Cardiovascular Indicators
Surveillance Set

FINAL REPORT

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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 Agricolture 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 CVDs have been identified as one of the leading contributors to the global disease burden, the number of indicators that are considered reliable for monitoring CVD and for which data are available on a comparable bases across EU countries is currently limited.

The aims of the EUROCISS project were therefore to define indicators for monitoring cardiovascular diseases (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 the prevention and control of CVDs.

Specific project objectives included:

1. identifying which CVDs are 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 applied within member countries to obtain reliable and significant data for the periodic monitoring of CVD.

Objective 1 - Identifying which CVDs are of importance in public health

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

Using these criteria, the most important CVDs are acute myocardial infarction and ischemic heart diseases; heart failure; and cerebrovascular accidents.

Objective 2 - Identifying specific indicators for assessing morbidity

Acute myocardial infarction

Recommended indicators include mortality, hospital discharge rates, incidence/attack rates and case fatality. Of these indicators, mortality and hospital discharge diagnoses are available for all countries. Information about incidence/attack rate and case fatality are available in some countries through population-based registries, usually at regional level. These registries have adopted simplified procedures and methods derived from the MONICA Project, based on record linkage of mortality and hospital discharge diagnoses, and employ some validation procedures.

Prevalence of ischaemic heart diseases is assessed by surveys, but information on important clinical measures is often lacking. 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, more sensitive biomarkers criteria will potentially cause a rise in the myocardial infarction incidence and a fall in the case fatality rate.

Heart failure

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.

Cerebrovascular accidents

Recommended indicators of cerebrovascular accidents include mortality, hospital discharge rate, incidence/attack rate, case fatality, and prevalence. Of these indicators, 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 registries; 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 we have called *short-term implementation indicators.* Others, 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 population epidemiologists to support their development.

Following the experience of many North European countries, we also recommend 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 standard methodology in all countries will result in the availability of reliable, valid and therefore comparable data on CVD morbidity at the European level.

2. Organisation and Management

The project is a collaborative effort of different member states.

Initially, twelve countries signed the agreement to participate. Two other countries (Denmark and Greece) joined the project later on. A questionnaire for the creation of an inventory of the available information sources and indicators was completed by the partner countries of the project.

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

- 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.

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)

The following manuscripts are in press 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)
- Development of cardiovascular morbidity indicators for the European Community: the EUROCISS Project (submitted to the Italian J Public Health)

3. Introduction

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

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.

CVDs have 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[1-9]. 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, a rich diet, with consequent high levels of total cholesterol, and high blood pressure. Differences in the prevalence these risk factors have been ascertained to be responsible for differences in the incidence of stroke and coronary heart disease (CHD) among participating countries[1-3,6];
- the WHO European Collaborative Trial in the Multifactorial Prevention of CHD demonstrated the reversibility of risk among European populations, through healthier life styles and treatment of high risk subjects [8]; in particular, the North Karelia Project represents a well-recognised approach to community-based primary prevention [9];
- the WHO-MONICA Project 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, that began in the 1970s[10]. One third of the decline in CHD mortality was explained by changes in case fatality rates related to advancements in coronary care[11] and two/thirds by declining incidence in coronary events, as partly explained by the reduction of classical risk factors[12].

In addition to these studies, others have contributed to the knowledge of risk factors for CVD and demonstrated that other factors such as low socio-economic status[13,14], physical inactivity [15] and diabetes [16] are also related to an increased risk of CVDs.

CVDs and their risk factors were also demonstrated to be associated with other adverse health outcomes including cognitive impairment, dementia and decreased physical performance in the elderly [17,18].

Overall, the major message that has emerged from all tese studies is that a decrease in the level of these risk factors in the population can prevent CVDs and that a reduction of CVDs 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 realisations of these aims will permit cross-country comparisons and will improve prevention and control of CVD.

The objectives of EUROCISS included:

- identifying which CVDs are 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 sexes, youths, adults and older people, taking into account differences in socio-economic status across countries; this involves: taking an inventory of sources of information for selected indicators, describing methods of collection, assessing the degree of comparability and quality control necessary to enhance comparability of existing data-sets;
- developing recommendations for collection and harmonisation of data that are easy to apply within the different countries to obtain reliable and significant data for the periodic monitoring of cardiovascular morbidity in the EU.

