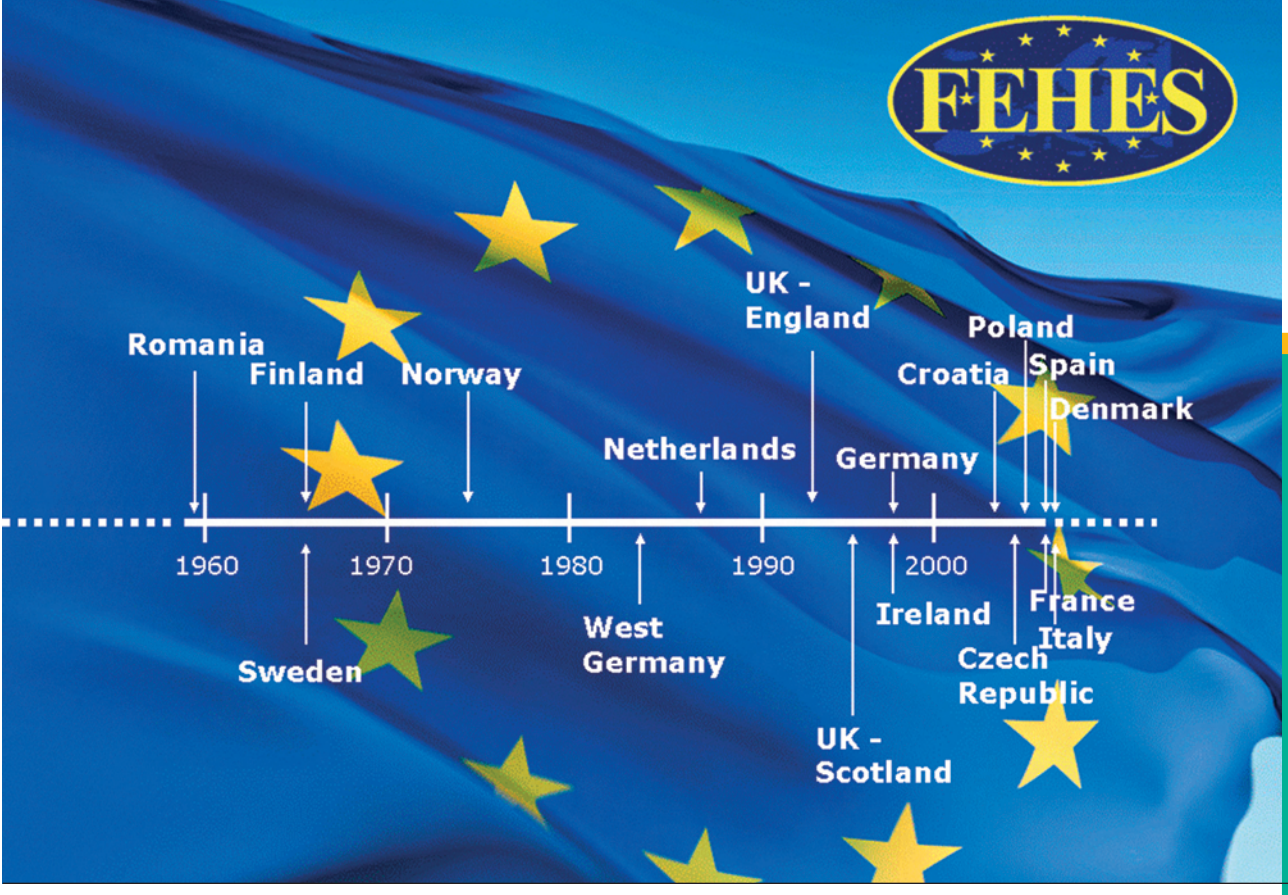

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Review of Health Examination Surveys in Europe

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CONTENTS

1. INTRODUCTION

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Information on the health, health risks and use of health services and medicines of the population are needed for planning and evaluating health policies and health care. Typical data sources for health information are various registers, such as mortality registers for total and cause-specific mortality and population surveys, which provide a cross-section of health and its determinants in the population. Different data sources provide information on different aspects of health, and therefore they are largely complementary.

Health surveys based on representative probability samples of the population are particularly suited for providing information on health behaviours; health determinants, such as obesity, blood pressure, and various blood parameters; prevalence of various diseases; met and unmet need for health services; functional capacity; and nutritional status. Surveys are often classified into health interview surveys (HISs) and health examination surveys (HESs). HISs are based on interviews or self-administered questionnaires, and can be used for measuring health, use of health services, lifestyle and health behaviour. HESs always include an interview or a self-administered questionnaire, and also include some or all of anthropometric, physiological, clinical and/or performance measurements and tests, and blood samples. Therefore, HESs can measure aspects that cannot be addressed through a HIS. Also, for many of the measurements a HES provides much more valid information than a HIS. An example of this is the prevalence of various diseases, where self-reported information is known to be quite inaccurate, although its validity varies with disease [1-5]. Sometimes the inaccuracy is due to the fact that the disease has not been diagnosed.

The longest series of national HESs with a wide range of measurements is in the United States, where the first National Health Examination Survey was carried out in the 1950s. European examples are the Finnish surveys since the 1970s, German surveys since the 1980s, Norwegian surveys since the 1980s, and English and Scottish surveys since the 1990s (see Chapter 2). The main international activity was the WHO MONICA Project, which carried out standardized cardiovascular risk factor surveys in 31 centres in 21 countries in the 1980s and 1990s [6]. More recently there have been occasional HESs in many other countries, comprising a varying set of measurements. However, the measurements have not been

standardized between the countries, and there are no comprehensive HES data available from most European countries.

In the 1990s, the European Union found that it was essential to consider public health in its agenda. The first effort was an extensive review by the Danish Ministry of Health published in 1994. The need for comparable health information from the Member States also becomes obvious. The Health Monitoring Programme was launched, with the aim of producing comparable information on health and health-related behaviour of the population, on diseases and health systems. The Health Monitoring Programme was followed in 2003-2008 by the Community Public Health Programme. One of its objectives was establishing and operating a sustainable health monitoring system. As a part of the implementation of the Programme, EUROSTAT, the European statistical agency, and DG Sanco, Directorate General for Health and Consumer Protection of the Commission, outlined the European Health Survey System, comprising a European HIS, coordinated by EUROSTAT, and a European HES, coordinated by DG Sanco [7].

Feasibility of a European Health Examination Survey (FEHES) is a project of the Public Health Programme 2003-2008, with its aim to assess the feasibility of carrying out a standardized HES in each European Country [8]. To meet its objectives, FEHES has created a network of experts and institutes in 32 countries (Annex 1). With their help, FEHES has collected information on relevant legal, data confidentiality and ethical issues, availability of sampling frames, previous HESs, experience and expertise, and perceived importance and interest in HESs at the national or regional level. FEHES has also conducted a review of the development of methods that has taken place to facilitate international standardization of HESs. Based on this information, FEHES has analyzed the feasibility of models of HES with different numbers of measurements and cost and makes proposals and recommendations for future standardized HESs. An important objective is to prepare a proposal for a European HES pilot.

FEHES is focusing on HESs in the adult population, although the need for health information about children and adolescents is also recognized. Many of the most relevant measurements are different in children and adults. The potential approaches to the surveys are also different, and there is much less experience of HESs in children than in adults. Therefore, we felt that the assessment of the feasibility of surveys in children and adolescents deserves more attention than can be devoted to it in this Project.

The work of FEHES is complementary to the recent work for the development of a European Health Interview Survey as well as to the work of various lifestyle and disease oriented projects of the EU's Public Health Programme [7, 9].

The purpose of this report is to document and assess the existing experience and knowledge of HESs, and hence to provide the evidence base for the proposals and recommendations for future standardized HESs. The proposals and recommendations will be reported separately.

Chapter 2 of this report elaborates the history and Chapter 3 the role and importance of HESs. Chapter 4 gives an overview of HESs that have been carried out or are being planned in European countries and outside Europe, also specifying the models of organizing the surveys. Chapter 5 reviews international activities for developing methods for HES and the need for international collaboration in HESs. Chapters 6-11 address different aspects relevant to conducting a HES, including:

- Legislation, data protection and ethical issues (Chapter 6);
- Sampling issues (Chapter 7);
- Topics and measurements covered in HESs (Chapter 8);
- Measurement procedures (Chapter 9);
- Quality assurance (Chapter 10); and
- Resources used in and cost of previous HESs (Chapter 11).

Finally, conclusions about the feasibility of a European Health Examination Survey are summarized and discussed in Chapter 12.

An important source of information for many of the chapters was direct communication with the experts of the FEHES network. They were sent a questionnaire, hereafter called "the FEHES questionnaire" (Annex 2). It included questions on HESs in the country in the past 10 years, expertise in the country for conducting a national HES, plans for HES in the future, availability of sampling frames, aspects affecting the feasibility of conducting a HES in the country, ethical and legal aspects of HESs, practical aspects of HESs and international aspects of HESs. Response was received from all 32 countries, and was often followed by additional communication. Additional questionnaires were used to get in depth information on the recruitment of survey participants (Annex 3), quality assurance (Annex 4) and costs of HESs (Annex 5).

REFERENCES

[1] Karen Jenum A, Lorentzen C, Anderssen SA, Birkeland KI, Holme I, Lund-Larsen PG, et al. Promoting physical activity in a multi-ethnic district - methods and baseline results of a pseudo-experimental intervention study. Eur J Cardiovasc Prev Rehabil. 2003 Oct;10(5):387-96.

[2] Klungel OH, de Boer A, Paes AH, Seidell JC, Bakker A. Cardiovascular diseases and risk factors in a population-based study in The Netherlands: agreement between questionnaire information and medical records. The Netherlands journal of medicine. 1999 Oct;55(4):177-83.

[3] Okura Y, Urban LH, Mahoney DW, Jacobsen SJ, Rodeheffer RJ. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. Journal of clinical epidemiology. 2004 Oct;57(10):1096-103.

[4] Haapanen N, Miilunpalo S, Pasanen M, Oja P, Vuori I. Agreement between questionnaire data and medical records of chronic diseases in middle-aged and elderly Finnish men and women. American journal of epidemiology. 1997 Apr 15;145(8):762-9.

[5] Newell SA, Girgis A, Sanson-Fisher RW, Savolainen NJ. The accuracy of self-reported health behaviors and risk factors relating to cancer and cardiovascular disease in the general population: a critical review. American journal of preventive medicine. 1999 Oct;17(3):211-29.

[6] Tunstall-Pedoe H, World Health Organization. MONICA Project. MONICA, monograph, and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva: World Health Organization 2003.

[7] The components of the European Health Survey System. 2007 [cited 03 March 2008]; Available from: http://ec.europa.eu/health/ph_information/dissemination/reporting/ehss_01_en.htm

[8] Feasibility of a European Health Examination Survey (FEHES) home page. 2006 [cited 15 December 2007]; Available from: http://www.ktl.fi/fehes/

[9] Europa - European Commission. DG Health and Consumer Protection. Public Health. [cited 15 December 2007]; Available from: http://ec.europa.eu/health/index_en.htm

2. HISTORY OF HEALTH EXAMINATION SURVEYS

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The first health examination surveys in the 19th and 20th century were those carried out by responsible general practitioners to increase knowledge of health, illness and their determinants in the population. Next, directed screening examinations were used in the 1920s to 1940s to find patients suffering from tuberculosis for treatment and sanitary purposes, and some types of cancer (cervical cancer) for early treatment. Although not comprehensive, these surveys were used to develop many principles and practices of screening examinations [1].

In the 1950s and 1960s, the fast development of laboratory automation led to a hope that a number of conditions and their early precursors could be detected cheaply by multiphase screening. Simultaneously, topics such as screening for lung cancer and breast cancer were under investigation. Unfortunately, only some of the hopes for improving prognosis by early detection of disease as a results of screening were proven to be correct. This reduced the perceived importance of screening in early diagnostics.

In Europe, the main tradition since the 1960s has been to carry out health interview surveys in household samples. Many of those studies such as the Finnish ones [2] followed US examples. From the point of view of describing the health of the whole population, these had two drawbacks: First, institutionalized persons were not included in the household samples, meaning that a large proportion of those with severe disability did not belong to the study population. Second, relying solely on interviews meant that conditions easily defined medically were not captured and the same was true of determinants of health such as hypertension or high serum cholesterol. Because of the relative ease with which HISs could be carried out, many countries did not consider the more expensive HESs – in fact the expense was considered prohibitive and the added value limited.

In the 1960s, the National Center for Health Statistics in the United States initiated examination surveys of random sample of the whole US population using multistage sampling. The first National Health Examination Survey (NHES I) was conducted 1960-1962 on adults aged 18-79. In the second NHES, children aged 6-11 were also included and the third NHES focused only on children aged 12-17. In the beginning of the 1970s, the nutrition

component became an important part of these health examination surveys, resulting in a National Health and Nutrition Examination Survey (NHANES). Since that survey, a series of NHANES and Hispanic Health and Nutrition Examination Surveys have been conducted including both children and adults. From the beginning, these surveys have been conducted in mobile clinics. [3]

In the Nordic countries, comparable efforts were initiated in the early 1960s in Finland and in Sweden. In Finland, the Mobile Clinic of Social Insurance Institution, examined a random sample of people aged 15 years and older around the country in 1966-1972 [4]. In Sweden, the Värmlandsundersökningen, tested the feasibility of large-scale laboratory screening [5]. These examination surveys still catered for the idea of early detection and treatment of diseases. Already since the early 1950s there were population based studies on cardiovascular diseases in several countries, but these were limited to a few regions in each country (Framingham [6], the Seven Country Study [7] including population groups from the USA, Croatia, Japan, Finland, Italy, the Netherlands, Greece and Serbia).

Since the 1970s, health examinations have been applied in major international studies in limited populations, on cardiovascular diseases and their determinants as well as their development (WHO MONICA Project [8]), cancer (EPIC [9]) and functional limitations [10]. Comparative studies of the efficacy of cancer screening have also been carried out.

In the United Kingdom, health examination surveys have been conducted annually since 1991 in England and in 1995, 1998 and 2003 in Scotland. These surveys have been household surveys, where the examinations have been conducted in the home of chosen participants. In England, surveys between 1991-1994 included only adults but from 1995 onwards children were also included. In Scotland, only adults were examined during the 1995 survey but in 1998 and 2003 children were also included.

In the Netherlands, health examination surveys have been carried out since 1987, first by the Monitoring Project on Cardiovascular Disease Risk Factors until 1991 [11], followed by the Monitoring Project on Risk Factors for Chronic Diseases (MORGEN) in 1993-1997 [12] and Risk Factors and Health in the Netherlands, a Survey by Municipal Public Services from 1999 to 2001 [13].

Germany carried out a national health examination survey of adults in 1998 [14]. Before the unification of West and East Germany, a series of health examination surveys was conducted in West Germany between 1984-1991 as part of the German Cardiovascular Prevention Study [15]. In 2003-2006, a comprehensive health examination survey was conducted among children and adolescents (KiGGS) [16].

In Norway, a series of regional HESs were conducted by the National Health Screening Service (SHUS) from 1974 until 2003, primarily to monitor risk factors for cardiovascular diseases. The HESs were conducted by county, and all inhabitants in the chosen age groups were invited. In 1974-1988, cardiovascular HESs were performed three times in three counties, inviting inhabitants aged 35-49 years in the first round. In 1985-1999, the Age 40-

programme was run, and by 1993, these regional HESs covered the entire country. [17] Since then, there has not been any nationally representative health examination survey. However, surveys have been carried out in Oslo [18] and the counties of Hedmark, Oppland, Troms and Finmark [19]. The data from these HESs and other large regional HES constitute the Cohort Norway which is used for research purposes. [20]

In addition to the massive health interview (80 000 persons) by the Statistical Office of Italy, the Italian Public Health Institute (ISS) organized a regional pilot HES 1998-2001 in 51 centres, each inviting 200 persons aged 35-74. This has not been continued by a national HES. [21]

Probably the most extensive experience of carrying out HESs in Europe is found in Finland. In addition to national health interview surveys since 1964, a range of health examination surveys has been carried out since the 1960s: the Social Insurance Institution's Mobile Clinic Surveys (1964-1978) [4, 22], the comprehensive Mini-Finland HES (1978-1980) [23], the FINRISK (and FinMONICA) surveys every five years since 1972 and finally the comprehensive Health 2000 survey of 2000 – 2001 [24]. The Finnish comprehensive surveys comprise interviews and examinations for health determinants, physiological measurements, a clinical examination by a doctor, a dental examination by a dentist, and symptom interviews including psychiatric symptoms and syndromes such as the CIDI.

In European countries with a long tradition of national health examination surveys, the demand for HES-based information has been very strong. The examination based assessments have been considered more trustworthy than those from interviews alone. In particular, there are many health determinants not well known to the average person. For example, most people do not know their actual value of serum cholesterol and blood pressure, body weight is often reported as lower than the actual, and the presence/absence of diseases may not be correctly reported. In addition, many measurements may provide information about individual disease risk. Furthermore, the ability to provide real measured data on health determinants and on many aspects of health and functioning is clearly appreciated by the media, politicians and professionals.

REFERENCES

[1] Wilson JMG, Jungner G. Principles and practice of screening for disease. Geneva,: World Health Organization 1968.

[2] Purola T, Kalimo E, Sievers K, Nyman K. The utilization of the medical services and its relationship to morbidity, health resources and social factors. Helsinki: Publications of the National Pensions Institute, Series A.3; 1968.

[3] National Health and Nutrition Examination Survey. Physical Examination Procedures Manual. 2004 [cited 21 January 2008]; Available from: http://www.cdc.gov/nchs/data/nhanes/nhanes_05_06/PE.pdf

[4] Aromaa A. Epidemiology and Public Health Impact of High Blood Pressure in Finland (In Finnish, summary in Englis). Helsinki: Social Insurance Institution 1981.

[5] Socialstyrelsen. Hälsoundersökningen i Värmland 1962-1965. Stockholm; 1965.

[6] Dawber TR. The Framingham study : the epidemiology of atherosclerotic disease. Cambridge, Mass.: Harvard University Press 1980.

[7] Keys AB. Seven countries : a multivariate analysis of death and coronary heart disease. Cambridge, Mass.: Harvard University Press 1980.

[8] Tunstall-Pedoe H, World Health Organization. MONICA Project. MONICA, monograph, and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva: World Health Organization 2003.

[9] IARC. European Prospective Investigation into Cancer and Nutrtion (EPIC). [cited 20 March 2008]; Available from: http://www.iarc.fr/epic/Sup-default.html

[10] Kattainen A, Reunanen A, Koskinen S, Martelin T, Knekt P, Sainio P, et al. Secular changes in disability among middle-aged and elderly Finns with and without coronary heart disease from 1978-1980 to 2000-2001. Annals of epidemiology. 2004 Aug;14(7):479-85.

[11] Verschuren W, van Leer E, Blokstra A, Seidel J, Smit H, Bueno de Mesquite H, et al. Cardiovascular disease risk factors in the Netherlands. Neth J Cardiol. 1993;6:205-10.

[12] Kromhout D. Primordial prevention of cardiovascular disease risk in The Netherlands. Preventive medicine. 1999 Dec;29(6 Pt 2):S106-10.

[13] REGENBOOG Project. Draaikoek voor de GGD-medewerker 1999.

[14] Bellach BM, Knopf H, Thefeld W. [The German Health Survey. 1997/98]. Gesundheitswesen. 1998 Dec;60 Suppl 2:S59-68.

[15] The German Cardiovascular Prevention Study (GCP): design and methods. GCP Study Group. European heart journal. 1988 Oct;9(10):1058-66.

[16] Kurth BM. [The German Health Interview and Examination Survey for Children and Adolescents (KiGGS): an overview of its planning, implementation and results taking into account aspects of quality management]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2007 May-Jun;50(5-6):533-46.

[17] Bjartveit K, Woien G. Cardiovascular disease risk factors in Norway. Results from surveys in 18 countries. Oslo: National Health Screening Service; 1997.

