluations and models')
7. http://www.share-project.org/
12. www.euphix.org
13. IDF Diabetes Atlas. 2002
16. www.gprd.com
17. http://www.rivm.nl/vt/v object_document/o3171n17964.html

Part 2


Appendix I

ECHIM indicators for diabetes, stroke and Ischaemic Heart Disease

<table>
<thead>
<tr>
<th>ECHIM indicator name</th>
<th>1) Health status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>21. Diabetes</td>
</tr>
</tbody>
</table>

**Definition of indicator**
Proportion of persons with (any type of) diabetes. Diabetes (diabetes mellitus) is a metabolic disorder causing chronically increased levels of glucose in the blood. Complex metabolic changes lead to damage of many organs. Most common complications include blindness, heart and blood vessel disease, stroke, kidney failure, amputations, and nerve damage. There are three main types of diabetes. Type 1 is diagnosed early in life and is due to decreased in insulin production. Type 2 diabetes is the most common form and is due to the development of insulin resistance. Gestational diabetes occurs during pregnancy.

**Calculation of the indicator (numerator, denominator)**
1) Proportion of individuals reporting to have been diagnosed with diabetes which occurred during the past 12 months, derived from EPHIS questions HS.4/5/6: HS.4: Do you have or have you ever had any of the following diseases or conditions? (11. Diabetes) [yes / no]. If yes HS.5: Was this disease/condition diagnosed by a medical doctor? [yes / no]. HS.6: Have you had this disease/condition in the past 12 months? [yes / no].
2) EU/EP/EIBRO: Prevalence of diabetes mellitus per 1000 population/ Prevalence of persons with impaired glucose tolerance, i.e., including previously unknown diabetes and only derived from EPHIS.
3) WHO: Cumulative number of patients with diabetes (ICD-10 E10-E14) at the end of the calendar year.
4) Child Health Indicators of Life and Development (CHILD) project annual incidence of Type 1 insulin-dependent diabetes per 100,000 population, in age groups 0-4, 5-9, 10-14, 15-17 and total ECHIM period.

**Additional underlying concepts**
Country also region, calendar year, gender, age group

**Preferred data source(s)**
1) EPHIS
2) National EPHIS
3) WHO based on a combination of primary care registers, national statistics, hospital discharges, surveys.

**Rationale**
Diabetes has become one of the most important public health challenges of the 21st century. Diabetes can be treated and partly prevented. The epidemic of diabetes requires resources to be devoted to the management of diabetes and its complications. Diabetes is the leading cause of blindness in industrialised countries in people ages 20-74 and one of the most common cause of end-stage renal disease. Comparisons on international and regional level can serve as a benchmark to identify gaps in healthcare.

**Data availability, quality, periodicity**
1) EPHIS implemented 2007/2009. Data will thus be available in the coming years (and will be pooled by Eurostat).
2) EUCID project: prevalence data for 10 countries in 2004, 2005 or 2006. The indicators for the EUCID project were established by the European Diabetes Indicators Project (EUDIP). If data from EPHIS or EUCID are not available, data from other reports are used.
3) WHO: Data series for less than half of EU. Data comes from a variety of sources (National diabetes registers, Routine reporting system, Hospital discharges, Surveys) and are considered not comparable. Eurostat has hospital discharge data, and mortality due to diabetes mellitus.

**References**
- WHO: EPHIS - http://www.euro.who.int/epi/ephis/
- European Diabetes Indicators Project, EUDIP (2005-2).
- European Core Indicators in Diabetes, EUCID (2006-8);
- http://www.eucid.eu/echid/home.do
- EUCID final report

