Cardiovascular Indicators Surveillance Set

Grant Agreement n.2003118

Project leader: Simona Giampaoli

FINAL REPORT

UPDATED MAY 2006

The EUROCISS Project (European Cardiovascular Indicators Surveillance Set http://www.cuore.iss.it/eurociss/eurociss.asp) was set up in 2000 by a partnership of EU countries under the co-ordination of the Istituto Superiore di Sanità (ISS), Centre of Epidemiology, Surveillance and Health Promotion, Unit of Epidemiology of Cerebro and Cardiovascular Disease, Rome, Italy, as part of the Health Monitoring Programme (HMP) of the European Commission (EC).

The project has received financial support from the European Commission, Health and Consumer Protection Directorate-General.

In the year 2004 the Project was re-funded and more European countries were involved. The Project actually involves 18 European countries and the European Heart Network

Partners of the EUROCISS project

AUSTRIA
BELGIUM
CZECH REPUBLIC*
DENMARK
FINLAND
FRANCE
GERMANY
GREECE
HUNGARY*
ICELAND*
ITALY
THE NETHERLANDS
NORWAY
POLAND*
PORTUGAL
SPAIN
SWEDEN
UNITED KINGDOM

EUROPEAN HEART NETWORK

*: partners involved in the Project 2nd phase

This report resulted from cooperation among the following partners:

K. Steinbach AUSTRIA

M. Kornitzer (200-2005), Guy De Backer (2006-) BELGIUM

J. Holub (2004-) CZECH REPUBLIC

M. Madsen DENMARK

V. Salomaa FINLAND

T. Lang, S. Paterniti (2000-2003), J. Bloch (2004-) FRANCE

H. Loewel (2000-2003), A. Doring (2004-) GERMANY

V. Benetou (2000-2003), A. Trichopoulou (2004-) GREECE

R. Adany (2004-) HUNGARY

V. Gudnason (2004-) ICELAND

S. Giampaoli, S. Panico, D. Vanuzzo, L. Palmieri, P. Ciccarelli, V. Rebella ITALY

B. Bloemberg (2000-2003), M. Verschuren (2004-) THE NETHERLANDS

S. Graff-Iversen NORWAY

A. Pajak (2004-) POLAND

J. Pereira Miguel (2000-2003), E. Rocha (2004-) PORTUGAL

S. Sans SPAIN

N. Hammar SWEDEN

H. Tunstall-Pedoe (2000-2003), P. Primatesta (2004-) UNITED KINGDOM

M. Rayner, S. Petersen (2000-2003), S. Allender (2004-) EUROPEAN HEART NETWORK

EUROCISS WORKING GROUP

AUSTRIA
Konrad K. STEINBACH
Ludwig-Boltzman-Institut für Arrhytmieforschung
Austrian Heart Foundation
Türkenstraße 12 / 3, 1090 Vienna, A-1090 Wien
Tel.: +43 1 405 91 55
Fax: +43 1 405 91 56
E-mail: office@herzfonds.at

BELGIUM
Marcel KORNITZER (former representative)
Guy DE BACKER
Dept. of Public Health
University Hospital
Ghent

CZECH REPUBLIC
Jiri HOLUB
Institute of Health Information and Statistics
of Czech Republic
Palackeho namesti 4 P.O. Box 60
128 01 Praha 2
Tel. : +420 224 972 243
Fax: +420 224 972 659
E-mail: holub@uzis.cz

DENMARK
Mette MADSEN
National Institute of Public Health
Oester farimagsgade 5, DK1399, Copenhagen
Tel.: +45 39 20 77 77
Fax: +45 39 20 80 10
E-mail: mm@niph.dk

FINLAND
Veikko SALOMAA
National Public Health Institute, KTL
Department of Epidemiology
Mannerheimintie 166, 00030 Helsinki
Tel.: +358 9474 48620
Fax: +358 9474 48338
E-mail: veikko.salomaa@ktl.fi

FRANCE
Juliette BLOCH
Institut de Veille Sanitaire
Dept Maladies Chronique et Traumatismes
12, rue du Val d'Osne, 94415 Saint-Maurice
Tel.: +33 1 41796829
Fax: +33 1 41796811
E-mail: j.bloch@invs.sante.fr

GERMANY
Angela DORING
Institute für Epidemiologie, GSF Forschungszentrum
für Umwelt und Gesundheit
Ingolstaedter Landstr. 1, D-85764 Neuherberg
Tel.: +49 89 31 87 4153
Fax: +49 89 31 87 3667
E-mail: doering@gsf.de

GREECE
Antonia TRICHOPOULOU
Dept. of Hygiene and Epidemiology
School of Medicine, University of Athens
75 Mikras Asias Str., Athens GR 115 27
Tel.: +30 210 7488 042
Fax: +30 210 7488 902
E-mail: antonia@nut.uoa.gr

HUNGARY
Roza ADANY
School of Public Health, University of Debrecen
Kassai str. 26/B – H-4012 Debrecen
Tel.: +36 52 460-190
Fax: +36 52 460-195
E-mail: adany@jaguar.dote.hu

ICELAND
Vilmundur GUDNASON
Icelandic Heart Association Research Institute
Holtasmara 1, 201 Kopavogur
Tel.: +354 535 1800
Fax: + 354 535 1801
E-mail: v.gudnason@hjarta.is

ITALY
Simona GIAMPAOLI (Project Leader)
Luigi PALMIERI
Paola CICCARELLI
Valentina REBELLA
Istituto Superiore di Sanità
Viale Regina Elena 299 – 00161 Rome
Tel: +39-06-49904231
Fax: +39-06-49904230
E-mail: sgiamp@iss.it

Salvatore PANICO
Università di Napoli Federico II
Via Pansini 5 – 80131 Napoli
Tel.: +39 081 7463687
Fax: + 39 081 5466152
E-mail: spanico@unina.it

Diego VANUZZO
Azienda per i servizi Sanitari 4 Medio Friuli
Piazza S.Maria della Misericordia, 15 – 33100 Udine
Tel.: +39 0432 552451
Fax: + 39 0432 552452
E-mail: diego.vanuzzo@sanita.fvg.it

THE NETHERLANDS
WM Monique VERSCHUREN
National Institute of Public Health and Environment (RIVM)
Box 1, NL-3720 BA Bilthoven
Tel.: + 31 30 274 3508
Fax: +31 30 274 4407
E-mail: wmm.verschuren@rivm.nl

NORWAY
Sidsel GRAFF-IVERSEN
Norvegian Institute of Public Health
P.O. Box 4404 Nydalen, 0403 Oslo
Tel.: +47 23408171
Fax: +47 23 40 82 60
E-mail: sidsel.graff-iversen@fhi.no (sgri@fhi.no)

POLAND
Andrzej PAJAK
Department of Epidemiology and Population Studies
Institute of Public Health, Medical College
Jagellonian University
St. Grzegórzecka, 20., 31-531 Kraków
Tel.: +48 12 4248321
Fax: +48 12 4218660
E-mail: mmpajak@cyf-kr.edu.pl

PORTUGAL
Evangelista Casimiro ROCHA
Faculdade de Medicina de Lisboa, Instituto de Medicina Preventiva
Av. Prof. Egas Moniz, P-1649-028 Lisbon
Tel.: +351 21 798 5130
Fax: +351 21 795 7409
E-mail: evangelistarocha@hotmail.com

SPAIN
Susana SANS
Institut d'Estudis de la Salut
Balmes 132
Barcelona 08008
Tel.:
Fax:
E-mail: susana.sans@uab.es

SWEDEN
Niklas HAMMAR
Department of Epidemiology
Norrbacka Building, S-17176 Stockholm
Tel.: +46 8 51 77 6606
Fax: +46 8 51 77 6529
E-mail: niklas.hammar@imm.ki.se

UNITED KINGDOM
Paola PRIMATESTA
University College London Medical School
Department of Epidemiology and Public Health
1-19 Torrington Place, London WC1E 6BT
Tel.: +44 20 76791269
Fax: +44 20 78130280
E-mail: p.primatesta@ucl.ac.uk

EUROPEAN HEART NETWORK
Steven ALLENDER
Research Fellow
Department of Public Health
University of Oxford
Old Rd Campus
Oxford OX3 7LF
Tel: 01865 226837
Fax: 01865 226720
E-mail: steven.allender@public-health.oxford.ac.uk

Contents

Appendix 1
Minutes of 1st EUROCISS II Partners' Meeting, 11-12 October 2004

Appendix 2
Minutes of the EUROCISS II Steering Committee Meeting, 24-25 February 2005

Appendix 3
Minutes of 2nd EUROCISS II Partners' Meeting, 4-6 October 2005

Appendix 4
Minutes of the EUROCISS II Steering Committee Meeting, 11-13 May 2006

Acronyms

ACS = Acute Coronary Syndromes
ADL = Activities of Daily Living
AMI = Acute Myocardial Infarction
ATC = Anatomical Therapeutic Chemical
CABG = Coronary Artery By-pass Grafting
CAD = Coronary Artery Disease
CVA = CerebroVascular Accidents
CVD = CardioVascular Disease
DDD = Defined Daily Dose
DG = Directorate General
DRG = Diagnosis Related Groups
EHRM = European Health Risk Monitoring
EQ = EuroQol
EU = European Union
EUROCISS = European Cardiovascular Indicators Surveillance Set
FAO = Food and Agriculture Organisation
GP = General Practitioner
HDR = Hospital Discharge Records
HES = Health Examination Surveys
HF = Heart Failure
HFA-DB = Health For All statistical DataBase
HIS = Health Interview Surveys
HMP = Health Monitoring Programme
I = incidence
ICD = International Classification of Diseases
ID = IDentification number
IHD = Ischaemic Heart Disease
LSHTM = London School of Hygiene and Tropical Medicine
MDB = Mortality DataBase
MDC = Major Diagnostic Categories
MONICA = Monitoring trends and determinants of Cardiovascular diseases
OECD = Organisation for Economic Co-operation and Development
P = prevalence
PTCA = Percutaneous Transluminal Coronary Angioplasty
SD = Sudden Death
TIA = Transient Ischaemic Attack
WHO = World Health Organization

1. Summary

Although cardiovascular disease (CVD) has been identified as one of the leading contributors to the global disease burden, the number of reliable indicators for monitoring CVD and for which data are available on a comparable basis across EU countries is currently limited.

Therefore, the aims of the EUROCISS project were to define indicators for monitoring CVD and to recommend standardised methods for future data collection in the European Union (EU). The achievement of these aims will facilitate cross-country comparisons and will assist efforts to improve CVD prevention and control.

Specific project objectives included:

1. prioritise CVD of importance in public health;
2. identifying specific indicators for assessing morbidity;
3. developing recommendations for collection and harmonisation of data that can be easily applicable within member countries in order to obtain reliable and significant data for the periodic monitoring of CVD.

Objective 1 - prioritise CVD of importance in public health

In prioritising CVD of greatest interest, two criteria have been selected: high prevalence of disease, in terms of mortality, morbidity and disability; and the possibility of prevention, in terms of modifiable risk factors.

On the basis of these criteria, acute myocardial infarction/acute coronary syndromes, ischemic heart diseases, heart failure and cerebrovascular accidents are considered the most important CVD.

Objective 2 - Identifying specific indicators for assessing morbidity

Acute myocardial infarction/acute coronary syndromes (AMI/ACS)

Recommended indicators include mortality, hospital discharge rates, incidence/attack rates and case fatality. Only mortality and hospital discharge diagnoses are available for all countries. Information about incidence/attack rate and case fatality is available in some countries through population-based registers, usually implemented at the regional level. These registers are based on record linkage of mortality and hospital discharge diagnoses and apply some validation procedures.

Recently, sensitive serologic biomarkers have become available for the identification of very small myocardial infarctions that would not have been detected earlier. The application of new and more sensitive biomarkers criteria will potentially cause a rise in the myocardial infarction incidence and a fall in the case fatality rate.

Heart failure and Ischemic Heart Diseases

Heart failure is a frequent complication of myocardial infarction and hypertensive disease. Hospitalisation rates are not sufficient to evaluate the frequency of the disease, because heart failure

does not necessarily require routine hospitalisation. For this reason, the EUROCISS working group suggests review of GP medical records, health examination surveys or CVD surveys and the adoption of standardised criteria. If hospital discharge records are used, validation studies are recommended because heart failure can be found under other diagnoses.

Other indicators can be used as a proxy to measure the burden of the disease if integrated with other sources of information, e.g. national consumption of drugs used to treat heart failure and its complications. Among the recommended indicators, functional disability and quality of life are suggested in patients with HF.

Prevalence of ischemic heart diseases is assessed by surveys, but information on important clinical measures is often lacking.

Cerebrovascular accidents

Recommended indicators for cerebrovascular accidents include mortality, hospital discharge rate, incidence/attack rate, case fatality and prevalence. Mortality and hospital discharge diagnoses are available for all countries. Information about incidence/attack rate and case fatality of stroke is available in some countries through population-based registers; prevalence is assessed by CVD surveys, health interview surveys and health examination survey. Special surveys at 1 year follow-up of stroke patients are recommended to evaluate the functional disability and the quality of life.

Objective 3 - Developing recommendation for data collection

The list of the new recommended indicators is based on available data and can be generated over a relatively short period of time: these indicators are called *short-term implementation indicators.* Others, called *long-term implementation indicators,* need a longer period of time to be implemented; most of these indicators represent validated versions of the available and short-term indicators and require, for each country, the training of a dedicated team of epidemiologists to support their development.

Following the experience of many Northern European countries, it is also recommended that all medical and death records across Europe adopt a personal identification number, which would allow an easier and more accurate record linkage among the different sources of information.

The application of the recommended indicators, validated through standardised methodology in all countries will result in the availability of reliable, valid and therefore comparable data on CVD morbidity at the European level.

In the year 2004 the Project was re-funded and one of the main objective of the 2nd phase is the preparation of the Manual of Operations for the implementation of population-based registers of acute myocardial infarction/acute coronary syndrome, stroke and of CVD surveys.

To this purpose, three Writing Groups have been formed in order to elaborate each Manual: the Writing group of the Manual of Operations of AMI/ACS Registers, the Writing group of the Manual of Operations of Stroke and the Writing group of the Manual of Operations of CVD Surveys.
Partners have been grouped according to their expertise. Each group is coordinated by a member of the Steering Committee who has the task to organize the activities of the members.
After an accurate bibliography revision (see Interim report 2005), the three Writing Groups have started the elaboration of the Manuals and they are still working on them.
The procedures described in the Manuals aim to be very simple. Starting from a minimum data set and following a step-wise procedure, a standardized model for the implementation of registers and surveys is provided.
A draft version of each Manual is enclosed to this Report.

Another achievement of the EUROCISS phase II has been the further development of the project WEB SITE (http://www.cuore.iss.it/eurociss/en/progetto/progetto.asp):
- under the section "Data at national level" tables summarising data about cardiovascular diseases by single country are now available in a more updated and completed version;
- a forum for discussion has been set up. This internal 'working page' can be accessed exclusively by EUROCISS partners through a password. Tables summarizing data from partner countries, draft Manuals of Operations, minutes of previous meetings and the Interim Report are among the most important documents available on the forum;
- a new page on the EUROCISS web site has been created to allow visitors to view all the past meetings where EUROCISS project had been presented;
- a list of future meetings can be found on the EUROCISS web site as well. This page contains the submitted proposals and abstracts and will be continually updated.

Being the web site the best and fastest way to spread information all over the world, all partners strongly contribute to its continuous development and updating.

2. Organisation and Management

The project is a collaborative effort of 18 different member states and the European Heart Network. Initially, twelve countries signed the agreement to participate (Austria, Belgium, Finland, France, Germany, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom).

Two other countries (Denmark and Greece) joined the project later on. In the year 2004 four further countries (Czech Republic, Hungary, Iceland, Poland) were involved in the Project.

A questionnaire for the creation of an of the available information sources and indicators was prepared and sent to each partner country who returned it completed.

A list of possible indicators and recommendations was generated during the meetings open to all formal participants. Six meetings were organised during the **I phase** of EUROCISS project:

- Rome, 5-6 April 2001;
- Amalfi, 18-21 October 2001;
- Luxembourg, 7-8 March 2002;
- Taormina, 17-20 April 2002;
- Dresden, 28-30 November 2002;
- Varese, 8-10 April 2003.

During the **II phase** of the project, two Partners' meetings were held:

- Rome, 11-12 October 2004
- Barcelona, 4-6 October 2005

The minutes of these meetings are reported in Appendix 1 and 3 respectively

At the beginning of the second phase, a *Steering Committee* was set up. It is constituted of 4 members (S Giampaoli, M Madsen, A. Pajak , P Primatesta, S Sans) who will undertake to perform the following activities:

- support the coordinating centre in its main decisions;
- represent the project in all occasions;
- assure the involvement of all participating in supporting the objectives of the project;
- contribute to the coordination of working groups;
- plan the dissemination of final results;
- give its contribution to other EU projects;
- compile a list of contents of each Manual of Operations (Manual of Operations of Cardiovascular Surveys; Manual of Operations of AMI/ACS; Manual of Operations of CVD

Registers) which will be distributed to the three groups dedicated to the preparation of the same manuals.

- assist the writing groups in organizing the work, discussing and reviewing the Manuals of Operations (Manual of Operations of Cardiovascular Surveys; Manual of Operations of AMI/ACS; Manual of Operations of CVD Registers) in collaboration with the coordinating centre.

Up to now, the Steering Committee members met twice:

- on February 24-25, 2005 in Rome
- on May 11-13 in Athens, on the occasion of the EUROPREVENT meeting

The minutes of these meetings are reported in Appendix 2 and 4 respectively

The EUROCISS project was presented:

- at the European Society of Cardiology Working Group on Epidemiology and Prevention (Taormina, 17-20 April 2002) in the symposium Surveillance of Cardiovascular Diseases 'The EUROCISS Project: the need for a common health currency in Europe' (S.Giampaoli);
- at the tenth Annual Meeting of the European Public Health Association (Dresden, 28-30 November 2002): *Workshop 'Monitoring of Cardiovascular Diseases and Risk Factors: results from the EUROCISS Project'* proposed by the EUROCISS Research Group: 'Monitoring of acute myocardial infarction and coronary heart disease' (N. Hammar); 'Monitoring of stroke and other cerebrovascular diseases' (V. Salomaa); 'Monitoring of cardiovascular risk factors' (S. Sans); 'Recommendations from the EUROCISS Project' (S. Giampaoli);
- at the International Epidemiological association - European Epidemiology Federation (Toledo, 1-4 October 2003): *Workshop 'Monitoring of Cardiovascular Diseases and Risk Factors: results from the EUROCISS Project'* proposed by the EUROCISS Research Group: 'Monitoring of acute myocardial infarction and coronary heart disease' (N. Hammar); 'Monitoring of stroke and other cerebrovascular diseases' (V. Salomaa); 'Monitoring of cardiovascular risk factors' (S. Sans); 'Recommendations from the EUROCISS Project' (S. Giampaoli);
- at the 11th Annual Meeting of the European Public Health Association (Rome, 20-22 November 2003): *Workshop 'Monitoring of Cardiovascular Diseases: results from the EUROCISS Project'* proposed by the EUROCISS Research Group: "The burden of cardiovascular diseases in Europe" (S Sans); "Recommended indicators for monitoring acute myocardial infarction and ischemic heart diseases" (N Hammar); "Recommended indicators

for monitoring stroke and other cerebrovascular diseases" (S Petersen); "Recommendede indicators for monitoring of heart failure and other forms of heart disease" (K Steinbach);

- at the Workshop "A Canadian Best Practices system for chronic disease prevention and control" (Toronto Ontario, Canada 10-11 March 2005);
- at the Sixth International Conference on Preventive Cardiology (Foz do Iguassu, Brazil, 21-25 May 2005): "European Cardiovascular Indicators Surveillance Set (EUROCISS): Recommendations for monitoring cardiovascular disease" (poster);
- at the ESC Congress 2005 (Stockholm, Sweden, 3-7 September 2005): "Population-based registers of Myocardial Infarction in Europe: results of the EUROCISS Project" (D. Vanuzzo);
- at the EUPHA 13th European Conference on Public Health (Graz, Austria, 10-12 November 2005): "The EUROCISS Project: development of cardiovascular morbidity indicators for the European Community" (S. Giampaoli); "Cardiovascular registers in Europe: results from EUROCISS Project" (S. Giampaoli);
- at the EUROPREVENT Congress (Athens, 10-13 may 2006): "EUROCISS: recommendations for coronary event surveillance in Europe" (S Giampaoli); "The EUROCISS Project: development of standardized measure for monitoring Coronaty Heart Disease in Europe" (M. Madsen);
- at the European Congress of Epidemiology (Utrecht, The Netherlands, 28 June-1 July 2006): "Population-based Registers for Myocardial Infarction in Europe: results from EUROCISS Project" (WM Monique Verschuren);

The following manuscripts have been published on behalf of the EUROCISS Working Group:

- Coronary and cerebrovascular population-based registers in Europe: are morbidity indicators comparable? Results of the EUROCISS Project (European J Public Health 2003;13, suppl3);
- "Population-Based Registers Of Acute Myocardial Infarction In Europe: Are Their Indicators Comparable?" (article to be submitted to European Journal of Cardiovascular Prevention and Rehabilitation)

The Project is coordinated by Simona Giampaoli, head of Unit of Epidemiology of Cerebro and Cardiovascular Diseases, National Centre for Epidemiology, Surveillance and Health Promotion.

She avails herself of the support of the following national officials: L.Palmieri, P.De Sanctis, C.Lo Noce, A.Giannelli, C.Donfrancesco, F.Dima.

Two full time researchers, P.Ciccarelli and V.Rebella are assigned to the activities of the Project and are paid by project funds.

3. Introduction

The EUROCISS Project (European Cardiovascular Indicators Surveillance Set) was launched in 2000 by a partnership of EU countries to develop health indicators and recommendations for the monitoring of CVD. It is part of the Health Monitoring Programme (HMP) financed by the European Commission.

As stated by the ECHI Project[1], health indicators describe the *health status* of a community and typically include measures of mortality, morbidity and disability; they also include *determinants of health* (biological, behavioural and socio-demographic risk factors) and *health systems* (use of health services, medication use, surgical procedures). Health indicators are essential to quantify the burden of diseases.

CVD has been identified as one of the leading contributors to the global disease burden. Fortunately, much is known about the risk factors and means of reducing CVD[2-10]. Many epidemiological studies have been conducted to identify CVD risk factors and demonstrate reversibility of risk through primary and secondary prevention. Among these studies, the most important are:

- the *Seven Countries Study* that identified several major risk factors for CVD: smoking, rich diet, with consequent high levels of total cholesterol, and high blood pressure. Differences in the prevalence of these risk factors among participating countries[2-4,7] have been ascertained to be responsible for differences in the incidence of stroke and coronary heart disease (CHD);
- the *WHO European Collaborative Trial in the Multifactorial Prevention of CHD* that demonstrated the reversibility of risk among European populations, through healthier lifestyles and high risk individuals treatment[9]. The North Karelia Project constitutes an example of well-recognised approach to community-based primary prevention[10];
- the *WHO-MONICA Project* that was carried out to assess the relative contribution of CHD incidence, case fatality, trends in classical risk factors and advancements in coronary care to the decline in CVD mortality in some industrialised countries[11]. In particular, one third of the decline in CHD mortality was due to changes in case fatality as a consequence of advancements in coronary care[12] and two/thirds to declining incidence in coronary events, as partly explained by the reduction of classical risk factors[13].

Others have contributed to the knowledge of CVD risk factors and demonstrate that factors such as low socio-economic status[14,15], physical inactivity[16] and diabetes[17] are also responsible of the increased CVD risk.