To evaluate the health status of a population, mortality and morbidity data are necessary, together with data on prevalence of risk factors. In fact, failure to do so produces an incomplete assessment and compromises the possibilities for prevention.

For the EUROCISS it was 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). However, we are aware that to evaluate the burden of the disease in a population, data on mortality and risk factor prevalence are also necessary.

5. Cardiovascular diseases to be considered

Two criteria have been followed in identifying the CVDs 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 CVDs are ischaemic 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 ischaemic and haemorrhagic stroke. In its section on Health Status indicators, under *diseases of large impact*, the European Community Health Indicators, ECHI Project[19], recommends AMI, IHD, CVA and HF within the CVDs. We would also suggest that other poorly defined CVDs of atherosclerotic origin and venous thromboembolic diseases be included as well.

In terms of importance, CVDs in Europe contribute to about 40% of overall mortality in persons 35 years and older and cause 4 million deaths each year [20]. IHD contributes to about 40% and CVA to an additional 25% of total CVD mortality [21] . Mortality data on HF are not available [22]. 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 a 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 [23]. 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[10]. Attack rates of acute coronary and cerebrovascular events, however, are in themselves not sufficient to describe the impact of CVDs 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 US it is estimated that the leading diagnosis in hospital admission of patients 65 years and over is heart failure [22].

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 based primarily 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 [19], 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) [24]; 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 [24];

ii) age-standardised death rate: death rate estimated after age-standardisation has been performed[24];

iii) age-specific death rate: the number of deaths divided by estimated mid-year population per 1,000 for specific age groups[24].

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 CVDs, 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 [24];

ii) attack rate: the number of events (first and recurrent) divided by the estimated mid-year population per 1,000 [24];

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 by 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 [24];

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 [24].

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 [19].

Definition of specific indicators:

i) *Disability-Adjusted Life Year (DALY):* takes into account years lost due to premature mortality and years lived with disability [25]. 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):* 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 [24];

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) [26,27].

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) [28].

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 [29].

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 under specific treatment divided by the total population. Blood pressure measurements should be obtained calculating the meaning of at least two consecutive readings [30];

ii) *proportion of hypertensives under control:* number of hypertensives under 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 [30];

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 under specific treatment divided by the total population. Hypercholesterolemia should be determined from at least two consecutive tests [30];

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 used 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 anatomical therapeutic chemical; DDD is the 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 prevention 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 CVDs 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 CVDs 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 myocardial infarction, 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 a 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 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 subjects older than 70 years. Their reliability depends greatly 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], 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 etiologic and public health administrative purposes. Their validity depends greatly 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 CVDs. 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 [1-3, 13,16-18, 35].

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 (GP) 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. GP networks may be affected by

selection bias; usually not all GPs participate in studies but only volunteers. Data from GP 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 [36-41].

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 the 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 [41]. This problem increases with ageing [42]. 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 [43]. The process is expensive. The method was used in the WHO European Office Myocardial Infarction Registers in 1970 and in the WHO MONICA project [44]. *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.

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 [45-47].

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 acute myocardial infarction (Belgium, Denmark, Finland, France, Germany, Italy, Norway, Spain and Sweden), fewer have them for stroke (Finland, France, Germany, 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, are applied as *gold 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 WHO Mortality DataBase (MDB) and the Health for All Statistical DataBase (HFA-DB) [48,49].

Both WHO databases contain data on about 600 health indicators, including basic demographic and socio-economic indicators; some lifestyle and environment-related indicators; mortality, morbidity and disability; hospitalisations; and health care resources, utilisation and expenditure. 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 a 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

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 the European Member States to the Regional Office or collected from other international organisations or sources. The Regional Office continuously collects new data and issues updated versions of the database twice a year, generally in January and June. The most recent version was issued in June 2003.The data is 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].

Mortality data by leading causes and more detailed age-groupings are available in the off-line HFA-DB supplementary database (HFA-MDB).

Along with standardised overall mortality rates, estimates are also available separately for men and women, for all combined ages or grouped into 0-65 or over 65 years, and for various calendar years.

For CVD morbidity, the HFA-DB website provides the indicators listed below for each country:

- number of hospitalisations for *circulatory system diseases*;
- hospitalisation rates/100,000 for *circulatory system diseases*, *ischaemic heart diseases* and *cerebrovascular diseases* (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*; a message warns that "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 diseases,* and *cerebrovascular diseases*;
- morbidity data are not available by sex and age;
- morbidity data are not always available for the same calendar years.