24.3.2009
- EFC: ELDERLY NAI
  http://www.eutaxia.org/english/EFC/ElternNAI/Efc_Elderly_Nai.htm
- WHO diagnostic criteria for diabetes mellitus or its preliminary stages (IGT and IFG):
  http://www.euphias.org/object_document/def/75027/1_d.html. Definition and diagnosis of
diabetes mellitus and intermediate hyperglycaemia: report of a WHO/IDF consultation.
- ELIS standard questionnaire (version of 1/2006):
pdf
- Child Health Indicators of Life and Development (CHILD) project: final report to the
European Commission:
- The EUHES (European Union Public Health Information & Knowledge System,
  www.euhris.org): the Health Status chapter dedicates a topic on diabetes among Diseases,
diseases, injuries / Other non-communicable diseases
  http://www.euphias.org/object_class/aspl_diabetes.html

Work to do
- Decide which definition, calculation method (source) to follow, EHTS?
- Projects to follow: EUDIP-European Core indicators for Diabetes Mellitus, HIRO,
  HiCID
<table>
<thead>
<tr>
<th>ECHM Indicator</th>
<th>B) Health status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMI</td>
<td>21. AMI</td>
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</table>

**Definition of indicator**

1) Incidence/attack rate of acute myocardial infarction or coronary death in the population.
2) Mortality from ischemic heart disease in the population
3) Prevalence of past AMI in the population

**Calculation of indicator (numerator, denominator)**

1) Age-standardised incidence/attack rate by sex in age group 35-74 in the population, based on hospital discharge and mortality data.
2) Age-standardised mortality rate by sex in age group 35-74 in the population
3) No. of persons with past AMI per 100,000 population, based on health interview survey. Here proportion of individuals reporting to be have been diagnosed with Myocardial infarction which occurred during the past 12 months, per 100,000 survey population, derived from EHS questions HS 4/5/6 HS 4. Do you have or have you ever had any of the following diseases or conditions? 3. Myocardial infarction (yes/no). If yes: HS 5 W was this disease/condition diagnosed by a medical doctor? (yes/no). HS 6: Have you had this disease/condition in the past 12 months? (yes/no).

**Additional underlying concepts**

1) A wider group of diagnoses is proposed for the fatal cases than for the non-fatal cases, because it is often impossible to tell whether the death was caused by a myocardial infarction or other coronary event. Incidence refers to person’s first event. Ideally the denominator should be those who have not had an AMI before, but in practice this is not possible. The total population in the denominator gives a good approximation. Attack rate counts the first and recurrent events, whenever they is at least 25 days between the onset of the events. Incidence is more important than attack rate, although both bring very similar information. Data for the attack rate are more widely available.
2) Here and for the incidence/attack rate the age range is limited because the disease is extremely rare in younger ones. On the other hand, co-morbidity and identification of the cause of death in the old people would complicate the interpretation of the results if these were included. It should be noted that the accuracy of the mortality diagnosis of ischemic heart disease varies considerably between countries.
3) The respondents reporting AMI ever (EHS questions HS 4/5/6) more reliable data on different forms of ischemic heart disease may be available from a HES questions (ECG Minnesota codes).

**Relevant dimensions (subgroups)**

Country (region), year, sex, SES (only for HS)

**Preferred data sources**

1) Eurostat project: incidence/attack rate from hospital discharge registries (ICD-10 codes I20.0, I21, I22) combined with causes of death registries (ICD-10 codes I20-I25). Alternatively, data from population-based AMI registries, possibly using validated diagnoses, can be used; see also Hospital Data project: inpatient discharge rates for acute myocardial infarction.
2) National causes of death registries (ICD-10 codes I20-I25)
3) EHS

**Rationale**

High-burden disease and cause of death. These diseases are preventable.

**Data availability, quality, periodicity**

1) In most countries, often limited to certain regions within countries
2) All European countries. The quality of the data for coronary heart disease varies considerably between countries.
3) HES, EHS implemented 2007-2009. Data will thus be available in the coming years (and will be matched by Eurostat) ECHM Survey recensio 17.4.2007: 14 of 19 countries have incidence data, 15 of 19 have prevalence data of varying quality.
AMI population-based registers are available in: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Norway and Sweden.