CVD and its risk factors were shown to be associated with other adverse health outcomes including cognitive impairment, dementia and decreased physical performance in the elderly [18,19].

Overall, the major message emerging from all these studies is that a decrease in the level of these risk factors in the population can prevent CVD and that a reduction of CVD may result in considerable benefits for public health care, cost and quality of life.

4. Aims and objectives

The aims of the EUROCISS project were to identify, among existing data-sets, the essential information required to objectively define morbidity indicators for CVD and to recommend standardised methods for future data collection in the European Union. The achievement of these aims permits cross-country comparisons and improve CVD prevention and control.

Specific objectives of the **I phase** of the project (2000-2004) included:

- prioritising CVD of importance in public health, on the basis of available knowledge, incidence, attack rate and prevalence in the population;
- identifying specific indicators for assessing morbidity in both genders, youths, adults and older people, taking into account differences in socio-economic status across countries; an inventory of available indicators was made to describe the different methods of data collection and assess the degree of comparability and quality control of existing data-sets;
- developing recommendations for collection and harmonisation of data that are easily applicable within the different countries in order to obtain reliable and significant data for the periodic monitoring of cardiovascular morbidity in the EU.

To evaluate the health status of a population and set appropriate prevention programs, mortality and morbidity data are necessary, along with data on prevalence of risk factors.

Partners of EUROCISS Project decided to focus only on morbidity because mortality and risk factors have already been studied in other Health Monitoring Projects, in particular the European Health Risk Monitoring (EHRM)[20].

The main objectives of the **II phase** of the EUROCISS Project include:

4. To develop knowledge, tools and expertise among Member States (MS) for CVD surveillance and prevention;
5. To complete the technical and scientific work begun during the first phase of EUROCISS project and necessary to finalise the list of indicators, the standardised procedures and methods of data collection that will assist MS in producing reliable, valid and comparable data;
6. To prepare the manual of operations for the implementation of surveillance systems for the collection and validation of indicators, in particular of population-based registers of myocardial infarction and stroke;
7. To prepare the manual of operations for the implementation of CVD surveys for collecting standardised indicators, in particular for prevalence of ischemic heart diseases, heart failure,

stroke and other CVD, and to identify a minimum set of questions and exams to be included in the health information surveys/health examination surveys (HIS/HES) for evaluating the prevalence of CVD at European level;

8. To assist in implementing recommendations for the development of population-based registers and surveys for monitoring temporal trends and geographical differences of CVD in MS.

5. Cardiovascular diseases to be considered

Two criteria have been followed in prioritising CVD of greatest interest: high frequency of disease, in terms of mortality, morbidity and disability; and the possibility of prevention, in terms of modifiable risk factors.

The most important CVD are ischemic heart diseases (IHD), which include acute myocardial infarction (AMI), acute coronary syndromes (ACS), effort angina, other forms of coronary heart disease; heart failure (HF); and cerebrovascular accidents (CVA), including ischemic and haemorrhagic stroke. In the section on Health Status indicators, under *diseases of large impact*, the European Community Health Indicators, ECHI Project[1], recommends AMI, IHD, CVA and HF within the CVD. It is also advisable that other poorly defined CVD of atherosclerotic origin and venous thromboembolic diseases be included as well.

Diseases of the heart and circulatory system (CVD) are the main cause of death in Europe: accounting for over 4.35 million deaths each year. Nearly half (49%) of all deaths are from CVD (55% of deaths in women and 43% deaths in men). The main forms of CVD are coronary heart disease and stroke. Just under half of all deaths from CVD are from CHD and nearly a third are from stroke. CHD by itself is the single most common cause of death, accounting for 1.95 million deaths in Europe each year. Over one in five women (23%) and over one in five men (21%) die from the disease. Stroke by itself is the second single most common cause of death, accounting for 1.28 million deaths in the EU each year. Over one six in women (18%) and one in ten men (11%) die from the disease[21]. IHD contributes to about 40% and CVA to an additional 25% of total CVD mortality[22]. Mortality data on HF are not available [23]. Although not currently included in most evaluations of CVD mortality, sudden death (SD) should also be considered among causes of death of interest.

Morbidity data are not available at the European level, in part because they are difficult to collect. Moreover, standardised morbidity rates are difficult to produce. One of the aims of the MONICA Project was to obtain valid and reliable information on fatal and non-fatal acute coronary and cerebrovascular events in different populations. Attack rates collected by MONICA have provided useful, accurate and reliable indicators for cross-country comparisons of acute coronary and cerebrovascular trends in men and women in the age range 35-64 years[24]. The MONICA study showed that for the age group 35-64 years, 1.0 to 1.5 events of hospitalised non-fatal AMI were registered for every death due to CHD[11]. Attack rates of acute coronary and cerebrovascular events, however, are in themselves not sufficient to describe the impact of CVD on the population. The demographic changes in Europe with the increasing proportion of older people and the advancements in treatment have resulted in an increasing prevalence of chronic forms of IHD.

Because of their frequency and cost there is a need to monitor the occurrence of both acute and chronic forms of the disease.

Interest has recently been focused on heart failure (HF) because of the poor quality of life among affected patients and the high cost of the disease. In the United States, it is estimated that the leading diagnosis in hospital admission of patients 65 years and over is heart failure[2].

6. Indicators: list and definitions

Health status indicators are a set of surveillance data that has been analysed in a way that permits assessment of the health status of the population so that public health priorities and actions can be appropriately identified. The selection of indicators should be primarily based on existing and comparable data sets for which regular monitoring is feasible, but it should also take into consideration likely future data needs and diagnostic and treatment developments. Indicators should be comprehensive, valid (sensitive), standardised, meet quality criteria, and be flexible (never fixed and final) to support evolving health policies.

Based on the suggestions of the ECHI project[1], indicators are subdivided into ***health status indicators*** (disease specific mortality, morbidity and disability), ***determinants of health*** (biological risk factors and health behaviours) and ***health systems*** (surgical procedures, medication use, use of health services).

6.1 Health status indicators

Disease-specific mortality, morbidity and disability should be available for the overall population and for age and sex subgroups. For each country or area it would be useful to have absolute numbers, crude and age-standardised rates according to a standard population (i.e. European standard population)[25]; standardisation in this case would improve comparability between countries with different age distribution in the population.

6.1.a Mortality, cause specific

Mortality data may provide a crude but simple way to assess health conditions; the source of information are death certificates where the underlying cause of death is coded. The reliability of mortality data depends on the completeness and accuracy of the vital registration system of the country.

CVD causes of death are coded according to the International Classification of Diseases and Causes of Death (ICD). Problems of temporal and geographic comparisons derive from the different versions of the ICD adopted over time (8^{th}, 9^{th}, 10^{th} revision) and from different coding practices in each country.

Definition of specific indicators:

i) *crude death rate:* the number of overall and cause-specific deaths divided by estimated mid-year population per 1,000[25];

ii) *age-standardised death rate:* death rate estimated after age-standardisation has been performed[25];

iii) *age-specific death rate:* the number of deaths divided by estimated mid-year population per 1,000 for specific age groups[25].

6.1.b Morbidity, diseases specific

Morbidity can be described using the following frequency measurements: hospital discharge rate, attack/incidence rate, prevalence and case fatality. In CVD, attack rates generally include first and recurrent events, while incidence rates represent only first event.

The importance of these measures differs according to the disease as well as the age range. In younger age groups the most important indicators are incidence, case fatality and prevalence; in older people, attack rate and prevalence are more important since patients with chronic diseases require more continuous therapy and rehabilitation, and have a greater impact on the public health system. For acute events, incidence rates are in general target measures, while for chronic conditions incidence as well as prevalence may be of interest. Incidence is used mostly for etiological research objectives; attack rate and prevalence are useful for hospital planning and for primary care.

Standardised rates are important to make cross-group comparisons and to investigate time trends, although absolute numbers are often necessary to evaluate the burden of the disease.

Definitions of specific indicators:

i) *hospital discharge rate or hospitalisation rate:* the number of hospital discharge records of a specified main diagnosis divided by the estimated mid-year population per 1,000[25];

ii) *attack rate:* the number of events (first and recurrent) divided by the estimated mid-year population per 1,000[25];

iii) *incidence rate:* the number of first events divided by the population at risk per 1,000 or person/years at risk. Person/years at risk consists of the sum of periods of time (years) at risk contributed by each of the person included in the study. Incidence may be estimated through the follow-up of a population enrolled in a cohort or the identification of new events in a dynamic population. It can be obtained using longitudinal studies or disease registers, when it is possible to eliminate those who have already experienced an event [25];

iv) *prevalence:* the proportion of persons with the disease in a population per 100 or per 1000 at a particular time. It is assessed by surveys;

v) *case fatality:* the number of fatal cases divided by the total number of events. It is usually expressed as the percentage of persons diagnosed as having a specified CVD who die from that disease within a given period[25].

6.1.c Disability

The following indicators have been used in literature to evaluate the consequences of CVD as well as the effectiveness of intervention. We propose to consider disability as a composite measure of health status according to ECHI definitions[1].

Definition of specific indicators:

i) *Disability-Adjusted Life Year (DALY):* takes into account years lost due to premature mortality and years lived with disability [26]. It is equal to the sum of the *number of years of life lost due to CVD in a population* (YLL) and the *number of years lived with disability of known severity and duration for a CVD in a population* (YLD);

ii) *Potential Years of Life Lost (PYLL):* it is a measure of the impact of premature mortality on the population. PYLL is the sum of the years that people dying from a CVD would have lived, had they experienced a normal life expectancy, usually determined at 65 years[25];

iii) *Activities of Daily Living (ADL):* the ADL index measures six basic functions (moving between rooms, using the lavatory, washing and bathing, dressing and undressing, getting in and out of bed, and feeding oneself) and has a score of A (independent in every item), B (dependent in one item), C (dependent in two items), D (dependent in three items), E (dependent in four items), F (dependent in five items) and G (dependent in all functions)[27,28];

iv) *Instrumental Activities of Daily Living (IADL):* the IADL-scale measures more complex functions (using the telephone, getting to places beyond walking distance, grocery shopping, preparing meals, doing housework or handyman work, doing laundry, taking medications, managing money). The score ranges from 8 (able to perform all functions) to 0 (cannot perform any function)[29];

v) *EuroQol (EQ):* the EQ is a standardised instrument for use as a measure of health outcome. Applicable to a wide range of health conditions and treatments, it provides a simple descriptive profile and a single index value for health status that can be used in the clinical and economic evaluation of health care as well as population health surveys[30].

6.2 Determinants of health

Blood pressure, tobacco smoking, total cholesterol, body mass index and physical activity are important determinants of the health status of the population. In particular, it is important to have

estimates on the prevalence of persons with hypertension, hypercholesterolemia, obesity, physical inactivity and smoking.

The main source of information on risk factors are CVD surveys conducted with internationally standardised procedures and methods; they are exhaustively described in the EHRM project.

Definition of specific indicators:

6.2.a Personal biological factors

i) *prevalence of hypertension:* number of persons with systolic blood pressure or diastolic blood pressure equal to or greater than 140/90 mmHg or undergoing specific treatment divided by the total population. Blood pressure measurements should be obtained calculating the meaning of at least two consecutive readings[20];

ii) *proportion of hypertensives under control:* number of hypertensives undergoing specific treatment with systolic blood pressure or diastolic blood pressure equal to or lower than 140/90 mmHg divided by the total number of hypertensives[20];

iii) *prevalence of hypercholesterolemia:* number of persons with serum total cholesterol equal to or greater than 193 mg/dl or 5.0 mmol/l or undergoing specific treatment divided by the total population. Hypercholesterolemia should be determined from at least two consecutive tests[20];

iv) *prevalence of overweight:* number of persons with body mass index equal to or greater than 25 kg/m^2 and lower than 30 kg/m^2 divided by the total population[31];

v) *prevalence of obesity:* number of persons with body mass index equal to or greater than 30 kg/m^2 divided by the total population[31].

6.2.b Health behaviours

i) *prevalence of physical inactivity during leisure time:* available questionnaires include many integrated questions measuring time spent in sport or other activities during leisure time; however it is easier to measure the prevalence of inactive persons during leisure time[32];

ii) *prevalence of current, former and non smokers:* number of current, former and non-smokers divided by the total population; smokers are persons who smoke one or more cigarettes a day;

iii) *number of cigarettes smoked per day:* number of cigarettes smoked per day divided by the total number of current smokers.

6.3 Health system indicators

Other indicators which measure health utilisation can be used as a proxy measures for CVD: national drug consumption, surgical operations, and use of health services. These indicators are not

sufficient to evaluate morbidity, but they can be used if integrated with other sources of information.

6.3.a Medication use

Drug consumption figures should preferably be presented as numbers of *ATC-DDDs/1000 inhabitants/day* or, when in-hospital drug use is considered, as DDDs per 100 bed days. ATC is the acronym for anatomical therapeutic chemical; DDD is the acronym for defined daily dose. Prescription data presented in DDD/1000 inhabitants/day may provide a rough estimate of the proportion of the population treated daily with certain drugs; DDD is the average maintenance dose of a medication used for its main indication in adults and assumed per day.

Drugs are classified in groups at five different levels: they are divided into fourteen main groups (1st level), with one pharmacological/therapeutic subgroup (2nd level); the 3rd and 4th levels are chemical/pharmacological/therapeutic subgroups and the 5th level is the chemical substance. DDDs are assigned per ATC 5th level by the WHO Collaborating Centre for Drug Statistics Methodology in Norway[33] Drug consumption information on antihypertensives, diuretics, beta-blocking agents, calcium channel blockers, ACE-inhibitors, nitrates, anti-arrhythmics, antithrombotic agents and cholesterol and triglycerides reducers are of interest. They are used in both primary and secondary prevention. However, they are not sufficient to evaluate morbidity and need to be integrated with other data, such as surveys. Thrombolytic treatment is used only in hospital in acute myocardial infarction. Drug consumption information is not very specific in the long term, because importance of medicine use changes with time.

6.3.b Surgical operations and invasive procedures

Surgical operations and invasive procedures, in particular *coronary artery by-pass grafting* (CABG), *percutaneous transluminal coronary angioplasty* (PTCA), *heart transplantation, carotid angioplasty, pace-maker, implantable cardioverter defibrillator, catheter ablation* and *peripheral vascular operations* are indicators of health care utilisation for CHD, stroke and other CVD in the population. These indicators are expressed as number of surgical operations divided by the total population.

6.3.c In-patient care utilisation and technology

Definition of specific indicators:

- *i)* *cause-specific aggregate bed-days:* the number of days spent in hospital for specific disease per population;
- *ii)* *mean and median length of stay:* mean and median number of days spent in hospital per patient;
- *iii)* *brain imaging:* number of CT-scans or MRI per population;

iv) *coronary angiography:* number of coronary angiographies per population;

v) *stroke unit:* number of stroke units per population.

7. Sources of information

Indicators are obtained using different sources of information. The most important for CVD are briefly described below.

7.1 Hospital discharge records

Hospital discharge records (HDR) give the number of hospitalisations by disease. Hospitalisation does not include less serious events. Problems arise when an acute event is followed by a period of rehabilitation or a transfer to other wards and the event could be counted more than once. Hospital discharge registers do not include emergency room records, seldom includes nursing homes and only in some instances private hospitals. Discharge diagnoses are rarely validated; validity may vary by case mix and total number of discharges. Hospital admission policies vary over time and place; the adoption of new diagnostic techniques, such as troponine for AMI/ACS, CT-scan and MRI for strokes, may cause major changes in event rates calculated from hospital discharge data.

In general, discharge records are more reliable than admission records. Hospital discharge data are available in most EU countries, but data may not be organised by age and sex.

Diagnosis Related Groups (DRG)

In some countries, hospital reimbursement is based on the DRG tariff system. The DRG system is based on equal-resources criteria and aggregates events in major diagnostic categories (MDC). Homogeneous groups of patients are defined as those requiring similar facilities, similar levels of organisation and diagnostic procedures. This system has been used in the United States for over 10 years, and is the basis for the prospective payment system of hospital stay for Medicare patients (elderly over 65 years). DRG may be useful in hospitals for acute events, but are not reliable for chronic diseases requiring a long hospital stay and rehabilitation. The DRG system takes into account the main hospital discharge diagnosis according to the MDC, complications, age and sex.

The main hospital discharge diagnosis is the condition identified for reimbursement of treatments and/or diagnostic procedures. Hence, information is synthesised and organised by economic objectives that could overestimate or underestimate seriousness, complications and co-morbidity; i.e. stroke units or specialist wards may selectively admit the most severe cases. For this reason, the use of the hospital discharge diagnosis may be misleading in countries applying the DRG tariff system. One of the advantages of the DRG tariff system, however, is its availability for the entire population of a country. This overcomes one of the drawbacks of hospital records, which is the difficulty of determining the population denominator by identifying the total country population as a reference.

Countries using the DRG system are Denmark, Finland, France, Italy, Norway, Portugal, Spain and Sweden. Countries where the DRG system will be implemented in the near future are Germany and the Netherlands.

7.2 Surveys

Health Interview Surveys (HIS) may be part of a permanent system of data collection at the national level. They are usually repeated periodically; information is self-reported and may not be sufficient to assess CVD morbidity.

High costs of clinical examination make the Health Examination Surveys (HES) difficult to carry out; they are usually based on a general broad health focus and conducted at the regional level. Only few HIS and HES use properly standardised and sensitive methods to assess CVD morbidity.

Ad hoc CVD surveys provide important information on risk factors and disease prevalence but are seldom representative of the whole country. They are usually conducted on adults and often exclude individuals older than 70 years. Their reliability greatly depends on the participation rate and methodologies adopted. If conducted in representative population samples, they may provide a reliable estimation of CVD prevalence. Standardised procedures and methods are available[34,35] such as the questionnaires from the London School of Hygiene and Tropical Medicine (LSHTM), used to identify angina pectoris, myocardial infarction and intermittent claudication. These have been used for many years in population studies and are available in different languages. They may evaluate the presence of symptoms of great importance for the health system when evaluating the burden of disease because not only the acute manifestations of the diseases, for example, myocardial infarction, but also the symptoms, for example, chest pain, contribute to the use of health services and to health costs. ECG, read according to the Minnesota Code (the Minnesota Code changes qualitative diagnoses into quantitative results), blood pressure, weight, height, total and HDL-cholesterol are usually collected to assess cardiovascular disease and risk factors. Echocardiography is recommended to make a reliable diagnosis of heart failure.

7.3 Cohort longitudinal studies

Cohort longitudinal studies are usually very comprehensive: they enrol a large *healthy* population, measure risk factors and observe over a long period, commonly years, the development and evolution of the disease. Incidence of disease can be determined in groups that differ in exposure level. These studies are very expensive, therefore seldom used for studying rare diseases, for example, CHD in women. They are useful for both aetiologic and public health administrative purposes. Their validity greatly depends on the representativeness of the enrolled population and on the number of persons lost during the follow-up. Almost all countries of the European Union have ongoing longitudinal studies of CVD. They include relatively small samples of the population and

in general involve collecting and validating hospital discharge diagnoses and deaths of the enrolled cohort. Diagnostic criteria for the definition of CVD events are specific to each study. Diagnostic criteria are based on history, clinical examination, hospital records, blood tests, and autopsies in cases of death.

Cohort longitudinal studies have contributed to the understanding of the differences in incidence across countries, to the measurement of the importance of risk factors in the prediction of disease and to the establishment of causality[2-4, 14, 17-19, 36].

Other longitudinal studies are those following cohorts of patients enrolled through registers. These studies lack the information on risk factors at baseline; they are defined as *long-term survival of population-based registers.*

7.4 GP networks

In some countries networks of general practitioners (GPs) can be useful when dealing with conditions not necessarily requiring hospitalisation. They may provide an adequate coverage for prevalence of chronic conditions such as IHD or HF. In a few countries these networks are operative (e.g. The Netherlands and UK). Information on this source has been exhaustively covered by the Project Health Monitoring in Sentinel Practice Network[37]. GPs networks may be affected by selection bias; usually not all GPs participate in studies but only volunteers. Data from GPs networks require validation.

7.5 Registers based on administrative data

In some countries registers are available, based on record linkage of mortality and hospital discharge records. These registers have existed for many years in a number of Nordic countries, where individuals are identified by a personal identification number (ID) thus allowing record linkage of all information sources. These registers are economical, cover the whole country, all age groups and collect large numbers of events; they are limited because they are not planned for scientific research and data are not standardised. Changes in the ICD version or the introduction of new diagnostic criteria may have unpredictable effects**.** These registers can be used when carefully validated[38-44].

7.6 Population-based registers

Population-based registers are usually formed through the linkage of various sources of information (mortality data, hospital discharge and GP records) and the validation of suspected events. Registers cover large samples of population, usually entire municipalities. Case finding (in- and out-of-hospital events, in-hospital events which occurred out of the region, home treatment events) and validity depend on the health system, medical care and diagnostic criteria applied in the definition of events. Potential sources of bias are the following: incompleteness of hospital records, death

certificates and autopsy records; coding errors; inaccuracy and non-comparability of the diagnostic criteria and autopsy rate.

The accuracy of rates produced using registers is related to the completeness and quality control of the data collected for the numerator (death and hospital discharge registers) and the denominator (population). Completeness also involves tracing subjects treated outside hospitals (nursing homes, clinics). In order to have a valid population-based register, the register should also collect events that happen to the residents but occur outside the area of surveillance. Data inaccuracy may be a problem for stroke: 50% of "new stroke diagnoses" are merely sequelae of an old stroke[43]. This problem increases with ageing[44]. Deaths occurring within 28 days are considered to reflect the same event. A unique ID for each subject would be very useful in linkage procedures between hospital discharge diagnoses and death certificate data sets; alternatively, multiple variables (e.g. name, date of birth, sex, residence), deterministic or probabilistic methods can be used for record linkage. Figure 1 shows the data flow in a population-based register.

The identification of events can be obtained by *hot pursuit* or *cold pursuit*. Hot pursuit means identifying case admissions to hospital usually within one or two days from the event onset and acquiring relevant information by visiting the ward or interviewing the patient. Information bias is minimised by the *hot pursuit* approach as information is collected immediately after the event[45]. The process is expensive. The method was used in the WHO European Office Myocardial Infarction Registers in 1970 and in the WHO MONICA project[46]. *Cold pursuit* implies the use of routine and delayed procedures, hospital discharge and death records. The process is easier and less expensive than hot pursuit; the number of cases studied is smaller because discharge diagnoses are more precise and specific than those on admission, but there is a possibility of missing important information. Both methods are used to identify suspected events, which must be validated applying the criteria of the WHO community register, or the MONICA methodology, or the new criteria of the European Society of Cardiology (see paragraph 10.3).

Registers are the best and most feasible source of morbidity data at a population level; they provide key indicators such as attack rate and case fatality. Incidence can be assessed if information on first event is available. If survival rates are available, also prevalence can be assessed[47-49].

The high cost of registers limits their implementation at a national level; therefore, they should be established in representative areas of a country (regions, macro-areas, etc).

Several countries have registers for AMI/ACS (Belgium, Denmark, Finland, France, Germany, Iceland, Italy, Norway, Poland, Spain and Sweden), fewer have them for stroke (Denmark, Finland, France, Germany, Greece, Italy, Norway and Sweden). Most adopt simplified methods derived from the MONICA project, which involves record linkage of death, hospital discharge and autopsy;

almost all apply the MONICA diagnostic criteria for the validation of all suspected events, or on a random sample or periodically.

8. Validation and quality of data

A measure of health status must not only be reliable but also valid. An indicator is valid if it measures the disease or condition it claims to measure. Validation evaluates the sensitivity and specificity. To validate coronary events collected within registers, the WHO diagnostic criteria, or the MONICA diagnostic criteria or the New Criteria of the Joint ESC/ACC, described later in this report (10.3), are applied as golden standard.