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 an international level: the *OECD (Organisation for Economic Co-operation and Development)*, *WHO*, the *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 [51].

Information and tables about cardiovascular disease morbidity are included in the first edition of the publication *Key data on health 2000 – Data 1985-1995*. This publication, which appears at regular intervals, offers a set of systematic and official statistics that are directly relevant to Community health policies. 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 and leisure time; the fourth describes the health status of EU populations. Chapter four contains the graphs *Age-standardised myocardial infarction incidence rates per 100,000 (35-64 age)* and *Case fatality rates at 28 days* (graph. 4.4.32) [52], 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 2002,* 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 [53]. Available in CD-ROM, this 11th edition contains more than 1,200 indicators across 30 countries for 1999/2000, with some time series as far back as 1960.

The OECD also provides *OECD Health Data 2001,* an essential tool for all those concerned with the analysis and strategic planning of resource allocation within and between national health care services of the OECD countries. It is available for a fee on the Internet.

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

All users of data on cross-national comparisons of health care should be reminded that there are still important gaps with respect to international agreements on statistical methods. The same term may refer to different indicators within the 30 OECD countries.

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[54].

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[10,39]; trends in CVD risk factors[12]; and trends in acute coronary and stroke health care for men and women, 35 to 64 years of age[11]. Indeed, MONICA has provided a unique opportunity for exploring the relationship between CVD morbidity and mortality [23].

Tables 2 and 3 list the EU countries involved in MONICA surveillance during the first 3 years of the study (1985-87) [55,56].

Public access to MONICA data is available at the MONICA website[57]. 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 [55].
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 [56].

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.
Table 4 reports information about HDR. In all countries HDR cover almost the entire population, both sexes 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.
Tables 5a and 5b provide the main surveys on CVDs. 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 [58]; WHO standard methods are used in CARDIO 2000 (Greece) and ERGO (The Netherlands) [34]. Data are accessible through national health or statistical institutions, universities and MONICA reference centres**.**

The 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 a 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-Osservatorio Epidemiologico Cardiovascolare, 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***).

Table 8 reports information on AMI from population-based registers. AMI registers are ongoing in Belgium, Denmark, Finland, France, Germany, Italy, Norway (Finnmark) and Sweden. Most of them started between the second half of the 80's and the first half of the 90's (Belgium, Finland, France, Germany, Italy, Spain and Sweden); others are more recent (Norway), while 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. Administrative registers, based on a record linkage methodology covering the entire population and all ages, have been established in Denmark, Finland and Sweden. They have been validated by retrospective examination of medical records and by linkage to MONICA registers. The existence of national registers of hospital discharges and deaths that may be linked using unique personal ID make the proposal of national registers possible. Currently, discussions on making joint comparative studies based on these national registers are taking place in the Nordic Countries.

Data available from stroke population-based registers are summarised in ***Table 9***. They are less frequent than AMI registers. The surveillance system is carried out on a regional or local basis in all countries (Finland, France-Dijon, Germany, Italy, Norway and Sweden-MONICA). Denmark,

Finland and Sweden also have an administrative register, which covers the entire population. The Swedish national register, however, is a hospital-based register set up primarily to evaluate treatment for stroke.

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***.

Different causes of death are considered in the selection of AMI events: the Swedish national AMI register includes only AMI (ICD-9 410). All other registers include IHD (ICD-9 410-414); Belgium and Spain add HF (ICD-9 428) to these codes; Finland, Germany and Norway add SD (ICD-9 798). Italy considers other causes of death (e.g. diabetes and hypertension) where one of the contributory causes of death is IHD; France limits the selection to IHD.

From HDR, selected causes for events are as follows: AMI (ICD-9 410) in Sweden; and AMI and other acute and subacute forms of ischaemic heart disease (ICD-9 411) and angina pectoris (ICD-9 413) in Finland. Denmark, Italy and Spain collect data on IHD (ICD-9 410-414); Norway adds HF (ICD-9 428) and PTCA; and Belgium and Germany add the CABG.

Linkage procedures between mortality and HDRs are automatically performed through the ID in Denmark, Finland, Norway and Sweden, and through name, date of birth, and place of residence in Germany and Italy. Linkage procedures are manual in Belgium, France and Spain.

Selection procedures of events, age range and attack rates, which are not stratified by, make data difficult to compare. There are ongoing discussions in the Nordic countries on how comparability may be achieved when comparing data based on routinely collected information from hospital discharges and deaths.