[18] Sogaard AJ, Selmer R, Bjertness E, Thelle D. The Oslo Health Study: The impact of self-selection in a large, population-based survey. Int J Equity Health. 2004 May 6;3(1):3.

[19] The TROFINN Health Study. 2008 [cited 21 January 2008]; Available from: http://www.fhi.no/eway/default.aspx?pid=233&trg=MainLeft_5670&MainArea_5661=5670:0:15,1871:1:0:0:::0:0&MainLeft_5670=5544:28259::1:5675:1:::0:0

[20] Naess O, Sogaard AJ, Arnesen E, Beckstrom AC, Bjertness E, Engeland A, et al. Cohort Profile: Cohort of Norway (CONOR). International journal of epidemiology. 2007 Nov 4.

[21] Giampaoli S, Vanuzzo D. Italian atlas of cardiovascular disease, 1st edition. Italian Heart Journal. 2003;4((Suppl 4.)).

[22] Reunanen A, Aromaa A, Pyorala K, Punsar S, Maatela J, Knekt P. The Social Insurance Institution's coronary heart disease study. Baseline data and 5-year mortality experience. Acta medica Scandinavica. 1983;673:1-120.

[23] Aromaa A, Heliovaara M, Impivaara O, Knekt P, Maatela J, Joukamaa M, et al. Health, functional limitations and need for care in Finland. Basic results from the Mini-Finland Health Survey (summary in English). Helsinki and Turku: Publications of the National Pensions Institue, AL: 32; 1989.

[24] Aromaa A, Koskinen S. Health and functional capacity in Finland. Baseline results of the Health 2000 Health Examination Survey. Helsinki: National Public Health Institute B12; 2004.

3. SOURCES OF HEALTH DATA AND USES OF INFORMATION FROM HEALTH EXAMINATION SURVEYS

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3.1 SOURCES OF HEALTH DATA

Information about the health of the population and health determinants can be obtained from different data sources such as administrative registers, specific disease registers, screenings, health interview surveys and health examinations surveys. All these data sources have their strengths and limitations but they also supplement each others.

Administrative registers, like hospital discharge registers and disease specific registers provide information about the incidence of diagnosed and treated diseases in the population. These are valuable data sources when most of the people getting the disease get treated in hospital. Good examples are cancers, which require treatment in hospital. Administrative and disease specific registers generally have limited information about the background of the persons, like their socio-economic status, which could provide valuable additional information about the socio-economic differences in the incidence of diseases.

Screenings are usually targeted at some population group and are focused on detection of a specific disease, for example pap-smear screening of women to detect cervical cancer. Screenings are good data sources when we want to know the incidence of a specific disease in the population and they are especially good for early diagnoses of diseases, which usually are unsymptomatic in the early stages.

Health interview surveys, where information about person's health and health determinants is collected by questionnaires, can provide representative information about perceived health, health attitudes, health behaviours and diagnosed diseases. Self reported data on health determinants and diseases depends on persons' recall of the diagnoses as well as the knowledge of the health determinants in question. Health interview surveys generally have information about the socio-economic status, health determinants and behaviours, and

diagnosed diseases in same person, which allows reporting of the results by different population groups and estimation of the associations between health determinants and behaviours and diagnosed diseases.

Health examination surveys, where information is collected with questionnaires and also through examinations and laboratory tests, can provide same information than health interview surveys and additional information about the disease diagnoses and health conditions of the same persons from whom the questionnaires information is obtained.

3.2 AIMS OF PREVIOUS HESS

Information collected through health examination surveys provides extensive information about the health and health determinants of the population and differences in health between population groups. The Chief Executive of the Information Centre for health and social care of England has stated that the Health Survey for England is vital for the understanding of health situation and behaviours of the population and it is a great help to ensure that policies are informed [1].

For several other health examination surveys similar aims have been stated. The aim of the Norwegian Age 40-programme was to monitor cardiovascular disease risk, to facilitate epidemiological research, to provide education for health professionals, to prevent cardiovascular disease risk in the total population through population strategies as well as through high risk strategies, and to do secondary prevention through early diagnoses of diseases. [2]

In Germany, the German Health Survey for Children and Adolescents (KiGGS) aims to identify health risks and health care demands among children and adolescents in Germany as a whole and in specific population subgroups, to serve as a reference base for biomedical parameters and various laboratory measures, to delineate subgroup-specific approaches to prevention, to serve as a basis for decision making and prioritization to health care providers, health authorities and politicians, to set the stage for future health monitoring programs and to generate new hypotheses for epidemiological and etiological research. [3]

The NHANES aims to determine rates of major diseases and health conditions (e.g., cardiovascular disease, diabetes, obesity, infectious diseases) as well as identify and monitor trends in medical conditions, risk factors, and emerging public health issues, so that the appropriate public health policies and prevention interventions can be developed. The surveys have been widely utilised in epidemiological research. Data derived from the surveys have been widely used in the development and implementation of a number of health-related guidelines and reforms and public-policy initiatives. [4]

The aim of the Canadian Health Measures Survey is that this information will help evaluate the extent of health problems associated with such major health concerns as diabetes,

obesity, hypertension, cardiovascular disease, exposure to infectious diseases, and the extent of exposure to environmental contaminants. It will serve to ascertain relationships among disease risk factors, health protection practices, and health status based on direct measures. The survey will also provide a platform to explore emerging public health issues and new measurement technologies. [5]

3.3 COMPARISON OF DIFFERENT DATA SOURCES

3.3.1 HEALTH INTERVIEW SURVEYS VS. ADMINISTRATIVE REGISTERS

Previous studies have shown that the validity of self-reported health varies between indicators. It has been found that for example self-reported hypertension can be confirmed by medical record in 86-94% of cases [6, 7] and diabetes in almost 100% of cases [6]. For myocardial infarction, the proportion of positive self-reports confirmed by medical records varies from 10% to 79% between studies [6].

3.3.2 HIS VS. HES DATA

Previous studies about the accuracy of self-reported health in comparison to the health examination survey results, where the measurements have been done to diagnose the conditions have shown that for many health outcomes, self-reported results are inaccurate.

For example, self-reported hypertension tends to be underestimated [8-10] so that results from health examination surveys may give up-to over two-fold higher prevalence than self-reported results [10]. Also the prevalence of hypercholesterolaemia [8], diabetes [8-10], osteoarthritis [9] and coronary heart disease [9] often get underestimated by self-reported data.

For weight and height data, which are used to calculate BMI and obesity prevalence, self-reported results for weight tend to be under-reported while height tends to be over-reported [8, 11]. Under-reporting of weight varies from 0.1 kg to 3.5 kg and over-estimation of height varies from 0.2 cm to 7.5 cm between studies [11]. As a consequence, BMI calculated from self-reported results tends to be under-estimated, from 0.2 kg/m^2 to 1.8 kg/m^2 [11].

It should also be noted that inaccuracy of self-reported data on health outcomes is not uniform throughout population groups. Women tend to over-report chronic diseases more frequently than men as well as 55-64 years old in comparison to younger persons. Also less educated over-report chronic diseases more frequently than persons with higher educational level. [9] For self-reported height and weight, there is tendency for young men to over-report

their height more than women in same age while women tend to under-report their weight more than men. [8]

3.4 USES OF HEALTH EXAMINATION DATA

Actual examples about the uses of data collected by health examination surveys can be found from every country which has conducted HESs. Here we will present few examples to illustrate the potentials of the health examination survey data

One example, how data from HES can be used to present the differences between population groups in given time point but also used to predict possible future trends is from England. Data from Health Survey for England have been used to forecast the obesity prevalence in the country in year 2010. This report first illustrates the situation in 2003 giving the prevalence and number of obese adults by different population groups (sex, social class and regions) and then provides the forecast for these population groups in year 2010. [12]

Examples from NHANES data show how HES data can be used to evaluate the efforts to lower risk factors like high total cholesterol [13], to monitor differences and trends in the obesity [14] and hypertension awareness, treatment and control [15] between population groups.

When cross-sectional health examination data can be linked to different kinds of register data for follow-up of individual's morbidity and mortality, new aspects of data use arise. This allows the estimation of the number of cases of a specific disease due to given risk factors in the country. An example of this is a SCORE project and risk score charts by ESC [16], for the use of clinical practitioners which are tailored to different countries using national HES data and mortality follow-up of the subjects.

In Norway, the HES data has been used in health reports as background for policy on nutrition and physical activity, policy for counteracting social inequity in health (such as giving extra resources to districts with less good health) and planning of health care (such as surgery for high-grade obesity). [17]

Examples can be found also from Finland, where population level, cross-sectional FINRISK, Mini-Finland and Health 2000 health examination survey data has been linked to the hospital discharge and causes of death registers. From FINRISK data a risk assessment calculator for CVD risk has been developed and this calculator is available on the web for practitioners and individuals to use and see how the changes in smoking status, blood pressure levels and total cholesterol levels could affect the CVD risk [18]. An other example is the Elämä pelissä (Life on stake) where person can estimate his/her expected years of life based on their health behaviours and determinants [19].

3.5 CONCLUSIONS

Different aspects of the health of the population can be obtained from number of data sources, such as administrative registers, screenings, health interview surveys and health examination surveys. Each of the data sources has their advantages and limitations, but generally they do not rule out each others, more so they supplement each others. For example, the incidence of cancers can only be obtained from the administrative or disease specific registers and in some cases from screenings, since for most cancers there is no test that could be conducted on the health examination survey to diagnose the cancer. On the other hand, administrative registers and health interview surveys can provide information about the prevalence of hypertension only among those who have been diagnosed and in health interview surveys, who can recall their diagnoses. In health examination surveys, where the blood pressure is measured from the participants, also undiagnosed cases of elevated blood pressure (often indicating hypertension) can be detected.

REFERENCES

[1] Craig R, Mindell J. Health Survey for England 2005. Volume 5. Methodology and documentation: The Information Centre; 2007.

[2] Bjartveit K, Woien G. Cardiovascular disease risk factors in Norway. Results from surveys in 18 countries. Oslo: National Health Screening Service; 1997.

[3] Robert Koch Institut. KiGGS. The German Health Survey for Children and Adolescents. 2005 [cited 23 January 2008; Available from: http://www.kiggs.de/experten/downloads/dokumente/kiggs_engl.pdf

[4] National Center for Health Statistics. National Health and Nutrition Examination Survey. 2007 [cited 23 January 2008; Available from: http://www.cdc.gov/nchs/nhanes.htm

[5] Statistics Canada. Canadian Health Measures Survey. 2007 [cited 23 January 2008; Available from: http://www.statcan.ca/english/survey/household/measures/measures.htm

[6] Klungel OH, de Boer A, Paes AH, Seidell JC, Bakker A. Cardiovascular diseases and risk factors in a population-based study in The Netherlands: agreement between questionnaire information and medical records. The Netherlands journal of medicine. 1999 Oct;55(4):177-83.

[7] Tormo MJ, Navarro C, Chirlaque MD, Barber X. Validation of self diagnosis of high blood pressure in a sample of the Spanish EPIC cohort: overall agreement and predictive values. EPIC Group of Spain. Journal of epidemiology and community health. 2000 Mar;54(3):221-6.

[8] Bowlin SJ, Morrill BD, Nafziger AN, Jenkins PL, Lewis C, Pearson TA. Validity of cardiovascular disease risk factors assessed by telephone survey: the Behavioral Risk Factor Survey. Journal of clinical epidemiology. 1993 Jun;46(6):561-71.

[9] Heliovaara M, Aromaa A, Klaukka T, Knekt P, Joukamaa M, Impivaara O. Reliability and validity of interview data on chronic diseases. The Mini-Finland Health Survey. Journal of clinical epidemiology. 1993 Feb;46(2):181-91.

[10] Molenaar EA, Van Ameijden EJ, Grobbee DE, Numans ME. Comparison of routine care self-reported and biometrical data on hypertension and diabetes: results of the Utrecht Health Project. European journal of public health. 2007 Apr;17(2):199-205.

[11] Gorber SC, Tremblay M, Moher D, Gorber B. A comparison of direct vs. self-report measures for assessing height, weight and body mass index: a systematic review. Obes Rev. 2007 Jul;8(4):307-26.

[12] Zaninotto P, Wardle H, Stamatakis E, Mindell J, Head J. Forecasting obesity to 2010: Department of Health; 2006.

[13] Schober SE, Carroll MD, Lacher DA, Hirsch R, Division of Health and Nutrition Examination Surveys. High serum total cholesterol - An indicator for monitoring cholesterol lowering efforts: U.S. adults, 2005-2006. NCHS data brief no 2. Hyattsville, MD: National Center for Health Statistics; 2007.

[14] Ogden CL, Carroll MD, McDowell MA, KFlagal KM, Division of Health and Nutrition Examination Surveys. Obesity among adults in the United State - No statistically significant change since 2003-2004.NCHS data brief no 1. Hyattsville, MS: National Center for Health Statistics; 2007.

[15] Ostchega Y, Yoon SS, Hughes J, Louis T, Division of Health and Nutrition Examination Surveys. Hypertension awareness, treatment, and control - continued disparities in adults: United States, 2005-2006. NCHS data brief no 3. Hyattsville, MD: National Center for Health Statistics; 2008.

[16] European Society of Cardiology. SCORE (Systematic COronary Risk Evaluation) Risk Charts. 2005 [cited 30 May 2008]; Available from: http://www.escardio.org/initiatives/prevention/prevention-tools/SCORE-Risk-Charts.htm

[17] Naess O, Rognerud M, Heine Strand B. Sosial ulikhet i helse. En faktarapport: Folkehelseinstituttet, Rapport 1; 2007.

[18] FINRISKI-laskuri. 2007 [cited 30 May 2008]; Available from: http://www.ktl.fi/portal/suomi/osastot/eteo/tutkimus/riskipiste/finriski-laskuri/

[19] YLE Tv1. Elama pelissa. [cited 30 May 2008]; Available from: http://elamapelissa.yle.fi/elama-pelissa-testi

4. EXPERIENCES, POTENTIALS AND PLANS FOR ORGANIZING AND CONDUCTING NATIONAL HEALTH EXAMINATION SURVEYS

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4.1 INTRODUCTION

This chapter provides an overview of recent and planned health examination surveys (HES) in Europe, i.e. European Union Member States and Candidate Countries, as well as EFTA/EEA Member States. In addition some major HESs in other industrialized countries outside Europe (e.g. USA, Canada, and Australia) are reviewed. In this respect, the text updates information from earlier reviews [1, 2]. This chapter presents an overview of the level of experience and expertise in HES in the European countries, and the views of FEHES network members on the interest and importance of HES in their countries. This chapter will focus on different models of organizing the HES and conducting the fieldwork. The availability of sampling frames, the level of response rates, and ethical and legal issues, which are also relevant for the feasibility of HES, are considered in other chapters.

The five main sources of information for this chapter are:

1. The European Health Surveys Information Database (HIS/HES database) [3],
2. The PubMed Database (Search term; "name of the country + health + survey") [4]
3. WHO information sources: the WHOLIS database [5], and the WHO Global InfoBase Online [6](covering surveys including risk factor measurements, search term; "health survey"), and
4. The International Health Data Reference Guide [7] prepared by the National Center for Health Statistics in USA.

5. The FEHES Questionnaire on Health Examination Surveys in Europe (FEHES questionnaire; Annex 2), and personal communication with FEHES network members in 32 countries.

The main focus of this chapter is on health surveys carried out in the adult population (aged 18 and over) at national or regional level using probability sampling. Surveys targeted at specific age groups to study major public health problems and their risk factors were considered. Excluded were small scale local surveys, surveys focusing on certain rare diseases, and surveys based on samples of hospital patients or disease registers.

4.2 RECENT HESS

Within the last ten years, national HESs have been carried out in ten European countries (Croatia, Czech Republic, Finland, France, Germany, Ireland, Netherlands, Poland, Romania, and UK), in most of them with quite irregular and long intervals (Table 4.1 and 4.4). There is a new ongoing national survey in three countries without previous national HESs (Denmark, Luxembourg, and Spain). Countries with the longest traditions of organizing national HESs in Europe are Finland (since 1960s), Germany and the Netherlands (since 1980s), and UK (since the beginning of 1990s) (see Chapter 2 and Annex 6). In England the HES is carried out annually, and the survey field work operates continuously. Scotland started similar continuous annual HES in 2008. In most countries, HESs have been carried out with quite irregular or long intervals. In contrast to the few national HESs, several national HISs have been carried out within the last 5-10 years and with regular intervals in most European countries.

There have been major regional surveys repeated at regular intervals and/or covering several regions in different parts of the country in nine countries which did not have any nationally representative surveys (Cyprus, Denmark, Iceland, Italy, Lithuania, Norway, Slovakia, Slovenia, and Sweden). Most of these were cardiovascular risk factor surveys that were initiated in the WHO MONICA Project [8] and/or carried out in CINDI [9] demonstration areas. Local, regional or topic-specific surveys have been carried out in almost all countries. Only large population-based surveys that might form a basis for organizing a national HES have been considered in this review and are listed in Annex 6. Therefore some regional or local topic-specific surveys may be missing.

Experiences in USA, Canada and Australia also give major examples of success and difficulties in organizing national HESs. The National Health and Nutrition Examination Survey (NHANES) in USA is the largest and longest-running national HES in the world [10]. The fieldwork for a new Canadian Health Measures Survey (CHMS) started in 2007 to address previous limitations within Canada's health surveillance system [11]. In Australia, large specific surveys, such as the 1999-2000 Australian Diabetes and Lifestyle Study, the AusDiab [12], have been carried out, as well as several major regional risk factor surveys. In

2003, a pilot test of a proposed new national Australian Health Measurement Survey (AHMS) was carried out [13, 14].

Pilot studies have been conducted in several countries to assess the feasibility of a full-scale national HES. They have not always led directly to full-scale national surveys, due to many challenges involved in creating the necessary survey organization involving several institutes, setting up the fieldwork capacity and obtaining the needed resources. For example in France two pilots carried out in 2002-2003 for a national HES suggested poor feasibility due to low response rates. However, a few years later in 2006 a new nutrition oriented HES was launched, and was well accepted by the population as the response rate was about 80%. Similarly, although the conduct of the Australian AHMS pilot was considered to be otherwise successful, the response rates were not satisfactory to justify the full AHMS. In 2007, a new pilot health measurement survey was started in Australia, which may become a nation wide survey in the future. In Italy, the pilot for national HES carried out in the city of Florence in 2000-2001 by Istituto Superiore di Sanità (ISS) in collaboration with other organizations did not proceed to a full scale nationwide survey, mainly due to difficulties in finding sufficient funding [15]. However, there are active plans in Italy that a previous cardiovascular risk factor survey [16] will be expanded to cover other health topics. Changes in the national healthcare system have also affected the possibility of organising HESs in some countries. In Romania, where a series of national HES have been conducted in the past, the FEHES contact persons judge that new HESs are no longer feasible due to the high cost following privatization of the family physicians in 1998.

4.3 FUTURE PLANS FOR NATIONAL HESS IN EUROPE

According to information we received from the FEHES contact persons, there are active plans for national HESs in a sample of the adult population within the next five years in 17 countries (Bulgaria, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, and UK). Preliminary plans have been prepared in three countries (Cyprus, Romania, and Turkey). In addition, plans for specific HESs in the elderly population and/or among children and adolescents were reported in four countries (Ireland, Finland, Luxembourg, Poland), as well as plans for regional surveys in most countries. Only in six countries no plans at all for future HESs were reported (Austria, Estonia, Hungary, Iceland, Latvia, Macedonia).

4.4 DIFFERENT MODELS OF ORGANIZING HESS

4.4.1 DATA COLLECTION BY PERSONAL INTERVIEWS, SELF-ADMINISTERED QUESTIONNAIRES AND EXAMINATIONS

The model of organizing the HES varies from the simple model of interview data supplemented by basic anthropometric and blood pressure measurements to a survey with an extensive clinical examination carried out by a team of different professionals and with several phases of fieldwork (Table 4.2). HESs usually include an interview phase before the examinations or the HES is directly linked with the national HIS. As an exception, no prior interview phase has been used in the German surveys. There are also models that select a sub-sample of the total HIS sample for the HES (e.g. Ireland). In the Netherlands, the participants of the HIS were later invited to the HES at the local health centre, which resulted in a high non-response rate for the examinations. In the Finnish Health 2000 survey, the prior health interview was used to motivate everybody to participate in the health examination and to make an appointment for the examination, resulting in high response rates (80 to 85 % of the whole sample). The NHANES in the USA and the Canadian CHMS also have two parts: the home interview followed by the invitation to the health examination in the mobile clinic.