Validation can be carried out in all or in a sample of suspected cases; the choice will depend on factors such as the type and the frequency of the disease and the precision desired. Examples of validation procedures are: first 500 cases identified in one year; all cases during one month; or a randomly selected sample. In order to produce validated indicators, a *conditio sine qua non* is to allow the epidemiological teams involved in the validation access to relevant medical records and routine raw data of health statistics.

Quality of data depends on:

- completeness of coverage in terms of cases and place of treatment (hospitals, nursing homes, clinics, etc.);
- completeness of records and information (date of admission, date of discharge, ID, gender, hospital discharge diagnostic codes, intervention/procedure codes, department/ward, date of birth);
- methods for checking duplicate records;
- methods for record linkage between different sources of data;
- consistency of coding with the diagnosis;
- autopsy rate, especially for out-of-hospital events;
- consistency of coding/comparability of the information for different areas of the country;
- consistency of coding over time;
- representativeness of the different areas in the country.

9. Data availability

9.1 Databases available at a European level

9.1.a *WHO statistical databases*

WHO produces two main health databases: the Health for All Statistical Data Base (HFA-DB) and the WHO Mortality Data Base (HFA-MDB)[50]

WHO HFA-DB database contains data on about 600 health indicators grouped into the following categories: demographic and socio-economic statistics, mortality-based indicators, morbidity, disability and hospital discharges, lifestyles, environment, health care resources, health care utilization and expenditure, maternal and child health. They allow a simple and user-friendly analysis of trends and international comparisons for a wide range of health statistics to support the formulation and monitoring of health policies at the national and international level.

The HFA-DB is used by the WHO for the routine analysis and assessment of the health situation in Europe; it provides easy and rapid access to a wide range of basic health statistics for the 51 (52 since 2004) Member States of the WHO European Region (including countries of the former Soviet Union). It was developed by the WHO Regional Office for Europe in the mid-1980s to support the monitoring of health trends in the Region.

The data are either submitted by European Member States to the Regional Office or collected from other international organizations or sources. The Regional Office continuously collects new data and issues updated versions of the database twice a year, generally in January and June. Data are presented in a user-friendly, graphical or tabular form.

There are two versions of the database:

- An **on-line** version, which allows rapid access to the data via the Internet [50]; and
- An **off-line** version, which can be downloaded from the Regional Office Website [50].

For CVD morbidity, the HFA-DB provides the following indicators for each country:

- number of hospitalisations for *circulatory system diseases* (ICD-9 390-459);
- hospitalisation rates/100,000 for *circulatory system diseases*, *ischaemic heart diseases* (ICD-9 410-414), and *cerebrovascular diseases* (ICD-9 430-438) (tables 1a,1b,1c);
- *new cases of ischaemic heart diseases* and *new cases of cerebrovascular diseases*;
- *incidence of ischaemic heart diseases/100,000* and *incidence of cerebrovascular diseases/100,000*.

There is no regular data collection for incidence and ad hoc sources are used when available; therefore, availability of data for this indicator is very limited. Furthermore, this indicator cannot be

used for comparisons between countries and/or time periods on account of the great differences in national definitions and registration practices.

Not all morbidity indicators are available by sex or age groups. In particular, in the HFA-DB only a relatively small number of indicators are directly collected from each country.

Tables 1 a, b and c report, as an example, years of the first and last available data, and the sources of the indicators mentioned.

Limitations involving the use of the morbidity WHO-HFA database can be summarised as follows:

- definitions of morbidity indicators are lacking;
- morbidity data are not available by ICD code; they are grouped within the nosologic definition as *circulatory system diseases, ischaemic heart diseases,* and *cerebrovascular diseases*;
- morbidity data are not available by sex and age;
- morbidity data are not always available for the same calendar years.

Mortality data by leading causes and more detailed age-groupings are available in the off-line HFA-DB supplementary mortality database (HFA-MDB) [50]. In June 2004, the HFA-MDB was improved and actually includes about 2500 mortality indicators by 67 causes of death, by age and sex; diseases of the circulatory system (ICD-9 390-459), Ischemic Heart Disease (ICD-9 410-414) and Cerebrovascular diseases (ICD-9 430-438) are available as cardiovascular diseases.

Overall, absolute number of deaths are available by sex and calendar year. Age-standardized death rate (SDR), calculated using the direct method and standard European population structure, are available for men and women separately, for all ages or grouped into 0-65, 65+, 25-64 years, or in the age ranges 0-14, 15-29, 30-44, 45-59, 60-74, 75+, 25-64 and for various calendar years. Along with mortality data, mid-year population by 5-year age range, sex and calendar year are available (being 0 and 85+ the first and the last age ranges). ICD version used by each country and calendar year is also available.

Mortality detailed basic underlying raw data files for the world WHO Member States, together with the necessary instructions, file structures, code reference tables, etc., which can be used by institutions and organizations requiring access to this level of detail, are also available [51]

9.1.b *EUROSTAT (The statistical office of the European communities)*

EUROSTAT was established in 1953 to meet the requirements of the Coal and Steel Community. Over the years, its task has broadened and, when the European Community was founded in 1958, it became a Directorate General (DG) of the European Commission. EUROSTAT is the only provider of statistics at the European level; its key role is to provide statistics to other DGs and to the

Commission, and to other European Institutions in support of their role in defining, implementing and analysing Community policies.

EUROSTAT's main role is to process and publish comparable statistical information at the European level. Its efforts are directed towards a common statistical 'language' that embraces concepts, methods, structures and technical standards. EUROSTAT does not collect data: these are provided by the Member States. EUROSTAT's role is to consolidate the data, ensuring comparability through the use of harmonised methodology.

Health statistics cover all 15 Member States as well as Iceland, Norway and Switzerland. EUROSTAT integrates information from the most relevant data sources existing at international level: *OECD (Organisation for Economic Co-operation and Development)*, *WHO*, *FAO (Food and Agriculture Organisation)*, etc. Data are available from as far back as 1960 in some cases. Most EUROSTAT publications and data are available for a fee on the Internet [52].

Information and tables about cardiovascular disease morbidity are included in the second edition of the publication *Key data on health 2002 – Data 1970–2001*. This second edition of Key Data on Health includes a comprehensive, consistent and internationally comparable set of health data and indicators, highlighted in New Programme of Community Action in the field of Public Health (2003-2008); this programme was adopted by the European Parliament and the Council on 23 of September 2002 in the framework for action in the field of public health. In this report Eurostat try to bring together information on a wide range of health topics from the most relevant data-sources available around the world: New Cronos of Eurostat, Ecosante from OECD, Health for All from WHO, FAO, International Agency for Cancer, Euro HIV, specific epidemiological studies, etc. Information on the Health Status of the population, the main Diseases as well as the statistical description of Health Care systems are at the core of this publication; however, Key Data on Health also addresses the issues of lifestyles (nutrition, smoking, drinking, physical activity, drug use), mortality (infant, causes of death) and health risks associated with environment, work, leisure and traffic. Key Data on Health covers the 15 EU Member States, as well as Iceland, Norway, Liechtenstein and Switzerland. Tables and graphs provide, where possible, data from 1970 onwards disaggregated by gender and age. The publication is divided into six chapters: the first presents data on populations; the second focuses on lifestyle issues; the third describes health risks associated with the environment, working conditions, leisure time, and traffic; the fourth describes the health status of EU populations. For *Cardiovascular diseases* Chapter four contains the table *Coronary event rates, coronary case fatalities, and annual changes; adults aged 35–64, by sex; years in 1980s and early 1990s* (graph. 4.7.29) [53], using data from the MONICA project. Chapter five presents a detailed picture of mortality, while the last chapter gives an overview of the health care system.

9.1.c *OECD*

The Organisation for Economic Co-operation and Development (OECD) provides the *OECD-Health Data 2006* (realised on the 6th June 2006), a unique software package consisting of an interactive database and query modules to provide a user-friendly tool for the comparative analysis of health systems within and among the 30 OECD Member countries. It is available for a fee on the Internet [54] or in a CD-ROM version; this edition contains more than 1200 indicators across 30 countries up to 2004, with some time series as far back as 1960. Most data cover the 1980s and 1990s, many series continue up to 2003 or 2004, including selected preliminary data for 2005. The 1200 series cover Health status, Health care resources, Health care utilisation, Expenditure on health, Health care financing, Social protection, Pharmaceutical market, Non-medical determinants of health, Demographic references, Economic references. The list of all variables is downloadable from the following internet address 'http://www.oecd.org/dataoecd/43/5/36946481.pdf'.

The OECD also provides a trial version of the *OECD Health Data 2006,* freely downloadable to evaluate the database and access the OECD Health Data 2006 software; the only restriction is the data coverage: 1990-1995 in the trial version instead of 1960-2005 in the database. Sources and Methods, software tools, map and chart modules are identical to the final release version of OECD Health Data 2006 (CD-ROM and online).

Data are gathered from different sources, mainly from public institutions such as Ministries of Health and Welfare, National Statistical Institutes, Research Institutes and hospital morbidity databases.

For cross-national comparisons of health care data, there are still important gaps with respect to international agreements on statistical methods. The same term can refer to very different things among the 30 OECD countries. Despite efforts to develop homogeneity, standardized health statistics is still a goal, not a reality. The statistics contained in *OECD Health Data 2006* reflect the situation at the time of release; they have been refined and improved year after year. The aim of the files and the accompanying sources and methods is to provide an objective working tool: the co-operation and, indeed, the criticism of the various national data providers and users will enable improvements in the future.

Under the Ageing-Related Disease Project, for the Study of Cross National Differences in the Treatment, Cost and Outcome of Ageing-Related Diseases, a final report with data on mortality, morbidity health system indicators and determinants of health is available on AMI, IHD and stroke[55].

9.1.d *MONICA – Monitoring cardiovascular disease*

The WHO MONICA (MONItoring trends and determinants of CArdiovascular diseases) Project was developed to answer questions arising from the 1978 Bethesda Conference on the decline in CHD mortality.

MONICA aimed at measuring, within defined populations, 10-year trends of CHD and stroke, and their case fatality rates[11,41,57,58]; trends in CVD risk factors[13]; and trends in acute coronary and stroke health care for men and women, 35 to 64 years of age[12]. Indeed, MONICA has provided a unique opportunity for exploring the relationship between CVD morbidity and mortality [24].

Tables 2 and 3 list the EU countries involved in MONICA surveillance during the study [58,59].

Public access to MONICA data is available at the MONICA website[61]. The website provides quality assessment reports on coronary and stroke event registration and demographic data.

Fatal and non-fatal coronary events are reported as the total number of definite coronary events for each year, with separate totals for men and women, for the age range 35-64 years. The data are also presented as crude percentage of first, recurrent and indeterminate events from previous history [58].

Fatal and non-fatal stroke events are reported for each year, and separately for men and women, as the total number of definite strokes, stroke following a coronary event and non-classifiable because of insufficient data; for the age ranges 35-64 and 65-74 years, data are also presented as crude percentages of first and recurrent events [59].

9.2 Databases available at a national level and methodologies adopted

9.2.a *Inventory*

For the previously mentioned sources of information (HDR, surveys, registers, cohort longitudinal studies and GP networks), tables were developed to summarise the available data, providing a comprehensive overview and facilitating a comparison between countries.

To up-date the inventory of available data in countries participating to the first phase of the EUROCISS Project and in those participating for the first time at EUROCISS II, the original questionnaire was up-dated taking into account the discussions on recommended indicators arisen during the first phase: available indicators in the country, sources of information, ICD codes used (ICD VIII, ICD IX, ICD X), operational definitions used, whenever the data are available, references of calendar years, all information necessary towards a valid inventory.

The questionnaire prepared during the first months of activity of the Project II phase is more detailed than the one produced during the first phase, making the most of the results of the previous phase. In order to provide greater reliable information on CVD indicators, much more questions on validation and more complete data were included in the questionnaire. This gives all partners the possibility to meditate upon the already proposed indicators and to find the best way to develop them in the future. The new questionnaire is divided into the following sections: AMI, ACS, IHD, HF, CVA, OFHD.

Before each section a table showing the recommended indicators (available, short-term, long-term) is provided.

At bottom of each section there are few lines dedicated to comments, where partners can indicate what they might consider useful and helpful for the comprehension of the methods adopted.

Table 4 reports information about HDR. In all countries HDR cover almost the entire population, both genders and all ages. National reimbursement systems based on DRG are applied in all countries except Austria, Belgium, Germany, The Netherlands and the UK. ICD-9 is used in Belgium, Italy, The Netherlands, Portugal and Spain. Linkage with mortality is possible for Denmark, Finland, The Netherlands, Sweden and the UK by different methods: ID in Denmark, Finland and Sweden; date of birth, sex and zip code in The Netherlands and UK. The *in-hospital case fatality* is computed in all partner countries except Belgium and Spain. In Finland the validation of HDR is implemented; in other countries validation is not performed (Austria, Belgium, Germany, Italy, The Netherlands, Norway) or has been performed by retrospective review on an *ad hoc* basis (Sweden and Denmark) or only in a sample of the population (France and Spain).

Data are generally accessible with previous written request of authorisation, through national health or statistical institutions.

Table 4a reports information about HDR in actual partner countries updated 2006.

Tables 5a and 5b provide the main surveys on CVD. HIS performed by national statistical institutes are included in ***Table 5a***; they usually report generic questions on health conditions and use a self-reported questionnaire. Therefore, some conditions such as the prevalence of hypertension and diabetes could be underestimated.

Finland, Germany, Italy, The Netherlands, Portugal and Spain carry out CVD surveys periodically (***Table 5b)***. All these include the LSHTM questionnaire for the evaluation of symptoms, medical examination and ECGs.

Information is available for 20-80 year-old men and women. The response rate is over 60% in all countries except in the MORGEN survey in The Netherlands (55%). The majority of CVD surveys adopt MONICA standard methodologies[61]; WHO standard methods are used in CARDIO 2000 (Greece) and ERGO (The Netherlands)[34,35]. Data are accessible through national health or statistical institutions, universities and MONICA reference centres**.**

Table 5c and ***5d*** provide the main Health Examination Survey and Health Interview Survey on IHD in actual partner countries updated 2006 respectively.

Available information on cohort longitudinal studies is summarised in ***Table 6***. These studies are performed in Belgium, Denmark, Finland, France, Germany, Italy, The Netherlands, Sweden and the UK. Age ranges between 20 and 84 years. Cohort longitudinal studies are predominantly performed at the regional level. Most do not include HF. Denmark and the UK include HF as well as The Netherlands. Some started in the 80's (Belgium, Germany-KORA, Italy-Progetto CUORE, The Netherlands-Zutphen and Doetinchem), some in the 90's (France-PRIME, The Netherlands-ERGO, Sweden-Stockholm), and others more recently, in the year 2000 (Finland-HEALTH 2000 and Germany); the Finland FINMARK started in 1972 and the British Regional Heart Study in 1978. The data are accessible through national health institutes or universities.

GP networks provide data only in The Netherlands, Portugal and UK (***Table 7***).

EUROCISS Project II phase is particularly focused on population-based Registers and the new questionnaire is an useful mean to collect sources of information, methods to define events, record linkage procedures and validation techniques which contribute to give a picture of the health status of populations.

Table 8 reports information on AMI population-based registers collected through the first questionnaire (2003).

Table 8 a reports information on AMI population-based registers updated 2006.

Population-based registers are available at the regional level in Belgium, Denmark, Finland, France, Germany, Italy, Norway, Poland, Spain and Sweden. Most of the registers started between the second half of the 80s and the first half of the 90s (Finland, France, Germany, Spain and Sweden) within the MONICA Project framework. The others are more recent (Belgium-Bruges, Italy and Norway), nevertheless they adopt simplified methodologies derived from the MONICA Project . The Danish register goes back to 1978.

Age of persons included ranges between 25 and 74 years or more. Many of the population-based registers adopt simplified methodologies derived from the MONICA Project and validate the events applying the MONICA diagnostic criteria.

In Denmark, Iceland, Sweden, and Finland, national AMI registers are compiled using a linkage of administrative records from national hospital discharge and mortality registers; they cover the entire population and all ages.

Available data on stroke population-based registers collected through the first questionnaire (2003) are summarised in ***Table 9***.

Table 9a reports information on stroke population-based registers updated 2006.

Out of 18 partner countries with available data, 5 participated in the MONICA stroke registration. Nine countries have regional stroke population-based registers, but only 2 have also a national stroke population-based register. Registers differ from each other in case definition -- ICD codes, record linkage (probabilistic, deterministic by personal identification number or by first name, last name, date of birth), and validation procedures (i.e. MRI, TAC, MONICA criteria) -- and population characteristics -- population size, age range (35-64, 35-74, all ages), and years covered. These differences make morbidity indicators difficult to compare.

9.2.b *Main differences between registers*

In different countries AMI and stroke population-based registers use different procedures for the selection of events. Record linkage of mortality and HDR and validation methods are reported in ***Table 10***.

In the definition of AMI/ACS, countries use different ICD revisions (ICD-8, ICD-9 or ICD-10) to code death certificates (Table 2). Denmark never used ICD-9 but replaced ICD-8 with ICD-10. Denmark and Norway select only acute myocardial infarction (ICD-10: I21, I22), Sweden considers acute myocardial infarction (ICD-10 I21, I22) and other acute and subacute forms of ischemic heart diseases (ICD-10 I20.0), while all other countries include all ischaemic heart diseases (ICD-9: 410-414; ICD-10: I20-I25); Belgium, Finland, France, Poland and Spain add also heart failure (ICD-9: 428; ICD-10: I50) and sudden non-violent death (ICD-9: 798,799; ICD-10: R96-R98). Germany and Italy add sudden non-violent death as well. In addition, Italy, Spain and France consider other

causes of death. Italy, in particular, considers diabetes (ICD-9: 250), hypertension (ICD-9: 401-404), other forms of heart disease (ICD-): 420-429) and disease of artheries, arterioles and capillares (ICD-9: 440-447), when one of the contributory causes of death is ischaemic heart disease.

Selected diagnoses for the identification of suspected non-fatal events from hospital discharge records are as follows: acute myocardial infarction (ICD-10: I21, I22) in Denmark; acute myocardial infarction (ICD-10: I21, I22) and other acute and subacute forms of ischaemic heart disease (ICD-10: I20.0) in Finland, Germany and Sweden; all ischaemic heart diseases (ICD-9: 410-414; ICD-10: I20-I25) in Belgium, France, Italy and Spain; Belgium and France add also heart failure (ICD-9: 428; ICD-10: I50); percutaneous transluminal coronary angioplasty (PTCA, ICD-9 CM 36.0) and coronary artery by pass grafting (CABG, ICD-9 CM 36.1) are selected in Belgium, Finland, Germany and Norway.

Linkage procedures between mortality and HDR are performed through the 'personal identification number' (ID) only in Denmark, Finland, Norway and Sweden. In Germany, Italy, Belgium, France and Spain events are identified through deterministic (first name, last name, date of birth) or probabilistic record linkage procedures since these countries do not have ID.

Validation of events can be realized on each single case or on a randomly selected sample. The validation of events is usually based on MONICA diagnostic criteria using an algorithm based on various combinations of symptoms, ECG changes, cardiac enzymes elevation, history of ischaemic heart diseases and, in fatal cases, autopsy findings. Some registers also adopt more sensitive and specific biomarkers of myocardial injury, such as creatine kinase MB mass (CK-MBm) and cardiac troponins (troponin T and troponin I) to recognize myocardial necrosis.

In the Swedish national register, the events are validated on a random sample of patients using diagnostic criteria recommended for use in Swedish hospitals. In Denmark the national register is validated through record linkage with the Danish MONICA register.

Table 11 summarises the codes used for the selection of stroke. Denmark, Finland (only national register), France, Germany, Greece, Norway and Sweden select all CVD for mortality and HDR.

All stroke registers adopt the personal ID number except for Italy and Germany which links mortality and HDR by name, birth date and place of residence. Validation is based on MONICA diagnostic criteria in all countries, except for Germany where validation takes use of health insurance data and CT-scans.

10. Definition of cardiovascular diseases

10.1 *Nosologic definitions*

Acute myocardial infarction: myocardial cell death due to prolonged ischaemia[62] .

Acute coronary syndrome: it is a big category which includes myocardial infarction, both Q-wave and non-Q-wave, and unstable angina. Unstable angina is an acute ischaemia without myocardial necrosis.

Angina pectoris: a pain in the chest and/or adjacent area associated with myocardial ischaemia but without myocardial necrosis[62]. It is an old term used to describe myocardial ischemia without necrosis. It is generally divided into unstable, which is part of acute coronary syndrome, and stable angina.

Ischaemic heart diseases and coronary heart diseases: are commonly due to the obstruction of coronary arteries by atheromatous plaques. These include acute myocardial infarction, other symptomatic and asymptomatic (silent) myocardial ischaemia, old myocardial infarction, angina pectoris, and other forms of chronic ischaemic heart disease. Generally speaking, congestive heart failure, cardiac arrhythmias and sudden death recognise the same etiology. There are also non-atherosclerotic causes of obstructive coronary artery diseases (CAD). Myocardial ischaemia may also occur in the absence of obstructive CAD, as in the case of aortic valve disease, hypertrophic cardiomiopathy, idiopathic dilated cardiomiopathy, and luetic aortitis [63]; they are rare.

Heart failure: it is a pathophysiological state in which an abnormality in cardiac function is responsible for the failure of the heart to pump blood at a rate commensurate with the requirements of metabolising tissues[62]. Hypertension, myocardial infarct, and coronary heart disease are the major causes of heart failure.

*Cerebrovascular accidents: s*troke is characterised by rapidly developing clinical symptoms and signs of focal, at times global, loss of cerebral function lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin [62].

There are four main types of stroke: two caused by blood clots or other particles and two by haemorrhage. Ischaemic stroke (thrombosis and embolism) is the most common, accounting for about 70-80% of all strokes [62].

Cerebral thrombosis: it occurs when a blood clot (thrombus) forms and blocks blood flowing in an artery that supplies blood to part of the brain. Blood clots usually form in arteries damaged by atherosclerosis [62].

Cerebral embolism: it occurs when a clot (an embolus) or some other particle formed in a blood vessel, usually in the heart, is carried in an artery leading to or in the brain, blocking the flow of blood. The most common cause of embolism is atrial fibrillation[63].

Subarachnoid haemorrhage: it occurs when a blood vessel on the surface of the brain ruptures and bleeds into the space between the brain and the skull [63].

Intracerebral haemorrhage: it occurs when a defective artery in the brain bursts, flooding the surrounding tissue with blood [63].

Other cardiovascular diseases: include rheumatic heart disease, hypertensive heart diseases, other forms of heart diseases, atherosclerosis, aortic aneurysm, acute cor pulmonale, dysrhythmias, acute pulmonary oedema and venous thromboembolic diseases.

10.2 *Nosographic definitions*

Table 12 shows the diseases and their codes following the ICD, 8th, 9th, and 10th Revisions. Most countries have adopted ICD-10 Revision, however ICD-9 is still used by almost all countries for coding HDRs, because of the classification of procedures (ICD9-CM)[66-68]. In 1996 the Nordic Medico-Statistical Committee (NOMESCO) published the Classification of Surgical Procedures adopted in the five Nordic Countries (Denmark, Sweden, Finland, Norway, and Iceland)[67].

10.3 *Standardised diagnostic criteria*

Diagnostic criteria are used to validate clinical diagnoses. Those used in standardised studies are here reported in detail.