Table 11 summarises the codes used for the selection of stroke. Denmark, Finland, France-Dijon, Germany and Norway select all CVDs for mortality and HDRs; Italy does not include transient ischaemic attack (TIA ICD-9 435) either for mortality or HDR, Sweden does not include TIA, other and ill-defined cerebrovascular disease (ICD-9 437), and the late effects of cerebrovascular disease (ICD-9 438).

All stroke registers adopt the personal ID number except for Italy, which links mortality and HDRs by name, birth date and place of residence. Validation is based on MONICA diagnostic criteria in Finland, Italy, Norway and Sweden. Validation makes use of health insurance data in Germany and

CT-scans in France-Dijon. The national Sweden stroke register (Riks-stroke) does not include subarachnoid haemorrhage, ICD-9 430.

10. Definition of cardiovascular diseases

10.1 *Nosologic definitions*

Acute myocardial infarction: myocardial cell death due to prolonged ischaemia [59].

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 (410-411-413).

Angina pectoris: a pain in the chest and/or adjacent area associated with myocardial ischaemia but without myocardial necrosis [59]. It is an old term used to describe myocardial ischaemia 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 ischemic 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 [60]; 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 [59]. 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 [59].

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 [59].

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 [60].

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 [60].

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 [60].

Intracerebral haemorrhage: it occurs when a defective artery in the brain bursts, flooding the surrounding tissue with blood [60].

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 recently 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) [61-63]. 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) [64].

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 [44]

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 [23]

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 [65, 66].

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 [43]

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 [67]

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 [68]

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 [67].

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

- major Q-waves corresponding to Minnesota Codes 1.1
- lesser Q-waves plus major T-wave findings, corresponding to Minnestoda 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 [22]

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 water in the right atrium)

- circulation time ≥25 seconds
- hepatojugular reflux
- pulmonary oedema, visceral congestion or cardiomegaly at autopsy
- weight loss ≥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 ≥120 beats/min)

Diagnosis of HF is given for two major or one major and two minor criteria [22].

Boston Criteria [69]

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 H2O* 3 *if greater than 6 cm H2O 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 [70]

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 [71]:

- 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 [72]

The recommended WHO stroke definition is *a focal (or at times global) neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death) and of presumed vascular origin.* This definition includes spontaneous subarachnoid haemorrhage, but excludes subdural and extradural haematomas and TIA.

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 [73]. When possible, incidence studies should register TIA because mild strokes are often misdiagnosed as TIA [74].

MONICA criteria [75]

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 uncoordination), 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 uncoordination), 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 (ischemic 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 indicators have been divided into 3 categories: already availableindicators; 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 that 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 validationof the long-term indicators.

Available indicators are indicators which 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.

Under ***short-term implementation*** we list indicators which build on the available indicators but offer a more exhaustive and desirable overview of CVDs. 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 CVDs. 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.

Under ***long-term implementation***, we list indicators which 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 these indicators it is highly recommended that each country invest 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 sexes together and separately for men and women, and for all ages together 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	**attack rate/incidence rate of HF** - *health status: morbidity/mortality*
Operational definition	validated hospitalisations for symptomatic HF and HF deaths per 100,000 population
ICD codes	non-fatal HF and HF deaths: 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	disease registers, longitudinal cohort studies
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
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	**mean 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 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

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 we 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, 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 has been proposed. Some are based on available data and can be produced over a relatively short period of time: these we have called *short-term implementation indicators.* Others, which we have 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. We have not included outcome and quality care indicators: 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, we therefore also recommend 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 cardiovascular diseases across Europe;
- defining of 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.