Nevertheless, there are several examples that demonstrate that if a survey has several phases and only the participants in the previous phase are invited to the next, the participation rates calculated from the original sample are bound to become low. In the Australian AHMS pilot, participants were recruited at the end of the National Health Survey interview [14]. Only 48% of eligible individuals aged 2-74 years living in private dwellings consented to being contacted about participating in the AHMS component (a nurse visit). It was concluded that future development of a national HES in Australia should consider a stand-alone survey to reduce respondent burden and thus the number of potential drop-out points. Similar experiences have been reported from New Zealand, where the linkage of the national health survey to the national nutrition survey was said to reduce the response rate in the second survey due to the multiple drop-out opportunities [14].

In most European surveys, there has been a personal interview at home prior to the health examination in a clinic (Table 4.2). In England and Scotland there is first an interview and another appointment is made for the health examination, both conducted at the home of the participant. Starting from 2008, the Scottish Health Survey includes the biological module (nurse visit) for around one-sixth of the sample whereas it was previously offered to the whole sample. In some surveys, a questionnaire is mailed together with the invitation to the examination. In the five-yearly FINRISK surveys in Finland, the self-administered questionnaire is mailed to the selected persons together with the invitation to the examination. All examinees are asked to complete the questionnaire and bring it with them to the examination, where it is checked and missing data are completed with the help of the survey

personnel. In Finland, there are positive experiences of such an approach used since the Mobile Clinic Health Examination Surveys in the 1960s and later used in the FINRISK surveys.

Some surveys, such as the Finnish Health 2000 survey, have used several questionnaires, both self-administered and computer-assisted personal interviews, at different phases of the survey. The last questionnaire was given at the end of the examinations to be filled in at home and returned by post (pre-paid mail). Such additional self-administered questionnaires given at the end of the examination have also been used in all the regional surveys in Norway. In the UK, self-administered questionnaires are filled in during or near the end of the interview phase, with different versions for specific age-groups. Telephone interviews are rare as a part of HESs. However, for example the Finnish Health 2000 survey employed telephone interviews to obtain basic health data from persons otherwise unable or unwilling to participate.

4.4.2 DURATION AND PLACE OF EXAMINATIONS, AND TYPE OF PERSONNEL

The average duration of the health examination has varied from ten minutes to four hours 30 minutes per participant. In most surveys, the examinations were carried out at specific (temporary) clinics, often located in local health centers, while the examinations in Croatia, UK and Ireland were conducted during home visits (Table 4.3). Home and/or institutional visits have also been used to complement the HES clinic visits when the respondent would otherwise have been unable to attend (e.g. in Finland). Mobile health examination units (buses and trailers) have been widely used in USA from the first national HES survey in 1959-1962 until the ongoing continuous NHANES survey. The mobile examination center (MEC) of NHANES is made up of trailers containing high-tech medical equipment. Partly the same and partly similar mobile units are also used in the Canadian CHMS.

Mobile units are rare in Europe. In the early surveys in Finland, buses were used in the 1960s and 1970s. Most recently, mobile survey units have been used in Europe only in Switzerland (the Bus Santé survey) and in Norway (Cohort Norway). In Norway, the buses are owned by the health care organization and they are used both for surveys and for clinical screening purposes in a mostly rural region, the county of Nord Trøndelag.

In some countries (e.g. Finland), the planning, coordination and fieldwork of the HES has been the responsibility of one organization in collaboration with several other organizations. In other countries, the fieldwork has been carried out by an organization selected through an open call for tender by the Ministry of Health (e.g. UK, Ireland). The fieldwork of recent HESs in Europe has been carried out either by personnel specially employed for the survey (e.g. surveys in Finland and in the UK), or by using the regular staff in the health care organizations, such as hospitals (as in the Italian Observatory study) or primary health care centres (in the Netherlands). The type and number of personnel depends

on the measurements included and the number of participants in the survey. The HESs have comprised variable topics from a few simple measurements (core topics) to extensive physical measurements, tests of functioning and clinical examinations. In the simplest cases, one nurse can carry out all measurements on one participant. In the extensive surveys, the examinations are carried out by a team of fieldwork personnel with different professional qualifications, such as physicians, dentists, nutritionists, laboratory technicians and trained interviewers. The number of personnel used in HESs varied from a few nurses to a large number of health measure specialist with different qualifications (Table 4.3).

The complexity of the examinations has also been affected by differences in whether the country organizes one comprehensive HES (e.g. in Germany and Finland), also organizes other topic-specific HESs, such as separate national dental health and also psychiatric/mental health surveys (e,g, in the UK and the Netherlands), or uses additional modules. In Germany, there were additional modules to the national core survey, such as an additional regional sample, and an additional environmental health module. Additional booster samples have been selected in the UK, to cover specific groups in the population, such as the largest ethnic minorities and the elderly. In Scotland, the Health Boards are given the option to boost their samples beyond the level which is being funded centrally, but these boosted interviews will only comprise core questions (no additional module questions). In Finland, the Health 2000 survey included an additional separate sample of the participants of the previous Mini Finland Survey. Other additional modules and phases of fieldwork were included to address selected scientific purposes. Persons selected with specific criteria were invited after the examination to attend for additional clinic visits. For example, a sub-sample was selected for the in-depth clinical examinations for cardiovascular diseases and diabetes in the Finnish Health 2000 survey; these persons were invited to the hospital clinics after the original fieldwork for the survey was completed. The data collection for the surveys has also been extended from the original cross-sectional survey to follow-up, most often based on register linkages (e.g. causes of death, cancer registers).

4.4.3 FREQUENCY AND TIMING OF THE SURVEY

Most surveys have been carried out at irregular or about five year intervals (Table 4.4). The timing of the surveys has also varied. Some of the surveys have been carried out throughout the year from January to December (France, the Netherlands, Norway, UK, Canada and USA). In most countries, the surveys have taken place within a few months during the autumn or winter season. The summer holiday months (July-August) have been quite rarely used. Both the seasonal variation and differences in the time of the day used for examinations are known to affect symptoms and many physiological and biochemical measurements. The time of the day used for the examinations has also affected the feasibility of including measurements requiring fasting, and the availability of opportunities for the participants to choose a time that is easy from the point of view of their personal schedule, thus affecting their willingness to participate.

Core health topics covered in previous national HESs are reviewed in Chapter 8. In the countries with extensive comprehensive surveys, there has been a set of core measurements targeted at all age groups and additional measurements (modules) targeted at specific age groups or other sub-samples of the participants comprising e.g. tests on functional capacity carried out only with the elderly, or a module on environmental health and another module on mental health targeted at a random sub-sample in Germany. In addition to the core measurements carried out every year, different specific topics and additional measurements have been selected for the survey each year in UK.

4.5 POTENTIALS FOR ORGANIZING HESS IN EUROPEAN COUNTRIES

In the FEHES questionnaire, we asked the national experts to assess how possible it would be to solve specified issues before a national HES could be conducted. Expertise is available in national research and public health organizations in most European countries. Only in four countries were difficulties identified in raising interest among these organisations to carry out a HES. Difficulties mentioned most often were related to obtaining national funding and challenges related to the participant recruitment and raising interest in HES among the general population (Figure 4.1). In particular, it was felt in many countries where no previous national HES had been carried out that the political authorities do not recognize the need for this type of survey to improve health information. Difficulties were also identified in accepting the value of health information obtainable only by HES. These issues were well reflected also in the comments of the individual contact persons. One of them thought that it will not be possible to raise additional funds unless there are strong arguments concerning the "added value" of HES in comparison with HIS. Another contact person pointed out that in a small country, conducting a HES will be difficult if it is not planned jointly with a national HIS. A third contact person referred to the difficulty of estimating the cost, determining a sample size and choosing the age range to include if no relevant experience concerning this kind of surveys was available in the country.

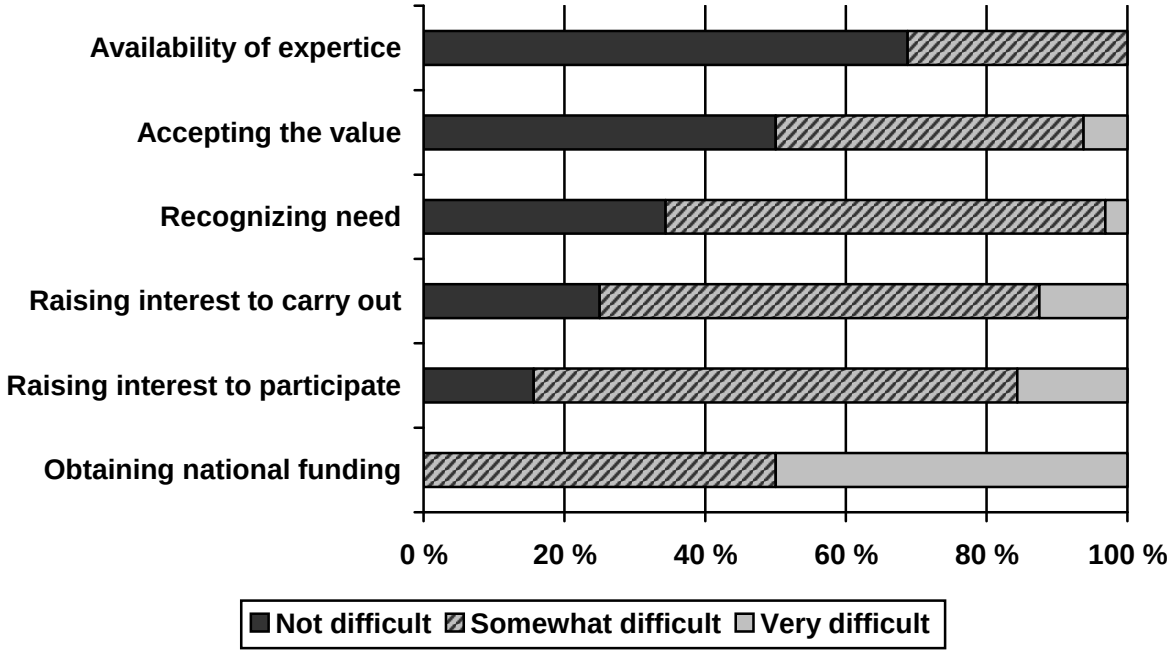

Figure 4.1 Potential for and difficulties in organising HES (Data source: FEHES questionnaire: % of countries/contact persons, total 32)

Some of the contact persons demonstrated a poor knowledge of the public health value of a HES. One contact person indicated that prevalence information on most chronic diseases would be available through valid central registers, another thought that the "digital health record system" might be an alternative for future use with a linkage to HIS. One referred to the difficulty of raising interest among the general population to participate in a HES. A further contact person named the rather good access to care and free of charge health examinations. He also thought that in such countries there is no benefit to the participants in getting test results that they could receive otherwise.

Normal health care facilities (e.g. health centres, general practitioner (GP) surgeries, hospital clinics) were considered to be the most feasible environment for the measurements of HES in most countries (Figure 4.2). Home visits and rented premises for temporary clinics were also considered to be feasible in several countries, while mobile clinics were prioritized in only four countries. This reflects the previous practices and experiences in organizing HESs in different countries. In Norway, mobile units were used in previous regional HESs. They are still available for future use in national surveys, but have to be rented. In a few countries with no previous experience in national HES, it was anticipated that the public health care facilities might be used. In one country, the use of the private sector was anticipated to increase response rates.

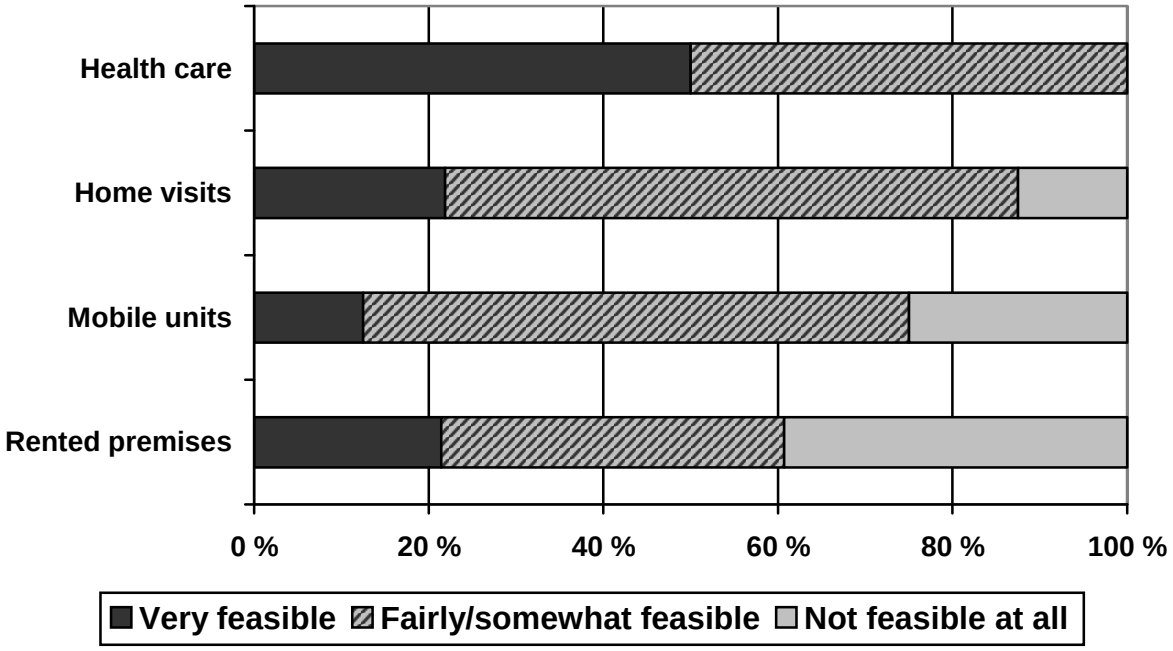

Figure 4.2 Feasibility of conducting HES fieldwork in different environments (Data souce: FEHES-questionnaire: % of countries/contact persons, total 32)

Physicians and dentists are needed if clinical examinations will be carried out and diagnoses will be made. With regard to standardized measurements and structured interviews, the personnel of choice are nurses, physicians and the like. There are differences in the qualifications and role of different health professionals in the European countries. We asked our contact persons to assess if physicians are needed to carry out a few selected measurements to see whether these differences should be taken into account in the training of fieldwork personnel and in cost estimates for future surveys. While all measurements can be carried out by specially trained nurses or laboratory technicians in most countries, physicians have been employed in others to carry out the measurements or at least their presence at the fieldwork site is required (Table 4.5).

4.6 SUMMARY AND CONCLUSIONS

Compared with HIS, national HESs are still relatively rare but active or preliminary plans are being prepared in most EU countries. In almost all European countries there is both previous experience and current interest in organizing HESs. However in a few countries, national HESs are considered too expensive and major difficulties are anticipated with organizing them. The views of the FEHES contact persons clearly demonstrated that in countries where HESs had not been carried out there is lack of information concerning both the limitations of register-based data and the added value of a HES. The doubts were clearly

associated with no recognition of the fact that data available from registers and health service utilization are insufficient and biased. Such data can only cover users of services and do not describe the population at large. As an example, socioeconomic differences in health care utilization only reflect users' health and are clearly biased in respect of the health of the population at large.

Previous surveys have typically covered risk factors and prevalence of a few chronic diseases, especially cardiovascular disease and diabetes. In many EU countries these are also considered to be the most important topics for future surveys. However, examination surveys can provide data on many items from health determinants through several chronic diseases to measures of functioning. Before initiating new examination surveys, it is essential to design them on the basis of national and European information needs, not only on previous national experiences alone. Successful public health initiatives based on cardiovascular surveys since the 1970s may have led to the assumption that there is no need for such surveys in the future. However, the value of HESs should be evaluated in respect to current public health challenges, such as the ageing European populations, widening social inequality in chronic diseases, and the increases in obesity and diabetes. In order to develop feasible survey protocols, one must also take into account the existing health care systems, the role and qualifications of health professionals, and other practical aspects.

Currently, the implementation of HESs in Europe varies considerably. As 17 European countries have active plans to conduct a HES in the next five years, there is an urgent need and an opportunity to standardize HES contents and practices.

REFERENCES

[1] Koponen P, Aromaa A. Health Examination Surveys (HES) Review of literature and inventory of surveys in the EU/EFTA Member States. 2001 [cited 12 May 2008]; Available from: http://ec.europa.eu/health/ph_projects/1998/monitoring/fp_monitoring_1998_annexe4_02_en.pdf

[2] Tolonen H, Wolf H, Jakovljevic D, Kuulasmaa K, European Health Risk Monitoring Project. Review of surveys for risk factors of major chronic diseases and comparability of the results. 2002 [cited 6 March 2008]; Available from: http://www.ktl.fi/publications/ehrm/product1/title.htm

[3] European Health Interview & Health Examination Surveys Database. 2008 [cited 6 March 2008]; Available from: https://hishes.iph.fgov.be

[4] PubMed. 2008 [cited 12 May 2008]; National Center for Biotechnology Information. Available from: http://www.ncbi.nlm.nih.gov/sites/entrez/

[5] World Health Organization. Publications. 2008 [cited 12 May 2008]; Available from: http://www.who.int/publications/en/

[6] World Health Organization. The WHO Global Infobase. 2008 [cited 12 2008]; Available from: http://www.who.int/infobase/report.aspx

[7] Centers for Diseasae Control and Prevention. International Health Data Reference Guide 2003. 2005 [cited 12 May 2008]; Center for Disease Control and Prevention, National Center for Health Statistics. Available from: http://www.cdc.gov/nchs/data/misc/ihdrg2003.pdf

[8] Tunstall-Pedoe H, World Health Organization. MONICA Project. MONICA, monograph, and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva: World Health Organization 2003.

[9] World Health Organization Regional Office for Europe. Protocol and Guidelines. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) Programme. 1996 [cited 27 May 2008]; Available from: http://whqlibdoc.who.int/hq/1994/EUR_ICP_CIND_94.02_PB04.pdf

[10] Centers for Diseasae Control and Prevention. National Health and Nutrition Examination Survey. 2008 [cited 12 May 2008]; Available from: http://www.cdc.gov/nchs/nhanes.htm

[11] Statistics Canada. Canadian Health Measures Survey. 2007 [cited 12 May 2008]; Available from: http://www.statcan.ca/english/survey/household/measures/measures.htm

[12] Dunstan DW, Zimmet PZ, Welborn TA, Cameron AJ, Shaw J, de Courten M, et al. The Australian Diabetes, Obesity and Lifestyle Study (AusDiab)--methods and response rates. Diabetes research and clinical practice. 2002 Aug;57(2):119-29.

[13] Australian Institute of Health and Welfare. Australian Health Measurement Survey: report of the pilot test. AIHW Cat. No CVD 28. 2004 [cited 12 May 2008]; Available from: http://www.aihw.gov.au/publications/cvd/ahms/ahms.pdf

[14] Hetzel D, (ed.). A proposal for the Australian Health Measurement Survey program. 2003 [cited 12 May 2008]; AHMS Working Paper Series No. 8. Public Health Information Development Unit, Adelaine, Australia. Available from: http://www.publichealth.gov.au/pdf/reports_papers/working_papers_ahms/ahms_wkg_ppr8_proposal_ahms_report.pdf

[15] Conti S, Farchi G, Masocco M, Minelli G, Toccaceli V, Vichi M, et al. La salute a Firenze: studio di fattibilità di una Health Examination Survey in Italy: Rapporti ISTISAN 03/12; 2003.

[16] The Italian Cardiovascular Epidemiological Observatory. Ital Heart J. 2004;5(Suppl 3):49S-93S.