10.3.a MYOCARDIAL INFARCTION

WHO criteria [46]

Myocardial infarction is defined as definite on the basis of history, ECG, enzyme and necropsy, as follows:

1) ECG with unequivocal serial changes, or 2) typical history or atypical history together with equivocal ECG and elevated enzymes, or 3) typical history and elevated enzymes with negative or non available ECG, or 4) fatal cases whether sudden or not, with naked-eye appearance of fresh myocardial infarction and/or recent coronary occlusion at necropsy (ante-mortem thrombus, haemorrhage into an atheromatous plaque or embolism).

MONICA criteria [24]

Non-fatal coronary events are classified as *definite* and *possible*. The major difference with the WHO criteria is the use of the Minnesota code, a quantitative system for coding ECGs [68,69].

A *definite non-fatal event* is defined as:

(1) Progression of Minnesota codes on serial ECGs;

- Progression from no Q-wave to a definite Q-wave; or

- A lesser Q-wave progression combined with progressive ST-segment depression, developing ST-segment elevation, or progressive T-wave inversion; or
- Persistent ST-segment elevation with progressive T-wave inversion in sequential daily ECGs; or

(2) Cardiac enzyme levels two times the normal cut-off point, either with typical symptoms and an abnormal ECG, or with lesser symptoms and an ECG progression labelled *probable*.

Non-fatal events are placed in the category *possible* if a typical prolonged chest pain (20 minutes) occurs together with lesser or no ECG and enzyme findings.

Fatal coronary events are classified as *definite*, *possible*, and *unclassifiable*.

Events are *definite* if they satisfy the following criteria:

- definite criteria reported for non-fatal events; or
- when autopsy shows recent myocardial infarction or coronary thrombosis.

Possible coronary death involves suggestive terminal symptoms, or a CHD history in the absence of chronic occlusive CHD, or old myocardial infarction without pathological findings suggestive of a fatal disease.

Limitations of the coronary MONICA criteria [45]

The MONICA Project provides thorough information on mortality and morbidity, diagnostic criteria, standardisation, validation, quality control and data comparability for the years 1985-1994. Consistent methodology and diagnostic criteria were used to identify coronary events over time. The methodology was expensive, however. Available indicators were attack rate and fatality rate.

There are some aspects that limit the study's generalisability:

- the age group under surveillance was limited to 35-64 year old individuals;
- areas selected for the study were those registering 100 to 300 coronary deaths in men below age 65 years;
- the selected areas were not necessarily representative of the whole country;
- it could not identify silent forms of myocardial infarction and misdiagnosed events.

New Criteria of the Joint ESC/ACC Committee for the Redefinition of Myocardial Infarction [70]

Recently, sensitive and specific serologic biomarkers have become available for the identification of very small myocardial infarctions that would not have been detected earlier. The biomarker of myocardial damage is cardiac troponine, which has nearly absolute myocardial tissue specificity, as well as a high sensitivity.

The application of these new, more sensitive criteria for MI will potentially cause the rise of MI incidence and the fall of case fatality rate. Thus, the new definition of MI may confuse efforts to

follow trends of disease rates in populations. Continued tracking of these trends will require methods for adjusting to the new criteria.

Criteria for acute, evolving or recent AMI

Either one of the following criteria satisfies the diagnosis for an acute, evolving or recent AMI:

(1) Typical rise and gradual fall (troponine) or more rapid rise and fall (CK-MB) of biochemical markers of myocardial necrosis with at least one of the following:
   (a) Ischaemic symptoms;
   (b) Development of pathologic Q-waves on the ECG;
   (c) ECG changes indicative of ischaemia (ST-segment elevation or depression); or
   (d) Coronary artery intervention (e.g., coronary angioplasty).

(2) Pathologic findings of an acute MI.

Criteria for established MI (past)

Anyone of the following criteria satisfies the diagnosis for established MI:

(1) Development of new pathologic Q-waves on serial ECGs. The patient may or may not remember previous symptoms. Biochemical markers of myocardial necrosis may have normalised, depending on the time elapsed since the infarct developed.

(2) Pathologic findings of a healed or healing MI.

Limitations of the Joint ESC/ACC criteria [71]

These new criteria, based on the rise and fall of the cardiac troponine marker, can be observed if myocardial infarction comes under care immediately after the onset of symptoms and the patient survives for several days, in order to guarantee the fall of the biochemical marker. Therefore the definition is not comprehensive of fatal cases.

10.3.b UNSTABLE ANGINA

According to the New Criteria of the Joint ESC/ACC Committee unstable angina is defined as an ACS with no ST-segment elevation at the ECG and no elevation of biochemical markers such as troponine or CK-MB measured by mass assay [72].

10.3.c ISCHAEMIC HEART DISEASE

The LSHTM questionnaires for angina pectoris on effort and myocardial infarction identify the characteristics of ischaemic pain - i.e., occurrence usually on walking, in certain chest site, usually causing the individual to slow his pace or stop, and promptly relieved by rest. ECG Minnesota Code provides a framework for uniform reporting in reasonably homogeneous, precisely defined classes, and includes instructions to reduce coding variability. Definition of the Minnesota ECG Codes are

given in the Publication of Rose and Blackburn[34,35]; diagnostic criteria for IHD are reported in the publication of Keys [36]:

- major Q-waves corresponding to Minnesota Codes 1.1
- lesser Q-waves plus major T-wave findings, corresponding to Minnesoda Codes 1.2 plus 5.1 or 1.2 plus 5.2
- major specific resting ECG abnormalities corresponding to one of the following Minnesota Codes: 1.2, 1.3; 5.1, 5.2; 6.1, 6.2; 7.1, 7.2, 7.4 or 8.3.

10.3.d HEART FAILURE

Framingham Criteria [23]

Criteria for HF as specified in the Framingham Study may be distinguished into major and minor criteria.

Major criteria include:

- paroxysmal nocturnal dyspnoea
- neck vein distension
- rales
- radiographic cardiomegaly (increasing heart size on chest X-ray film)
- acute pulmonary oedema
- third sound gallop
- increased central venous pressure (>16 cm H_2O in the right atrium)
- circulation time $\geq$25 seconds
- hepatojugular reflux
- pulmonary oedema, visceral congestion or cardiomegaly at autopsy
- weight loss $\geq$4.5 kg in 5 days in response to treatment of HF.

Minor criteria include:

- bilateral ankle oedema
- nocturnal cough
- dyspnoea on ordinary exertion
- hepatomegaly
- pleural effusion
- decrease in vital capacity by 33% from maximal value recorded
- tachycardia (rate $\geq$120 beats/min)

Diagnosis of HF is given for two major or one major and two minor criteria [23].

Boston Criteria [73]

Criterion	Point value [*]
Category I: history	
Rest dyspnoea	4
Orthopnea	4
Paroxysmal nocturnal dyspnoea	3
Dyspnoea while walking on level area	2
Dyspnoea while climbing	1
Category II: physical examination	
Heart rate abnormality	1 *if 91 to 110 beats per minute* 2 *if more than 110 beats per minute*
Jugular venous elevation	2 *if greater than 6 cm* H_2O 3 *if greater than 6 cm* H_2O *plus hepatomegaly or oedema*
Lung crackles	1 *if basilar* 2 *if more than basilar*
Wheezing	3
Third heart sound	3
Category III: chest radiography	
Alveolar pulmonary oedema	4
Interstitial pulmonary oedema	3
Bilateral pleural effusion	3
Cardio thoracic ratio greater than 0.50	3
Upper zone flow redistribution	2

[*] The composite score (the sum of the subtotal from each category) has a possible maximum of 12 points. The diagnosis of heart failure is classified as *definite* at a score of 8 to 12 points, *possible* at a score of 5 to 7 points, and *unlikely* at a score of 4 points or less.

ESC definition of HEART FAILURE[73]

1. Symptoms of heart failure (at rest and during exercise)

and

2. Objective evidence of cardiac dysfunction (at rest)

and

3. Response to treatment directed towards heart failure (in cases where the diagnosis is in doubt)

Criteria 1 and 2 should be fulfilled in all cases.

Limitations of HF case finding

To obtain an exhaustive picture regarding HF, which does not necessarily require routine hospitalisation, review of GP records or ad hoc surveys are necessary.

In HDRs, HF can be found under different diagnoses. Therefore if validation studies on HF are carried out these codes should be taken into account [74]:

- heart failure: ICD-9 428, ICD-10 I50
- hypertensive heart disease: ICD-9 402, ICD-10 I11
- other primary cardiomyopathies: ICD-9 425.4, ICD-10 I42.5, I42.8
- alcoholic cardiomyopathy: ICD-9 425.5, ICD-10 I42.6
- secondary cardiomyopathy, unspecified: ICD-9 425.9, ICD-10 I42.9
- chronic cor pulmonale: ICD-9 416.9, ICD-10 27.9

10.3.e STROKE

WHO criteria [75]

The recommended WHO stroke definition is *a focal (or at times global) disturbance of cerebral function lasting more than 24 hours (or leading to death) with no apparent cause other than that of vascular origin. Transient episodes of cerebral ischaemia were excluded by definition*. Cerebrovascular lesions discovered at autopsy without having shown clinical manifestations in life were not registered as stroke. A careful review of the patient's history is required to differentiate a previous stroke from previous TIA, as the two episodes may be misclassified.

This definition is normally used in longitudinal studies [76]. When possible, incidence studies should register TIA because mild strokes are often misdiagnosed as TIA [77].

MONICA criteria[78]

Definite stroke is a *rapid development of focal signs (or global) or disturbance of cerebrovascular function lasting more than 24 hours (unless interrupted by surgery or death), with no apparent cause other than that of vascular origin; this category includes patients presenting clinical signs and symptoms suggestive of subarachnoid haemorrhage, intracerebral haemorrhage, or cerebral ischaemic infarct. The term "global" refers to patients with subarachnoid haemorrhage or deep coma but it excludes coma of systemic vascular origin such as shock, Stokes-Adams syndrome or hypertensive encephalopathy*.

This definition of stroke includes reference to a focal or global disturbance of the cerebral function. One or more of the following definite focal signs must be present to make a diagnosis of stroke: unilateral or bilateral motor impairment (including un-coordination), unilateral or bilateral sensory

impairment, aphasia/dysphasia (non-fluent speech), hemianopia (half-sided impairment of visual fields), diplopia, forced gaze (conjugate deviation), apraxia of acute onset, ataxia of acute onset (muscular un-coordination), perception deficit of acute onset.

Time dimension has to be met and the signs should have developed from a presumed vascular origin.

Limitations of stroke case finding

The above criteria were developed to allow comparisons of stroke rates in communities with different availability of diagnostic image technologies (CT and MRI) necessary for stroke type definition (ischaemic and hemorrhagic).

11. Recommended indicators

Despite efforts to develop homogeneity, internationally standardised statistics still remain a goal to be achieved. The definition of disease differs from country to country, sometimes only slightly but sometimes more fundamentally, and it varies over time.

With the aim of improving future monitoring of CVD morbidity in Europe, indicators have been divided into 3 categories: already available indicators; those that should be implemented in the short-term; and those recommended for long-term implementation. Some countries have already implemented data collection for all three categories of indicators. For those which have not, stepwise implementation is strongly recommended, with development of adequate systems for collecting the short term indicators prior to proceeding with systems for collection and validation of the long-term indicators.

Available indicators are simple and already available in almost all countries of the EU, for example, hospital discharge rates or mortality figures. Usually, these indicators are available for an entire country.

Short-term implementation are built on the available indicators but offer a more exhaustive and desirable overview of CVD. The data derive from a variety of currently available sources but require a further level of processing to ensure accuracy. The data can be collected in samples representative of the population or in representative areas of the countries. Registers, which have already been implemented in many countries, represent an important source of this type of indicator (e.g. attack rates and incidence). Other available sources for indicators in this category include data collection systems that can be used to obtain indirect estimates of frequency of CVD. Examples of this group are medication use, data sets which can be used as a proxy for burden of diseases and public health expenditures. It should be noted that, due to the ongoing evolution of treatment strategies over time and the appearance of new drugs, their consumption is not dealt with in detail in the current document.

Long-term implementation indicators will require more time and more resources to be operational. Most of these indicators represent validated versions of the available and short term indicators in which medical records are carefully reviewed by expert epidemiologists using standardised diagnostic criteria. Long-term indicators would be collected in addition to available and short-term indicators. In order to develop and validate long-term indicators it is highly recommended that each country invests in dedicated population epidemiology. As reported in chapter 8, validation can be carried out in all or in a sample of suspected cases; the choice will depend on factors such as the type and the frequency of the disease and the precision desired.

Five final tables (tables 13–19) summarise the common set of recommended indicators for each nosographic group.

For each **health status** and **health system indicator** we provide its *operational* and *ICD nosographic definition*, and describe the appropriate *data sources*. All indicators should be provided for both genders and for men and women separately, for all ages and for age-specific groups. Indicators should be reported as absolute numbers and as crude population rates. Recommended age groups for monitoring morbidity are decennia. It is particularly important to present data for the age ranges 35-44 years, 45-54 years, 55-64 years, 65-74 years, 75-84 years, 85 years and over. To ensure comparability between different countries, indicators should be directly standardised by age and sex using the European population as a reference.

11.1 ACUTE MYOCARDIAL INFARCTION (*Table 13*)

Following recommendations issued by the WHO and MONICA Project, AMI was defined by a combination of symptoms, enzyme and ECG patterns. With their high sensitivity, technology advances (serologic biomarkers and imaging techniques) allow the identification of very small infarcts that would not have been considered an AMI adopting WHO or MONICA criteria. With the new diagnostic criteria, any amount of myocardial necrosis caused by ischaemia is labelled as an infarct, so an individual who was formerly diagnosed as having severe stable or unstable angina pectoris might be diagnosed today as having had a MI.

The adoption of the new criteria may lead to a separate treatment of AMI and ACS. Therefore, as *available* they are considered jointly, but as *short-term implementation* and *long-term implementation* they will be distinct.

11.1.a *Available indicators*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual AMI deaths per 100,000 population
ICD codes	ICD-9 410-414 ICD-10 I20-I25
Data source	vital statistics

Indicator	**hospital discharge rate** - *health status: morbidity*
Operational definition	annual AMI hospitalisations per 100,000 population
ICD codes	ICD-9 410 ICD-10 I21, I22
Data source	hospital discharge records (main diagnosis)

Indicator	**in-hospital case-fatality** - *health status: morbidity*
Operational definition	annual proportion of deaths among AMI hospitalisations
ICD codes	ICD-9 410 ICD-10 I21, I22
Data source	hospital discharge records

Indicator	**aggregate bed-day rate** – *health system: health care utilisation*
Operational definition	sum of days in one year spent in hospital for AMI per 100,000 population
ICD codes	ICD-9 410 ICD-10 I21, I22
Data source	hospital discharge records

Indicator	**mean length of stay** – *health system: health care utilisation*
Operational definition	mean number of days spent in hospital per patient with AMI
ICD codes	ICD-9 410 ICD-10 I21, I22
Data source	hospital discharge records

11.1.b *Short-term implementation*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual AMI deaths from per 100,000 population
ICD codes	ICD-9 410 ICD-10 I21-I22
Data source	vital statistics

Indicator	**attack rate/incidence rate** - *health status: morbidity/mortality*
Operational definition	annual AMI events (first and recurrent) per 100,000 population
ICD codes	- non-fatal AMI events (ICD-9 410, ICD-10 I21-I22 from HDRs-main diagnosis) and - coronary deaths (ICD-9 410-414, ICD-10 I20-I25 from mortality-underlying cause). Events less or equal 28 days apart are counted only once.
Data source	population-based AMI register, record linkages between HDRs and death records (figure 1)

Indicator	**1-day, 28-day case-fatality** - *health status: morbidity*
Operational definition	proportion of fatal AMI within the specified period of time
ICD codes	non-fatal AMI and coronary deaths (ICD-9 410, ICD-10 I21-I22 from HDRs and ICD-9 410-414, ICD-10 I20-I25 from mortality)
Data source	population-based AMI registers

Indicator	**thrombolytic therapy** - *health system: health care utilisation*
Operational definition	proportion of AMI patients treated with thrombolytic therapy
ICD codes	ICD-9-CM 99.10 (injection or infusion of thrombolytic agent)
Data source	population-based AMI registers

Indicator	**median length of stay** – *health system: health care utilisation*
Operational definition	median number of days spent in hospital per patient with AMI
ICD codes	ICD-9 410 ICD-10 I21, I22
Data source	hospital discharge records

11.1.c *Long-term implementation*

It is suggested to validate a sample of hospital discharge and mortality records using medical records and adopting diagnostic criteria described in paragraph 10.3. This will allow to estimate the sensitivity and specificity of hospital discharge diagnoses and mortality causes for AMI (see chapter 8).

Indicator	**validated mortality rate** – *health status: mortality*
Operational definition	validated AMI annual deaths per 100,000 population
ICD codes	ICD-9 410-414 ICD-10 I20-I25
Data source	vital statistics, medical records

Indicator	**validated attack rate/incidence rate** - *health status: morbidity/mortality*
Operational definition	validated annual first (and recurrent) AMI per 100,000 population
ICD codes	first non-fatal AMI (ICD-9 410, ICD-10 I21-I22) and coronary deaths (ICD-9 410-414, ICD-10 I20-I25)
Data source	- population-based AMI registers, record linkage between HDRs and death records by a unique ID - cohort longitudinal studies - medical records

Indicator	**re-admission after 1 year** - *health status: morbidity*
Operational definition	re-admission one year following initial admission for AMI due to re-infarction, IHD, HF and all causes
ICD codes	AMI: ICD-9 410, ICD-10 I21-I22 IHD: ICD-9 410-414, ICD-10 I20-I25 HF: ICD-9 428, ICD-10 I50
Data source	population-based AMI register

Indicator	**1 year survival** - *health status: morbidity*
Operational definition	proportion of patients who survived a non-fatal AMI, who are alive after 1 year
ICD codes	non-fatal AMI (ICD-9 410, ICD-10 I21-I22) and coronary deaths (ICD-9 410-414, ICD-10 I20-I25)
Data source	population-based AMI registers, population cohort studies

Indicator	**28-day case-fatality among first day survivors** - *health status: morbidity*
Operational definition	proportion of fatal AMI within the specified period of time
ICD codes	non-fatal AMI and coronary deaths (ICD-9 410, ICD-10 I21-I22 from HDRs and ICD-9 410-414, ICD-10 I20-I25 from mortality)
Data source	population-based AMI registers

Indicator	**CABG per AMI** – *health system: health care utilisation*
Operational definition	proportion of AMI patients who have received a CABG up to 90 days following the initial admission for AMI
ICD codes	CABG: ICD-9-CM 36.1; NOMESCO: FNA-FNE AMI: ICD-9 410, ICD-10 I21-I22
Data source	population-based AMI register linked with hospital discharge records or procedure register

Indicator	**PTCA per AMI** – *health system: health care utilisation*
Operational definition	proportion of AMI patients who have received a PTCA up to 90 days following the initial admission for AMI
ICD codes	PTCA: ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent); NOMESCO: FNG0 AMI: ICD-9 410, ICD-10 I21-I22
Data source	population-based AMI register linked with hospital discharge records or procedure register

Indicator	**emergency CABG (within 24 hrs) rate** – *health system: health care utilisation*
Operational definition	proportion of CABG performed within 24 hours from the onset of the AMI
ICD codes	ICD-9-CM 36.1; NOMESCO: FNA-FNE
Data source	**-** hospital discharge records - population-based AMI and procedure registers

Indicator	**emergency PTCA (within 24 hrs) rate** – *health system: health care utilisation*
Operational definition	proportion of PTCA performed within 24 hours from the onset of the AMI
ICD codes	PTCA: ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent); NOMESCO: FNG0
Data source	**-** hospital discharge records - population-based AMI and procedure registers

Indicator	**30-day case-fatality for CABG** – *health system: health care utilisation*
Operational definition	30-day case fatality of hospital discharges of CABG
ICD codes	ICD-9-CM 36.1; NOMESCO: FNA-FNE
Data source	linkage between hospital discharge records for CABG and mortality

11.2 ACUTE CORONARY SYNDROMES

11.2.a *Short-term implementation*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual ACS deaths per 100,000 population
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	vital statistics

Indicator	**hospital discharge rate** - *health status: morbidity*
Operational definition	annual ACS hospitalisations per 100,000 population
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	hospital discharge records

Indicator	**aggregate bed-day rate** – *health system: health care utilisation*
Operational definition	sum of days in one year spent in hospital for ACS per 100,000 population
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	hospital discharge records

Indicator	**mean length of stay** – *health system: health care utilisation*
Operational definition	mean number of days spent in hospital per patient with ACS
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	hospital discharge records

11.2.b *Long-term implementation*

It is suggested to validate a sample of hospital discharge and mortality records using medical records and adopting diagnostic criteria described in paragraph 10.3. This will allow to estimate the sensitivity and specificity of hospital discharge diagnoses and mortality for ACS (see chapter 8).

Indicator	**validated mortality rate** – *health status: mortality*
Operational definition	validated annual deaths of ACS per 100,000 population
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	vital statistics

Indicator	**validated attack rate/incidence rate** - *health status: morbidity/mortality*
Operational definition	annual ACS (first and recurrent) per 100,000 population
ICD codes	non-fatal ACS (ICD-9 410, 411; ICD-10 I20.0, I21, I22) and coronary deaths (ICD-9 410-414; ICD-10 I20-I25)
Data source	population-based ACS registers, record linkage between HDRs and death records by a unique ID; medical records

Indicator	**CABG per ACS** – *health system: health care utilisation*
Operational definition	proportion of ACS patients who have received a CABG up to 90 days following the initial admission for ACS
ICD codes	CABG: ICD-9-CM 36.1; NOMESCO: FNA-FNE ACS: ICD-9 410, 411, 413, ICD-10 I20.0, I21, I22, I24
Data source	population-based AMI register linked with hospital discharge records or procedure register

Indicator	**PTCA per ACS** – *health system: health care utilisation*
Operational definition	proportion of ACS patients who have received a PTCA up to 90 days following the initial admission for ACS
ICD codes	PTCA: ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent) NOMESCO: FNG0 ACS: ICD-9 410, 411, 413, ICD-10 I20.0, I21, I22, I24;
Data source	population-based ACS register linked with hospital discharge records or procedure register

Indicator	**emergency CABG (within 24 hrs) rate** – *health system: health care utilisation*
Operational definition	proportion of CABG performed within 24 hours from the onset of the ACS event
ICD codes	ICD-9-CM 36.1
Data source	population-based ACS and procedure registers

Indicator	**emergency PTCA (within 24 hrs) rate** – *health system: health care utilisation*
Operational definition	proportion of PTCA performed within 24 hours from the onset of the ACS event
ICD codes	PTCA: ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent)
Data source	population-based ACS and procedure registers

Indicator	**median length of stay** – *health system: health care utilisation*
Operational definition	median number of days spent in hospital per patient with ACS
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	hospital discharge records

Indicator	**ACS patients in ICU** – *health system: health care utilisation*
Operational definition	percentage of ACS patients admitted in Intensive Care Units (ICU) per year
ICD codes	ICD-9 410, 411 ICD-10 I20.0, I21, I22
Data source	population-based ACS register

11.3 ALL ISCHAEMIC HEART DISEASES

11.3.a *Available indicators*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual deaths from IHS per 100,000 population
ICD codes	ICD-9 410 - 414 ICD-10 I20 - I25
Data source	vital statistics

Indicator	**hospital discharge rate** - *health status: morbidity*
Operational definition	annual IHD hospitalisations per 100,000 population
ICD codes	ICD-9 410 - 414 ICD-10 I20 - I25
Data source	hospital discharge records

11.3.b *Short-term implementation*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual deaths from HIS and SD per 100,000 population
ICD codes	ICD-9 410 - 414, 798 ICD-10 I20 - I25, R96, R98
Data source	vital statistics

Indicator	**prevalence of effort angina** - *health status: morbidity*
Operational definition	number of subjects who have experienced typical angina per 100,000 population
ICD codes	ICD-9 413 ICD-10 I20
Data source	HES and CVD surveys which include the LSHTM questionnaire

Indicator	**CABG rate** – *health system: health care utilisation*
Operational definition	annual CABG hospitalisations per 100,000 population
ICD codes	ICD-9-CM 36.1 NOMESCO: FNA-FNE
Data source	hospital discharge records

Indicator	**PTCA rate** – *health system: health care utilisation*
Operational definition	annual PTCA hospitalisations per 100,000 population
ICD codes	ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent)
Data source	hospital discharge records, NOMESCO: FNG0

Indicator	**coronary angiography rate** – *health system:* health care utilisation
Operational definition	annual number of coronary angiographies per 100,000 population
ICD codes	ICD-9-CM 88.55-88.57
Data source	hospital discharge records

11.3.c *Long-term implementation*

Indicator	**prevalence of IHD** - *health status: morbidity*
Operational definition	number of subjects who have experienced IHD (myocardial infarction AND/OR by-pass AND/OR PTCA AND/OR angina) per 100,000 population
ICD codes	in the first hospital discharge diagnosis: - IHD: ICD-9 410-414, ICD-10 I20-I25 - CABG: ICD-9-CM 36.1; NOMESCO FNA-FNE - PTCA: ICD-9-CM 36.01, 36.02, 36.05, 36.06 (stent); NOMESCO FNG0
Data source	- HES which include the LSHTM questionnaire, questions on re-vascularisation procedures, ECG (Minnesota code) and physician diagnoses - linkage between specific registers (AMI, CABG, PTCA) and mortality

Indicator	**functional disability and quality of life** - *health status: disability*
Operational definition	proportion of patients affected by IHD impaired in ADL or positive to EuroQol questionnaire
Data source	HES or CVD surveys which include the ADL questionnaire or the EuroQol questionnaire

11.4 HEART FAILURE

11.4.a *Available indicators*

Currently no specific indicators for HF are available directly from routine health statistics. However data exist for mortality and hospital discharge records at a national level. To obtain routine HF indicators for each country is only a matter of reporting existing routine data in different formats.