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**

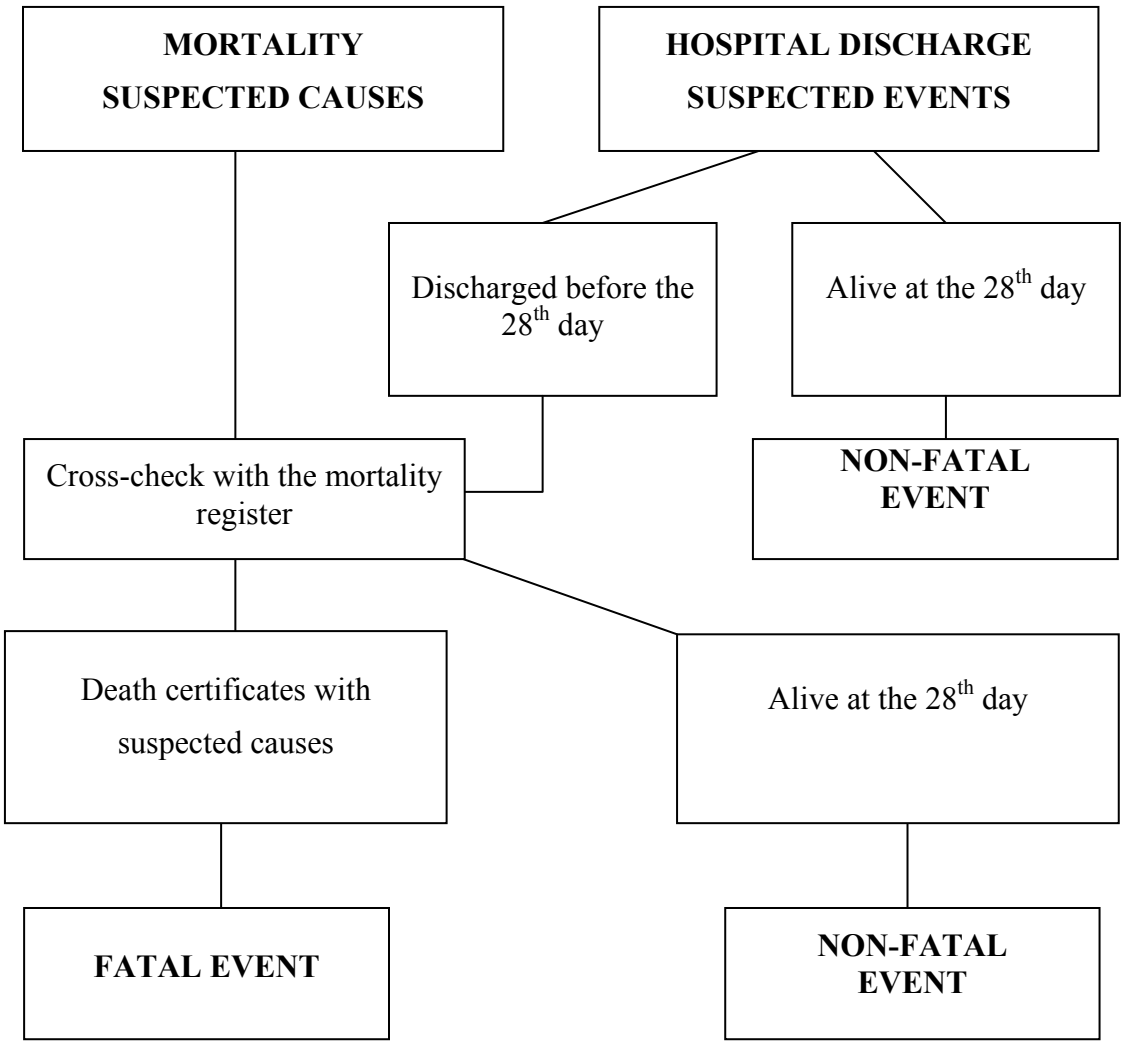

Table 1a – **WHO: HFA - DB**
"Morbidity" available years and source

	FIRST		LAST		SOURCES
	Rate	Year	Rate	Year	
Hospital discharges: circulatory system disease / 100 000					
AUSTRIA	3087.2	1989	4074.0	2000	
BELGIUM	1766.8	1992	2609.3	1998	Ministry of Social Affairs, Public Health and the Environment
DENMARK	2185.1	1987	2658.6	2000	National Patient Registry, Ministry of Health. January 2000: only patients discharged from public hospitals are included December 2002: From 1994 Denmark started using ICD-10
FINLAND	3259.5	1987	3653.7	2001	Hospital Discharge Register, Stakes. From 1998 Stakes Care Register
FRANCE	2219.1	1993	2244.5	2000	
GERMANY	2629.2	1993	3367.4	1999	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients
GREECE	2115.0	1997	2214.2	1998	
IRELAND	1414.9	1994	1522.9	2001	Hospital in-Patient Enquiry; figures refer to discharges and not to individual people. Data from private, maternity or psychiatric hospitals are not included
ITALY	1807.5	1982	2544.7	2000	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	-	-	-	-	
NETHERLANDS	1419.7	1990	1374.3	2001	Dutch Centre for Health Care Information: National Medical Registry
NORWAY	1992.1	1991	2371.3	2001	
PORTUGAL	721.8	1991	1193.8	2001	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	1363.8	1999	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	2815.3	1987	2812.0	2001	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	1092.5	1980	1607.2	1994	January 2001: data refer to Great Britain only. Change of basis (definition) in 1998
EU average	**2017.8**	**1991**	**2359.8**	**2000**	