Table 4.1 Recent and planned HESs in European countries (number of countries, FEHES questionnaire: number of countries/contact persons, total 32)

	Past (including surveys ongoing in 2007)	**Active plans for surveys between 2008-2012**	**Preliminary plans[3]**
National HES in the general adult population[1]	13	17	3
National HES specific for children and adolescents	1	2	-
National HES specific for the elderly	0	2	-
Major regional surveys[2]	10	5	-

[1] May include also children, adolescents and the elderly, and specific modules for them

[2] Includes regional risk factor surveys covering a substantial part of the country or several regions (e.g. CINDI program areas)

[3] Not including other than national HES in the general adult population

Table 4.2 Models of fieldwork for the questionnaire data collection (Data source: HIS/HES database and personal communication with survey coordinators [3])

Country	Survey	Year	Questionnaire data collection in relation to examinations		
			Before	**During**	**After**
Croatia	Croatian Health Survey	2003	None	Face-to-face interview	None
Czech Republic	Health, Lifestyle and Environment	2004	Self-administered questionnaire	None	None
Finland	Health 2000	2000	Face-to-face interview and self-administered questionnaire	Face-to-face interview and self-administered questionnaire	Self-administered questionnaire
	FINRISK	2007	Self-administered questionnaire	Face-to-face interview and self-administered questionnaire	Self-administered questionnaire
France	National Survey on Nutrition and Health	2006	Self-administered questionnaire and face-to-face and telephone interviews	Face-to-face interview	None
Germany	German National Health Interview and Examination Survey	1998	None	None	None
Ireland	SLAN	2006	Face-to-face interview	Face-to-face interview	None
Netherlands	Netherlands Health Examination Survey	2001	Face-to-face interview	None	None

Country	Survey	Year	Questionnaire data collection in relation to examinations		
			Before	**During**	**After**
Norway	Cohort Norway	1994-2003	Self-administered questionnaire	None	Self-administered questionnaire
Poland	WOBASZ	2005	None	Face-to-face interview	None
Slovakia	CINDI Health Examination Survey	2003	Face-to-face interview and self-administered questionnaire	Face-to-face interview and self-administered questionnaire	None
UK	Health Survey for England	2005	Face-to-face interview and self-administered questionnaire	Face-to-face interview	None
	Scottish Health Survey	2003	Face-to-face interview and self-administered questionnaire	Face-to-face interview	None
Canada	Canadian Health Measures Survey	2007	Self-administered questionnaire	None	None
USA	National Health and Nutrition Examination Survey	2005-2006	Face-to-face interview	Face-to-face interview and self-administered questionnaire	None

Table 4.3 Models of fieldwork for the examinations (source HIS/HES database [3] and personal communication with survey coordinators)

Country	Survey	Year	Computer aided data collection during examination	Place of the examination	Average length of examination	Type (number) of personnel carrying out the examinations/ measurements
Croatia	Croatian Health Survey	2003	No	Participant's home	10 minutes	Nurses (number not reported)
Czech Republic	Health, Lifestyle and Environment	2004	No	Normal health care facilities (primary health care)	10 minutes	Nurses (1), physicians (1)
Finland	Health 2000	2000	Yes	Stationary clinic set up in normal health care facilities or other suitable location + Participant's home (if needed)	240 minutes	Nurses (60), physicians (5), dentists (5), dental hygienists (6), laboratory technicians (5)
	FINRISK	2007	Yes, partly	Stationary clinics and primary health care units	60 minutes	Nurses (15), laboratory technicians (10), nutritionists (10)
France	National Survey on Nutrition and Health	2006	No	Participant's home or stationary clinics and health care facilities (primary health care unit)	45-90 minutes	Nurses (100), physicians (70), laboratory technician (30), nutritionist (40)
Germany	German National Health Interview and Examination Survey	1998	No	Normal health care facilities (e.g. primary health care unit)	30 minutes	Physicians (4), laboratory technicians (4), interviewers (8), nutritionists (4), organizer (4)

Country	Survey	Year	Computer aided data collection during examination	Place of the examination	Average length of examination	Type (number) of personnel carrying out the examinations/ measurements
Ireland	SLAN	2006	No	Participant's home, stationary clinic (mobile equipment), normal health care facilities and other suitable locations e.g. hotel as required	35 minutes	Nurses (10)
Netherlands	Netherlands Health Examination Survey	2001	No	Normal health care facilities (e.g. primary health care unit)	30 minutes	Medical technical assistant (1), medical receptionist (1)
Norway	Cohort Norway	1994-2003	Yes	At stationary clinics set up for the examination and mobile clinic	10-15 minutes for the core survey	Nurses (8-16), driver/ technicians (3-4), receptionists (3-4)
Poland	WOBASZ	2005	No	Normal health care facilities (e.g. primary health care unit) or participant's home	70 minutes	Nurses (90), physicians (10), laboratory technicians (20)
Slovakia	CINDI Health Examination Survey	2003	Yes	Public Health Institutions-Health Counselling Centres	60 minutes	Nurses and physicians (number not reported)
UK	Health Survey for England	2005	Yes	Participant's home	Not reported	Nurses (number not reported), survey Physician on-call (1), interviewers (100), laboratory technicians (20)

Country	Survey	Year	Computer aided data collection during examination	Place of the examination	Average length of examination	Type (number) of personnel carrying out the examinations/ measurements
	Scottish Health Survey	2003	Yes	Participant's home	Not reported	Nurses (number not reported), survey Physician on-call (1), interviewers (100), laboratory technicians (20)
Canada	Canadian Health Measures Survey	2007	Yes	Mobile clinic	150 minutes	Senior Health Measure Specialists (6), other Health Measure Specialists (4), laboratory technicians (4), clinic manager (1), clinic coordinators (4), dentists (2), dental recorders (2), site logistics officer (1), household health interviewers (10, plus manager)
USA	National Health and Nutrition Examination Survey	2005-2006	Yes	Mobile clinic	180 minutes	Nurses, physicians, dentists, laboratory technicians, trained/ lay interviewers, nutritionists (numbers not reported)

Table 4.4 Timing of the survey (Data souce: HIS/HES database [3])

Country	Survey	Year	Frequency of the survey	Months	Days of the week	Hours
Croatia	Croatian Health Survey	2003	Irregular	May-July	Information not available	Information not available
Czech Republic	Health, Lifestyle and Environment	2004	Irregular (past years 1998, 2002)	October-December	Monday to Saturday	According to the possibilities of the collaborating centres
Finland	Health 2000	2000	Irregular (first 1978)	January-July, September-December	Monday to Friday (additional Saturdays offered when needed)	07:00 to 21:00
	FINRISK	2007	5 yearly (since 1972)	January- March	Monday to Friday	7:00 to 15:00 (11:00 to 19:00)
France	National Survey on Nutrition and Health	2006	5 yearly	January-December	In clinic Monday to Friday and at home also Saturday and Sunday	07:00 to 11:00
Germany	German National Health Interview and Examination Survey	1998	5 to 7 yearly (since 1984)	January-December	Monday to Saturday	Monday: 10:00 to 20:00 Tuesday-Friday: 8:00 to 20:00 Saturday: 8:00 to 12:00
Ireland	SLAN	2006	4 yearly (past years 1998, 2002)	February-July	Monday to Friday (Saturday if needed)	From early morning to evening

Country	Survey	Year	Frequency of the survey	Months	Days of the week	Hours
Netherlands	Netherlands Health Examination Survey	2001	Continuous between (1998 - 2001), but not ongoing	January-December	Monday to Thursday	8:30 to 14:00
Norway	Cohort Norway	1994-2003	Irregular (past years 1994, 2000)	January-December	Monday to Friday	09:00 to 18:00 (Friday till 14:00)
Poland	WOBASZ	2005	5 to 6 yearly	December, January-May	Monday to Saturday	8:00 to 14:00 .
Slovakia	CINDI Health Examination Survey	2003	5 yearly	March-June	Information not available	Information not available
UK	Health Survey for England	2005	Annually/ continuous (since 1994)	January-December	Monday-Sunday	08:00 to 22:00
	Scottish Health Survey	2003	3 to 5 yearly (since 1995); annually since 2008	June-December	Monday-Sunday	08:00 to 22:00
Canada	Canadian Health Measures Survey	2007	Ongoing (no previous surveys)	January-December	Weekend appointments also possible	Information not available
USA	National Health and Nutrition Examination Survey	2005-2006	Continuous, ongoing (since 2005, previous 1976-80, -82-84, -88-94, 1999-2002)	January-December	Weekdays but also during weekends	Also evening hours

Table 4.5 Measurements that might need to be carried out by physicians in various countries (Data source: FEHES questionnaire: number of countries/contact persons, total 32)

	No physician needed	**Carried out in the presence of a physician or physician needs to be available**	**Carried out by physician**
Blood pressure measurement	28	1	3
Electrocardiogram	22	8	2
Drawing blood samples	20	11	1
Measurement of lung function by spirometry	20	8	4

5. GUIDELINES AND RECOMMENDATIONS FOR HEALTH EXAMINATION SURVEYS

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5.1 INTRODUCTION

Methods that can be used in health interviews and examinations have been developed in innumerable research studies, but the number of international guidelines that are available specifically for health examination surveys is quite moderate. The longest tradition of guidelines is for cardiovascular surveys. WHO published the first edition of their international guidelines on cardiovascular survey methods in 1968 [1]. These guidelines were later revised and updated in 1982 and 2004 [2, 3]. Several standards have been prepared by different organizations for specific measurements, resulting in differences between the existing standards, e.g. for spirometry. In 2005, the American Thoracic Society and the European Respiratory Society published common standards for lung function tests (Miller et al 2005). However, these are focused on clinical settings rather than survey environments. For many other health topics, several gaps still exist in the availability of methodological guidelines and recommendations both for clinical practice and for surveys.

Much work has been done to promote the use of standardized Health Interview Survey (HIS) methods in Europe. In 1988, the WHO Regional Office for Europe initiated a series of international consultations to develop common methods for HIS. In 1996 some general recommendations for methodology and recommended instruments for perceived health, some aspects of disability, chronic conditions, health determinants, and socioeconomic classification were published [4]. As a result of the EuroHIS project, these were updated and supplemented in 2003 [5]. Several Eurostat initiatives have aimed at developing standardized instruments and survey methods, leading to the adoption of the standard European Health Interview Survey (EHIS) Questionnaire in 2006 [6]. The EHIS has been prepared by Eurostat in collaboration with several experts and organizations. The aim is that it will be implemented in EU Member States during the period of 2007-2009. EHIS includes modules for background variables, health status, health care and health determinants. Three Task Forces have developed the guidelines for the methods of EHIS. The results of the first task force have

been published on the development and criteria for the adoption of Health Survey instruments [7].

Despite these several efforts to develop international standards, also doubts have been expressed concerning the need and feasibility of the use of standardized methodology in national or local health surveys in Europe [8]. Several methodological problems, such as difficulties in conceptualization and translation across different cultures and societies, have been reported [9, 10].

This chapter focuses on guidelines and recommendations developed in international collaborative projects. The project Health Surveys in the EU: HIS and HIS/HES Evaluations and Models assessed the comparability of findings of previous HIS and HIS/HES, and summarized the previous and ongoing projects in the 1990's and before the year 2003 [11]. Therefore this chapter comprises mainly projects carried out and/or finalized in 2003-2007. Major earlier activities are included only as background for the recent development. We give an overview of recent international projects that have developed or are currently developing methods for HES. Finally the FEHES contact persons' views on the need for international standards and collaboration for national HESs are summarized.

5.2 INTERNATIONAL PROJECTS

5.2.1 PROJECTS ON CHRONIC DISEASE RISK FACTORS AND CARDIOVASCULAR DISEASES

The WHO MONICA Project collected valid and internationally comparable data on risk factors for coronary heart disease and the incidence of myocardial infarction in geographically defined populations in 21 countries in the 1980s and 1990s. The aim was to compare trends in risk factors and in the disease. The MONICA project laid the basis for international training, quality control and assessment of the achieved quality of the surveys [12]. A detailed manual of operations was prepared, including procedures for sample selection, measurement procedures and quality assurance [13]. The WHO Regional Lipid Reference Centre in Prague, Czech Republic, provided external quality control for the cholesterol determination methods for MONICA partners, but also for other laboratories from 1978 to 1997, when the European level reference laboratory activities ceased. For the American surveys, the standardization has been in the hands of the Centers for Disease Control (CDC) Atlanta for several decades, using methods which guarantee stability of the reference values over the years. The MONICA project made thorough assessment of the standardization [14]. The standardization was successful, although considerable variation in the quality of data was also observed [15]. In a few study areas, such as in two Swedish regions, the MONICA surveys have been repeated at regular intervals also after the project.

The MONICA methods have been used widely beyond the WHO MONICA Project, and were updated for future use in European HES by the European Health Risk Monitoring (EHRM) project, carried out in 1999-2002. The EHRM prepared a recommendation for indicators, international collaboration, protocol and manual of operations (listed in Table 5.1.) for chronic disease risk factor surveys [16]. The experience and technical developments over the 20 years were taken into account, and protocols for other relevant measurements, such as fasting blood glucose, were added. The EHRM recommendations pointed out the importance of establishing a replacement for the previous WHO Regional Lipid Reference Centre to serve European surveys. The WHO Cardiovascular Survey Methods were also updated in 2004 [2]. These latest editions go beyond practical guidelines to different methods for data collection, editing, analysis and interpretation. They provide the conceptual background and literature base for proposed research approaches and procedures.

The Countrywide Integrated Non-communicable Disease Intervention (CINDI) Programme involves demonstration areas in 26 countries of the European Region, plus Canada and Cyprus. The evaluation part of CINDI involves health surveys in the demonstration areas. The CINDI protocol published in 1994 [17] includes guidelines for blood pressure measurement, height and weight measurements, and questionnaires on smoking habits, alcohol, physical activity, diet, and disability assessment (Table 5.1). For measurements that were conducted in MONICA, CINDI adopted the MONICA methods. However, the quality assurance activities have not been as extensive as in MONICA. One of the conclusions of a feasibility study of surveys across CINDI countries was that although countries attempt to follow the agreed principles of the survey implementation, the methodology varied and depended on local conditions and possibilities [18].

The HAPIEE (Health, Alcohol and Psychosocial factors in Eastern Europe) study is a prospective cohort study designed to investigate the effect of several risk factors on cardiovascular and other non-communicable diseases in Eastern Europe and the former Soviet Union [19]. The baseline survey was conducted in 2002-2005 with the total planned sample size 36 500. Data were collected by structured questionnaires and examination in clinic including blood samples, anthropometric measurements, blood pressure, lung function and cognitive function. Re-examination of the cohorts started in spring 2006. Achieving satisfactory response rates was identified as the most serious challenge in the study, as the total response rate for the baseline study was 59%. The HAPIEE study is an ongoing multi-country study, where the experiences in survey co-ordination, participant recruitment and fieldwork organization may provide valuable information needed in assessing feasibility of HESs in these Eastern European countries.

The WHO has several initiatives of standardization of health surveys on an international level. The WHO STEPwise approach to Surveillance (STEPS) focuses on obtaining core data on the established risk factors that determine the major disease burden. It is sufficiently flexible to allow each country to expand on the core variables and risk factors, and to incorporate optional modules related to local or regional interests. The STEPS survey

protocol includes both standardized questionnaires and protocols for the physical and biochemical measurements [20] (see Table 5.1). The STEPS programme is targeted primarily at low and middle income countries outside Europe, providing an entry point to start chronic disease surveillance activities. WHO delivers and funds regional training workshops for planning and implementing STEPS as well as for analyzing, reporting and disseminating STEPS data. For the European HESs, the STEPS programme can be used as an example of an international survey organization with core and optional modules.

The EUROCISS-project (phase I in 2000-2003) has defined cardiovascular disease indicators and survey items including e.g. risk factors (hypertension, hypercholesterolemia, overweight), health behaviours (physical inactivity, smoking) and medication use. Although register-based data (hospital discharges) have mainly been assessed, other sources of information (including surveys) by country have also been evaluated and reported. During its second phase (2004-2007), the project prepared a manual of operations for the implementation of CVD surveys for the collection of standardized indicators, in particular for prevalence of ischaemic heart disease, heart failure, stroke and other CVDs. It also identified a minimum set of questions and examinations to be included in the HIS/HES for evaluating the prevalence of CVDs at European level. [21, 22]

5.2.2 PROJECTS ON RESPIRATORY HEALTH

The European Community Respiratory Health Survey (ECRHS) was the first study that assessed the prevalence of asthma and allergic disease in a large number of countries using a standardized protocol [23]. The protocol was published in 1993 [24]. Men and women aged 20-44 years were randomly selected for the study. A short screening questionnaire was posted and a random sample of respondents was selected for the clinical examination. The ECRHS included a interviewer-administered questionnaire, an indoor environment questionnaire, occupational modules and women's questionnaire, blood samples and the detailed protocol for lung function measurement [25]. The quality control programme included training seminars before the study and quality control visits to each centre during the study. However, a wide variation in participation rates (12-90%) was reported between the 25 countries and 56 study centres [23].

The ECRHS II began in 1998: it was a nine-year follow-up in 14 countries and 29 study centres. Individuals taking part in the clinical stage of ECRHS I were sent a short screening questionnaire and all those who responded were invited to a local fieldwork centre, situated in an outpatient or lung function laboratory in a local hospital or centre. Environmental information was collected by home visits in a subsample of homes, and past and current exposure to air pollution was assessed through retrieval of air pollution records and by a programme of air pollution monitoring. In the fieldwork centre, the following procedures were performed: detailed interviewer and self-administered questionnaires on symptoms, exposure to known or suspected risk factors of asthma, and health service utilization; SF-36, a

quality of life questionnaire, and a disease-specific measure of quality of life; blood samples for measurement of specific IgE and total IgE; and measurement of lung function and bronchial challenge testing. In some centres, samples were stored for later use in DNA studies. Higher response rates have been reported in ECRHS II than in the first stage. [26, 27]

In the first phase of the Indicators for Monitoring COPD and Asthma in the EU (IMCA) project (2002-2004), indicators for monitoring Chronic Obstructive Pulmonary Disease (COPD) and asthma were selected and defined and methods for data collection were recommended. The availability of data from surveys and "routine data" in EU Member States was evaluated. The indicators include health status (e.g. prevalence of symptoms, bronchial hyperresponsiveness, sensitization to allergens, total IgE, BMI), determinants of health (e.g. smoking), and health care (e.g. hospital admissions and primary care visits). The ongoing second phase of IMCA (2006-2008) aims to develop a module to be incorporated in future HESs and to test its feasibility. Four geographical areas in Spain, Italy, Sweden and Germany have been selected to explore the use of innovative technological methods to carry out measurements, validate and transmit the data (fieldwork online) and the use of a telemedicine network to provide training and support online to the fieldworkers. A new questionnaire module based on previously validated questionnaires to estimate the IMCA I indicators will be developed. The project will also explore the feasibility of taking a blood sample at home to measure relevant indicators on allergy (total IgE and specific IgE) and to obtain DNA samples to create a DNA databank in future HES. The pilot includes measurements such as spirometry, pulse-oximetry, exhaled NO, blood pressure, height and weight. [28, 29]

5.2.3 PROJECTS ON DIABETES

The European Diabetes Indicators Project (EUDIP, carried out in 1999-2002) developed indicators for the risk of diabetes and for the situation of diabetes patients in European countries. The European Core Indicators for Diabetes Mellitus (EUCID) project (2006-2007) continues the work of EUDIP to reach agreement on core indicators and methodology. The EUCID project [30] aims to demonstrate the feasibility of the data collection on 27 indicators of Diabetes Mellitus and it's risk factors from EU countries. It will prepare a proposal for collection of data in the future, using a stable paper and electronic platform for reporting. A codebook of indicators has been prepared and surveys (HISs and HESs) have been considered as potential sources of information. Only a few indicators, such as BMI and impaired fasting glucose, are defined for the general population, while most indicators are defined for the diabetic population. [30]

5.2.4 PROJECTS ON NUTRITION

The European Prospective Investigation into Cancer and Nutrition (EPIC) was designed to investigate the relationships between diet, nutritional status, lifestyle and environmental factors and the incidence of cancer and other chronic diseases [31]. It is the largest study of diet and health ever undertaken, carried out in ten European countries in 23 study centres. The recruitment was principally volunteers from the adult population aged 20 years and over, and took place between 1993 and 1999. The subjects agreed to have their health status followed up for the rest of their lives. However in some countries, volunteers from selected groups of persons, such as blood donors or members of the local vegetarian society or members of a health insurance plan, were recruited. The EPIC questionnaires contained common diet and lifestyle questions across each centre (core questions, including standardised Food Frequency Questionnaires, and Health and Lifestyle Questionnaires), and some optional sections or questions. Anthropometric examinations were undertaken by trained observers using standardized methods and included measurements of weight, height and waist and hip circumference. The process for collecting and storing the blood was standardized throughout the participating countries. Additional measurements have been carried out in different study centres. Some validation and quality control results have been published [32]. EPIC includes several follow-up studies and ongoing research activities covering e.g. cardiovascular diseases and ageing, and particular cancer sites.