Indicator	**heart transplant rate** - *health system: health care utilisation*
Operational definition	annual heart transplant hospitalisations per 100,000 population
ICD codes	ICD-9-CM 37.5
Data source	hospital discharge records

11.4.b *Short-term implementation*

Indicator	**mortality rate** - *health status: mortality*
Operational definition	annual HF deaths per 100,000 population
ICD codes	ICD-9 428 ICD-10 I50
Data source	vital statistics
Indicator	**hospital discharge rate** - *health status: morbidity*
Operational definition	annual HF hospitalisations per 100,000 population
ICD codes	ICD-9 428 ICD-10 I50
Data source	hospital discharge records

Indicator	**aggregate bed-day rate**– *health system: health care utilisation*
Operational definition	annual sum of number of days spent in hospital for HF per 100,000 population
ICD codes	ICD-9 428 ICD-10 I50
Data source	hospital discharge records

Indicator	**mean length of stay** – *health system: health care utilisation*
Operational definition	mean number of days spent in hospital per HF patient
ICD codes	ICD-9 428 ICD-10 I50
Data source	hospital discharge records

11.4.c *Long-term implementation*

It is suggested to validate a sample of hospital discharge and mortality records using medical records and adopting diagnostic criteria described in paragraph 10.3. This will allow to estimate the sensitivity and specificity of hospital discharge diagnoses and mortality causes for HF (see chapter 8).

Indicator	**validated mortality rate** - *health status: mortality*
Operational definition	validated annual deaths from HF per 100,000 population in the following causes of death: heart failure, hypertensive heart disease,

	other primary cardiomyopathies, alcoholic cardiomyopathy, secondary cardiomyopathy, chronic cor pulmonale
ICD codes	ICD-9: 428.0, 428.1, 428.9, 402, 416, 425.4, 425.5, 425.9 ICD-10: I27.9, I50, I11, I42.5, I42.8, I42.6, I42.9
Data source	- vital statistics - medical records
Indicator	**validated hospital discharge rate** - *health status: morbidity*
Operational definition	validated annual HF hospitalisations per 100,000 population in the following diagnoses: heart failure, hypertensive heart disease, other primary, cardiomyopathies, alcoholic cardiomyopathy, secondary cardiomyopathy, chronic cor pulmonale
ICD codes	ICD-9: 428.0, 428.1, 428.9, 402, 416, 425.4, 425.5, 425.9 ICD-10: I27.9, I50, I11, I42.5, I42.8, I42.6, I42.9
Data source	hospital discharge records, medical records
Indicator	**prevalence of HF** - *health status: morbidity*
Operational definition	number of patients with HF per 100,000 population
ICD codes	heart failure: based on Framingham or Boston or ESC criteria.
Data source	- HES surveys - CVD surveys - GP-network
Indicator	**median length of stay** – *health system: health care utilisation*
Operational definition	median number of days spent in hospital per patient
ICD codes	ICD-9 428 ICD-10 I50
Data source	hospital discharge records
Indicator	**functional disability and quality of life** - *health status: disability*
Operational definition	proportion of patients affected by HF impaired in ADL or positive to EuroQol questionnaire
Data source	HES or CVD surveys which include the ADL questionnaire or the EuroQol questionnaire

11.5 OTHER FORMS OF HEART DISEASES

11.5.a *Available indicators*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual deaths per 100,000 for the following causes: rheumatic heart disease, hypertensive disease, other forms of heart diseases
ICD codes	ICD-9: 393-398, 401-405, 420-429

	ICD-10: I05-I09, I11-I13, I30-I49, I51
Data source	vital statistics
Indicator	**hospital discharge rate** - *health status: morbidity*
Definition	annual hospitalisations per 100,000 population for the following diagnoses: rheumatic heart disease, hypertensive disease, other forms of heart diseases
ICD codes	ICD-9: 393-398, 401-405, 420-429
	ICD-10: I05-I09, I11-I13, I30-I49, I51
Data source	- hospital discharge records
Indicator	**mean length of stay** – *health system:* health care utilisation
Operational definition	mean number of days spent in hospital per patient
ICD codes	ICD-9: 393-398, 401-405, 420-429 ICD-10: I05-I09, I11-I13, I30-I49, I51
Data source	hospital discharge records
Indicator	**aggregate bed-day rate** – *health system:* health care utilisation
Operational definition	sum of days in one year spent in hospital for other forms of heart diseases (rheumatic heart disease, hypertensive disease, other forms of heart diseases) per 100,000 population
ICD codes	ICD-9: 393-398, 401-405, 420-429 ICD-10: I05-I09, I11-I13, I30-I49, I51
Data source	hospital discharge records

11.5.b *Short-term implementation*

Indicator	**mortality rate** – *health status: mortality*
Operational definition	annual deaths per 100,000 for the following causes: atherosclerosis, aortic aneurisms, acute cor pulmonale, dysrhythmias, acute pulmonary oedema
ICD codes	ICD-9: 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I70, I71, I82, I44-I49, I50, I51
Data source	vital statistics
Indicator	**hospital discharge rate** – *health status: morbidity*
Operational definition	annual hospitalisations per 100,000 for the following causes: atherosclerosis, aortic aneurisms, acute cor pulmonale, dysrhythmias, acute pulmonary oedema
ICD codes	ICD-9: 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I70, I71, I82, I44-I49, I50, I51

Data source	hospital discharge records
Indicator	**mean length of stay** – *health system: health care utilisation*
Operational definition	mean number of days spent in hospital per patient
ICD codes	ICD-9: 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I70, I71, I82, I44-I49, I50, I51
Data source	hospital discharge records
Indicator	**aggregate bed-day rate** – *health system: health care utilisation*
Operational definition	number of days spent in hospital for other forms of heart diseases (atherosclerosis, aortic aneurisms, acute cor pulmonale, dysrhythmias, acute pulmonary oedema) per 100,000 population
ICD codes	ICD-9: 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I70, I71, I82, I44-I49, I50, I51
Data source	hospital discharge records
Indicator	**hospital discharge rate for surgical operations and invasive procedures** - *health system: health care utilisation*
Operational definition	annual hospitalisation for valvular operations, aortic aneurism operations, other aneurism operations, pace makers, implantable cardioverter defibrillators, catheter ablation per 100,000 population
ICD codes	- valvular: ICD-9-CM 35.0-35.3, 35.95, 35.96, 35.99 - aortic and other aneurysm: ICD-9-CM 39.71-39.79, 36.91, 37.32, 38.03-38.04, 39.51, 39.52, 39.54 - pacemaker: ICD-9-CM 00.50, 37.7-37.8, 39.64, 39.8, 89.4 - catheter ablation: ICD-9-CM 37.34 - implantable cardioverter defibrillators: ICD-9-CM 37.94, 00.51
Data source	hospital discharge records

11.5.c *Long-term implementation*

Indicator	**validated mortality rate** – *health status: mortality*
Operational definition	validated annual deaths per 100,000 for the following causes: rheumatic heart disease, hypertensive disease, other forms of heart diseases, atherosclerosis, aortic aneurisms, acute cor pulmonale, dysrhythmias, acute pulmonary oedema
ICD codes	ICD-9: 393-398, 401-405, 420-429, 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I05-I09, I11-I13, I30-I49, I51, I70, I71, I82, I44-I49, I50, I51
Data source	vital statistics, medical records
Indicator	**validated hospital discharge rate** – *health status: morbidity*
Operational definition	validated annual hospitalisations per 100,000 for the following causes: rheumatic heart disease, hypertensive disease, other forms of heart

	diseases, atherosclerosis, aortic aneurisms, acute cor pulmonale, dysrhythmias, acute pulmonary oedema
ICD codes	ICD-9: 393-398, 401-405, 420-429, 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I05-I09, I11-I13, I30-I49, I51, I70, I71, I82, I44-I49, I50
Data source	Hospital discharge and medical records

Indicator	**median length of stay** – *health system: health care utilisation*
Operational definition	median number of days spent in hospital per patient
ICD codes	ICD-9: 393-398, 401-405, 420-429, 440, 441, 444, 415, 426-427, 428, 429 ICD-10: I05-I09, I11-I13, I30-I49, I51, I70, I71, I82, I44-I49, I50
Data source	hospital discharge records

11.6 CEREBROVASCULAR DISEASES AND VASCULAR DEMENTIA

11.6.a *Available indicators*

Indicator	**cerebrovascular mortality rate –** *health status: mortality*
Operational definition	annual deaths from cerebrovascular diseases per 100,000 population
ICD codes	ICD-9 430 - 438 ICD-10 I60 - I69, G45
Data source	vital statistics
Indicator	**dementia mortality rate –** *health status: mortality*
Operational definition	annual deaths from dementia per 100,000 population
ICD codes	ICD-9 290.4 ICD-10 F01
Data source	vital statistics

Indicator	**cerebrovascular hospital discharge rate** - *health status: morbidity*
Operational definition	annual hospitalisations for cerebrovascular diseases per 100,000 population
ICD codes	ICD-9 430 – 438 ICD-10 I60 - I69, G45
Data source	hospital discharge records

Indicator	**dementia hospital discharge rate** - *health status: morbidity*
Operational definition	annual hospitalisations for dementia per 100,000 population
ICD codes	ICD-9 290.4 ICD-10 F01

Data source	hospital discharge records
Indicator	**aggregate bed-day rate** – *health system: health care utilisation*
Operational definition	sum of days in one year spent in hospital for stroke
ICD codes	ICD-9 430-438 ICD-10 I60 - I69, G45
Data source	hospital discharge records
Indicator	**mean length of stay** – *health system: health care utilisation*
Operational definition	mean number of days spent in hospital per patient
ICD codes	ICD-9 430-438 ICD-10 I60-I69, G45
Data source	hospital discharge records
Indicator	**carotid angioplasty rate** – *health system:* health care utilisation
Operational definition	annual procedures of carotid angioplasty per 100,000 population age 40 years and over
ICD codes	ICD-9-CM 39.50 NOMESCO: XAC85 (Denmark)
Data source	hospital discharge records

11.6.b *Short-term implementation*

Indicator	**mortality rate –** *health status: mortality*
Operational definition	annual deaths from ischaemic stroke, subarachnoid haemorrhage, intracerebral haemorrhage, unspecified stroke per 100,000 population
ICD codes	- occlusion, stenosis and thrombosis of cerebral arteries: ICD-9 434; ICD-10 I66, I63 - subarachnoid haemorrhage: ICD-9 430, ICD-10 I60 - intracerebral haemorrhage: ICD-9 431, 432, ICD-10 I61, I62 - unspecified stroke: ICD-9 436-437; ICD-10 I64, I67, I68 (check)
Data source	vital statistics
Indicator	**hospital discharge rate** - *health status: morbidity*
Operational definition	annual hospitalisations for ischaemic stroke, subarachnoid haemorrhage, intracerebral haemorrhage, unspecified stroke per 100,000 population
ICD codes	- occlusion, stenosis and thrombosis of cerebral arteries: ICD-9 434; ICD-10 I66, I63 - subarachnoid haemorrhage: ICD-9 430, ICD-10 I60 - intracerebral haemorrhage: ICD-9 431, 432, ICD-10 I61 I62 - unspecified acute stroke: ICD-9 436; ICD-10 I64

Data source	hospital discharge records
Indicator	**attack rate/incidence rate** - *health status: morbidity*
Operational definition	annual stroke events (first and recurrent) per 100,000 population
ICD codes	fatal and non-fatal: ICD-9 430-438 ICD-10 I60-I69, G45
Data source	- HDRs linked with mortality
Indicator	**7-day case-fatality rate** - *health status: morbidity*
Operational definition	the proportion of ischaemic and haemorrhagic (subarachnoidal and intracerebral) stroke events that are fatal within 7 days from the onset
ICD codes	fatal and non-fatal: ICD-9 430-438 ICD-10 I60-I69, G45
Data source	- HDRs linked with mortality
Indicator	**brain imaging per population** – *health system: health care utilisation*
Operational definition	number of CT-scans (Computerized axial Tomography of head) and MRI (Magnetic Resonance Imaging of brain and brainstem) per 100,000 population
ICD codes	CT-scan: ICD-9-CM 87.03 MRI: ICD-9CM 88.91
Data source	hospital discharge records
Indicator	**median length of stay for cerebrovascular diseases** – *health system: health care utilisation*
Operational definition	mean or median number of days spent in hospital per patient
ICD codes	ICD-9 430-438 ICD-10 I60-I69, G45
Data source	hospital discharge records

11.6.c *Long-term implementation*

It is suggested to validate a sample of hospital discharge and mortality records using medical records and adopting diagnostic criteria described in paragraph 10.3. This will allow to estimate the sensitivity and specificity of hospital discharge diagnoses and mortality causes for cerebrovascular accidents (see chapter 8).

Indicator	**validated mortality rate –** *health status: mortality*
Operational definition	validated annual deaths from ischaemic stroke, subarachnoid haemorrhage, intracerebral haemorrhage, unspecified stroke per 100,000 population
ICD codes	- occlusion, stenosis and thrombosis of cerebral arteries: ICD-9 434; ICD-10 I66, I63 - subarachnoid haemorrhage: ICD-9 430, ICD-10 I60 - intracerebral haemorrhage: ICD-9 431, 432, ICD-10 I61, I62 - unspecified stroke: ICD-9 436-437; ICD-10 I64, I67, I68 (check)
Data source	vital statistics, medical records

Indicator	**validated attack rate/incidence by subtype of stroke** – *health status: morbidity*
Operational definition	validated annual subtype (ischaemic, subarachnoidal haemorrhage, intracerebral haemorrhage) of stroke events (first or recurrent) per 100,000 population
ICD codes	non-fatal: - occlusion and stenosis of cerebral arteries and cerebral infarction: ICD-9 434, 436; ICD-10 I66; I63, I64 - subarachnoid haemorrhage: ICD-9 430, ICD-10 I60 - intracerebral haemorrhage and other non-traumatic intracranial: ICD-9 431-432, ICD-10 I61-I62 - unspecified acute stroke: ICD-9 436, ICD-10 I64 fatal: ICD-9 430-438 ICD-10 I60-I69, G45
Data source	population-based stroke registers, cohort longitudinal studies if population acute stroke registers unavailable, medical records

Indicator	**prevalence of stroke** - *health status: morbidity*
Definition	number of subjects who survived a cerebrovascular event per 100,000 population
ICD codes	- occlusion, stenosis, thrombosis of cerebral arteries and not specified: ICD-9 434, 436; ICD-10 I66, I64 - subarachnoid haemorrhage: ICD-9 430; ICD-10 I60 - intracerebral haemorrhage and other non-traumatic intracranial: ICD-9 431-432; ICD-10 I61-I62
Data source	- CVD surveys, HIS and HES, ad hoc elderly HES. - prevalence can be derived from other indicators: incidence (I) and duration (D) of CVA as follows: P = I x D - population registers: prevalence can be calculated if there is a long period of registration and there is information on incidence and survival (P = I x S)

Indicator	**stroke units per population** – *health system: health care utilisation*
Operational definition	number of stroke units per 100,000 population *(A stroke unit is a pool of dedicated human and technological resources used in the treatment of stroke)*
Data source	Ministry of Health
Indicator	**functional disability and quality of life** - *health status: disability*
Operational definition	proportion of patients affected by stroke impaired in ADL or positive to EuroQol questionnaire
Data source	HESor CVD surveys which include the ADL questionnaire or the EuroQol questionnaire; ad hoc surveys at 1 year follow-up of stroke patients

11.7 MEDICINE USE FOR CARDIOVASCULAR DISEASES AND THEIR RISK FACTORS

Indicator	**medication use** - *health system: health care utilisation*
Definition	annual DDDs / 1000 inhabitants
ATC codes	- antihypertensives C02 - diuretics C03 - beta blocking agents C07 - calcium channel blockers C08 - ACE inhibitors C09A, C09B - nitrates C01DA - statins C10AA - fibrates C10AB - acetylsalicylic acid (aspirine) B01AC - antithrombotic agents, vitamin K antagonist B01AA - antithrombotic agents, heparin group B01AB - digitalis glycosides C01AA - spironolactone C03DA01
Data source	Ministry of Health, register of medicine consumption
Indicator	**medicine use for patients with diagnosed IHD** - *health system: health care utilisation*
Operational definition	proportion of patients with IHD using
ATC codes	- beta blocking agents C07 - calcium channel blockers C08 - ACE inhibitors C09A, C09B - nitrates C01DA - acetylsalicylic acid (aspirine) B01AC - statins C10AA
Data source	CVD surveys

Indicator	**proportion of patients using evidence-based drugs** - *health system: health care utilisation*
Operational definition	proportion of stroke patients using: - antithrombotic B01 - antiplatelet B01AC - anticoagulant B01AA
Data source	population-based stroke registers

A page on the EUROCISS website (http://www.cuore.iss.it/eurociss/en/dati/altri.asp) provides all recommended indicators available in each partner country

12. Conclusions

The ultimate aim of this project was to prepare a list of recommended indicators to improve the information and knowledge needed for monitoring cardiovascular diseases of major importance and to contribute to the promotion of health and prevention throughout the European Union.

In addition to developing the lists of indicators, a major outcome of this project was the development of a spirit of collaboration among participating countries. The suggested recommendations described in this final report have been developed through a close collaboration among the partner countries. They derive from the work partners have undertaken to compile a detailed inventory of data sources already available in the different countries and the methods used by each country to collect them, and from detailed discussions of proposed indicators and the best way of prioritising them, as well as how to maximise the use and quality of existing data. The collaboration developed as a result of the project will undoubtedly have long term positive implications for future CVD monitoring efforts in Europe.

A list of new indicators was proposed. Some are based on available data and can be produced over a relatively short period of time: these are called *short-term implementation indicators.* Others, which are called *long-term implementation indicators,* need a longer period of time to be implemented, and require, for each country, the training of a dedicated team of epidemiologists to support their development. Outcome and quality care indicators were not included: these go beyond the scope of the project and are to be developed in the future.

Cardiovascular diseases are responsible for a great deal of hospitalisation and death. However, to obtain a comprehensive picture of those diseases, many sources of information must be integrated. Clinical events may be acute or chronic and vary in their severity; hospitalisation may be for the first occurrence of a disease or for treatment of further episodes or sequelae. Validation of data thus becomes essential and the ability to temporally link events in time is of great potential interest. Following the experience of the Nordic countries, it is therefore also recommended that all medical and death records across Europe adopt a personal identification number, which would allow an easier and more accurate record linkage among the different sources of information.

In summary, the project added value by:

- creating of a network of experts from each country to support the monitoring of cardiovascular diseases across Europe;
- defining a list of common indicators to be adopted by each country;
- underlining the need for each country to invest in a dedicated population epidemiology team to develop validated data sources which will allow cross national monitoring;

- establishing the basis for an improved future regulation in public health policies concerning the surveillance of cardiovascular diseases throughout European countries;
- proposing a stepwise procedure for the implementation of the recommended indicators (registers of AMI, Stroke and CVD Surveys).

The application of the recommended standard methodology in all countries will result in the availability of reliable, valid and therefore comparable data on CVD morbidity at the European level.