See below a table un different event definitions reported in EUROISS Manual of Operation for the implementation of AMI/ACS population-based register

**References**

- Eurostat project [http://www.euro.who.int/web].
Wors to do

- Alternative, longer name: Acute Myocardial infarction – Ischaemic Heart Disease
- Check for availability of data according to Eurocase definition
- Check for available information on the validity of the data sources (e.g., Tansell-Deeoe, H, Kuhlmann K, Aasenay P, Arwiler D, Rajananka A-M, Fajik A, for the MONICA Project: Myocardial infarction and coronary deaths in the World Health Organisation MONICA Project. Registration procedures, event rates and case fatality in 38 populations from 21 countries in 4 continents. Circulation 1994;90:583-582 for mortality data). Eurocase may have made a review of more recent validation studies.

<table>
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<tr>
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## ECHM Indicator name
- **Stroke**

### Definition of Indicator
1. Incidence/attack rate of stroke in the population
2. Mortality from cerebrovascular diseases in the population
3. Prevalence of past stroke in the population

### Calculation of the indicator (name, acronym, denominator)
1. Age-standardised incidence/attack rate by sex in age group 35-84 in the population, based on hospital discharge and mortality data
2. Age-standardised mortality by sex in age group 35-84 in the population
3. No. of persons with past stroke, per 100,000 population, based on health interview survey. Here: proportion of individuals reporting to have been diagnosed with stroke which occurred during the past 12 months, per 100,000 survey population, derived from EIHs questions: H4.556c. H5.4: Do you ever have or have you ever had any of the following diseases or conditions? 6. Stroke (cerebral hemorrhage, cerebral thrombosis) (yes/no). If yes: H5.5. Was this disease/condition diagnosed by a medical doctor? (yes/no). H5.6: Have you had this disease/condition in the past 12 months? (yes/no).

### Additional underlying concepts
1. Incidence refers to person’s first stroke event (ideally the denominator should be those who have not had a stroke before, but in practice this is not possible. The total population in the denominator gives a good approximation). Attack rate counts the first and recurrent events, whenever here is at least 28 days between the onset of the events. Incidence is more interesting than attack rate, although both yield very similar information. Data for the attack rate are more widely available. Distinction between a first stroke event and a recurrent one is practically impossible in many countries without specific follow-up and data linkage across several years of hospital discharge records. Only local registers with active follow-up can capture those stroke attacks that never reach the hospital (estimated between 5% and 10% by the US Bureau of Disease). Routine data linkage of hospital and mortality data is not possible in many countries because of privacy rules and data protection legislation.
2. Here and for the incidence/attack rate the age range is limited because the disease is rare in younger people. On the other hand, co-morbidity in the older people would complicate the interpretation of the results if this were included. Ad hoc studies to validate estimates of stroke due to stroke from routinely collected mortality data have shown that this source of information is of varying quality (from 70% to 90% are confirmed by registers).
3. Respondents reporting past stroke ever (EIHs question H5.5). Interview surveys are an inaccurate source of information, here because self-report data tend to involve substantial misreporting.

### Relevant dimensions (subgroups)
- Country (region), year, sex, SES (only for H5s)

### Preferred data source(s)
1. Eurovics project: incidence/attack rate from hospital discharge registers combined with causes of death registers (ICD-10 codes I63-I64). Alternatively, data from population-based stroke registers, possibly using validated diagnosis, can be used. The also: Eurovics project: impact on discharge rates for acute myocardial infarction. Here too, report separately: a) hemorrhagic stroke (ICD-10 codes I61, I62), b) ischemic stroke (ICD-10 codes I63, I64) and c) subarachnoid stroke (ICD-10 codes I60).
2. National causes of death registries (ICD-10 codes I60-I69). Where possible, report also separately: a) hemorrhagic stroke (ICD-10 codes I61, I62), b) ischemic stroke (ICD-10 codes I63, I64) and c) subarachnoid stroke (ICD-10 codes I60).
3. EIHs.