The European Food Consumption Survey Methods (EFCOSUM) Project [33] involved 14 EU Member States. Consensus recommendations were published in 2002 for sampling, recruitment, fieldwork, biomarkers, interviewer qualifications, and training and quality control. The 24h recall was chosen as the preferred method for assessing the diet. In the EFCOSUM project it was assumed that collection of biological material necessitates special logistical conditions, special safety needs and increases the risk of non-response. Therefore, it was recommended to measure biomarkers in the context of other public health monitoring systems. It was concluded that specific and sensitive markers for the dietary intake of iodine, sodium, iron, folate and vitamin D are available, which have the advantage of being more accurate than intake estimations derived from dietary surveys, but more basic data for the validity of cross-country comparisons are needed [34].

5.2.5 PROJECTS ON MENTAL HEALTH

The European Study of the Epidemiology of Mental Disorders (ESEMeD) (also referred to as the Mental health disability: a European assessment in the year 2000, MHEDEA study) was a cross-sectional study investigating the prevalence of and the factors associated with mental disorders, as well as their effect on health-related quality of life and the use of services in six European countries [35]. Trained interviewers used a computer-assisted personal interview (CAPI) including the most recent version of the Composite International Diagnostic

Interview (CIDI), a well-established epidemiological survey instrument for assessing mental disorders. This was the first international study using the standardized up-to-date methodology for epidemiological assessment in mental health with representative samples (n=6,000 per country). With co-ordinated analyses and rigorous quality control, the study aimed to ensure validity and comparability of results. The European Policy Information Research for Mental Disorders (2005-2007) aims to maximise the realisation of the policy information research, scientific and community potential of the ESEMeD/MHEDEA project [36].

The MINDFUL project [37] developed a database of mental health indicators with metadata (descriptions, definitions and data sources) and statistics (numerical data by indicator/country/year). It recommended a set of survey instruments (see Table 5.1.) and carried out a pilot survey in five countries to test the implementation of the set of mental health indicators [38]. The pilot sample consisted of 2,059 participants interviewed by phone. The conclusions were that the set of indicators could be easily incorporated into general health surveys, as the average length of the interviews was less than 15 minutes and the interviewed persons found the survey easily acceptable. Given the importance of the burden of poor mental health and its high co-morbidity with many physical disorders, it was strongly recommended that mental health measures should be included in any health-related survey. It was also recommended that a mental health survey should be conducted every five to 10 years, with a minimum sample size of 3 000 per country.

5.2.6 PROJECTS ON COGNITIVE AND PHYSICAL CAPACITY

The European Collaboration on Dementia (EuroCODE) -project (2006-2008) aims to develop guidelines and indicators for Alzheimer's disease and other forms of dementia, European guidelines on the diagnosis and treatment of Alzheimer's disease and other forms of dementia, European guidelines for psycho-social interventions in dementia, and European parameters for the risk factors of dementia and risk reduction and prevention strategies. It will develop a network bringing together the main actors in the field of dementia in Europe, such as Alzheimer Europe, Alzheimer's Disease International, the Cochrane Dementia and Cognitive Improvement Group, the European Alzheimer's Disease Consortium, the European Association of Geriatric Psychiatry, the Dementia Panel of the European Federation of Neurological Societies, the INTERDEM (Early detection and timely intervention in dementia) group, the International Association of Gerontology (European Region) and the North Sea Dementia Research Group. The various guidelines and indicators will be developed by specific working groups comprised of representatives of the network partners and other experts chosen for their expertise. The project will provide basis for the development of health survey instruments by gathering existing epidemiological studies and analyzing the respective merits and shortcomings of the individual studies [39].

The baseline wave of the Survey on Health, Ageing and Retirement in Europe (SHARE) was carried out in 2004 in 11 European countries [40, 41]. The survey includes some 27 000 persons aged 50 and over, with a 57 % household response rate (ranging from 38 to 69 in different countries). To ensure comparable data sampling, interview and measurement procedures were harmonized. The survey included measurements of cognitive and physical functioning (such as hand grip strength and walking speed). The second wave of the data was collected in 2006-2007 from the original sample and additional samples from three new European countries. This is planned to be the beginning of a European Longitudinal Ageing Survey. The intensive methodological development and fieldwork protocols applied in SHARE are relevant for the development of HESs.

5.2.7 PROJECTS ON ORAL HEALTH

The European Global Oral Health Indicators Development Phase II (EGOHID II, 2006-2008) continues the work of EGOHID I (2003-2005) to develop and promote the use of common oral health instruments in Europe. It aims to facilitate comparisons of indicator data by promoting standardization of methods. It also aims to improve the capacity of area health services to monitor their oral health improvement activities in a standardized manner. In the longer term, it aims to improve service specifications across health services with a view to maintaining and improving performance, and to enhance the capacity to analyze the social, economic, behavioural and political determinants with particular reference to poor and disadvantaged populations. The EGOHID II will develop recommended common instruments for national health interview surveys, and for national health clinical surveys. The next step is to promote the actual implementation of these instruments in the national oral health interview survey, the national oral health clinical survey and to evaluate their performance. [42] The project has published EGOHID software at the end of 2007 to support the data collection [43]. The recommendations will be published during the year 2008.

5.2.8 PROJECTS ON MUSCULOSKELETAL HEALTH AND PHYSICAL ACTIVITY

The Indicators for monitoring Musculoskeletal Conditions project recommended in 2003 a set of core questions on musculoskeletal pain to be included in all HIS questionnaires. It also recommended questions on function and specific questions about diagnoses in HIS and/or HES. HES was mentioned as the recommended source of information on the prevalence of rheumatoid arthritis, osteoarthritis, osteoporosis fractures and low bone mineral density, but no guidelines for measurement were given. [44]

The European Network for Action on Ageing and Physical Activity (EUNAAPA) project (2006-2008) includes a work package with objectives to collect information on current instruments for the assessment of physical activity and physical function in older people. The project is evaluating the measurement properties and appropriateness of existing instruments

through critical review of the literature and collaboration with other organizations and networks on assessing instruments for evaluating physical activity and physical functioning among older populations. [45] The project has published an overview of instruments currently used in assessing physical activity and physical functioning in elderly people. [46]

5.2.9 PROJECTS ON ENVIRONMENTAL HEALTH AND HUMAN BIOMONITORING

Human Biomonitoring aims to assess human exposure to and health effects from environmental pollutants based on sampling and analysis of human tissues and fluids (e.g. blood, urine) and it is seen as a powerful tool to support environmental policy as well as public health policy. The ESBIO project [47] aimed to prepare the European Pilot Project to develop a coherent approach to Human Biomonitoring in Europe in close cooperation with the Member States in 2004-2007. Several of the pilot aims are also relevant for FEHES as it aims to gain practical knowledge of access to study populations, recruitment procedures and response rates, to test the developed guidelines, protocols and technical procedures for field work, questionnaires, chemical analyses, data handling and processing, to test ethical guidelines and gain experience on ethical rules. The study population for the proposed biomonitoring pilot study will be children (aged 6-11years) and their mothers. Scenario 1 (biomarkers: lead, cadmium, methyl-mercury and cotinine) forms the obligatory element, and Scenario 2 (a number of organic pollutants) the optional part of the project. Questionnaires will be used to assess exposure of the individual pollutants, and blood, urine and hair specimens will be collected.

A questionnaire has been prepared to be used in the EU Human Biomonitoring Pilot Study. It includes questions on children's potential exposure pathways, behaviours and socio-demography [48]. Protocols for blood sampling, urine and hair samples are included. Guidelines have been proposed for data collection (population sampling, recruitment and chemical analysis) [49], and for laboratory selection (criteria for selection, invitation to tender and evaluation of proposals) in the framework of a EU Human Pilot Study [50]. In addition guidelines have been prepared for quality control, data management, data treatment and reporting [51].

5.2.10 USE OF POOLED DATA

Several previous projects, such as the EURALIM (EURope ALIMentation) and EURODEM (the European Community Concerted Action on the Epidemiology and Prevention of Dementia Group), have used pooled data from different European population-based studies. These projects indicate the possibilities and difficulties in pooling data from independent studies without standardized methodology. EURALIM aimed to determine and describe the extent to which European data on risk factor distributions from different populations could be pooled and harmonized in a common database for international

comparisons [52]. The main result of the project was that because of the variability among methods used in the seven independent surveys from six European countries, direct comparisons of risk factor distributions and prevalence between studies were overly problematic. However, international comparisons of within population contrasts by sex, age-group, and other health determinants were considered as meaningful. In the EURODEM project a total of 20 centres participated by sending original data from 23 population studies [53].

Primatesta et al [54] used HIS and HES data from three national surveys (England, Germany and Italy) to investigate the possibility of merging data, and the practices of pooling and analyzing the merged data. The study aimed to compare the self-assessed health status of people with some chosen risk factors for cardiovascular disease. The self-assessed health status was measured by the Short Form Health Survey instrument (SF-36/SF-12). Information on hypertension and obesity were collected by direct measurement and self-reporting. The study demonstrated that the task of merging data collected in national health surveys is possible, but subject to several restrictions because of differences in instruments used, phrasing of questions, and protocols used in the measurements. Similar methodological problems have been identified in other international comparisons based on national survey data.

5.3 INTERNATIONAL ASPECTS OF NATIONAL HESS

International standards and protocols have been developed to improve the comparability of data between different regions and countries. It is anticipated that this will also enhance implementation in countries with less experience of national HESs. However, a possible drawback in countries already having a tradition of national surveys is that the application of international standards and protocols could impact negatively on the assessment of national time trends, if the old and new procedures differ.

In the FEHES questionnaire, we asked our contact persons to assess the importance of different standards, and the way they could be incorporated in national HESs in their country. All contact persons seemed to value the adoption of international standards, and most of them assessed the international collaboration for quality assurance as very important (Table 5.2). International expert consultation was considered most important in countries without much previous experience in national surveys.

We presented two alternatives for a European HES to the FEHES contact persons. The first alternative would be to conduct the European HES as a part of a national survey incorporating some topics and modules to meet the international needs. The other alternative would be to conduct a separate internationally-standardized survey. Most contact persons considered both alternatives as very or somewhat likely in their country (Table 5.3.). Assuming that the international standardization would be funded by an outside source (e.g. by

the European Commission research funds), most contact persons considered that the needed additional national funding could be found. One contact person anticipated that participation in an international initiative, even if only a pilot study would be very useful in convincing national political authorities of the importance and utility of HES, thus increasing the chance of receiving sufficient national funds.

5.4 CONCLUSIONS

Most FEHES contact persons considered international standardization and quality assurance important. However, for countries with a long tradition of national surveys, such as the UK, it is important to find an optimal strategy to integrate the European standards without impeding time trends. There are no fully standardized and internationally comparable HES data in Europe after the WHO MONICA project, for which the data collection ended in the mid 1990s. Several recent projects have focused on specific disease groups or health topics, such as oral health, diabetes, musculoskeletal diseases, mental health, and cardiovascular diseases. Some of these projects are ongoing, and are continuing their work in indicator development and promotion of standardized and comparable survey methodology. The input of these projects is a good basis and several opportunities exist for collaboration for the future development of European standards for national HESs. It is important to notice that some aspects relevant in surveys focusing on specific diseases may not be feasible in national surveys targeted to a sample of the whole adult population.

Several gaps still exist in the availability of methodological guidelines in many health topics, such as in the field of musculoskeletal diseases, and measurement of functional capacity and disability. Even though some recommendations may be available, they have not been properly tested and evaluated in actual field surveys, and there may be lack of agreement on the feasibility and quality of the methods developed and proposed by various experts. One major drawback in respect of biochemical determinations is the lack of a European reference laboratory network and other quality assurance and control schemes. A reference laboratory is needed for providing secondary calibrators for the survey laboratories as well as providing external quality control [16].

In most recent European projects, much work has been done to standardize instruments and measurements. However, standardization of the sampling process has been less successful, and even less attention has been given to differences in survey administration and adaptation of the fieldwork protocols. These require much more attention due to the highly complex circumstances of the European context [9, 10].

Difficulties reported at local level, such as in achieving an acceptable response, can be solved with thorough implementation and addressing different aspects related to survey co-operation throughout the study process [55]. It needs to be accepted that many sources of variation and bias can also be affected by several apparently random factors and culturally

sensitive issues. Thus international standards need to be carefully adapted into national circumstances, at the same time taking care to not jeopardize either international comparability or national time trends.

REFERENCES

[1] Rose GA, Blackburn H. Cardiovascular Survey Methods. Geneva: World Health Organization 1968.

[2] Luepker RV, Evans A, McKeigue O, Reddy KS. Cardiovascular Survey Methods, 3rd edition. Geneva: World Health Organization 2004.

[3] Rose GA, Blackburn H. Cardiovascular Survey Methods, 2nd edition. Geneva: World Health Organization 1982.

[4] de Bruin A, Picavet HSV, Nossikov A, eds. Health interview surveys. Towards international harmonization: WHO Regional Publications, European Series, No. 58 1996.

[5] Nossikov A, Gudex C, eds. EUROHIS: developing common instruments for health surveys: IOS Press, Biomedical and health research, Volume 57 2003.

[6] European Commission, Eurstat, Partnership on Public Health Statistics Group HIS. European Health Interview Survey (EHIS) Questionnaire - English version. 2006 [cited 28 May 2008]; Available from: http://circa.europa.eu/Public/irc/dsis/health/library?l=/methodologiessandsdatasc/healthsinterviewssurvey/2007-2008_methodology/questionnaire_versionpdf/_EN_1.0_&a=d

[7] Tafforeau J, Lobez Cobo M, Tolonen H, Scheidt-Nave C, Tinto A. Guidelines for the Development and Criteria for the Adoption of Health Survey Instruments. Eurostat Working Papers and Studies. 2005 [cited 27 May 2008]; Available from: http://ec.europa.eu/health/ph_information/dissemination/reporting/healthsurveys_en.pdf

[8] Morabia A. Worldwide surveillance of risk factors to promote global health. American journal of public health. 2000 Jan;90(1):22-4.

[9] Fernandez-Ballesteros R. Methodological and theoretical cultivation in cross-European research on ageing. Eur J Ageing. 2007;4(2):97-100.

[10] Tesch-Romer C, von Kondratowitz H-J. Comparative ageing research: a flourishing field in need of theoretical cultivation. Eur J Ageing. 2006;3(3):155-67.

[11] Aromaa A, Koponen P, Tafforeau J, Vermeire C, (eds.). Status and future of health surveys in the European Union. Final report of Phase 2 of the project Health Surveys in the EU: HIS and HIS/HES Evaluation and Models. 2003 [cited 10 March 2008]; National Public Health Institute B15/2003, Helsinki. Available from: http://ec.europa.eu/health/ph_projects/2000/monitoring/fp_monitoring_2000_frep_04_en.pdf

[12] Tunstall-Pedoe H, World Health Organization. MONICA Project. MONICA, monograph, and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva: World Health Organization 2003.

[13] WHO MONICA Project. MONICA Manual, Part III: Population Survey, Section 1: Population Survey Data Component. 1997 [cited 28 May 2008]; Available from: http://www.ktl.fi/publications/monica/manual/part3/iii-1.htm

[14] WHO MONICA Project. Quality Assessment reports. [cited 28 May 2008]; Available from: http://www.ktl.fi/publications/monica/index.html

[15] Tolonen H. Towards the High Quality of Population Health Surveys. Standardization and Quality Control. 2005 [cited 12 May 2008]; Available from: http://www.ktl.fi/attachments/suomi/julkaisut/julkaisusarja_a/2005/2005a27.pdf

[16] Tolonen H, Kuulasmaa K, Laatikainen T, Wolf H, the European Health Risk Monitoring Project. Recommendations for indicators, international collaboration, protocol and manual of operations for chronic disease risk factor surveys. 2002 [cited 4 February 2008]; Available from: http://www.ktl.fi/publications/ehrm/product2/title.htm

[17] World Health Organization Regional Office for Europe. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) Program. Protocol and Guidelines. 1995 [cited 7 March 2008]; Available from: http://whqlibdoc.who.int/hq/1994/EUR_ICP_CIND_94.02_PB04.pdf

[18] World Health Organization Europe. CINDI Health Monitor: A Study of feasibility of a health behavious monitoring survey across CINDI countries. Data book. 2003 [cited 28 May 2008]; Available from: http://www.euro.who.int/document/e79396.pdf

[19] Peasey A, Bobak M, Kubinova R, Malyutina S, Pajak A, Tamosiunas A, et al. Determinants of cardiovascular disease and other non-communicable diseases in Central and Eastern Europe: rationale and design of the HAPIEE study. BMC public health. 2006;6:255.

[20] World Health Organization, Noncommunicable Disease and Mental Health. STEPS Manual. [cited 6 March 2008]; Available from: http://www.who.int/chp/steps/manual/en/index.html

[21] Primatesta P, Allender S, Ciccarelli P, Doring A, Graff-Iversen S, Holub J, et al. Cardiovascular surveys: manual of operations. Eur J Cardiovasc Prev Rehabil. 2007 Dec;14 Suppl 3:S43-61.

[22] Eurociss. 2008 [cited 28 May 2008]; Available from: http://www.cuore.iss.it/eurociss/progetto/progetto.asp

[23] Janson C, Anto J, Burney P, Chinn S, de Marco R, Heinrich J, et al. The European Community Respiratory Health Survey: what are the main results so far? European Community Respiratory Health Survey II. Eur Respir J. 2001 Sep;18(3):598-611.

[24] Burney PG, Luczynska C, Chinn S, Jarvis D. The European Community Respiratory Health Survey. Eur Respir J. 1994 May;7(5):954-60.

[25] ECRHS. European Community Respiratory Health Survey. Questionnaires, Protocols and Instructions. 2007 [cited 28 May 2008]; Available from: http://www.ecrhs.org/quests.htm

[26] The European Community Respiratory Health Survey II. Eur Respir J. 2002 Nov;20(5):1071-9.

[27] ECRHS. European Community Resporatory Health Survey. 2007 [cited 28 May 2008]; Available from: http://www.ecrhs.org/default.htm

[28] IMCA II - Indicators for Monitoring COPD and Asthma in the EU. 2005 [cited 28 May 2008]; Available from: http://ec.europa.eu/health/ph_projects/2005/action1/action1_2005_22_en.htm

[29] IMCA. Indicators for monitoring COPD and asthma in the EU. 2008 [cited 28 May 2008]; Available from: www.imca.cat

[30] EUCID. EUropean Core Indicators in Diabetes - EUCID. [cited 28 May 2008]; Available from: http://www.eucid.eu/eucid/home.do

[31] Riboli E, Kaaks R. The EPIC Project: rationale and study design. European Prospective Investigation into Cancer and Nutrition. International journal of epidemiology. 1997;26 Suppl 1:S6-14.

[32] Klipstein-Grobusch K, Georg T, Boeing H. Interviewer variability in anthropometric measurements and estimates of body composition. International journal of epidemiology. 1997;26 Suppl 1:S174-80.