***Figure 1*: Data flow in a population-based register**

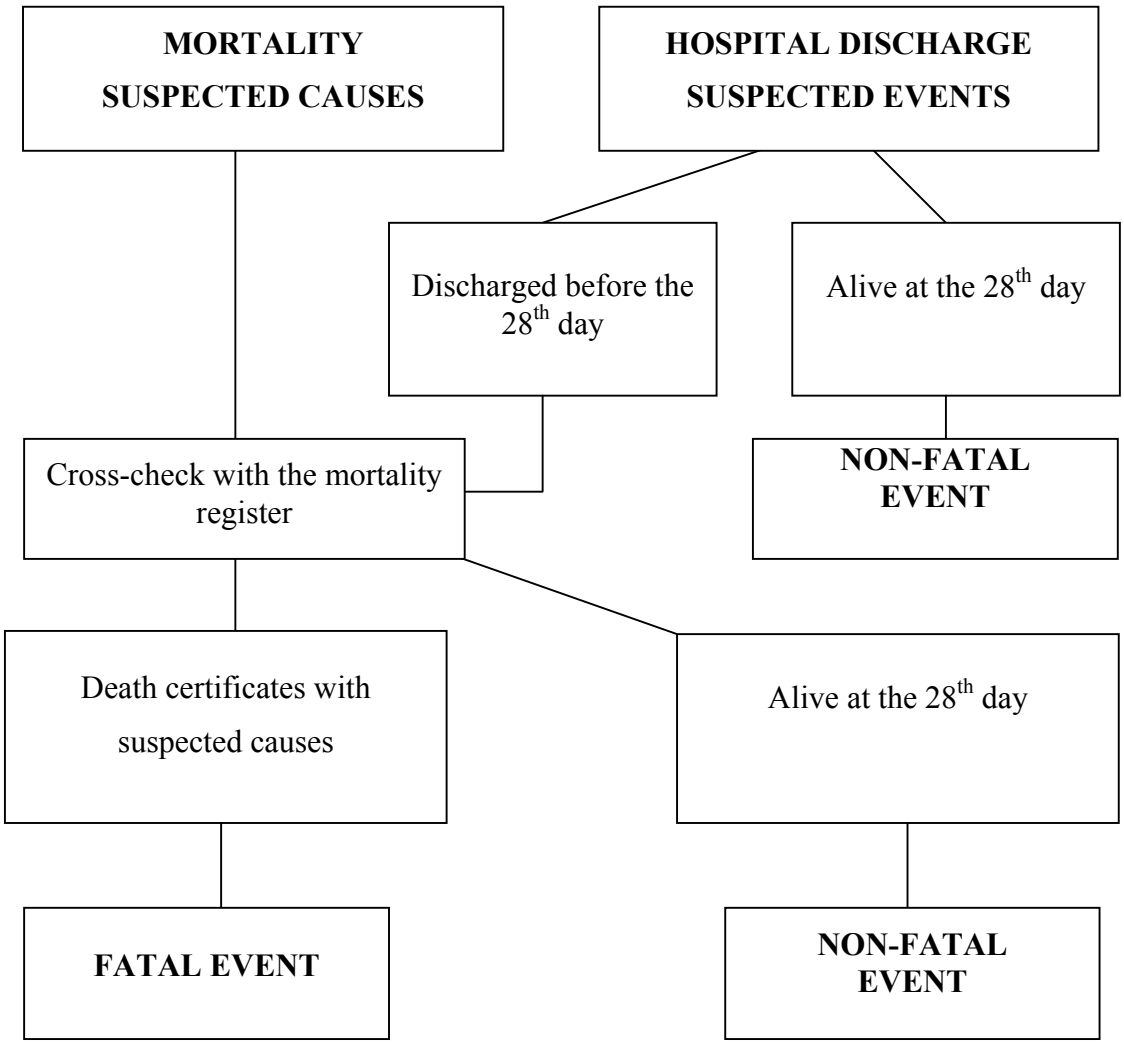

Table 1a – **WHO: HFA - DB**

"Morbidity" available years and source

	FIRST		LAST		SOURCES
	Rate	Year	Rate	Year	
Hospital discharges: circulatory system disease / 100 000					
AUSTRIA	3087.2	1989	4009.3	2003	
BELGIUM	1766.8	1992	2070.8	2003	Ministry of Social Affairs, Public Health and the Environment
CZECH	2358.8	1981	3634.8	2004	Institute of Health Information and Statistics of CR (IHIS CR)
DENMARK	2185.1	1987	2412.7	2004	National Patient Registry, Ministry of Health. Only patients discharged from public hospitals are included. From 1994 Denmark started using ICD-10
FINLAND	3259.5	1987	3670.4	2004	Hospital Discharge Register, Stakes. From 1998 Stakes Care Register
FRANCE	2219.1	1993	2218.3	2003	
GERMANY	2629.2	1993	3237.1	2003	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients. From the reporting year 2000, for the first time, data have been collected according to ICD-10. Day cases are not included.
GREECE	777.7	1970	2196.1	1999	
HUNGARY	2798.9	1992	4288.0	2004	Center for Health Care Information (GYOGYINFOK)
ICELAND	1939.5	1989	1797.3	2003	The Directorate of Health / Ministry of Health and Social Security.
IRELAND	1424.4	1994	1437.5	2004	Hospital in-Patient Enquiry. Figures refer to discharges and not to individual people. Data refer to discharges from publicly funded acute hospitals and (from 2003) to two private hospitals.
ITALY	1807.5	1982	2552.1	2002	Data on discharges are obtained by a sample survey referred to discharges over the first week in each month of the year. Under the hypothesis of uniform distribution of the discharges in the whole month, an estimation of annual discharges is obtained multiplying the sample data by a coefficient (4,35 = average number of weeks in month). Source until 1996: ISTAT. Source from 1997:Data derived from S.D.O. (Scheda di Dimissione Ospedaliera) and refer to all public and private hospitals. Source: Ministry of Health.
LUXEMBOURG	2481.0	1998	2433.2	2003	Total number of patients admitted in all hospitals during the given calendar year with the principal discharge diagnosis falling into the appropriate WHO defined chapter of ICD-10. Source since 1998: Rapport general del'IGSS. Annual report of the General Inspection of Social Security.
NETHERLANDS	1419.7	1990	1549.2	2004	Dutch Centre for Health Care Information: National Medical Registry.
NORWAY	1992.1	1991	2477.2	2004	
POLAND	1343.5	1980	2483.7	2003	
PORTUGAL	714.5	1991	1247.6	2004	November 2001: Only the acute hospitals that belong to the National Health Service (NHS) on the mainland are included. The data from the hospitals located in the autonomous regions of Azores and Madeira, and the private hospitals are not included.
SPAIN	675.9	1986	1412.6	2003	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of Chapter II of ICD-9MC. Source: National Statistics Institute. Hospital Morbidity Survey.
SWEDEN	2815.3	1987	2481.0	2004	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	1475.6	1996	1452.2	2003	1. covers UK National Health Service hospitals only; 2. financial year (01-04 to 31-03) basis, e.g. 1996-97 presented for 1996; 3. excludes one-day cases i.e. when admission and discharde date the sam;. 4. based on diagnosis recorded at discharge
EU members before May 2004	**2001.3**	**1991**	**2277.8**	**2003**	
EU members since May 2004	**1662.1**	**1980**	**3009.0**	**2004**	

Table 1b **- WHO: HFA - DB**

"Hospital discharges: ischaemic heart disease / 100 000" available years and source

	FIRST		LAST		SOURCES
	Rate	Year	Rate	Year	
Hospital discharges: ischaemic heart disease / 100 000					
AUSTRIA	723.1	1989	991.9	2003	
BELGIUM	544.3	1992	733.4	2003	Ministry of Social Affairs, Public Health and the Environment
CZECH	1091.5	1981	1070.9	2004	Institute of Health Information and Statistics of CR (IHIS CR)
DENMARK	704.6	1987	794.4	2004	National Patient Registry, Ministry of Health. Only patients discharged from public hospitals are included. From 1994 Denmark started using ICD-10
FINLAND	1094.1	1987	1091.3	2004	Hospital Discharge Register, Stakes. From 1998 Stakes Care Register
FRANCE	489.8	1993	513.4	2003	
GERMANY	798.7	1993	959.8	2003	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients. From the reporting year 2000, for the first time, data have been collected according to ICD-10. Day cases are not included.
GREECE	190.8	1970	751.9	1999	
HUNGARY	838.5	1994	833.9	2004	Center for Health Care Information (GYOGYINFOK)
ICELAND	812.0	1989	726.7	2003	The Directorate of Health / Ministry of Health and Social Security.
IRELAND	455.4	1994	464.0	2004	Hospital in-Patient Enquiry. Figures refer to discharges and not to individual people. Data refer to discharges from publicly funded acute hospitals and (from 2003) to two private hospitals.
ITALY	343.8	1982	606.4	2002	Data on discharges are obtained by a sample survey referred to discharges over the first week in each month of the year. Under the hypothesis of uniform distribution of the discharges in the whole month, an estimation of annual discharges is obtained multiplying the sample data by a coefficient (4,35 = average number of weeks in month). Source until 1996: ISTAT. Source until 1996: ISTAT. Source from 1997:Data derived from S.D.O. (Scheda di Dimissione Ospedaliera) and refer to all public and private hospitals.
LUXEMBOURG	758.9	1998	930.6	2003	Source: Rapport general de l'IGSS. Annual report of the General Inspection of Social Security.
NETHERLANDS	545.6	1990	555.3	2004	Dutch Centre for Health Care Information: National Medical Registry.
NORWAY	860.5	1991	969.8	2004	
POLAND	331.9	1980	945.9	2003	
PORTUGAL	205.7	1994	285.3	2004	November 2001: Only the acute hospitals that belong to the National Health Service (NHS) on the mainland are included. The data from the hospitals located in the autonomous regions of Azores and Madeira, and the private hospitals are not included.
SPAIN	160.7	1986	362.2	2003	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of Chapter II of ICD-9MC. Source: National Statistics Institute. Hospital Morbidity Survey.
SWEDEN	866.1	1987	818.1	2004	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	535.4	1996	532.5	2003	1. covers UK National Health Service hospitals only; 2. financial year (01-04 to 31-03) basis, e.g. 1996-97 presented for 1996; 3. excludes one-day cases i.e. when admission and discharde date the sam;. 4. based on diagnosis recorded at discharge
EU members before May 2004	**582.1**	**1992**	**648.9**	**2003**	
EU members since May 2004	**590.4**	**1981**	**973.8**	**2004**	

Table 1c **- WHO: HFA - DB**

"Hospital discharges: cerebrovascular disease / 100 000" available years and source

	FIRST		LAST		SOURCES
	Rate	Year	Rate	Year	
Hospital discharges: cerebrovascular disease / 100 000					
AUSTRIA	620.8	1989	617.3	2003	
BELGIUM	119.1	1992	392.1	2003	Ministry of Social Affairs, Public Health and the Environment
CZECH	492.9	1981	626.2	2004	Institute of Health Information and Statistics of CR (IHIS CR)
DENMARK	418.98	1987	395.5	2004	National Patient Registry, National Board of Health. From 1994 Denmark started using ICD-10.
FINLAND	643.97	1987	632.6	2004	In 1996 the change to ICD-10 classification occurred and in Finland it appears that the ICD-9 codes 430-438 and the ICD-10 codes I60-I69 to not totally correspond to each other. Source: Hospital
FRANCE	279.3	1993	212.7	2003	
GERMANY	441.03	1993	453.2	2003	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients. From the reporting year 2000, for the first time, data have been collected according to ICD-10.
GREECE	117.11	1970	387.4	1999	
HUNGARY	601.3	1994	1192.8	2004	Center for Health Care Information (GYOGYINFOK)
ICELAND	242.2	1989	251.3	2003	The Directorate of Health / Ministry of Health and Social Security.
IRELAND	225.52	1994	251.4	2004	Source: Hospital in-Patient Enquiry. Figures refer to discharges and not to individual people. Data refer to discharges from publicly funded acute hospitals and (from 2003) to two private hospitals.
ITALY	369.34	1984	502.8	2002	ISTAT-Data on discharges are obtained by a sample survey referred to discharges over the first week in each month of the year. Under the hypothesis of uniform distribution of discharges in the whole month, an estimation of annual discharges is obtained multiplying the sample data by a coefficient (4.35 = average number of weeks in a month); January 2001, Ministry of Health: information derives from S.D.O. (Scheda di Dimissione Ospedaliera) and refers to all public and private hospitals
LUXEMBOURG	207.55	1998	164	2003	
NETHERLANDS	175.3	1990	213.3	2004	Dutch Centre for Health Care Information: National Medical Registry
NORWAY	292.06	1991	344.2	2004	
POLAND	130.0	1980	365.6	2003	
PORTUGAL	287.48	1994	336.2	2004	November 2001: Only the acute hospitals that belong to the National Health Service (NHS) on the mainland are included. The data from the hospitals located in the autonomous regions of Azores and Madeira, and the private hospitals are not included.
SPAIN	104.78	1986	267.8	2003	December 2001: Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of Chapter VII of ICD-9MC. Source: National Statistics Institute. Hospital Morbidity Survey
SWEDEN	617.17	1987	418.4	2004	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	210.94	1996	224.9	2003	1. covers UK National Health Service hospitals only; 2. financial year (01-04 to 31-03) basis, e.g. 1996-97 presented for 1996; 3. excludes one-day cases i.e. when admission and discharde date the same; 4. based on
EU members before May 2004	**333.4**	**1992**	**351.4**	**2003**	
EU members since May 2004	**245.6**	**1981**	**462.9**	**2004**	

Table 2 : Table summarising EU population involved in the MONICA Project for Coronary events (Quality Assessment of Coronary Event Registration Data in the WHO MONICA Project)

Country	Population	Years of Study	ICD Version Used (*)	Finding Methods (**)
Belgium	Charleroi	1983 - 1992	9	H
	Ghent	1983 - 1992	9	H
	Luxembourg	1985 - 1991	9	M
Czech Republic	Czech Republic	1984 - 1993	9	M
Denmark	Glostrup	1982 - 1991	8	C
Finland	Kuopio Province	1983 - 1992	8, 9 (1987)	H
	North Karelia	1983 - 1992	8, 9 (1987)	H
	Turku/Loimaa	1983 - 1992	8, 9 (1987)	H
France	Lille	1985 - 1994	9	M
	Strasbourg	1985 - 1993	9	C
	Toulouse	1985 - 1993	9	C
Germany	Augsburg	1985 - 1994	9	H
	Bremen	1985 - 1992	9	C
	East Germany (***)	1984 - 1993	9	M
	Rhein-Neckar Region	1984 - 1988	9	H
Hungary	Budapest	1982 - 1989	9	H
	Pecs	1984 - 1989	9	H
Iceland	Iceland	1981 - 1994	9	C
Italy	Area Brianza	1985 - 1994	9	H
	Friuli	1984 - 1993	9	C
Poland	Tarnobrzeg Voivodship	1984 - 1993	9	C
	Warsaw	1984 - 1994	9	C
Spain	Catalonia	1985 - 1994	9	C
Sweden	Gothenburg	1984 - 1994	8	H
	Northern Sweden	1985 - 1995	8, 9 (1987)	C
UK	Belfast	1983 - 1993	9	M
	Glasgow	1985 - 1994	9	C

(*) ICD version used indicates the version of the International Classification of Diseases. 8, 9 (1987) means that version 8 was used until 1986, and version 9 was used thereafter.

(**) “H” indicates hot pursuit, non-fatal events identified mainly at hospital admission; “C”, cold pursuit, non-fatal events identified from hospital discharge; and “M”, mixed pursuit, the combination of hot and cold pursuit.

(***) More fatal and non-fatal events are to be added.

Table 3 : Table summarising EU population involved in the MONICA Project for Stroke (Quality Assessment of Stroke Event Registration Data in the WHO MONICA Project)

Country	Population	Years of Study	ICD Version Used (*)	Finding Methods (**)
Denmark	Glostrup	1982 - 1991	8 (1987)	C
Finland	Kuopio Province	1983 - 1992	8, 9 (1987)	M
	North Karelia	1982 - 1991	8, 9 (1987)	M
	Turku/Loimaa	1983 – 1992	8, 9 (1987)	M
Germany	Halle County	1984 – 1988	9	M
	Karl-Marx Stadt	1985 - 1989	9	M
	Rest of DDR	1984 - 1989	9	M
	Rhein-Neckar Region	1984 - 1987	9	M
Hungary	Budapest	1983 - 1989	9	H
	Pecs	1984 - 1989	9	H
Italy	Friuli	1984 - 1993	9	C
Poland	Warsaw	1984 - 1994	9	C
Sweden	Gothenburg	1984 - 1994	8, 9 (1987)	M
	Northern Sweden	1985 - 1994	8, 9 (1987)	C

(*) ICD version used indicates the version of the International Classification of Diseases. 8, 9 (1987) means that version 8 was used until 1986, and version 9 was used thereafter.

(**) “H” indicates hot pursuit, non-fatal events identified mainly at hospital admission; “C”, cold pursuit, non-fatal events identified from hospital discharge; and “M”, mixed pursuit, the combination of hot and cold pursuit.
(***) More fatal and non-fatal events are to be added.

TABLE 4 ***2003***

SOURCE: **HOSPITAL DISCHARGE RECORDS (HDR)**

DISEASE: **ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION, CEREBROVASCULAR ACCIDENTS, HEART FAILURE, PTCA, CABG**

COUNTRY	Disease				Area	DRG	ICD	1°-last years	Age range	Population			Cove rage	Mortal. linkage	Indicators				In hospital	Access data	Valid
	IHD	AMI	CVA	HF	Nat.					Men x1000	Women x1000	Total x1000	%		Hosp rate	N° pats admitt.	N° stays	Length of stays	Case fatality		
Austria	✓	✓	✓	✓	✓	-	IX	1997 →	all	3,941	4,170	8,111	100	-					✓	Statist. Austria	-
Belgium	✓	✓	✓	✓	✓	-	IX	1995 →	all	5,018	5,245	10,263	100	-	✓	✓	✓	✓	✓	Minist. Health	-
Denmark	✓	✓	✓	✓	✓	✓	VII I,X	1978 →	all	2,654	2,714	5,368	100	ID	✓	✓	✓	✓	✓	Nat. Board Health	✓
Finland	-	✓	✓	-	✓	✓	X	1982 →	all	2,500	2,500	5,000	100	ID					✓	KTL, Stakes *	✓
France	✓	✓	✓	✓	✓	✓	X	1997 →	all	all	all	60,000	100	-					✓	Minist. Health	✓
Germany	✓	✓	✓	✓	✓	-	X	1993 →	all	all	all	80,000	99.9	-	✓	-	-	-	✓	Minist. Health	-
Italy	✓	✓	✓	✓	✓	✓	IX	1998 →	all	28,000	29,000	57,000	95	-					-	Minist. Health	-
The Netherlands	✓	✓	✓	✓	>120 hosp	-	IX	1978-2000	all	all	all	16,000	99	DOB, sex, zipcode					✓	Web site	-
Norway	✓	✓	✓	✓	✓	✓	X	1990-2000	all	all	all	4,400	100	-	-	yearly	year ly	✓	✓	Statist. Norway	-
Portugal	✓	✓	✓	✓	✓	✓	IX	1993-2000	all	4,570	4,919	9,490	90	-					✓	Dir.Gen Saude	✓
Spain (**)	✓	✓	✓	✓	✓	✓	IX	1977-1998	all	all	all	39,413	100	-		✓	✓	✓	-	Ist.Nat. Estadist	✓
Sweden	✓	✓	✓	✓	✓	✓	X	1987 →	all	4390	4490	8880	100	ID	✓	-	-	-	✓	NBHW #	✓
UK - England	✓	✓	✓	✓	✓	-	X	1989-2002	all	all	all	all	90-95	-	-	✓	✓	✓	✓	Dept of Health	-
UK - Scotland	✓	✓	✓	✓	✓	-	X	1962-2002	all	all	all	all	100	DOB, sex zipcode	-	✓	✓	✓	✓	NHS Scotland	✓

(*) National Centre of Welfare and Health

TABLE 4a 2006

SOURCE: **HOSPITAL DISCHARGE RECORDS (HDR)**

DISEASE: **ACUTE MYOCARDIAL INFARCTION (410), ACUTE CORONARY SYNDROME (410,411), CEREBROVASCULAR DISEASES (430-438), ALL ISCHAEMIC HEART DISEASES (410-414), HEART FAILURE (438)**

COUNTRY	Estimated coverage		Estimated % of discharges	ICD version		1st year of applic. of ICD X	Instit. resp.of data collect.
	all hospitals	sample (%)		9	10		
Austria	√		84%		√	1996	Statistik Austria
Belgium	√			√		1998	Ministry of Health/Hosp dep.
Czech Republic	√		100%		√	1996	National Inst. of Welfare & Health
Denmark	√		100%		√	1994	National Board of Health
Finland	√		100%		√	1996	National Institute of Welfare & Health
France	√			√	√	1997	ATIH
Germany	√		99%		√	2000	Inst. of Statistics of G. Countries
Greece		15%		√			National Inst. Of Statistics
Hungary	√				√	1996	Centre for Healthcare Information
Iceland				√			
Italy	√			√			Ministry of Health/ISTAT
Netherlands	√		90%	√			Prismant
Norway	√				√	1999	Statistics Norway/SINTEF Helse
Poland		85%	90%		√	2002	National Inst.of Hygene
Portugal	√(excl psych)		100%	√			IGIF
Spain				√			
Sweden	√		100%		√	1997	National Board of Health and Welfare
UK					√		

Blank spaces: missing or unclear information

(**) Statistical data are available only for 50% of the total HDR; (#) National Board of Health and Welfare

TABLE 5 a ***2003***

SOURCE: **SURVEYS AT NATIONAL LEVEL**

DISEASE: **ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION, CEREBROVASCULAR ACCIDENTS, HEART FAILURE**

COUNTRY	Disease				Sample	Indicators		Periodicity	Source		1st year	Age range	Population			Response rate	Access data	Stand meth.
	IHD	AMI	CVA	HF	x 1000	Preval	Other		Quest	Exam			Men x1000	Women x1000	Total x1000	%		
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belgium HIS	✓	✓	✓			✓	-	4-years	✓	-	-	-	5.9	6.2	12.1	61	-	-
Denmark HIS	General questions on health				5-20	✓	-	4-years	✓	-	1987	16→	8.2	8.5	16.7	75	Nat. Inst. of Public Health	Questionn
Finland HEALTH 2000	✓	✓	✓	✓	8	✓	-	15-years	✓	✓	2000	25→	2500	2500	5000	80	KTL	MONICA WHO
France	✓	✓	-	-	20	✓	-	10-years	✓	-	1960	0→	-	-	20	-	INSEE	-
Germany-National HIS/HES	-	✓	✓		7.124	✓	-	4/8-years	✓	-	1998	18 - 79	3.4	3.7	7.2	61	R. Koch Institute	Questionn
Greece CARDIO 2000	✓	-	-	-	1	✓	-	-	✓	-	2000	26 - 84	0.7	0.148	0.848	-	Dr. Panagiotakos	WHO
Italy HIS	✓	✓	✓	-	70	✓	-	3-4 years	✓	-	1980	0 →	-	-	70	-	ISTAT	-
Netherlands POLS	✓	✓	✓	✓	18	✓	-	yearly	✓	-	1981	0→	5.4	5.5	10.9	59	CBS	own std.
Norway HIS	✓	✓	✓	✓	5	✓	-	3-years	#CAPI	-	1998	16→	-	-	5	73	Statistic Norway	CAPI
Portugal HIS	Question about circulatory system				49.718	-	% by cause	1987, 1995, 1998	✓	-	1987	1-79	20	22	42	77	Min. of Health	Questionn
Portugal EPICA	-	-	-	✓	6.3	✓	-	-	✓	✓	1998	25-80+	2	3	5	66	Min. of Health	ESC
Spain - Encuesta nacional de salud	Only one question on disease in general				8.4	-	-	Irregular, lately every two years	✓	-	1987	0→	4	4	8	-	Min. de Sanidad and CIS	-
Sweden National survey on living conditions	General questions on health				12-13			every 2 yrs	✓	-	1975	16 - 84			7.5		Statistic Sweden	
UK Health Survey for England	✓	✓	✓	-	23	✓	-	Irregular 1993/94/98	✓	✓	1993	16→	7	9	16	69	UCL & Dept of Health	Questionn
UK – Scottish Health Survey	✓	✓	✓	-	12	✓	-	Irregular 1995/98	✓	✓	1995	16 -74	-	-	9	76	UCL & Dept of Health	Questionn

TABLE 5 b *2003*

SOURCE: **SURVEYS AT REGIONAL LEVEL**

DISEASE: **ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION, CEREBROVASCULAR ACCIDENTS, HEART FAILURE**

COUNTRY	Disease				Sample	Indicators		Periodicity	Source		1st year	Age range	Population			Resp. rate	Access data	Standard method.
	IHD	AMI	CVA	HF	x 1000	Preval	Other		Quest	Exam			Men x1000	Women x1000	Total x1000	%		
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belgium Ghent Charleroi	✓ ✓	✓ ✓	-	-	-	-	-	1992 last	✓ ✓	✓ ✓	1983	25-64	-	-	-	50	MONICA	MONICA
Finland FINRISK	✓	✓	✓	-	6	✓	-	5-years	✓	✓	1972	25-74	185	189	374	78	KTL	MONICA
Germany Augsburg	✓	✓	✓	-	6.5	✓	-	5-years	✓	✓	1984	25-74	2	2	4	66	GSF	MONICA LSH
Germany SHIP	✓	-	✓	-	7	✓	-	-	✓	✓	1997	20-80	2	2	4	69	Greifswald Univ.	MONICA LSH
Italy OEC	✓	✓	✓	-	6	✓	-	no	✓	✓	1998	35-74	3.2	3.2	6.4	-	ISS	MONICA
Netherlands Rotterdam ERGO	✓	✓	✓	✓	10.3	✓	Incid.	-	✓	✓	1990	55→	3.1	4.9	8	78	Erasmus Univ.	WHO
Netherlands Morgen	✓	✓	✓	-	10 x year	✓	-	yearly (1993-97)	✓	-	1993	20-59	10	12	22	55	RIVM	protocol
Norway (**) Nord-Trondelag	✓	✓	✓	-	65	✓	-	5 to 10 yrs	✓	-	1984	20-90	30	35	65	69	HUNT	Questionn
Norway Hordaland	✓	✓	✓	-	37	✓	-	5 to 10 yrs	✓	-	1992	39-72	-	-	26	60	Bergen Univ.	Questionn
Spain-MONICA Catalonia	✓	✓	✓	✓	5	✓	-	last 1996	✓	✓	1986	25-64	1.8	1.6	3.4	72	MONICA	MONICA
Sweden Gothenburg	✓	-	✓	-	1.5	✓	-	5-years	✓	✓	1985	25-64	-	-	1	70-73	Ostra Hospital	MONICA
Sweden Northern Sweden	✓	-	✓	-	2/2.5	✓	-	4/5-years	✓	✓	1986	25-74	-	-	1.95	73-83	Umea Univ.	MONICA