### Rationale
- High burden disease and cause of death. These diseases are preventable.

### Data availability, quality, periodicity
1. In most countries, often limited to certain regions within countries.
2. All European countries.
3. EIHs implemented 2007-2009. Data will thus be available in the coming years (and will be pooled by Eurostat).

### References
- Eurovics project: [http://www.eurovics.eu](http://www.eurovics.eu)
Hospital data project:
EPC: ELDERLY NAH:
- EUS standard questionnaire (version of 11/2016):

Work to do:
•
Appendix II

Details of the IHD data identified by country: sources considered

Denmark

Danish National Health Survey
OLA EKHOLM, ULRIK HESSE, MICHAEL DAVIDSEN & METTE KJØLLER
The study design and characteristics of the Danish national health interview surveys - Scandinavian Journal of Public Health, 2009; 0: 1–8 – not used based on health survey.


Hospital discharge data available – but not considered representative of all cases.
Monica study 1982/93 for Denmark (only 35-64 yrs) gives the rate of first and recurrent events (fatal and non-fatal) from one region 0.00517 in men and 0.00140 in females. – data too old.

Finland

Health 2000 Survey
• Survey coordinated by the KTL with data collected form the fall of 2000 to the spring of 2001.

A Menotti,M Lanti, P E Puddu, D Kromhout. Coronary heart disease incidence in northern and southern European populations: a reanalysis of the seven countries study for a European coronary risk chart. Heart 2000;84;238-244 – very old data.

Finnish CVD disease register (http://www3.ktl.fi/stat/) – not suitable as based on hospital discharge only.

France

PRIME study – Prospective Epidemiological Study of Myocardial Infarction

- Not selected as conducted only in selected cities, only in men, and limited age range


Bulletin epidemiologique hebdomadaire. Numéro thématique Surveillance de la pathologie coronaire en France : l’après MONICA No 8-9. RÉPUBLIQUE FRANÇAISE Feb 2006. Data were considered, but a different approach for IHD used instead.

Germany

Bundes-Gesundheitssurvey: conducted by the Robert Koch Institute (RKI)

- Representative sample of the resident population
- N=7124 individuals aged 18-79 years; Response rate=61.4%
- Survey data were collected by means of self-administered questionnaire, medical interview and physical examination. Data were considered, but a different approach for IHD used instead.


Ireland

Survey of Lifestyles, Attitudes and Nutrition in Ireland (SLAN) 2007 (Also conducted in 1998, 2002). Data were considered, but a different approach for IHD used instead.


- Conducted in 2007.
- National survey representative of general population of Ireland (when compared with Census 2006 figures) and weighted in the analysis to match Census data.
- N=10,364 respondents; Response rate = 62%.
- Data were collected by personal interviews.

Italy

Attack rates and case fatality of coronary events in Italy for men and women, 1998-1999, ages 35-74 years (Italian Heart Journal 2006;6:667). Data were considered, but a different approach for IHD used instead.


Health interview survey in 35-74 yrs at http://www.epicentro.iss.it/ (OEC survey). Not considered as a health survey.

Netherlands

RIVM registry data were considered, but a different approach for IHD used instead.

Incidence and prevalence rate data from GP registries were obtained from the Dutch National Institute of Public Health website (www.rivm.nl). The links to the web pages on the RIVM website from which the data were downloaded for each disease are as follows: http://www.rivm.nl/vtv/object_document/o1320n17964.html

Poland


Spain


- Data collection from June 2006-June 2007
- Nation-wide survey of households
- A stratified tri-stage sample type is used. The first-stage units are the census sections. The second-stage units are the main family dwellings. One adult (aged 16 and over) is selected within each household to fill out the Adults Questionnaire and, should there be any minors (aged 0 through 15), a minor is also selected to fill out the Minors Questionnaire.
- Sample: approximately 31,300 households distributed among 2,236 census sections. Data were considered, but a different approach for IHD used instead.