[33] De Henauw S, Brants HA, Becker W, Kaic-Rak A, Ruprich J, Sekula W, et al. Operationalization of food consumption surveys in Europe: recommendations from the European Food Consumption Survey Methods (EFCOSUM) Project. European journal of clinical nutrition. 2002 May;56 Suppl 2:S75-88.

[34] Ovesen L, Boeing H. The use of biomarkers in multicentric studies with particular consideration of iodine, sodium, iron, folate and vitamin D. European journal of clinical nutrition. 2002 May;56 Suppl 2:S12-7.

[35] Alonso J, Angermeyer MC, Bernert S, Bruffaerts R, Brugha TS, Bryson H, et al. Sampling and methods of the European Study of the Epidemiology of Mental Disorders (ESEMeD) project. Acta psychiatrica Scandinavica. 2004(420):8-20.

[36] EPREMED - European Policy Information for Mental Disorders. 2004 [cited 28 May 2008]; Available from: http://ec.europa.eu/health/ph_projects/2004/action1/action1_2004_04_en.htm

[37] MINDFUK Project. MINDFUL - Mental Health Information and Determinants for the European Level. 2008 [cited 28 May 2008]; Available from: http://www.stakes.fi/mindful

[38] Pez O, Bitfoi A, Carta M, Jordanova V, Mateos R, Prince M, et al. Survey instruments and methods. In: Lavikainen J, Fryers T, Lehtinen V, eds. *Improving Mental Health Information in Europe Proposal of the MINDFUL Project*. Helsinki: Stakes 2006.

[39] Alzheimer Europe. 2008 [cited 28 May 2008]; Available from: http://www.alzheimer-europe.org

[40] Borsch-Supan A, Hank K, Jurges H. A new comprehensive and international view on ageing: introducing the 'Survey of Health, Ageing and Retirement in Europe'. Eur J Ageing. 2005;2(4):245-53.

[41] SHARE. SHARE - Survey of Health, Ageing and Retirement in Europe. 2008 [cited 28 May 2008]; Available from: http://www.share-project.org

[42] ECOHID II. European Global Oral Health Indicators Development - Phase II. 2007 [cited 28 May 2008]; Available from: http://www.egohid.eu

[43] ECOHID. European Global Oral Health Indicators Development. 2007 [cited 28 May 2008]; Available from: http://egohid.smile-on.com

[44] Indicators for Monitoring Musculoskeletal Problems and Conditions. Musculoskeletal Problems and Functional Limitations. The Great Public Health Challenge for the 21st Century. 2003 [cited 28 May 2008]; Available from: http://ec.europa.eu/health/ph_projects/2000/monitoring/fp_monitoring_2000_frep_01_en.pdf

[45] EUNAAPA. European Network for Action on Ageing and Physical Activity. [cited 28 May 2008]; Available from: http://www.eunaapa.org

[46] Frandin K, Rydwik E, Bergland A, Waaler Loland N, Forsen L. European Report. Work Package 4. Expert Survey regarding Assessment Instruments of Physical Activity and Physical Functioning in Older People. [cited 28 May 2008]; Available from: http://www.eunaapa.org/cms/files/EUNAAPA,%20WP4%20REPORT.pdf

[47] European Human Biomonitoring. [cited 28 May 2008]; Available from: http://www.eu-humanbiomonitoring.org/sub/esbio.htm

[48] ESBIO. Development of a coherent approach to human biomonitoring in Europe. D 2.3.2 Questionnaire for the Pilot Study. 2007 [cited 28 May 2008]; Available from: http://www.eu-humanbiomonitoring.org/doc/esbio_wp2.3.2.pdf

[49] ESBIO. Development of a coherent approach to human biomonitoring in Europe. Deliverable D 2.3.1 Guidelines for Population Sampling, Recruitment and Biological Sampling. 2007 [cited 28 May 2008]; Available from: http://www.eu-humanbiomonitoring.org/doc/esbio_wp2.3.1.pdf

[50] ESBIO. Development of a coherent approach to human biomonitoring in Europe. Deliverable D 2.5 Protocol for inter-laboratory comparison and proposal for organisation of laboratory work. 2007 [cited 28 May 2008]; Available from: http://www.eu-humanbiomonitoring.org/doc/esbio_wp2.5.pdf

[51] ESBIO. Development of a coherent approach to human biomonitoring in Europe. Deliverable D 2.4 Protocol for harmonised way of collecting and analysing selected pollutants and for data management. 2007 [cited 28 May 2008]; Available from: http://www.eu-humanbiomonitoring.org/doc/esbio_wp2.4.pdf

[52] Beer-Borst S, Morabia A, Hercberg S, Vitek O, Bernstein MS, Galan P, et al. Obesity and other health determinants across Europe: the EURALIM project. Journal of epidemiology and community health. 2000 Jun;54(6):424-30.

[53] Hofman A, Rocca WA, Brayne C, Breteler MM, Clarke M, Cooper B, et al. The prevalence of dementia in Europe: a collaborative study of 1980-1990 findings. Eurodem Prevalence Research Group. International journal of epidemiology. 1991 Sep;20(3):736-48.

[54] Primatesta P, Marmot M, Kurth B, Gargiulo L. Comparison of HIS/HES data: Health-related quality of life and cardiovascular risk. In: Aromaa A, Koponen P, Tafforeau J, Vermeire C, Primatesta P, Marmot M, et al., eds. *Health surveys: evaluation and recommendations Subproject reports of Phase 2 of the project Health Surveys in the EU: HIS and HIS/HES evaluation on models*. Helsinki: National Public Health Institute B16 2003.

[55] Koponen P, Aromaa A. Survey design and methodology in national health interview and health examination surveys. In: Aromaa A, Koponen P, Tafforeau J, Vermeire C, Primatesta P, Marmot M, et al., eds. *Health surveys: evaluation and recommendations Subproject reports of Phase 2 of the project Health Surveys in the EU: HIS and HIS/HES evaluations and models*. Helsinki: National Public Health Institute, B16 2003.

Table 5.1 Recommendations and reference protocols for HES (published or under development)

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
WHO Cardiovascular Survey Methods	2002	London School of Hygiene Questionnaire Smoking questionnaire MHS Alcohol questions Quality of life questionnaire Leisure Time Physical Activities Food Record Form, Food Frequency Questionnaire	anthropometry blood pressure clinical examination of the heart cardiorespiratory fitness (protocols for treadmills) electrocardiography ultrasound of the heart, peripheral arteries blood sampling (lipids, glucose tolerance testing and insulin sensitivity, insulin levels, insulin resistance)	Sampling, fieldwork and quality control

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
European Health Risk Monitoring (EHRM)	2002	smoking questionnaire, socio-economic status, awareness and treatment of hypertension, awareness and treatment of high cholesterol, awareness and treatment of diabetes mellitus, use of acetylsalicylic acid, use of hormone replacement therapy	blood pressure, blood collection (lipids, glucose), anthropometry (weight, height, waist and hip circumference)	Survey organisation, sampling procedures, recruitment, fieldwork practices and quality assurance.
WHO STEPS Surveillance Manual	2001	Demographic information, Behavioural measurements, Tobacco use, Alcohol consumption, Diet, Physical activity	height, weight, waist circumference, hip circumference, blood pressure, heart rate	Planning and preparing the survey, sampling, fieldwork, training

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
EUROCISS II	2004-2007		Minimum measurements for HES on Cardiovascular, Diseases, Height, weight, Blood pressure, Waist circumference, Total and HDL cholesterol and glucose assay in a non-fasting blood sample Recommended procedures for more specialized CVD tests: Electrocardiogram, Ankle-brachial index, Echocardiography. Ultrasound of peripheral arteries	

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
IMCA II	2006-2008	Questionnaire module	Indicators for Chronic Obstructive Pulmonary Disease and Asthma Pilot study for respiratory measurements in HES: spirometry, pulse oximetry, weight, height, exhaled NO, glucose	
EUCID	2006-2007		Indicators for Diabetes Mellitus, Indicators defined for the general population: BMI, fasting glucose	
European Food Consumption Survey Methods (EFCOSUM)	2002	24 h recall	Biomarkers: folate, vitamin D, iron, iodine, sodium	Sampling, recruitment, fieldwork, interviewer training, quality control

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
MINDFUL	2004-2006	Alcohol dependency: AUDIT-5, Positive mental health: Sense of mastery, Self-Esteem Scale Health status: Mental Health Index (MHI-5), Energy vitality, and Role limitation due to emotional problems from RAND-36, CIDI-SF, Strengths and Difficulties Questionnaire Social and cultural environment: Childhood adversities, List of Threatening Experiences, Oslo-3 Social support scale		
European Global Oral Health Indicators Development Phase II (EGOHID)	2006-2008	Common instruments for national oral HIS	National oral health clinical surveys	

Name of the project/organisation	Year(s)*	Topics covered in the recommendation/protocol		
		Questionnaires	**Measurements**	**Other topics**
Human Biomonitoring (ESBIO)	2004-2007	potential exposure pathways, behaviours socio-demography	blood sampling, urine, hair samples.	Guidelines for data collection (population sampling, recruitment and chemical analysis), for laboratory selection (criteria for selection, invitation to tender and evaluation of proposals),and for quality control, data management, data treatment and reporting
Indicators for monitoring Musculoskeletal Conditions	2000-2003	Recommended core questions on musculoskeletal pain		
EUNAAPA	2006-2008	Instruments for the assessment of physical activity and physical function in older people	Instruments for the assessment of physical activity and physical function in older people	

* Year of the publication/project funding

Table 5.2 Importance of international standards and collaboration for a national HES in European countries (FEHES questionnaire: number of countries/contact persons, total 32)

	Very important	**Important**	**Not important at all**
Adoption of international standards	23	9	0
Continued use of national standards to follow national time trends	14	13	5
International collaboration for quality assurance and control	21	10	1
Receiving international expert consultation	17	12	3

Table 5.3 Participation in a HES with European standards (FEHES questionnaire: number of countries/contact persons, total 32)

	Very likely	**Somewhat likely**	**Not at all likely**
National survey incorporating topics/modules to meet the international needs	7	21	4
Participation in a separate internationally standardised survey	19	12	1
Availability of national funding if international co-ordination and much of the international standardisation would be funded by an outside source	10	16	4

6. LEGISLATION AFFECTING HEALTH SURVEYS

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6.1 INTRODUCTION

As part of the FEHES project, we have assessed the obligations in and limitations of HES data collection due to legal and ethical issues. In conducting research involving humans, fundamental concerns include the ethical conduct of the research itself, the safeguarding of privacy, and obtaining informed consent. We investigated how countries in Europe have addressed these concerns in the HESs conducted to date. We performed a survey using a specifically designed questionnaire, which was included as part of the more extensive "Questionnaire on HES in Europe" (Annex 2) sent to the national contact persons of the FEHES network.

The contact persons from all 32 countries in FEHES completed our questionnaire. We asked these persons to send us copies of the informed consent form and information notice used in the HES or, if no HES had been performed, in similar studies. In this chapter, we provide the results of the survey. We also discuss the issues fundamental to safeguarding privacy and obtaining informed consent, including a brief description of some of the most important reference documents in the ethical conduct of medical research in general and a glossary of terms used in this field.

6.2 ETHICS IN MEDICAL RESEARCH

To have a clearer understanding of how ethical issues in medical research are addressed in Europe, we start with a description of some important documents which many countries have used as a reference for national legislation or recommendations. These documents address issues regarding the ethical conduct of research, the safeguarding of privacy, and obtaining informed consent.

In historical terms, the most important document (and the first to address informed consent in research) is the Nuremberg Code [1], a set of principles for human

experimentation. It was created in 1947 as a result of the Nuremberg trials, in response to the experimentation carried out by the Nazis during World War II. Since then, a number of documents have served as important references. In particular, the Declaration of Helsinki ("Ethical Principles for Medical Research Involving Human Subjects") [2] is considered internationally to be the pillar of ethical standards for biomedical research involving humans. It was created by the World Medical Association (an international organization representing physicians from hundreds of nations) [3] in 1964 and was last updated in 2000. The Declaration outlines the basic principles for medical research, including in-depth coverage of informed consent. It was the first document to introduce the concept of an independent ethical review committee. Another important document is the Belmont Report ("Ethical Principles and Guidelines for the Protection of Human Subjects of Research") [4], created in 1979 in an attempt to summarize the basic ethic principles ("Respect for Persons", "Beneficence", and "Justice") of the U.S. National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research.

The principles of ethics in biomedical research have also been addressed at the government level. Two important acts of the Council of Europe merit mention: the Recommendation of the Committee of Ministers No. R(90) 3 [5] concerning medical research on human beings (6 February 1990) and the Oviedo Convention on Human Rights and Biomedicine (1997) [6].

In our survey, we asked the national contact persons to provide information on legislation regarding the ethical conduct of research involving humans in their countries, specifically:

- Acts regulating the status and/or rights of patients
- Medical research acts
- Other national ethical principles of research involving humans
- International biomedical research guidelines
- Other (contact person asked to specify)

We downloaded the actual laws from the internet and reviewed them for salient points. Information on this legislation for the individual countries is provided in Table 6.1. With regard to acts regulating the status and/or rights of patients, nearly all of the countries surveyed have laws for protecting rights (e.g., the right to physical and mental integrity and security and the right to respect for private life and to dignity of treatment). The right to confidentiality is guaranteed by all of these laws. In some cases, for instance Hungary, reference is made to "professional secrecy". In other countries, such as Cyprus, reference is made to a Data Protection Act. In Portugal, there is a general law on health (the Health Framework Law of 1990) which establishes that the protection of health is a right of citizens

and of the community and that protecting this right is the joint responsibility of citizens, the society and the State, in terms of freedom of research and provision of care, as stipulated in the Constitution and laws.

With regard to medical research acts and international biomedical research guidelines, most of the countries make reference to the Declaration of Helsinki; some also refer to the Oviedo Convention. Finally, all the countries reported that the research protocol must be approved by a regional or national ethics committee; Portugal makes reference to an ethics committee at the institute that performs the survey.

6.3 SAFEGUARDING PRIVACY: DATA PROTECTION AND SUBJECTS' RIGHTS

As stated in the Declaration of Helsinki (Paragraph 21) *"…Every precaution should be taken to respect the privacy of the subject [and] the confidentiality of the patient's information…"*. The need to safeguard privacy has become increasingly important, given the progress made in information technology and the consequent ease of access to data. The most important document regarding this issue in Europe, though not dealing exclusively with medical research, is "Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data" [7]. According to this Directive, *"Member States shall protect the fundamental rights and freedoms of natural persons, and in particular their right to privacy with respect to the processing of personal data"*.

To understand better the procedures applied to the use and protection of data, definitions of some commonly used terms are provided below. More detailed definitions are provided in the above-mentioned Directive.

- *Personal Data* – information regarding an identifiable person, that is, one who can be directly or indirectly identified, in particular by reference to an identification number or to factors specific to his/her physical, physiological, mental, economic, cultural or social identity
- *Processing of Personal Data* – any operation (automatic or not) performed on personal data, for example, collection, storage, adaptation or alteration, retrieval, destruction and dissemination
- *Controller* – the person or entity that determines the purposes and means of the processing of personal data

- *Processor* – the person or entity that processes personal data on behalf of the controller
- *Personal Data Act* (or Data Protection Act) – legislation for protecting the privacy of natural persons in the processing of personal data
- *Sensitive Data* – personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, criminal convictions, and data concerning health or sex life
- *Right of Access* – the right of a human subject to consult the data collected on him/her
- *Duty of Notification* – the obligation of the controller to notify the data protection authorities of the intention to perform data processing, including a description of the processing

Given that performing a HES includes collecting a particular type of personal data (i.e., sensitive data regarding health), respecting the privacy and confidentiality of participants entails carefully controlling the processing of personal data, which may be governed by national-level legislation, often referred to as a "Personal Data Act".

To this regard, the following aspects, which are covered in the above-mentioned EC Directive, are particularly important:

- the authorities responsible for data protection (e.g., Data Inspectorate, Data Protection Board)
- for individual studies, the persons or institutions responsible for controlling the use of personal data (Controller, which could be the study's Project Leader or Principal Investigator), and those who process the data (Processor, including those who analyse the data collected)
- duty of notification
- time limits on the storage of personal data
- right of access to personal data
- transfer of personal data to other countries
- electronic handling/transmission of data (e.g., via Internet)
- information to be given to the data subject

In our survey, we also requested information on legislation for protecting personal data. All countries have a data protection act, except Turkey; most made reference to the aforementioned EC directive (Table 6.1).

The Network of Competent Authorities (NCA) of the Health Information Strand of DG SANCO has also reviewed the legislation on the protection of health data. Although the NCA was not able to obtain information from all Member States, their summary report [8] provides an in-depth analysis. Some passages from this report have been quoted below.

"Obviously health data require a high level of protection due to their sensitive nature. On the other hand, the public interest of health monitoring at population level can be regarded as overriding the privacy interests of the individual. EU Directive 95/46/EC on Data Protection appears to be sensitive to both the needs and rights of the individual citizen and the needs and rights of society. In principle the processing of health data is prohibited. At the same time, exemptions are made for data collection without consent of the data subject for provision of health care services and for important public needs. The EU Member States, however, have interpreted these possibilities in different ways, resulting in extreme differences between Member States: while processing of personal health data is hardly possible in some, sophisticated national data collection systems are present in others."

The report goes on to state that though most data protection acts make reference to the same Directive, *"…there is a lot of confusion. Laws are difficult to interpret and there is no common definition of key terminology […]. Conditions for the exchange of health data between Member States appear to differ. The current situation in Europe seems to be at odds with the situation aimed for by the Directive, whose objective is to provide adequate protection of the fundamental rights of individuals, and at the same time to ensure that Member States cannot use reasons connected with this protection for inhibiting the free flow of personal data between Member States."*

6.4 OBTAINING INFORMED CONSENT (INFORMED CONSENT FORM AND INFORMATION NOTICE)

Research involving humans cannot be performed without the explicit consent of the research subjects. This consent is provided on what is known as an "informed consent form", which must be signed by the individual after he/she has received all of the necessary information on the study and on what participation entails. This information is either provided on the informed consent form itself or in a separate document known as an "information notice". However, obtaining informed consent goes beyond merely getting an individual to sign a written form: it is a process of communication between the individual and the healthcare professional who is conducting the study, with the goal of ensuring that the individual fully understands the scopes of the study, the methods adopted, and how the data will be used. This communication process is both an ethical and a legal obligation. The

concept of consent is relevant to both the performance of the study itself and protecting the privacy of the individual.

The fundamental issues regarding consent in medical research on humans are particularly well expressed in the Declaration of Helsinki. Selected paragraphs from this Declaration are provided below.

> Paragraph 20) The subjects must be volunteers and informed participants in the research project.
>
> Paragraph 22) In any research on human beings, each potential subject must be adequately informed of the aims, methods, sources of funding, any possible conflicts of interest, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it may entail. The subject should be informed of the right to abstain from participation in the study or to withdraw consent to participate at any time without reprisal. After ensuring that the subject has understood the information, the physician should then obtain the subject's freely-given informed consent, preferably in writing. If the consent cannot be obtained in writing, the non-written consent must be formally documented and witnessed.
>
> Paragraph 23) When obtaining informed consent for the research project the physician should be particularly cautious if the subject is in a dependent relationship with the physician or may consent under duress. In that case the informed consent should be obtained by a well-informed physician who is not engaged in the investigation and who is completely independent of this relationship.
>
> Paragraph 24) For a research subject who is legally incompetent, physically or mentally incapable of giving consent or is a legally incompetent minor, the investigator must obtain informed consent from the legally authorized representative in accordance with applicable law. These groups should not be included in research unless the research is necessary to promote the health of the population represented and this research cannot instead be performed on legally competent persons.
>
> Paragraph 25) When a subject deemed legally incompetent, such as a minor child, is able to give assent to decisions about participation in research, the investigator must obtain that assent in addition to the consent of the legally authorized representative.
>
> Paragraph 26) Research on individuals from whom it is not possible to obtain consent, including proxy or advance consent, should be done only if the physical/mental condition that prevents obtaining informed consent is a necessary characteristic of the research population. The specific reasons for involving research subjects with a condition that renders them unable to give informed consent should be stated in the experimental protocol for consideration and approval of the review committee. The protocol should state that consent to remain in the research should be obtained as soon as possible from the individual or a legally authorized surrogate.