(A), (B), (C), (D) distinguish different Surveys in the same country
(**) surveys like those in Nord-Trondelag are conducted in several regions, with 5-10 year's intervals (e.g. FINNMARK)
 # Computer Assisted Personal Interview (CAPI)
National Institute of Public Health, Denmark

TABLE 5 c 2006 SOURCE: HES **DISEASE:** ***ISCHAEMIC HEART DISEASE***

COUNTRY	Years of data collection		Periodicity	Gender		Age range	Population			Methods of data collection				Age-Std values	Comp./ last year avail.	Access data
	1st	last		M	W		Men x1000	Women x 1000	Total x 1000	LSHTM quest	Other quest	Exam	ECG			
Denmark 1	1976	2001	1976-78; 81-83; 91-93, 2001-03	√	√	20+	9.3	10.3	19.6	√	-	√	√	-	2000	Copenhagen City Heart Study
Denmark 2	1964	2005	2 or more times	√	√	35-85+	17	24	41	√	√	√	√	-	2001	Research Center for Prevention and Health
Finland	1972	2002	*	√	√	35-85+	2,600	2,600	5,200		√	√	√**	√	2002	National Inst. of P. H.
Germany (BGS)	1997	1999	5-6 years	√	√	18-79				-	√	√	-	√		National Inst. of P. H.
Greece	1994	2004	3-4yrs	√	√	all	12	17	29	-	√	√	-	-	2004	Univ. of Athens, Medical School
Hungary	2001	2001		√	√	55-64	3.7	4.7	8.4	-	-	-	-	-	2001	School of Public Health
Iceland	1967	2005	continually	√	√	all tog.	15	15	30	-	√	√	√	√	2005	Icelandic Heart Ass.
Italy	1998	2002		√	√	35-74	3.2	3.2	6.4	√	√	√	√	√		National Inst. of P. H.
The Netherlands	1987	2001	continously	√	√	35-74	25	25	50	-	√	√	-	-	2001	National Institute of P.H.
Norway I	1974	2001	discontinued	√	√	30-75			a)	√	√	b)	-	-	2001	Norwegian Institute of P.H.
Norway II	1985	1995	next:2006-8	√	√	20+	55	55	110	-	√	b)	-	-	1995	Univ. of Trondheim
UK	1994	2004	every year	√	√	16-85+ 2-15 (child.)			14	-	√	√	-	√	2003	Department of Health

|* 5 years (FINRISK); 15 years (Health 2000) ** only for Health 2000

1 Copenhagen City Heart Study **2** Surveys at the Research Centre for Prevention and Health in Copenhagen

II North Trondelag

a) County surveys of adults within the range 30-75yrs, 5000 to 100 000 invited. b) risk factors

Blank spaces: missing or unclear information

TABLE 5d 2006 **DISEASE:** ***ISCHAEMIC HEART DISEASE***

SOURCE: **HIS**

COUNTRY	Years of data collection		Periodicity	Gender		Age range	Population			Questions included	Age-Std values	Comput./ lat year avail.	Access data
	1st	last		M	W		Men x1000	Women x1000	Total x 1000				
Belgium	1997	2004	every 4 yrs	√	√	35-85+/all together	6	6	12	on AMI, PCI	-	2001	Nat. Inst. of Public H.
Czech Republic	1993	2002	every 3 yrs	√	√	15+ 5yrs ranges				on stroke, IHD	-	2002	Inst of Health Inf. and Stat. of CR
Denmark	1987	2000	1987, 91, 94, 97, 2000, 2005	√	√	15+	8.2 (in 2000)	8.5 (in 2000)	16.7	on AP and all heart diseases	√	2000	Nat. Inst. of P.H.
Finland	1978	2004	every year	√	√	all	2,600	2,600	5,200	on AMI, AP, HF	-	2004	Nat. Inst. of P. Health
Germany (BGS)	1997	1999	5-6 years	√	√	18-79				on AMI, HF, AP, IC, Stroke	√		Nat. Inst. of P. Health
Hungary	2000	2003	every 3 yrs	√	√	*			7	on AMI, stroke	-	2003	Nat. Inst. of P. Health
Italy	1999	2000		√	√	20-79			140	on AMI, stroke			Nat. Inst. of P. Health
The Netherl.	1981	2004	continously	√	√	35-85+	5	5	10	on AMI, ACS, AP, Stroke	-	2004	Nat. Inst. of Statistics
Norway	1975	2002	every year	√	√	16+			4.5	on all CVD	√	2002	N.Inst.Stat./ N.Inst P.H.
Poland	1996		only once	√	√	35-85+/all together				on isch. heart dis	-	1996	Nat. Inst. of Statistics
Portugal	1987	1998/99	5yrs	√	√	35-74 (10-year grp), 75+	23. 3	25..3	48.6	on AMI, Stroke	-	1998	INSA/ONSA
Spain	1987	2003	1987, 95, 97, 2003	√	√	0-4, 5-74, (10-year grp), 75+	20,000	20,000	40.000	on heart dis and arter. hypert.	-	√	Ministry of Health
Sweden	1975	2004	every year	√	√	16-84	6	6	12	health questions		2003	Nat. Inst of Statist.
UK	1994	2004	every year	√	√	16-85+ 2-15 (children)			14	on AMI, ACS, HF, AP, Stroke	√	2003	Department of Health

* non-institutionalized adult population aged 18 years or older

Blank spaces: missing or unclear information

TABLE 6 *2003*

SOURCE: **LONGITUDINAL STUDIES**

DISEASE: **ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION, CEREBROVASCULAR ACCIDENTS, HEART FAILURE**

COUNTRY	Disease				Area			Source			1st year	Age range	Population			Resp. rate	Indicators			Access data	Valid
	IHD	AMI	CVA	H F	Nat	Reg	Sample x1000	Quest	Exam	Re - exam			Men x1000	Women x1000	Total x1000	%	Incid	Mort	Case fatality		
Austria	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Belgium	✓	✓	✓	-	✓	-	4	✓	✓	-	1980	55-74	2	2	4	70	✓	-	-	School of Pub. Health	WHO
Denmark (A) Copenhagen City Heart Study	✓	✓	✓	✓	-	✓	14	✓	✓	✓	1976	20→	7	7	14	72	✓	✓	✓	CCHS, Bispebjerg Hospital	-
Denmark (B) Glosrup Population Studies	✓	✓	✓	✓	-	✓	25	✓	✓	✓	1964	20→	12	13	25	53-88	✓	✓	✓	Res. Centre for Prevention and Health	
Denmark DANCOS F-U of Nat. Health Interview Survey	Outcome measures from registers				✓	-	46	✓	-		1987	16→	23	23	46	75-80	✓	✓	✓	Nat. Inst. of Public Health	-
Finland FINRISK	-	✓	✓	-	-	✓	36	-	-		1972	25-74	18	18	36	78	✓	-	✓	KTL	MON
Finland HEALTH 2000	-	✓	✓	-	✓	-	8	-	-		2000	25→	4	4	8	80	✓	-	✓	KTL	MON, WHO
France - PRIME	✓	✓	✓	-	-	-	7.8	✓	✓		1991	50-59	7.8	-	7.8	97	✓	-	✓	INSERM	MON
Germany KORA	-	✓	-	-	-	✓	18	✓	✓		1984	25-74	7	7	14	75-80	✓	-	-	GSF	MON
Germany (B) (*)	✓	✓	✓	-	-	✓	6.5	✓	✓		2001	45-75	-	-	-	-	✓	-	-	Essen Univ.	MON
Italy	✓	✓	✓	-	-	-	47	✓	✓		1984	20-69	13	17	30	65	✓	-	-	Milano Univ.	MON
Netherlands Rotterdam ERGO	✓	✓	✓	✓	-	✓	10.3	✓	✓		1990	55→	3	5	8	78	✓	-	✓	Erasmus Univ.	WHO
Netherlands Zutphen	✓	✓	✓	-	-	✓	1.3	✓	-		1985	65-84	1	-	1	74	✓	✓	✓	RIVM	SCS
Netherlands Doetinchem	✓	✓	✓	-	-	✓	6	✓	-		1987	20-59	3	3	6	75	✓	-	-	RIVM	protocol
Norway	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Portugal	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Sweden Stockholm	✓	✓	✓	-	-	✓	4.178	✓	✓	-	1997	60	1.67	1.59	3.26	78	✓	✓	✓	Karolinska Institutet	protocol
United Kingdom BRHS	✓	✓	✓	✓	✓		7.7	✓	✓	✓	1978	40-60	7.7		7.7	78	✓	✓	✓	UCL	WHO

(A), (B), (C) distinguish different Longitudinal Studies in the same country **(*) Germany (B) is ongoing (RECALL Study);** **# National Institute of Public Health, Denmark**

TABLE 7 *2003*

SOURCE: **GENERAL PRACTITIONERS RECORDS**

DISEASE: **ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION, CEREBROVASCULAR ACCIDENTS, HEART FAILURE**

COUNTRY	Disease				Area				GPs proportion	1st year	Duration	Age range	Population			Indicators					Access data	Valid
	IHD	AMI	CVA	HF	Nat.	Reg.	Sample	Other	%		years		Men x1000	Women x1000	Total x1000	Incid	Preval	Attack rate	Case fatality	Other		
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belgium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Finland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Italy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Netherlanls LINH	✓	✓	✓	✓	✓	-	228	-	3	1993	onward	0→	-	-	424	-	-	-	-	contacts x patient	NIVEL	-
Netherlands NHL	✓	✓	✓	✓	-	✓	56	-	20	1985	onward	0→	39	41	80	✓	✓	-	-	-	Maas Univ.	-
Norway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	✓	✓	-	✓	-	200	-	0.5	1990	10	0-75+	77	85	162	✓	-	✓	-	-	Inst. Nac. de Saude	-
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sweden	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
UK – England	✓	✓	✓	✓	✓	-	137	-	3	1987	onward	all	2000	2000	4000	-	✓	-	-	-	ONS	-
UK - Scotland	✓	✓	✓	✓	✓	✓	80	-	8	1992	onward	all	-	-	400	✓	✓	-	-	-	IDS	-

(A), (B) distinguish different General Practitioners Registers in the same country

TABLE 8 2003 *DISEASE:* ACUTE MYOCARDIAL INFARCTION

SOURCE: POPULATION BASED REGISTER

COUNTRY	Area	Year	Age range	Population			Sources			Indicators				Access data	Valid
				Men x1000	Women x1000	Total x1000	Mortal	HDR	Other	Incid	Preval	Attack rate	Case fatality		
Regional Registers															
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belgium Ghent	-	1983-1997	25-69	50	51	101	✓	✓	-	✓	-	✓	In/out	University of Ghent	
Ghent	-	1998 →	25-74	70	72	142							hospital	University of Ghent	MONICA and
Bruge	-	1999 →	25-74	75	76	151								University of Ghent	troponine
Charleroi	-	1983 →	25-69	58	59	117								School of Pub.Health	
Denmark	-	1977 →	0 →			493	✓	✓	-	✓	-	✓	In/out hospital	Aarhus University	-
Finland FINAMI	-	1993-2002	35-100	104	128	232	✓	✓	-	✓	-	✓	In/out hospital	KTL	MONICA, proponine; comparison with FINAMI register
France	-	1985 →	35-74	✓	✓	1,800	✓	✓	GP	✓	-	✓	In/out hospital	Ministry of Health	MONICA
Germany	-	1985 →	25-74	200	200	400	✓	✓	-	✓	-	✓	In/out hospital	GSF KORA	MONICA
Italy	8 areas	1996-1999	35-74	-	-	3,360	✓	✓	-	✓	✓	✓	In/out hospital	ISS	MONICA
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway Regional MI	-	2001 →	18 →	150	150	300	-	-	Information by physicians in hospital	-	-	-	In hospital	Trondheim University	by HDR
Norway (Finmark)	-	2000 →	15 →	29	29	58	✓	✓	In-hosp inform	✓	✓	✓	In/out hospital	Kirkenes hospital	MONICA and onine
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spain	Barcelona	1985-1998	25-74	380	386	766	✓	✓	necropsy	✓	-	✓	In/out hospital	MONICA	MONICA
Sweden Northern Swed.	-	1985 →	25-74	250	260	510	✓	✓	-	✓	-	✓	In/out hospital	MONICA	MONICA
UK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 8 2003 *DISEASE:* ACUTE MYOCARDIAL INFARCTION

SOURCE: POPULATION BASED REGISTER

COUNTRY	Area	Year	Age range	Population			Sources			Indicators				Access data	Valid
National Registers															
Denmark	-	1978 →	0 →			5,368	✓	✓	-	✓	-	✓	In/out hospital	NIPH #	MONICA Register
Finland	-	1991 →	0 →			5,000								KTL, Stakes	
Norway-cardiac surgery register	-	1995	20 →	-	-	4.5 (2000)	-	-	Information by heart surgeon	-	-	-	In hospital	Norwegian surgeons' association	-
Sweden	-	1987 →	0→			8,880	✓	✓	-	✓	✓	✓	In/out hospital	Nat. Board of Health & Welf	Recommended national diagnostic criteria

 # National Institute of Public Health, Denmark

TABLE 8a 2006 *DISEASE:* **ACUTE MYOCARDIAL INFARCTION**

SOURCE: **REGIONAL POPULATION BASED REGISTER**

Country	Area coverage	Year	Age range	Population		Access data	Validation	Age-Std. values
				Men x 1000	Women x 1000			
Belgium	Charleroi	1983-2003	25-69	50	50	missing	ECG; enzymes; symptoms, MONICA	√
Belgium	Ghent	1983-2003	25-74	71	71	missing	ECG; enzymes; symptoms, MONICA	√
Belgium	Bruges	1999-2003	25-74	75	75	missing	ECG; enzymes; symptoms, MONICA	√
Denmark	Northern Jutland	1978-2001	35-85+	247	247	Århus Univ. Hospital	-	√
Finland FINAMI		1993-2002	all	90	103	Nat. Inst of Publ. H.	MONICA, troponine, enzymes, ECG, symptoms, autopsy	√
France	Lille,Strasbourg,Toulouse	1985-2004	35-74	752	767	INSERM U258	MONICA	√
Germany	Ausburg	1985-2002	25-74	203	204	Nat. Institute of Stat. GSF and official German health report via inernet	ECG; enzymes; symptoms, autopsy ; MONICA; troponine	√
Italy	7 areas	1996-1999	35-74	tot: 3,600		Nat Inst. Public Health	MONICA	√
Norway		1972-2002	35-85+/all tog	tot: 1000		Health Reg. West	ECG; enzymes; symptoms, autopsy	√
Poland	1 urban/1 rural popul.	1983-93	35-64	180	200	missing	ECG; enzymes; symptoms, autopsy ; MONICA	√
Spain		1985-98	25-74	234	246	Catalan Dep. of Health Inst. of Health Studies	ECG; enzymes; symptoms, autopsy ; MONICA	√
Sweden		1987-2001	35-74	160	162	NBHW	MONICA	√

TABLE 8b 2006 *DISEASE:* **ACUTE MYOCARDIAL INFARCTION**

SOURCE: **NATIONAL POPULATION BASED REGISTER**

COUNTRY	Year	Age range	Population		Access data	Validation	Age-Std. values
			Men x1000	Women x1000			
Denmark	1978-2001	35-85+	2,677	2,734	Nat. Institute of Public Health	MONICA	√
Finland	1991-2003	all	2,600	2,600	Nat. Inst. of P. Health	ECG, MONICA, troponine, enzymes, autopsy, symptoms	√
Iceland	1981-2002	25-74			Nat. Inst P.H. ; Icelandic Heart Association	ECG, enzymes, symptoms, autopsy, MONICA	√
Sweden	1987-2001	all ages	4545	4466	Nat. Board of H. and Welfare	ECG; enzymes; symptoms; autopsy; troponine	√

Blank spaces: missing or unclear information

TABLE 9 *2003* ***DISEASE:*** **CEREBROVASCULAR ACCIDENTS**

SOURCE: **POPULATION BASED REGISTER**

COUNTRY	Area	Year	Age range	Population			Sources			Indicators				Access data	Valid
				Men x1000	Women x1000	Total x1000	Mort.	HDR (*)	Other	Incid.	Preval	Attack rate	Case-fatality		
Regional Registers															
Austria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Belgium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denmark															
Finland FINSTROKE	-	1993-1997	25-99	97	114	232	✓	✓	-	✓	-	✓	In/out hospital	KTL	MONICA
France - Dijon Stroke Register	Dijon	1985 →	01 →	70	80	150	✓	✓	GP	✓	-	✓	In/out hospital	Dijon	CT-Scan
Germany	-	1994 →	18 →	48	52	100	✓	✓	case ascertainment	✓	-	-	In/out hospital	Erlangen University	CT-Scan, Health Insurance
Italy	8 areas	1996-1999	35-74	-	-	3,360	✓	✓	-	✓	✓	✓	In/out hospital	ISS	MONICA
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	-	1998 →	24-95+	29	29	58	✓	✓	hosp. journal	✓	✓	✓	In/out hospital	Kirkenes hospital	MONICA
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern Sweden	-	1985 →	25-75	160	162	322	✓	✓	-	✓	-	✓	In/out hospital	MONICA	MONICA
UK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
National Registers															
Denmark	-	1978 →	0 →	2,654	2,714	5,368	✓	✓	-	✓	-	✓	In/out hospital	Nat. Inst. Pub.Health	-
Finland		1991 →	25-99			5,000	✓	✓		✓		✓	In/out hospital	KTL stakes	comparison with FINSTROKE register
Sweden Riks-Stroke	-	1995 →	01 →	4,390	4,490	8,880	✓	✓	-	✓	-	✓	In hospital	Umea University	HDR

(*) HDR = Hospital Discharge Records

TABLE 9a ***2006*** ***DISEASE:*** **CEREBROVASCULAR ACCIDENTS**

SOURCE: **REGIONAL POPULATION BASED REGISTER**

COUNTRY	Area coverage	Year	Age range	Population		Access data	Validation	Age-Std. values
				Men x1000	Women x1000			
Denmark*	Glostrup (Copenhagen city)	1982-1991	25-74	326		Danish Institute of Public Health	MONICA	√
Finland		1993-97	all	93	103	Nat. Inst.of P. Health	MONICA	√
France	Dijon (town)	1985-2004	6 months→	69	81	Ministry of Health	MONICA, autopsy, examinations, surg./pharm.treatment, signs & symptoms	√
Germany	Erlangen Stroke R.	1994-....	18+	49	51	University of Erlangen	signs and sympt; surg. or pharmac. treatment; exam.: neurologist, TAC, MRI	√
Greece	Arcadia	1993-95	all	42	39	Alexandra Hospital, Univ. of Athens		
Italy	8 areas	1998-1999	35-74	4,500		National Institute Public Health	signs and sympt; surg. or pharmac. treatment; exam.: neurologist, TAC, MRI, Carotid Doppler; autopsy; MONICA	√
Norway		1972-2002	all	tot: 1,000		Nat.Inst.Stat./HDR	-	-
Poland	Pol-MONICA	1984-93	35-64			Nat. Inst. of Cardiology	Examin: neurologist, TAC; autopsy; MONICA	√
Sweden		1985- 2004	35-74	160	162	MONICA Northern Sweden	MONICA	

TABLE 9b 2006 ***DISEASE:*** **CEREBROVASCULAR ACCIDENTS**

SOURCE: **NATIONAL POPULATION BASED REGISTER**

COUNTRY	Year	Age range	Population		Access data	Validation	Age-Std. values
			Men x1000	Women x1000			
Denmark	1978-2001	35-85+	2,677	2,734	Nat. Inst. of P. Health	-	√
Finland	1991-2003	35-85+	2,600	2,600	Nat. Inst. of P. Health	MONICA	√

Blank spaces: missing or unclear information

Table 10 Registers of AMI: case definition in each country

Country	*ICD version*	*Sources of information*		*Linkage mortality / HDR*	*Validation*
		Mortality ICD codes (*)	*HDR ICD codes (*)*		
Belgium Charleroi, Ghent, Bruges	IX, X	410-414, 428, 798, 799	410-414, 428, PTCA, CAGB	name, date of birth	MONICA
Northern Denmark	VIII,X	410	410	ID	----
Finland	X	410, 411, 428, 798, 799	410, 411, PTCA, CABG	ID	MONICA, troponine
France	IX, X	410-414, 428, 798, 799, others	410-414, 428	name, date of birth	MONICA
Germany	X	410-414, 798, 799	410, 411, PTCA, CAGB	name, date of birth	MONICA, troponine
Italy	IX	410-414, 798, 799, others	410-414	name, date of birth	MONICA
Norway	X	410	410, PTCA, CABG	ID	MONICA, troponine
Poland	X	410-414, 428, 798, 799	410-413	-	MONICA
Spain	IX	410-414, 428, 798, 799, others	410-414	name, date of birth	MONICA
Northern Sweden MONICA	X	410, 411	410, 411	ID	MONICA
Denmark	VIII, X	410-414, 798, 799	410, PTCA, CABG	ID	Recommended national diagnostic criteria and MONICA
Finland	X	410-414, 428, 798, 799	410-414, 428, PTCA, CABG	ID	MONICA, troponine
Iceland	IX, X	410-414, 428, 798, 799	410-412, 414, PTCA, CABG	ID	MONICA
Sweden	IX, X	410	410	ID	Recommended national diagnostic criteria, troponine

(*) all codes are presented in the ICD-9 revision to facilitate the comparison

Table 11 Registers of Stroke: case definition in each country

Regional Registers		*Sources of information*			
Country	*ICD version*	*Mortality ICD codes*	*HDR ICD codes*	*Linkage mortality / HDR*	*Validation*
Finland	X	430-432, 435, 436	430-438	ID	MONICA
France	X	430-438, 442.81	430-438, 442.81	ID, date of birth	CT-Scan
Germany	X	430-438	430-438	name, date of birth	CT-Scan, Health Insurance
Greece	IX	430-438	430-438	ID	MONICA CT-Scan
Italy	IX	430-434, 436-438	430-434, 436-438	name, date of birth	MONICA
Norway	X	430-438	430-438	ID	MONICA
Sweden MONICA	IX, X	430-438, 798, 799	430-438, 798, 799	ID	MONICA
National Registers					
Denmark	VIII, X	430-438	430-438	ID	-
Finland	X	430-438	430-438	ID	MONICA CT-Scan