Sweden


Messner T, Lundberg V, Boström S, Huhtasaari F, Wikström B. Trends in event rates of first and recurrent, fatal and non-fatal acute myocardial infarction,
Swedish survey of living conditions (ULF). http://www.scb.se/default.aspx. Survey data not considered for IHD.
Data made available by Prof Rosengren, Gotborg University. – Data considered but a different approach was used for IHD.

United Kingdom

UK GPRD – www.gprd.com – used in the DYNAMO model.
Health Survey for England, 2006 and Scottish Health survey, 2003 (IHD Incidence
Quality of Outcomes Framework
Coronary Heart Disease Statistics, 2008 (www.heartstats.org)

IHD case fatality
  o Norris et al, 1998;
  o MONICA Belfast & Glasgow studies;
  o British Regional Heart Study, 1978-1980
Appendix III

Details of the stroke data identified by country: sources considered

Denmark

Danish National Health Survey
OLA EKHOLM, ULRIK HESSE, MICHAEL DAVIDSEN & METTE KJØLLER
The study design and characteristics of the Danish national health interview surveys -
Scandinavian Journal of Public Health, 2009; 0: 1–8

Truelsen, T; Prescott, E; Gronbaek, M; Schnohr, P; Boysen, G. The Copenhagen City Heart Study Stroke. 28(10):1903-1907, October 1997.

Per Thorvaldsen, Michael Davidsen, Henrik Bronnum-Hansen and Marianne Schroll
Stable Stroke Occurrence Despite Incidence Reduction in an Aging Population :
Stroke Trends in the Danish Monitoring Trends and Determinants in Cardiovascular Disease (MONICA) Population Stroke 1999;30;2529-2534

Finland

Health 2000 Survey
- Survey coordinated by the KTL with data collected form the fall of 2000 to the spring of 2001.

Finnish CVD disease register (http://www3.ktl.fi/stat/) – not suitable as based on hospital discharge only.

France

Benatu, Rouaud, Durier, Contegal, Couvreur, Bejot, Osseby, Ben Salem, Ricolfi, Moreau, Giroud. Stable Stroke Incidence Rates but Improved Case-Fatality in Dijon, France, from 1985 to 2004. Stroke 2006;37;1674-1679;


Germany

Bundes-Gesundheitssurvey: conducted by the Robert Koch Institute (RKI)
• Representative sample of the resident population
• N=7124 individuals aged 18-79 years; Response rate=61.4%
• Survey data were collected by means of self-administered questionnaire, medical interview and physical examination.


Ireland

Survey of Lifestyles, Attitudes and Nutrition in Ireland (SLAN) 2007 (Also conducted in 1998, 2002)


• Conducted in 2007.
• National survey representative of general population of Ireland (when compared with Census 2006 figures) and weighted in the analysis to match Census data.
• N=10,364 respondents; Response rate = 62%.
• Data were collected by personal interviews.

Italy

ISTITUTO NAZIONALE DI STATISTICA Compendio statistico italiano Italian Statistical Abstract 2008 – National statistics for Italy.


Health interview survey in 35-74 yrs at http://www.epicentro.iss.it/ (OEC survey)
Netherlands
Incidence and prevalence rate data from GP registries were obtained from the Dutch National Institute of Public Health website (www.rivm.nl). The links to the web pages on the RIVM website from which the data were downloaded for each disease are as follows:

Stroke:  http://www.rivm.nl/vtv/object_document/o1027n17966.html

Poland


Spain

- Data collection from June 2006-June 2007
- Nation-wide survey of households
- A stratified tri-stage sample type is used. The first-stage units are the census sections. The second-stage units are the main family dwellings. One adult (aged 16 and over) is selected within each household to fill out the Adults Questionnaire and, should there be any minors (aged 0 through 15), a minor is also selected to fill out the Minors Questionnaire.
- Sample: approximately 31,300 households distributed among 2,236 census sections.