As mentioned, we asked the national contact persons for copies of the informed consent form and information notice used for HES or for similar types of studies involving humans. The contact persons from four of the 32 countries informed us that they did not have a specific informed consent form or information notice for HES or similar studies. Specifically, Latvia responded that when a HES-type study was performed in 1991, the country was in the middle of Soviet occupation and that no consent form existed at the time. Malta responded that a model for a consent form does not yet exist for a HES, yet the reference person described those points that according to Maltese law must be covered. Macedonia and Romania responded that there is no specific consent form. For an additional eight countries, it was not possible to obtain a copy of the informed consent form or information notice (Austria, Belgium, Croatia, Czech Republic, Iceland, Luxembourg, Slovenia, and Spain). Thus the information on consent provided in this report refers to 20 countries.

The issues covered in the informed consent forms and information notices used in the HES performed to date are summarized in Table 6.2 and discussed below. The specific studies in which these forms were used are specified in Table 6.3.

The informed consent forms and information notices vary greatly by individual country. Some use a more detailed information notice and consequently a reduced informed consent form. For example, the United Kingdom uses a hefty information booklet.

In some cases, the information notice was mailed to participants before the informed consent form, to provide potential participants with time to read and understand the information before deciding whether or not to participate. In many countries, the telephone numbers of persons or institutions available for providing clarification were provided (usually the project leader). In France and Ireland, a toll-free hotline was created for any questions regarding the information notice; in Lithuania, the telephone numbers of the national and regional ethics committees were provided. In some cases (e.g., France), the duration of the interview and the visit was specified.

An interesting feature of the information notice sent by the contact person in Poland is that the study is described in the wider context of the overall health situation in the country, which could help to understand the importance of the study. *"State of health of the Polish society is still not satisfactory in spite of some improvement. It is mainly connected with improper style of living of Poles and with not sufficient control of well known cardiovascular risk factors that maintain the highest threat of the modern societies".*

Below we discuss some of the key elements of informed consent forms and information notices revealed in our survey (Table 6.2).

6.4.1 GENERAL OR SPECIFIC CONSENT

Some informed consent forms and information notices request that the participant provide general consent only, whereas others require that consent be provided for individual aspects of the study. According to our survey, the latter is required in six of the 20 countries that provided this information. A related point is that some forms and notices specify which tests will be performed. For example, in France, it is specified that a sample of hair will be taken to test for traces of heavy metal and that the participant should not wash his/her hair for three days. Others specify which tests will NOT be performed: in some cases it is only stated that nothing else will be done, whereas in other cases they specify exactly what will not be done (for example, stating that no drug or HIV testing will be performed).

A related issue is that for certain aspects of the studies (e.g. the future use of data or of biological samples, the linking or merging of data with other databases, and the providing of information to the subject's general practitioner), some countries ask for consent, but others merely state that these activities will be performed, so that general consent is also a consent to perform these activities.

6.4.2 FUTURE USES OF DATA

Some informed consent forms and information notices request specific consent to use the data in the future, to contact the subject for follow up or additional research, and/or to link or merge the data with other registries (e.g., cancer registries). In Norway, linking or merging the results of the HES with information in other registries requires not only the consent of the subject but also the approval of the Norwegian Data Inspectorate.

6.4.3 FUTURE USE OF BLOOD SAMPLES

Some forms and notices include a specific request for consent to store blood samples for further medical research. In France, there is a separate detailed consent form entitled, "Biotheque" (bio-bank); on this form it is specified that the Comité Consultatif de Protection des Personnes participant à une Recherche Biomédicale (Consulting Committee for the Protection of Participants in Biomedical Research) has approved the development of the bio-bank.

6.4.4 NAME OF PERSON RECEIVING CONSENT

In many countries, the name of the person who obtains the consent from the subject is specified on the form. In some countries, the signature of the director of the laboratory or a

laboratory technician in the laboratory that conducts the analyses is provided. In Turkey, the signature of an “interview witness” is required.

6.4.5 HOW RESULTS ARE COMMUNICATED TO THE STUDY PARTICIPANTS

The results of the HES are generally provided directly to the subjects. In Bulgaria, the subject is asked if he/she wishes to receive the results of the examinations performed. In Lithuania, study candidates are asked to provide general consent for the entire study, yet it is specified that among the future uses of blood samples stored in the bio-bank is the possibility of studies for the presence of genetic markers of various diseases and that the subjects will not be provided with the results because, as stated on the informed consent form, “It is not yet known what effect these genes have on disease risk”.

6.4.6 INVOLVEMENT OF GENERAL PRACTITIONERS (GP)

In some countries, the subject’s GP is involved. On the informed consent forms and information notices used in the United Kingdom, Portugal and Ireland, there is an explicit request for consent to provide some measures to the subject’s GP. On the consent form used in the United Kingdom, it is also stated that the GP could inform health insurance companies of test results. In France, when the results of analyses are abnormal, the HES organizers will prepare a letter that the subject can give to his or her GP. In Hungary, the subject’s GP is extracted together with the subject and it is this GP who visits the subject, although the study in which this was done was not a HES.

6.4.7 THE POSSIBILITY OF WITHDRAWING FROM THE STUDY AT ANY TIME

In most countries, the consent form explicitly stated that participants could withdraw from the study at any time.

6.4.8 RISKS/BENEFITS RELATED TO PARTICIPATION IN THE STUDY

In Bulgaria, the information notice specifically mentions that blood collection may pose a minimal risk. Insurance coverage is provided for the days in which blood is collected and the medical examinations are performed. In Turkey, it is stated that blood taking poses a risk, though low, of infection or prolonged bleeding. Some informed consent forms and information notices specifically state some of the advantages of participating in the study. For example, in Norway it is stated that the participant will be given a free medical check up; in Denmark the information notice specifies that a health screening test will be performed to

determine whether the individual has an increased risk of developing several common diseases.

6.4.9 CONSENT FORMS SPECIFIC FOR CHILDREN, ADOLESCENTS, AND PERSONS NOT LEGALLY COMPETENT TO PROVIDE CONSENT

Depending on the target population, it may be necessary to take into account the issue of obtaining consent from minors (the definition of which varies by country) or persons not capable of providing consent. According to the results of our survey, the informed consent form or information notice addressed the issue of consent from minors in three countries, though one of the studies was conducted specifically among children and adolescents. None of the informed consent forms or information notices mentioned obtaining consent from persons considered to be incapable of providing it. Although these population groups may not be involved in a European HES, this is nonetheless an important issue, which is covered in the Declaration of Helsinki (see above, Paragraphs 24, 25, and 26).

6.5 RELATIONSHIP BETWEEN INFORMED CONSENT AND LEGISLATION FOR SAFEGUARDING PRIVACY

In the information notice and informed consent form in many countries, explicit reference is made to data protection laws. In Cyprus, prior to gaining access to any personal data, the researcher must have the approval of the Cypriot Ombudsman. In France, explicit reference is made to the law “Informatique et Liberté” (Computing and Freedom), and it is specified that the survey was approved by the Commission Nationale de l’Informatique et des Libertés (CNIL). In Lithuania, it is stated that all personal and medical information will be protected according to the Personal Data Protection Act. In Slovakia, the act on the Protection of Personal Data is cited (Act 428/2002). In Norway, it is stated that the study had been approved by the Norwegian Data Inspectorate. In Malta, according to the Data Protection Act of 2001, it is necessary to notify the Data Protection Commissioner that personal sensitive data will be collected and, if a longitudinal component is envisaged, that patient details will be kept for follow-up.

6.6 CONCLUSIONS

The results of our survey revealed both similarities and differences in terms of safeguarding privacy and obtaining informed consent in the countries considered and that these issues are closely related. In performing a European-level HES, a standardized set of criteria to be adhered to by all participating countries will have to be developed. These criteria will need to be flexible enough to take into account the specific legislation in these countries,

as well as their specific objectives in conducting a HES, which could slightly vary from country to country.

Regarding the safeguarding of privacy, as mentioned, the ease of access to data is progressively increasing, and in conducting a European-level HES all efforts must be made to protect the privacy of individuals. This will constitute quite a challenge, considering that multiple stakeholders will be involved in a European-level HES and that each of them will be required to act in accordance with national-level legislation, which varies from country to country.

With respect to informed consent, it is clear that being truly "informed" signifies awareness not only of what participation in the study itself entails but also of how data and biological samples will be used in both the present and the future. In the European-level HES, although it remains to be decided whether or not separate consent must be obtained for each aspect of the study, the fundamental concern is that participants be completely aware and that the communication process through which information is provided is both an ethical and a legal obligation.

REFERENCES

[1] National Institutes of Health. Nuremberg Code. [cited 29 May 2008]; Available from: http://ohsr.od.nih.gov/guidelines/nuremberg.html

[2] The World Medical Association. Declation of Helsinki. 2003 [cited 29 May 2008]; Available from: http://www.wma.net/e/ethicsunit/helsinki.htm

[3] The World Medical Association. The World Medical Association. 2007 [cited 29 May 2008]; Available from: http://www.wma.net/e/

[4] National Institutes of Health. The Belmont Report. Ethical Principles and Guidelines for the protection of human subjects of research. [cited 29 May 2008]; Available from: http://ohsr.od.nih.gov/guidelines/belmont.html

[5] Council of Europe, Committe of Ministers. Recommendation No. R(90) 3 of the Committee of Ministers to Member States concerning medical research on human beings. 1990 [cited 29 May 2008]; Available from: https://wcd.coe.int/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=569941&SecMode=1&DocId=590274&Usage=2

[6] Oviedo. Convention for the protection of Human Rights and dignity of the human being with regard to the application of biology and medicine: Convention on Human Rights and Biomedicine. [cited 29 May 2008]; Available from: http://www.portaledibioetica.it/documenti/001316/001316.htm

[7] Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data. *Official Journal* 1995:31-50.

Table 6.1 Legislation on data protection and subjects' rights

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Austria	Federal Act concerning the Protection of Personal Data (Datenschutzgesetz 2000 - DSG 2000)	No	No	Yes, but no further information provided.	Yes, but no further information provided.	Regional
Belgium	Royal Decree on personal data protection / public statistics of 04/07/1962 modified on 22/03/2006; see also privacy protection decrees of 01/08/85, 21/12/1994, 02/01/2001, 13/02/2001	Royal decree of 07/05/2004 related to experimentation on human beings and modified 18/05/2006	Royal decree 22/08/2002	Cooperation agreement of 15/01/1993 on creation of a consultative committee for bioethics	No answer	National / Regional / National Commission for Privacy Protection
Bulgaria	Law on personal data protection January 1, 2002	No answer	No answer	No answer	No answer	Regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Croatia	O.G. 103/2003 The act on personal data protection – 18 June	O.G. 175/2003 Ordinance on clinical research and clinical practice	O.G. 169/2004	In the responsible institution, ethical committee approval is needed	O.G. 47/2004 Ordinance of medical ethic and deontology	National / National bioethics committee enacted by the Minister of Health and Social Welfare
Cyprus	The processing of personal data law, 2001 Law 138(1)	No answer	The safeguarding & protection of the patients' rights Law, 2004	National Bioethics Committee Law, 2001 Law 150(1)	Yes, but no further information provided.	National
Czech Republic	Act No. 101/2000 Coll. on the Protection of Personal Data and on Amendments to Some Related Acts	Act No. 20/1966 Coll. on People's Health Care and on the Amendment of Related Laws; Act No. 258/2000 Coll. on Public health Protection and Amendments to Some Related Acts	Act No. 20/1966 Coll. on People's Health Care and on the Amendment to Some Related Acts	Ethical research framework, Resolution No. 1005/2005 of the Government of the Czech Republic	Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects	Regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Denmark	Act No. 429 of 31 May 2000	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Regional
Estonia	2007 new Personal Data Protection law will be passed in the coming months Law 1/10/2003 amended 2003 29/8/1997 amended 2006	2007-2008, Digital Health Record Law which regulates specifically medical data exchange possibilities, but might be difficult for research purposes	No	No	2002 protocol on clones; 2003 protocols on transplants	National / Data Protection Inspectorate
Finland	Personal Data Act 1999	Medical Research Act 1999, Act Amending the Medical Research Act 2004, Decree 2004	Act on the Status and Rights of Patients 1992	Finnish version of the revised Helsinki Declaration, Instruction for researchers and ethics committees drawn up by the National Advisory Board on Health Care Ethics/Sub-committee on Medical Research Ethics in 2001	The Declaration of Helsinki on Biomedical Research 1964, revised version 2000, IEA Guidelines for Good Epidemiological practice	Regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
France	CNIL Loi informatique et liberté août 2004	Loi Bioéthique 6 août 2004	Code de la santé publique	Code de la santé publique	No answer	Regional ethical committee CNIS, CCTIRS and CNIL
Germany	Bundesdatenschutzgesetz 1997; Datenschutzgesetze der Lander (1991-2001)	No answer	No answer	Good Epidemiological Practice Guidelines (GEP) 2005	Declaration of Helsinki, 2000	Regional
Greece	National Independent Authority for Protection of Personal Data: Law 2472/1997 on the Protection of Individuals with regard to the Processing of Personal Data	Particularly with respect to clinical trials and monitored by the National Drug Organization (NDO)	Clinical trials monitored by the NDO: Art.47 Law 2071/92; Law 3418/2005 on medical deontology; Law 2619/1998 on human rights and medicine	Principles of the Committee of Bioethics of the University of Athens	Yes, but no further information provided.	National / Committee of Bioethics of the University of Athens
Hungary	Act on protection of personal data and access to public data Act LXIII of year 1992	Act on management and protection of health and health related data Act XLVII of year 1992	Act on healthcare Act CLIV of year 1997	No answer	Helsinki Declaration, 95/46/EC Directive; Oviedo Convention	National / Regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Iceland	Act no. 77/2000 on the Protection of Privacy as regards the Processing of Personal Data.	Act on Biobanks no. 110/2000	Act on the Rights of Patients no. 74/1997	Regulation on clinical trials of medical products in humans No. 443/2004. Regulations on the keeping and utilisation of biological samples in biobanks No. 134/2001. Regulation on Scientific Research in the Health Sector No. 552/99.	No answer	National / Icelandic Data Protection Agency
Ireland	Data protection Act 1988 and the Data Protection Amendment Act 2003	Health (Corporate Bodies) Act 1961 and the Industrial Research & Standards Act 1961	Nurses Act 1992, Medical Act 1894, Misuse of Drugs Act 1981, Medical practitioners Act 2006, Poisons Act 1964 and radiation Safety Act 1975	Medical Council of Ireland. A Guide to Ethical Conduct and Behaviour 6th Edition, 2004	WMA Declaration of Helsinki, 2000 and International Ethical Guidelines for Biomedical Research Involving Human Subject, WHO 2003	National / Regional / University Ethics Committees

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Italy	Italian Personal Data Protection Code (Legislative Decree No. 196 of June 30, 2003); Code of conduct and professional practice applying to processing of personal data for statistical and scientific purposes, 2004 (sect 106 Leg Decree 196/03); Administrative Decree: Electronic Data Transmission Pertaining to Clinical Medical Experimentation, 2000	Italian Medical Deontology Code, 2006	Italian Medical Deontology Code, 2006	Opinions of the Italian National Bioethics Committee	Declaration of Helsinki, 2000	National / Regional
Latvia	Personal data protection law, 2000	No	No	No	Directive of EU Commission 2005/28/EU	Ethics committee at the University
Lithuania	Law on Legal Protection of Personal Data Jan 2003	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	National/ Regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Luxembourg	2002 Loi du 2 août 2002 relative à la protection des personnes à l'égard du traitement des données à caractère personnel.	1984	1998	No	No	National / Commission for data protection
Macedonia	Law on personal data protection – 25 January 2005 – No. 07-378/1	No answer	No answer	No answer	No answer	National
Malta	2001 Data Protection Act - ACT XXVI of 2001, amended by Acts XXXI of 2002 and IX of 2003; and Legal Notices 181 and 186 of 2006.	No	No	Health Ethics	No answer	National / Data Protection Office
Netherlands	Law for Protection Personal Data 2001	Code of Conduct for medical research	No	No	No	Regional
Norway	Act of 14 April 2000 No. 31 relating to the processing of personal data (Personal Data Act)	The Act on the application of Biotechnology in Human Medicine 2003-02-21 no 12	Medical registers act 2001-05-18-no 24 - Act on the right of patients 1999-07-02 no 63	Medical ethical committee, national and regional	Declaration of Helsinki, 2000	National / regional

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Poland	Personal Data Protection Act - August 29, 1997, amended 2006	No answer	No answer	Decree of Polish Minister of Health 10/12/2002 (Directive 2001/20/EC of the European Parliament and of the Council)	Good clinical practice (Directive 2001/20/EC)	Regional
Portugal	Act 67/98 on the protection of Personal Data	No answer	No answer	No answer	No answer	Ethics committee of the institution responsible for the survey
Romania	Law no. 102/2005	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Ph commission; Mo Health
Slovakia	Act 428/2002 on protection of Personal Data (amended 2003, 2004, 2005)	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	Yes, but no further information provided.	National / Regional
Slovenia	Personal Data Protection Act, 2004 (newest update)	Healthcare Database Act, 2000 (new version in preparation)	NO (but in a process of adopting)	Ethical Committee of the Republic of Slovenia	No answer	National

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
Spain	Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal	Ley 16/2003, de 28 de mayo, de cohesión y calidad del Sistema Nacional de Salud	Ley 41/2002, de 14 de noviembre, básica reguladora de la autonomía del paciente y de derechos y obligaciones en materia de información y documentación clínica	No	No	Consejo Interterritorial del Sistema Nacional de Salud
Sweden	1995 Personal Data Act (1998:204)	1998	2007	2004: Etikprovningslagen http://epn.mirror.nu	2006	Regional
Turkey	No	National Institutional Ethical Committees are present Medical Deontology Regulation (13 January 1960)	Basic Law on the Healthcare Services (15 May 1987)	The Amendment Relating to Drug Research (29 January 1993); The Guideline of Good Clinical Practice and The Guideline of Good Laboratory Practice (29 December 1995)	Yes, but no further information provided.	National / Universities and State Training and research hospitals

Country	Data Protection Act	Medical Research Act	Act regulating the status and/or rights of patients	National ethical principles of research involving human subjects	International biomedical research guidelines	Ethical approval
United Kingdom	Data Protection Act of 1998	NO: Not for HES, but there is an act for fertility / embryology research	Found information for Rights of patients but cannot locate specific info with relation to HES	Various ethical principles for conducting research with human participants can be found, many universities seem to have a document. The General Medical Council and the Medical Research Council, among others, have documents.	First initiated in 1982; Freedom of information Act 2000	National / Regional

Table 6.2 Specific points covered on the information notice and informed consent form

Item	BG	CY	DK	EE	FI	FR	DE	GR	HU	IR	IT	LT	NL	NO	PL	PT	SK	SE	TR	UK
Declaration of having received and understood the information notice	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Assurance of data confidentiality	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Request for general consent only (i.e., for all aspects of the study)	X	X		X	X		X		X	X	X	X			X		X	X	X	
Possibility of consenting to only certain parts of the study			X			X		X					X	X		X				X
Future uses of data specified in detail					X						X		X	X						
Request/statement to contact subject for follow up or additional research	X		X				X	X			X	X	X	X						
Request/statement to link/merge data with other Registries (e.g., Cancer R., Causes of Death R., Municipal R., National Census),			X		X			X			X	X	X	X						X
Request/statement to store blood samples or urine specimen for further medical research / biobank	X		X			X	X				X	X	X	X		X		X		X
Explicitly stated that certain tests will not be performed on samples (e.g., HIV or drug use)																				X