***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	923.9	2000	
BELGIUM	544.3	1992	777.6	1998	Ministry of Social Affairs, Public Health and the Environment
DENMARK	704.6	1987	829.2	2000	National Patient Registry, Ministry of Health. January 2000: only patients discharged from public hospitals are included December 2002: From 1994 Denmark started using ICD-10
FINLAND	1094.1	1987	1139.8	2001	Hospital Discharge Register, Stakes. From 1998 Stakes Care Register
FRANCE	489.8	1993	488.3	2000	
GERMANY	798.7	1993	1035.0	1999	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients
GREECE	729.2	1997	738.5	1998	
IRELAND	451.1	1994	495.5	2001	Hospital in-Patient Enquiry; figures refer to discharges and not to individual people. Data from private, maternity or psychiatric hospitals are not included
ITALY	343.8	1982	591.7	2000	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	-	-	-	-	
NETHERLANDS	545.6	1990	511.8	2001	Dutch Centre for Health Care Information: National Medical Registry
NORWAY	860.5	1991	946.0	2001	
PORTUGAL	207.8	1994	280.8	2001	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	312.5	1997	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	866.1	1987	917.0	2001	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	313.1	1980	544.5	1994	January 2001: data refer to Great Britain only. Change of basis (definition) in 1998
EU average	**586.2**	**1992**	**657.9**	**2000**	

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	847.0	2000	
BELGIUM	119.1	1992	388.9	1998	Ministry of Social Affairs, Public Health and the Environment
DENMARK	419.0	1987	434.8	2001	National Patient Registry, Ministry of Health. January 2000: only patients discharged from public hospitals are included December 2002: From 1994 Denmark started using ICD-10
FINLAND	644.0	1987	660.6	2001	Hospital Discharge Register, Stakes. From 1998 Stakes Care Register
FRANCE	279.3	1993	214.3	2000	
GERMANY	441.0	1993	580.4	1999	Federal Statistical Office, Hospital statistics - diagnostic data of the hospital patients
GREECE	365.0	1997	384.5	1998	
IRELAND	223.5	1994	258.9	2001	Hospital in-Patient Enquiry; figures refer to discharges and not to individual people. Data from private, maternity or psychiatric hospitals are not included
ITALY	369.3	1984	482.0	2000	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	-	-	-	-	
NETHERLANDS	175.3	1990	185.8	2001	Dutch Centre for Health Care Information: National Medical Registry
NORWAY	292.1	1991	321.3	2001	
PORTUGAL	290.4	1994	353.7	2001	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	104.8	1986	220.8	1997	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	617.2	1987	494.4	2001	ICD-9: 390-459. Source: Hospital Discharge Register, NBHW
UNITED KINGDOM	231.1	1980	257.0	1994	January 2001: data refer to Great Britain only. Change of basis (definition) in 1998
EU average	**342.8**	**1992**	**385.5**	**2001**	

Table 2: Table summarising EU population involved in the MONICA Project for Coronary events (7; WHO-MONICA coronary event registration data book 1980-1995)

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
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
Italy	Area Brianza	1985 - 1994	9	H
	Friuli	1984 - 1993	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 (29; WHO-MONICA stroke event registration data book 1982-1995)

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
Italy	Friuli	1984 - 1993	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, combination of hot and
cold pursuit.