(*) all codes are presented in the ICD-9 revision to facilitate the comparison

Table 12: **Conversion table between ICD-VIII, IX and X revisions**

ICD-VIII	ICD-VIII label	ICD-IX	ICD-IX label	ICD-X	ICD-X label
Rheumatic heart disease					
		393-398	Chronic rheumatic heart disease	I05-I09	Rheumatic heart disease
Ischaemic heart disease					
410 - 414	Ischaemic heart disease	410 - 414	Ischaemic heart disease	I20 - I25	Ischaemic heart disease
410	Acute myocardial infarction	410	Acute myocardial infarction	I21, I22	Acute myocardial infarction
411	Other acute and subacute forms of ischaemic heart disease	411	Other acute and subacute forms of ischaemic heart disease	I20.0	Other acute ischaemic heart disease
		412	Old myocardial infarction	I25.2	Old myocardial infarction
413	Angina pectoris	413	Angina pectoris	I20	Angina pectoris
412, 414	Chronic ischaemic heart disease, asymptomatic ischaemic heart disease	414	Other forms of chronic ischaemic heart disease	I25 (excluding I25.2)	Chronic ischaemic heart disease
Heart failure					
		428	Heart failure	I50	Heart failure
427.0	Congestive heart failure	428.0	Congestive heart failure	I50.0	Congestive heart failure
		428.1	Left heart failure, acute oedema of lung	I50.1	Left heart failure, acute oedema of lung
Other cardiovascular diseases					
400-404	Hypertensive disease	401-405	Hypertensive disease	I11-I13	Hypertensive disease
		415	Acute pulmonary heart disease	I26	Acute pulmonary heart disease
420-429	Other forms of heart disease	420-429	Other forms of heart disease	I30-I49, I51	Other forms of heart disease
		426-427	Conduction disorders and cardiac dysrhythmias	I44-I49	Conduction disorders and cardiac dysrhythmias
440	Atherosclerosis	440	Atherosclerosis	I70	Atherosclerosis
		441-442	Aortic aneurysm	I71-I72	Aortic aneurysm
		444	Arterial embolism and thrombosis	I74	Arterial embolism and thrombosis
451-456	Venous thromboembolic disease	451-456	Venous thromboembolic disease	I80-I87	Venous thromboembolic disease

Table 12: **Conversion table between ICD-VIII, IX and X revisions**

ICD-VIII	ICD-VIII label	ICD-IX	ICD-IX label	ICD-X	ICD-X label
Cerebrovascular diseases					
430 - 438	Cerebrovascular diseases	430-438	Cerebrovascular diseases	I60 - I69, G45	Cerebrovascular diseases
430	Subarachnoid haemorrhage	430	Subarachnoid haemorrhage	I60	Subarachnoid haemorrhage
431	Cerebral haemorrhage	431	Intracerebral haemorrhage	I61	Intracerebral haemorrhage
431	Cerebral haemorrhage	432	Other and unspecified intracranial haemorrhage	I62	Other non-traumatic intracranial haemorrhage
432	Occlusion of precerebral arteries	433	Occlusion and stenosis of precerebral arteries	I65	Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction
433, 434	Cerebral thrombosis, cerebral embolism	434	Occlusion and stenosis of cerebral arteries	I66	Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction
433	Cerebral thrombosis	434.9	Cerebral infarction	I63	Cerebral infarction
435	Transient cerebral ischaemia	435	Transient cerebral ischaemia	G45	Transient cerebral ischaemic attacks and related syndromes
436	Acute but ill-defined cerebrovascular disease	436	Acute, but ill-defined, cerebrovascular disease	I64	Stroke, not specified as haemorrhage or infarction
437, 438	Generalised ischaemic cerebrovascular disease, other and ill-defined cerebrovascular disease	437	Other and ill-defined cerebrovascular disease	I67, I68	Other cerebrovascular disease, Cerebrovascular disorders in diseases classified elsewhere
		438	Late effects of cerebrovascular disease	I69	Sequelae of cerebrovascular diseases
Sudden death					
795	Sudden death	798	Sudden death, cause unknown	R96 – R98	Sudden death
			ICD 9 CM	NOMESCO	
		36.1	CABG	FNA-FNE	
		36.01-36.06	PTCA	FNG0	
		88.55-88.57	Coronary angiography	XAC85 (Denmark)	
		35.0-.35.3, 35.95, 35.96, 35.99	Valvular operations	FG, FJ, FK, FM	

Table 13

INDICATORS FOR ACUTE MYOCARDIAL INFARCTION

(ICD-9 410, ICD-10 I21-I22)

AMI	*AVAILABLE*	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS:			
MORTALITY	**Mortality rate** *ICD-9* 410-414 *ICD-10* I20-I25	**Mortality rate** *ICD-9* 410 *ICD-10* I21-I22	**Validated mortality rate**
MORBIDITY	**Hospital Discharge Rate** *ICD-9* 410 *ICD-10* I21, I22 **In-hospital case-fatality**	**Attack rate/incidence rate** **1-day, 28-day case-fatality**	**Validated attack/incidence rate** **Re-admission after 1 year** **1 year survival** **28-day case-fatality among first day survivors**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***			
Medicine use		**Thrombolytic therapy**	
Surgical operations and invasive procedures			**CABG per AMI** **PTCA per AMI** **Emergency CABG (**within 24 hrs**)** **Emergency PTCA (**within 24 hrs**)** **30-day case-fatality rate for CABG**
In-patient care utilisation	**Aggregate bed-day rate** **Mean length of stay**	**Median length of stay**	

Table 14

INDICATORS FOR ACUTE CORONARY SYNDROMES

(ICD-9 410-411, 413 ICD-10 I20.0, I21, I22, I24)

ACS	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS:		
MORTALITY	**Mortality rate** *ICD-9* 410-411 *ICD-10* I20.0, I21, I22	**Validated mortality rate**
MORBIDITY	**Hospital discharge rate** *ICD-9* 410-411 *ICD-10* I20.0, I21, I22	**Validated attack rate/incidence**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***		
Surgical operations and invasive procedures		**CABG per ACS** **PTCA per ACS** **Emergency CABG** (within 24 hrs) **Emergency PTCA** (within 24 hrs)
In-patient care utilisation	**Aggregate bed-day rate** **Mean length of stay**	**ACS patients in ICU** **Median length of stay**

Table 15

HEALTH STATUS INDICATOR FOR ALL ISCHAEMIC HEART DISEASES

(ICD-9 410-414, ICD-10 I20-I25)

ALL ISCHAEMIC HEART DISEASES	*AVAILABLE*	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS:			
MORTALITY	**Mortality rate** *ICD-9* 410-414 *ICD-10* I20-I25	**Mortality rate** *ICD-9* 410-414+ 798 *ICD-10* I20-I25, R96, R98	
MORBIDITY	**Hospital Discharge rate** *ICD-9* 410–414, *ICD-10* I20-I25	**Prevalence of effort angina**	**Prevalence of IHD** **MI, CABG, PTCA, angina**
DISABILITY			**Functional disability and quality of life indicators**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***			
Surgical operations and invasive procedures		**CABG rate** **PTCA rate** **Coronary angiography rate**	

Table 16

HEALTH STATUS INDICATOR FOR HEART FAILURE

(ICD-9 428, ICD-10 I50)

HEART FAILURE	*AVAILABLE*	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS			
MORTALITY		**Mortality rate** *ICD-9* 428 *ICD-10* I50	**Validated mortality rate**
MORBIDITY		**Hospital Discharge Rate** *ICD-9* 428 rate *ICD-10* I50 rate	**Validated hospital discharge rate** **Prevalence**
DISABILITY			**Functional disability and quality of life indicators**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***			
Surgical operations	**Heart transplant rate**		
In-patient care utilisation		**Aggregate bed-day rate** **Mean length of stay**	**Median length of stay**

Table 17

HEALTH STATUS INDICATOR FOR OTHER FORMS OF HEART DISEASE

OTHER FORMS OF HEART DISEASE	*AVAILABLE*	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS:			
MORTALITY	**Mortality rate** *ICD-9* 393-398, 401-405, 420-429 *ICD-10* I05-I09, I11-I13, I30-I49, I51	**Mortality rate** *ICD-9* 440, 441, 444, 415, 426-427, 428, 429 *ICD-10* I70, I71, I82, I44-I49, I50, I51	**Validated mortality rate**
MORBIDITY	**Hospital Discharge Rate** *ICD-9* 393-398, 401-405, 420-429 *ICD-10* I05-I09, I11-I13, I30-I49, I51	**Hospital Discharge Rate** *ICD-9* 440, 441, 444, 415, 426-427, 428, 429 *ICD-10* I70, I71, I82, I44-I49, I50, I51	**Validated hospital discharge rate**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***			
In patient care utilisation	**Mean length of stay** **Aggregate bed-day rate**	**Mean length of stay** **Aggregate bed-day rate**	**Median length of stay**
Surgical operations and invasive procedures		**HDR rates and mean length of stay for:** ***Valvular operations,*** ***Aortic and other aneurism,*** ***Pace maker,*** ***Catheter ablation,*** ***Implantable cardioverter defibrillators***	

Table 18

HEALTH STATUS INDICATORS FOR CEREBROVASCULAR DISEASES

(ICD-9 430-438, ICD-10 I60-I69, G45)

STROKE	***AVAILABLE***	***SHORT-TERM IMPLEMENTATION***	***LONG-TERM IMPLEMENTATION***
HEALTH STATUS:			
MORTALITY	**Mortality rate** *ICD-9* 430-438, dementia (290.4) *ICD-10* I60-I69, G45, F01	**Mortality rate** *ICD-9* 430, 431+432, 434, 436+437 *ICD-10* I60, I61+I62, I66, I64+I67, I68	**Validated mortality rate**
MORBIDITY	**Hospital Discharge Rate** *ICD-9* 430–438 dementia (290.4) *ICD-10* I60-I69, G45, F01	**Hospital Discharge Rate** *ICD-9* 430, 431+432, 434, 436+437 *ICD-10* I60, I61+I62, I66, I64+I67 **Attack rate/incidence** **7-day case-fatality rate**	**Attack rate / incidence by subtype of stroke (ischaemic subarachnoid, intracerebral haemorragic)** **Prevalence of stroke**
DISABILITY			**Functional disability and quality of life indicators**
HEALTH SYSTEM: ***HEALTH CARE UTILISATION***			
In-patient care utilisation	**Aggregate bed-day rate** **Mean length of stay**	**CT, MRI per population** **Median length of stay**	**Stroke units per population**
Surgical operations and invasive procedures	**Carotid angioplasty rate**		

REFERENCES

1. Kramers PG, Achterberg PW. Design for a set of European Community Health Indicators: final report by the ECHI Project. Bilthoven: National Institute of Public health and the Environment (RIVM, the Netherlands), 2001.
2. Keys A, Aravanis C, Blackburn H, et al. Seven Countries Study. A multivariate analysis of death and coronary heart disease. London: Harvard University Press, Cambridge, Mass, 1980.
3. Menotti A, Seccareccia F. Risk factors and mortality patterns in the Seven Countries Study. In Toshima KBK, ed. *Lessons for Sciences from Seven Countries Study*, pp 17-33. Springer: 1995.
4. Keys A, Aravanis C, Van Buchm F, et al. The diet and all causes death rate in the Seven Countries Study. *Lancet* 1981; **11:58**.
5. Tyroler HA, Heyen S, Bartel A. Blood pressure and cholesterol as coronary heart disease risk factors. *Arc Intern Med* 1971; **128:907**-14.
6. Kagan A, Popper J, Rhoads G. Factors related to stroke incidence in Hawaii Japanese The Honolulu Heart Study. *Stroke* 1982; **11:14**-21.
7. Mariotti S, Capocaccia R, Farchi G. Differences in the incidence rate of coronary heart disease between North and European cohorts of the Seven Countries Study as partially explained by risk factors. *Eur Heart J* 1982; **3:481**-7.
8. Mac Mahon S, Peto R, Cutler J, et al. Blood pressure, stroke and coronary heart disease: part 1. Prolonged differences in blood pressure: prospective observational studies corrected for the regression dilution bias. *Lancet* 1990; **335:765**-74.
9. World Health Organization European Collaborative Group. European collaborative trial of multifactor prevention of coronary heart disease: final report of the 6 years study. *Lancet* 1986;**1**:869-72.
10. Puska P, Nissinen A, Salonon JT, Tuomilehto J. Ten years of the North Karelia Project: results with community based prevention of coronary heart disease. *Scand J Soc Med* 1983; **11:65**.
11. Tunstall-Pedoe H, Kuulasmaa K, Mahonen M, Tolonen H, Ruokokoski E, Amouyel P. Contribution of trends in survival and coronary-event rates to changes in coronary heart disease mortality: 10-year results from 37 WHO MONICA project populations. Monitoring trends and determinants in cardiovascular disease. *Lancet* 1999; **353:1547**-57.

12. Tunstall-Pedoe H, Vanuzzo D, Hobbs M, Mahonen M, Cepaitis Z, Kuulasmaa K *et al*. Estimation of contribution of changes in coronary care to improving survival, event rates, and coronary heart disease mortality across the WHO MONICA Project populations. *Lancet* 2000; **355:688**-700.

13. Kuulasmaa K, Tunstall-Pedoe H, Dobson A, Fortmann S, Sans S, Tolonen H *et al*. Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project populations. *Lancet* 2000; **355:675**-87.

14. Marmot MG, Rose G, Shipley M, Hamilton PJS. Employment grade and coronary heart disease in British civil servants. *J Epidemiol Community Health* 1978; **32:244**-9.

15. Marmot MG, Aldestein AM, Robinson N, Rose G. Changing social class distribution of heart disease. *BMJ* 1978; **2:1109**-12.

16. Morris JN, Everitt MG, Pollard R, Chave SPW, Semmence AM. Vigorous exercise in leisure time: protection agaist coronary heart disease. *Lancet* 1980; **2:1207**-10.

17. Barrett-Connor E, Cohn BA, Wingard DL, Edelstein SL. Why is diabetes mellitus a stronger risk factor for fatal ischemic heart disease in women than inm? The Rancho Bernardo Study. *Jama* 1991; **265:627**-31.

18. Breteler MMB, Van Swieten JC, Bots ML, Grobbee DE, Claus JJ, Van Den Hout JHW *et al*. Cerebral white matter lesions, vascular risk factors, and cognitive function in a population-based study: The Rotterdam Study. *Neurology* 1994; **44:1246**-52.

19. Sauvaget C, Tsuji I, Aonuma T, Hisamichi S. Health-life expectancy according to various functional levels. *JAGS* 1999; **47:1326**-31.

20. Tolonen H, Wolf H, Jakovljevic D, Kuulasmaa K and the European Health Risk Monitoring Project European Health Risk Monitoring (EHRM) Project. Review of surveys for risk factors of major chronic diseases and comparability of the results. October 2002. http://www.ktl.fi/publications/ehrm/product1/title.htm

21. Petersen S, Peto V, Rayner M, Leal J, Luengo-Fernandez and Gray A. Total mortality. In George C, British Heart Foundation and Logstrup S, European Heart Network (editors): European cardiovascular disease statistics. London; 2005. p. 10.

22. Sans S, Kesteloot H, Kromhout D: The burden of cardiovascular disease mortality in Europe. *Europ Heart Journal* 1997; 18:1231-1248

23. Kannel W. Vital epidemiological clues in heart failure. *J Clin Epidemiol* 2000;**53**:229-35.

24. Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, et al. Myocardial infarction and coronary deaths in the World Health Organization MONICA Project: registration procedures, event rates, and

case-fatality rates in 38 populations from 21 countries in four continents. *Circulation* 1994; **90:583**-612.

25. Kue Young T. Population health; concepts and methods. Oxford university press. New York, 1998.
26. Murray CJL. Quantifying the burden of disease: the technical basis for disability-adjusted life years. *Bull of the World Healt Organ.* 1994; **72:429**-45.
27. Collin C, Wade DT, Davies S, Horne V. The Barthel ADL index: a reliability study. *Int.Disabil.Studies* 1988; **10:61**-3.
28. Kats S, Ford AB, Moscowich RW, Jackson BA, Jaffe MW. Studies of illness in the aged. *Jama* 1963; **185:914**-9.
29. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 1969; **9:179**-86.
30. http://www.euroqol.org/
31. WHO Expert Committee on Physical Status: *The Use and Interpretation of Anthropometry*. 1998. WHO Technical Report Series, No. 854.
32. U.S. Department of Health and Human Services. Physical activity and health: a report of the surgeon general. Atlanta: CDC, 1996.
33. WHO Collaborating Centre for Drug Statistics Methodology. Guidelinens for ATC classification and DDD assignment. Oslo: 2002.
34. Rose GA, Blackburn H, Gillum RF, Prineas RJ. Cardiovascular survey methods (Second Edition). WHO, 1982.
35. Luepker RV, Evans A, McKeigue P, Reddy KS. Cardiovascular survey methods (Third Edition). WHO, 2004
36. Keys A. Classification - codes and cohorts. Coronary heart disease in Seven Countries *Circulation*, 1970, 14-9.
37. http://europa.eu.int/comm/health/ph_projects/1998/monitoring/fp_monitoring_1998_frep_05_en.pdf
38. Hammar N, Alfredsson L, Rosén M, et al. A national record linkage to study acute myocardial infarction incidence and case fatality in Sweden. *Int J Epidemiol* 2001; 30: S30-S34
39. Mahonen M, Miettinen H, Pyorala K, et al. Hospital discharge register data in the assessment of trends in the acute myocardial infarction. *Ann Med* 1995; 27: 547-554

40. Madsen M, Davidsen M, Rasmussen S, Abildstrøm SZ, Osler M. The validity of the diagnosis acute myocardial infarction in routine statistics. A comparison of mortality data and hospital discharge data with the Danish MONICA registration. *Journal of Clinical Epidemiology* 2003;56:124-30.

41. Asplund K, Bonita R, Kuulasmaa K *et al*. Multinational comparisons of stroke epidemiology. Evaluation of case ascertainment in the WHO MONICA Stroke Study. World Health Organization Monitoring Trends and Determinants in Cardiovascular Disease. *Stroke* 1995; **26:355**-60.

42. Ellekjaer H, Holmen J, Kruger O, Terènt A. Identification of Incident Stroke in Norway Hospital Discharge Data Compared With a Population-Based Stroke Register. *Stroke* 1999; **30**:56-60.

43. Mahonen M, Salomaa V, Keskimaki I *et al*. The feasibility of combining data from routine Hospital Discharge and Causes-of-Death Registers for epidemiological studies on stroke. *EurJ Epidemiol* 2000; **16:815**-7.

44. Stegmayr B, Asplund K: Measuring stroke in the population: quality of routine statistics in comparison with Population-based Stroke Registry. *Neuroepidemiology* 1992; **11:204**-13

45. Tunstall-Pedoe H: Problems with criteria and quality control in the registration of coronary events in the MONICA study. *Acta Med Scand Suppl* 1988; **728:17**-25

46. World Health Organization International Collaborative Study. Public health in Europe 5. Myocardial infarction community registers. Results of a WHO International Collaborative Study co-ordinated by the Regional Office for Europe. Copenhagen: WHO, 1976.

47. De Angelis G, De Angelis R, Frova L, Verdecchia A. MIAMOD: a computer package to estimate chronic disease morbidity using mortality and survival data. *Computer Methods and Programs in Biomedicine* 1994; **44:99**-107.

48. Giampaoli S, Palmieri L, Capocaccia R et al. Estimating population-based incidence and prevalence of major coronary events. *Int J Epidemiol* 2001; **30**: S5-S10.

49. Giampaoli S, Palmieri L, Pilotto L, Vanuzzo D. Incidence and prevalence of ischemic heart disease in Italy: estimates from the MIAMOD model. *Ital Heart J* 2001; **2:349**-55.

50. http://www.euro.who.int/HFADB.

51. http://www3.who.int/whosis/mort/text/download.cfm?path=whosis,inds,mort,mort_download&language=english

52. http://europa.eu.int/comm/eurostat/.

53. http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1073,46587259&_dad=portal&_schema=PORTAL&p_product_code=KS-08-02-002

54. http://www.oecd.org/document/30/0,2340,en_2825_495642_12968734_1_1_1_1,00.html

55. A disease-based comparison of health systems: what is best and at what cost? Proocedings of the OECD Ageing-related Disease Workshop, OECD 2003 pp. 363 - Paris 20-21 June 2002.

56. Tolonen H, Mahinen M, Asplund K, rastenyte D, Kuulasma K, Vanuzzo D, Tuomilehto J for the WHO MONICA Project. Do Trends in Population levels of Blood Pressure and Other Cardiovascular Risk Factors Explain Trends in Stroke Events Rates?. Comparisons of 15 populations in 9 countries within the WHO MONICA Stroke Project. Stroke 2002; 33: 2367-75

57. Truelsen T, Mahonen M, Tolonen H, Asplund K, Bonita R, Vanuzzo D; WHO MONICA Project. Trends in stroke and coronary heart disease in the WHO MONICA Project. Stroke. 2003;34(6):1346-52

58. http://www.ktl.fi/publications/monica/coredb/coredb.htm.

59. http://www.ktl.fi/publications/monica/strokedb/strokedb.htm

60. http://www.ktl.fi/publications/monica.

61. http://www.ktl.fi/publications/monica/manual/index.htm

62. Clinical Evidence; the international source of the best available evidence for effective health care. BMJ, 2001.

63. Braunwald E. Heart Disease. Philadelphia: Saunders Company, 1997

64. International Classification of Diseases, VIII Revision; WHO 1970.

65. Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death, IX Revision, WHO 1977.

66. Manual of the International Statistical Classification of Diseases and Related Health Problems, X Revision, WHO 1992.

67. NOMESCO Classification of Surgical Procedures Version 1.7. NOMESCO Uppsala and Copenhagen 2002 (www.nordclass.uu.se/verksam/ncspe.htm)

68. Beaglehole R, Stewart A, Butler M. Comparability of old and New World Health Organization Criteria for Definite Myocardial Infarction. *Int J Epidemiol* 1987; **16:373**-6.

69. Tunstall-Pedoe H. Diagnosis, Measurement and Surveillance of Coronary Events. *Int J Epidemiol* 1989; **18:169**-73.

70. The Joint European Society of Cardiology/American College of Cardiology Committee. Myocardial infarction redefined - A consensus document of The Joint European Society of

Cardiology/American College of Cardiology Committee for the Redefinition of Myocardial Infarction. *Eur Heart J* 2000; **21:1502**-13.

71. Tunstall-Pedoe H: Comment on the ESC/ACC redefinition of Myocardial infarction by consensus dissenter. Eur Heart J 2001; **22**, 7, 613-615

72. Marantz PR, Tobin JN, Wassertheil-Smaller S, Steingart RM, Wexler JP, Budner N. The relationship between left ventricular systolic function and congestive heart failure diagnosed by clinical criteria. *Circulation* 1988; **77:607**-12.

73. The Task Force on Heart Failure of the ESC. *Eur Heart J* 1995; **16:741**-51.

74. Stewart S, MaclintyreK, MacLeod MMC, Bailey AEM, Capewell S, McMurray JJV: Trends in hospitalisation for heart failure in Scotland, 1990-1996 An epidemic that has reached its peak? Europ Heart J 2001, 22: 209-217

75. Hatano S. Experience from a multicentre stroke register: a preliminary report. *Bull of the World Health Organ* 1976; **54:541**-53.

76. Di Carlo A, Launer LJ, Breteler MMB, Fratiglioni L, Lobo A, Martinez-Lage J *et al*. Frequency of stroke in Europe: A collaborative study of population-based cohorts. *Neurology* 2000; **54:28**-33.

77. Malmgren R, Warlow C, Banford J, Sandercock P. Geographical and secular trends in stroke incidence. *Lancet* 1987; **2:1196**-200.

78. Asplund K, Tuomilehto J, Stegmayr B, Wester PO, Tunstall-Pedoe H. Diagnostic criteria and quality control of the registration of stroke events in the MONICA project. *Acta Med Scand Suppl* 1988; **728:26**-39.