Sweden


Data made available by Prof Rosengren, Gotborg University. – Data considered but a different approach was used for Stroke.

The Swedish survey of living conditions (ULF). http://www.scb.se/default____2154.aspx. Survey data not considered for IHD.

United Kingdom

UK GPRD – www.gprd.com – used in the DYNAMO model.

Health Survey for England, 2006 and Scottish Health survey, 2003 (IHD Incidence Quality of Outcomes Framework

Appendix IV

Details of the diabetes data identified by country: sources considered

Denmark

Danish National Health Survey
OLA EKHOLM, ULRIK HESSE, MICHAEL DAVIDSEN & METTE KJØLLER
The study design and characteristics of the Danish national health interview surveys - Scandinavian Journal of Public Health, 2009; 0: 1–8


Finland

Health 2000 Survey
- Survey coordinated by the KTL with data collected form the fall of 2000 to the spring of 2001.

Diabetes federation produced a report with age-sex specific prevalence data for 2002.


France


Chronic Diseases: the French Diabetes Management Program sophia
C. Bismuth. French Health Insurance Fund for employees (CNAMTS), France

SURVEY'S FOCUS - Self perceived health status, Public coverage and private supplementary health insurance, Visits to a physician, Consumption of medical goods and services, Hospitalization

Germany
Bundes-Gesundheitssurvey: conducted by the Robert Koch Institute (RKI)
- Representative sample of the resident population
- N=7124 individuals aged 18-79 years; Response rate=61.4%
- Survey data were collected by means of self-administered questionnaire, medical interview and physical examination.


Ireland
Survey of Lifestyles, Attitudes and Nutrition in Ireland (SLAN) 2007 (Also conducted in 1998, 2002)

- Conducted in 2007.
- National survey representative of general population of Ireland (when compared with Census 2006 figures) and weighted in the analysis to match Census data.
- N=10,364 respondents; Response rate = 62%.
- Data were collected by personal interviews.

Italy

ISTITUTO NAZIONALE DI STATISTICA Compendio statistico italiano Italian Statistical Abstract 2008 – National statistics for Italy.


Health interview survey in 35-74 yrs at http://www.epicentro.iss.it/ (OEC survey)

Netherlands

Incidence and prevalence rate data from GP registries were obtained from the Dutch National Institute of Public Health website (www.rivm.nl). The links to the web pages on the RIVM website from which the data were downloaded for each disease are as follows:

Diabetes: http://www.rivm.nl/vtv/object_document/o1270n17502.html


Poland


Spain


- Data collection from June 2006-June 2007
- Nation-wide survey of households
- A stratified tri-stage sample type is used. The first-stage units are the census sections. The second-stage units are the main family dwellings. One adult (aged 16 and over) is selected within each household to fill out the Adults Questionnaire and, should there be any minors (aged 0 through 15), a minor is also selected to fill out the Minors Questionnaire.
- Sample: approximately 31,300 households distributed among 2,236 census sections.


Sweden

([http://www.scb.se](http://www.scb.se)), but self-reported. May be used for comparison only

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**United Kingdom**

UK GPRD – [www.gprd.com](http://www.gprd.com) – used in the DYNAMO model.

Health Survey for England, 2006 and Scottish Health survey, 2003

Quality of Outcomes Framework

National Diabetes Audit (2005/6)

Diabetes Atlas, 3rd Ed

Diabetic Audit and Research in Tayside, Scotland (DARTS) register (McAlpine et al, 2005)

Q Research - [http://www.qresearch.org/Public_Documents/DataValidation/Diabetes%20in%20the%20UK%20analysis%20of%20QRESEARCH%20data.pdf](http://www.qresearch.org/Public_Documents/DataValidation/Diabetes%20in%20the%20UK%20analysis%20of%20QRESEARCH%20data.pdf)