TABLE 4 *DISEASE:* ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION,

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

TABLE 5 a *DISEASE:* ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION,

SOURCE: SURVEYS AT NATIONAL LEVEL 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 *DISEASE:* ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION,

SOURCE: SURVEYS AT REGIONAL LEVEL 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 6 *DISEASE:* ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION,

SOURCE: LONGITUDINAL STUDIES 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 *DISEASE:* ISCHAEMIC HEART DISEASE, ACUTE MYOCARDIAL INFARCTION,

SOURCE: GENERAL PRACTITIONERS RECORDS 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 SOURCE: POPULATION BASED REGISTER *DISEASE:* ACUTE MYOCARDIAL INFARCTION

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	Barc elona	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 SOURCE: **POPULATION BASED REGISTER** ***DISEASE:*** **ACUTE MYOCARDIAL INFARCTION**

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 9 *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 10 Registers of AMI: case definition in each country

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

* 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	430-438	430-438	ID	MONICA
France	X	430-438	430-438	ID, date of birth	CT-Scan
Germany	X	430-438	430-438	name, date of birth	CT-Scan, Health Insurance
Italy	IX	430-434, 436-438,	430-434, 436-438	name, date of birth	MONICA
Norway	X	430-438	431, 434, 436	ID	MONICA
Sweden MONICA	IX, X	430-434,436	430-438	ID	MONICA
National Registers					
Denmark	VIII, X	430-438	430-438	ID	-
Finland	X	430-438	430-438	ID	Clinical diagnosis, CT / MRI
Sweden Riks-Stroke	X	431, 434, 436	431, 434, 436	ID	Clinical diagnosis

(*) 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	***ICD-9* 410-414 rate** ***ICD-10* I20-I25 rate**	***ICD-9* 410 rate** ***ICD-10* I21-I22 rate**	**Validated mortality rate**
MORBIDITY	**Hospital Discharge Rate** ***ICD-9* 410** ***ICD-10* I21, I22** **In-hospital case-fatality**	**Attack rate/incidence** **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, I21, I22, I24)

ACS	*SHORT-TERM IMPLEMENTATION*	*LONG-TERM IMPLEMENTATION*
HEALTH STATUS		
MORTALITY	***ICD-9* 410, 411 rate** ***ICD-10* I20.0, I21, I22 rate**	**Validated mortality rate**
MORBIDITY	**HDR *ICD-9* 410, 411** ***ICD-10* I20.0, I21, I22 rate**	**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) rate** **Emergency PTCA (within 24 hrs) rate** **ACS patients in ICU**
In-patient care utilisation	**Aggregate bed-day rate** **Mean length of stay**	**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	***ICD-9* 410-414rate** ***ICD-10* I20-I25rate**	***ICD-9* 410-414+ 798 rate** ***ICD-10* I20-I25, R96, R98 rate**	
MORBIDITY	**HDR *ICD-9* 410–414, *ICD-10* I20-I25 rate**	**Prevalence of effort angina**	**Prevalence of IHD**
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		***ICD-9* 428 rate** ***ICD-10* I50 rate**	**Validated mortality rate**
MORBIDITY		**HDR *ICD-9* 428 rate** ***ICD-10* I50 rate**	**Validated hospital discharge rate** **Attack rate / Incidence** **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	***ICD-9* 393-398, 401-405, 420-429 rate** ***ICD-10* I05-I09, I11-I13, I30-I49, I51 rate**	***ICD-9* 440, 441, 444, 415, 426-427, 428, 429 rate** ***ICD-10* I70, I71, I82, I44-I49, I50, I51 rate**	**Validated mortality**
MORBIDITY	**HDR *ICD-9* 393-398, 401-405, 420-429 rate** ***ICD-10* I05-I09, I11-I13, I30-I49, I51 rate**	**HDR 440, 441, 444, 415, 426-427, 428, 429 rate** ***ICD-10* I70, I71, I82, I44-I49, I50, I51 rate**	**Validated hospital discharge rate**
HEALTH SYSTEM: *HEALTH CARE UTILISATION*			
In patient care utilisation surgical operations and invasive procedures	**Mean length of stay** **Aggregate bed-day rate**	**HDR rates for surgical operations, invasive procedures:** ***Valvular operations, Aortic and other aneurism, Pace maker, Catheter ablation, Implantable cardioverter defibrillators*** **Mean length of stay**	**Median length of stay**

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	***ICD-9* 430-438, 290.4 rate** ***ICD-10* I60-I69, G45, F01 rate**	***ICD-9* 430, 431+432, 434, 436+437 rate** ***ICD-10* I60, I61+I62, I66, I64+I67, I68 rate**	
MORBIDITY	**HDR *ICD-9* 430–438, 290.4** ***ICD-10* I60-I69, G45, F01**	**HDR *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**
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** **Carotid angioplasty rate**	**CT, MRI per population** **Median length of stay**	**Stroke units per population**

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