Item	BG	CY	DK	EE	FI	FR	DE	GR	HU	IR	IT	LT	NL	NO	PL	PT	SK	SE	TR	UK
Explicitly stated which tests will be performed on samples	X		X			X	X			X		X			X			X		X
Stated that tests will be performed without specifying which ones				X				X	X		X		X	X						
Name of person receiving the consent specified	X		X	X	X	X						X			X				X	X
Request/statement to inform the person's general practitioner of some measures (e.g., blood pressure, lung function)									X	X		X				X				X
Possibility of withdrawing from the study at any time	X	X	X		X	X	X		X	X	X	X	X	X	X			X	X	X
Consent forms specific for children and adolescents						X	*													X

* The study is specific for children and adolescents

BG – Bulgaria, CY – Cyprus, DK – Denmark, EE – Estonia, FI – Finland, FR – France, DE – Germany, GR – Greece, HU – Hungary, IR – Ireland, IT – Italy, LT – Lithuania, NL – Netherlands, NO – Norway, PL – Poland, PT- Portugal, SK – Slovakia, SE- Sweden, TR – Turkey, UK – United Kingdom

Table 6.3 Studies for which the described information notices and informed consent forms were used

Country	Survey	Institution / Organization
Bulgaria	Balkan Endemic Nephropathy (BEN): Environmental/Clinical Epidemiology (2003-2007)	National Institute of Health
Cyprus	Standardized Consent Form –	--
Denmark	HELBRED 2006 (2006-2008)	Research Centre for Prevention and Health – Glostrup University Hospital – Copenhagen County
Estonia*	CVD risk factors in young families of Tallinn	Estonian Institute of Cardiology
Finland	Health 2000 was a health interview/examination survey carried out in Finland from fall 2000 to spring 2001	National Public Health Institute (KTL); Statistics Finland
France	Etude Nationale Nutrition Santé (ENNS)	Institut de Veille Sanitaire (InVS)
Germany	KiGGS The German Health Survey for Children and Adolescents (2005)	Robert Koch Institut (RKI), Berlin; Federal Environmental Agency (UBA). On behalf of the Federal Ministry of Health and Social Security and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Greece *	EPIC European Prospective Investigation into Cancer	Department of Nutrition and Biochemistry of the Athens School of Hygiene; Department of Hygiene and Epidemiology of the University of Athens; Hellenic Society for Food and Nutrition
Hungary*	The incidence and clinical characteristics of Metabolic X Syndrome study (2006)	Medical and Health Science Centre of University of Debrecen; National Public Health and Medical Officers' Service; Department of Internal medicine of University of Debrecen Hungarian Diabetes Association; SANOFI-AVENTIS

Country	Survey	Institution / Organization
Ireland	SLAN 2006: Survey of Health and Lifestyles	The Royal College of Surgeons in Ireland (RCSI);- The Economic and Social Research Institute (ESRI); University College Cork (UCC) ; The National University of Ireland Galway (NUIG)
Italy	The Italian Cardiovascular Epidemiological Observatory (1998)	Association of Hospital Cardiologists; National Health Institute (ISS)
Lithuania	HAPIEE (Health, Alcohol and Psychosocial Factors in central and Eastern Europe) study among Kaunas population aged 45-72 (Lithuania) – 2006	Institute of cardiology of Kaunas University of Medicine
Netherlands	Regenboog Project 1998-2001 (NETHERLANDS HES 2001)	National Institute for Public Health and Environment (RIVM); Statistics Netherlands (CBS); Municipal Health Centres
Norway	MoRo Project 1998-2001 is part of COHORT NORWAY 2002 (database that comprises information from several examination surveys)	Norwegian Institute of Public Health (FHI)
Poland	WOBASZ: Polish National Multicenter Health Survey – 2005	National Institute of Cardiology in Warsaw, Lodz Medical University, Medical Academy in Gdansk and Poznan, Silesian Medical Academy, Collegium Medicum of Jagiellonian University
Portugal*	National Serological Survey – 2001/2002	National Institute of Health; General Directorate of Health
Slovakia	CINDI 2003	Regional Authority of Public Health Banska Bystrica
Sweden	MONICA-projektet och Medicinska biobanken	Umea Universitet
Turkey	Example of Consent Form	--
United Kingdom	The Health Survey for England: 2004	National Centre of Social Research (NatCen); University College London (UCL); Department of Health

* Study cannot be defined as a “HES”

7. SAMPLING AND RECRUITMENT

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7.1 INTRODUCTION

To be able to carry out nationally representative and comparable health examination surveys (HESs) in the European countries, it is important to have a common understanding and definition of the respective populations we want to obtain data on and also, to understand and agree on how a sample of this population can be drawn.

One important prerequisite for a HES is the availability of an up-to-date sampling frame, which is a list of units (most often persons) with contact information for the target population.

In the first section of this chapter some main explanations about and characteristics of target populations and sampling frames used in different countries for HES and health interview surveys (HISs) are given. General knowledge about sampling techniques and sample sizes are presented as well. Information is available through the HIS-HES-database and from the "Questionnaire on HES in Europe" (Annex 2).

A trend towards decreasing participation rates has been reported in several European countries during the last decades [1], and recruitment methods are of increasing interest for this reason. The second section of this chapter describes briefly recruitment strategies and methods used to increase participation in different countries, based on both available recent literature and on information collected through the "Questionnaire on recruitment and participation" (Annex 3). Both questionnaires were sent to our FEHES contact persons in 32 countries.

7.2 SAMPLING

7.2.1 THE TARGET POPULATION

The target population for a survey is a set of units (individuals, households) that we want to get data from. In survey sampling theory, this target population is finite, meaning that the units can be labelled (i.e. identified by names or numbers) and counted. This is different from populations in other fields of statistics where the population is a concept. For instance, if you carry out an experiment to test the effect of a new medicine for patients with diabetes, the population to which the results will be generalised is “patients with diabetes” as a concept, and not a finite set of individuals.

The first step in planning a survey is to define the target population. Important characteristics of the target population are i) a finite size, ii) existence within a specified time interval, and iii) accessibility. The population within a country or within any geographical area is continuously changing. As people are born, aging, dying and migrating, it is crucial to specify the time interval together with the population characteristics. In addition, the target population (e.g. the individuals) in that specific area has to be accessible either directly through a population register or indirectly through another sampling frame (a list of units covering the target population, e.g. a list of households, housing addresses, maps). The definition of the target population determines for whom the results should be considered relevant.

Some people may be physically or mentally incapable of taking part in the examinations or providing information on their health. Some groups of incapable people may be identifiable as such in the sampling frame, like people living in institutions. Institutionalised persons have been regarded as being ineligible for the survey, and this criterion has been used to exclude these groups from the target population [2]. In other cases these groups may be missing from the sampling frame initially.

Unfortunately, the above a priori considerations mean that a proportion of the people we should examine are excluded. The institutionalised elderly have more illnesses and disabilities than the rest of the population and excluding them leads to underestimation of health problems. Since care delivery and criteria for institutional care differ between different countries, such exclusions will also distort comparisons.

Exclusions in general limit generalisation of the results. In typical household health interview survey the results may be representative for the non-institutionalised population but not for all adults.

7.2.1.1 TARGET POPULATION IN EUROPEAN COUNTRIES

In earlier European surveys the target population was chosen differently in different countries conducting the surveys (Table 7.1). All European countries with a recent national HES, and some of the countries with regional HES experience, have given information about the target population in the HIS-HES-database [3]. The age range in the surveys differed considerable from narrow 45-72 years to a wide age range without any age limits. In a few countries children were included, and some included elderly people. In previous HESs from the countries reporting an age range, most included persons aged 25-64 years. Recent HES from Czech Republic and Ireland did not include the young age groups and started their HES at 45 years. From six countries including the oldest citizens, only two had also included institutionalized elderly in the survey.

Languages used in survey materials may in practice cause exclusion. Where a large proportion of the sample does not master any of the majority languages in a country, special facilities have sometimes been provided. In surveys in England, Germany and Norway efforts were made to include ethnic minorities by using several languages (see Section 7.3.1). The Finnish Health 2000 survey provided interpreters for persons using other languages than Finnish and Swedish.

7.2.2 SAMPLING FRAMES

A sampling frame is a list of individuals in the target population from which a sample can be drawn. The sample is drawn by names, by other personal identification, by households or by addresses.

An ideal sampling frame includes all population units while excluding a defined “non-population”. Moreover, it has no duplicates, assigns the units correctly to clusters (by age, educational level, etc.) and contains correct auxiliary information. It also has up-to-date contact information [4].

The available sampling frame, as different from ideal ones, may not cover all population groups we wish to survey. Examples of groups not covered by a frame can be children, homeless persons, individuals with no legal residence, persons in institutional care, and persons with a temporary residence. Very often, if not always, the target population for a survey needs to be limited to the population covered by the frame. However, it is vitally important to try to overcome the weaknesses of available sampling frames.

Available frames have what is called over-coverage and/or under-coverage. Over-coverage consists of frame units that do not cover units in the target population, e.g. persons who have recently emigrated or died or are listed in duplicate. Under-coverage consists of units that should have been in the frame but are not there. Coverage errors occur in changing populations since the frames are not completely up-to-date and there is always a time lag

between the most recent updating of the sampling frame, the sampling, and the data collection. Over-coverage will often, however not always, be uncovered in the data collection and can be removed from the sample. An example of over-coverage being problematic is from two countries taking part in MONICA. Both countries had major over-coverage in the sampling frame, and the contact information was not up-to-date. As a result, it was never possible to tell, for a substantial percentage of the initial sample, if the persons belonged to the target population or not.

Under-coverage will usually not be identified and may, if considerable, lead to bias in the estimates from the survey. This is counteracted by continual updating of the frame until the end of the reference period for the survey. If the survey is long-term, sampling might occur in several stages to be based on an as up-to-date frame as possible.

Possible sampling frames

Population register	In a continually updated population register, all inhabitants with valid residence permit are included (however with some time lag).
Census	A census includes the entire population at a fixed time. Problems increase with time since the last update.
Electoral register	Listing adult people eligible for voting in election. Mostly used when population register or an updated census are not available.
General practitioner list or lists from other health care organisations	Lists of patients from physicians (general practitioners, GPs) may cover all citizens in some countries, but in general only those who seek a doctor. The lists may be advantageous for the possibility of including non-citizens or the institutionalized.
Telephone directory	Telephone lists may not include all, and the coverage of households will differ between the countries. The lists often name one family member only, and persons may be listed twice.

Postcode address file	The frame lists each house in the street/area or each private household address, but has no information about the people living at the address. In this way, non-citizens are included.
High school/ university lists	The list may be useful for supplementary contact information.
Address list	The list may be useful for supplementary contact information.
Insurance registers	The list may be useful for supplementary contact information.
Maps [5, 6]	Maps of administrative or statistical geographical units along with reasonably good statistics of their population sizes.

It is essential to know how completely the sampling frames account for deaths, migration and change of address and to what extent temporary addresses are taken into account and how up-to-date they are. From the potential sampling frames listed above, the population register will normally have the best coverage, but the update intervals vary. In a continually updated population register, all inhabitants (including also those with valid residence permits) are included. But there are population groups without valid residence, such as refugees, the homeless, seasonal workers and long term tourists. In general, the delay in notifying changes when people move from one residence to another will contribute to error. Thus, the contact information will never be fully up-to-date.

Regarding telephone lists, the increasing number of mobile phones and decreasing number of fixed lines in most countries, as well as an increasing proportion of unlisted numbers, causes further problems [2]. There may be registers covering temporary inhabitants like seasonal workers, students (high-schools and universities' lists, postal register) and long-term tourists (postal address or properties list).

7.2.2.1 SAMPLING FRAMES IN EUROPEAN COUNTRIES

From the Questionnaire on HES in Europe (Annex 2) we obtained information about existing and preferred sampling frames and their coverage and updating (Table 7.2). From 23 countries with a population register (national or regional), 16 preferred to use them for the sample for HES. Census lists were preferred by seven countries as the sampling frame and electoral rolls by three countries.

The Postcode Address List was preferred by UK [7, 8]. Addresses are selected rather than individuals, which gives the opportunity to reach all people in the target population, temporary as well as permanent residents (except for homeless people). In this way it is easier to include students, refugees, foreign temporary workers and other population groups not registered in official registers. For example, the English HES uses the Small User Postcode Address File, to try to limit the sampling frame to domestic addresses and not businesses. When calculating response rates, the numerator would become relatively valid and correct, but a correct denominator would be difficult to assess, as the exact number of individuals in each of the addresses not visited will be unknown.

The population registers were continually updated in 14 of the 16 countries preferring to use them. Among the seven countries wanting to use census data, three had them continually updated. Among three countries wanting to use data from electoral rolls, one had them continually updated. The population registers covered the entire population in 11 of the 16 countries. The census data covered the entire population in five of the seven countries with a preference for using these (Table 7.2).

Altogether nine countries had a continually updated population register covering the whole population. All nine countries also indicated in the FEHES questionnaire that they wanted to use the population register in a future HES. In addition, Bulgaria and the Czech Republic have population registers covering the whole population, and are "annually or more frequently updated". Lithuania, Latvia, Poland, Slovakia and The Netherlands have population registers which are continually updated, but may have some problems to cover the entire population, as institutionalized persons or non-citizens are not in the frame (Table 7.2).

Three countries provided no information about a preferred sampling frame for HES, but two of these countries reported that they had a population register (Hungary and Poland). At present we have no knowledge about possible sampling frames in Austria and Northern Ireland (UK), but we know that recent national HISs or a census have been carried out in both countries.

Maps are important for dividing each country into small areas or neighbourhoods of suitable sizes to be handled by an examination clinic. Maps may be the basis for carrying out a survey in countries where no individual or postal code based frame exist. This is the case in the US NHANES survey. The design of NHANES is roughly described on [5] as follows: *"In simple terms, NHANES divides the United States into communities. The communities are divided into neighbourhoods. The neighbourhoods are selected at random. From each neighbourhood, housing units are selected at random. Selected households are approached by our interviewers who ask residents a few short questions to determine if their household is eligible for the study"*. The neighbourhoods described here must be small enough to make this approach feasible.

7.2.3 SAMPLE SIZE

Sample size depends on the topics to be studied and their occurrence in the population as well as the size of the differences (between sexes, regions, and population groups) one needs to detect. It is important to note that sample size does not depend on the size of the target population. Relatively common public health problems can be well described in HES, whereas rare conditions can most often not be analysed by geographical and socioeconomic groups. The conclusion from the above is that sample size in national HES is a compromise between characteristics of the target population, study aims and survey costs.

The following is a theoretical presentation of sample size determination.

The sample size depends on:

1. Measurement characteristics: the planned level of precision in estimates of disease prevalence, levels and distribution of risk factors and other measures. The precision of an estimate from a survey is measured by the standard error. The lower the standard error is the higher the precision. In one-stage samples, the standard error decreases by $1/\sqrt{n}$ where n is the net sample size. The standard errors are less dependent on the finite population size.

2. The variation of the value of the characteristic among sampling units. For comparing results with other nations and earlier national results, the variation within each nation matters. If results are planned for subgroups in the national target population, the sample sizes for some of the subgroups may have to be increased, depending on the relative size of these groups and the variation within them. A very important consideration is the need to make geographical and socioeconomic comparisons. Estimates for these requirements must be made.

National health surveys are a special case, however, since they are multipurpose and make statistical sample size calculations problematic. For a practical rough estimate of sample size it is advisable to look back at previous international experiences. Thus, the original NHES studies in US employed samples of 8 000 persons to represent the whole of US, the recent Canadian health measures survey between 7 000 and 8 000, The Netherlands Regenboog survey 7 000, the original Mini-Finland survey 8 000 persons and the Finnish Health 2000 survey 10 000 persons. To allow sufficiently large samples by region, the Finnish FinRisk Survey included a total sample of 13 500 adults. Large samples have been used in the German HESs, for adults 13 000 and for children (KiGGS) 28 000.

7.2.3.1 SAMPLE SIZES IN EUROPEAN COUNTRIES

Table 7.3 shows the sample sizes in European HESs. For most European HESs the samples size was 7 000-13 000 persons. The purpose of most of these surveys was research in addition to health monitoring. The high number in some countries was either because of the survey's additional use for research or because precise information for sub-groups of the population was desired, to monitor inequalities or to identify or monitor target groups for interventions.

7.2.4 SOME BASIC SAMPLING TECHNIQUES

The purpose of sampling is to obtain information that is representative of the full population of interest, without the need to examine everybody in the population. With good sampling, the number of people examined can be only a small fraction of the total population, and the required sample size is practically independent of the size of the total population (see section Sample size above.) Such a sample can be obtained through probability sampling, where the probability of each possible sample is determined by the sampling scheme. Probability sampling allows unbiased estimation of the population characteristics of interest and the estimation of the error of the population estimates. Non-probability sampling should be considered only in situations where everybody is selected, such as everybody in a household when households have first been selected through probability sampling. (Choosing everybody is actually a special case of probability sampling, where all are selected with probability one.)

Probability sampling can be classified into one-stage sampling and multistage sampling. In one-stage sampling, there is probability sampling in a single stage, whereas in multistage sampling, there are several stages of probability sampling, and the next stage of sampling is carried out within the selected sampling units of the previous stage. As an example of a three-stage sampling that may be relevant for HES, in the first stage municipalities of the country are sampled, in the second stage households of the selected municipalities are sampled, and in the third stage, one individual from each selected household is sampled. In each stage of a multistage sampling, one-stage samplings are carried out.

In multistage probability sampling each stage has its sampling frame. Often, administrative units are drawn at random in the first stage, for instance municipalities from a list of all such unites. In the second stage, individuals are drawn within each of the first stage units (example: inhabitants are drawn within each drawn municipality). This method will make it less expensive to carry out measurements and face to face interviews by reducing the costs of travelling per participant. This may be the only feasible method, if there are regional but no national population register with individuals as the units. This is the only feasible method for HESs also in large countries and countries with complicated communications.

A special case of one-stage sampling is the simple probability sampling, where each possible sample of *n* units has the same probability of being selected. Such a sample is easy to analyze, but is not often feasible for a HES because it may require long travel of the participants or examination teams. Another example of one-stage sampling is cluster sampling, where the population is divided into subgroups (clusters). A sample of clusters is drawn, and all members of the selected cluster are selected to the next stage. The Health Survey for England is an example of cluster sampling. A sample of households (clusters) is selected, and everyone in the selected households is examined. The use of cluster sampling and two-stage sampling can be cost-effective; in particular if the survey is carried out with home-visits, since less travelling will be necessary to reach the same number of individuals. However, if there are positive intra class correlations within the clusters for some variables of interest, cluster and two-stage sampling will lead to increased sampling variances compared to sampling the same number of individuals directly.

In ”two-phase sampling” a large sample is selected first. In this large sample information is collected by a short questionnaire or a non-expensive test, in order to screen for a defined condition, which could be symptoms suggesting a disease. An example from Norwegian surveys is to screen all health survey participants by means of a test for non-fasting serum glucose, and in this way define a subpopulation at increased risk of diabetes. In the next phase one can sample e.g. 10 percent within this high-risk subgroup or invite the whole high-risk group for extended examination.

In stratification, the population is first divided into non-overlapping subpopulations called strata, and sampling is then carried out independently within each stratum. The sampling fraction can be the same in all strata (proportional allocation) or there can be different fractions in different strata. Stratification is possible only if the necessary information on the strata is available in the sampling frame. By use of population register or census as sampling frame, stratification can be applied for age, sex, marital status, region, urban- or rural area, socio-economic status, country of origin or living in institution. If proportional allocation was not used in the stratified sampling, the data have to be weighted to give population representative results, and the information needed for assigning the weights will need to be collected when planning and during the sampling.

If a subgroup of interest of the population would otherwise have too small a number of representatives in the sample to obtain conclusive results about it, the sampling probabilities of its members can be increased. Examples are sparsely populated areas, age groups or other specific interest groups, such as children, adolescents or the elderly, disabled persons and minority groups. The sampling probabilities can be increased for example by suitable stratification or by over-representation, where one chooses to add extra units to the number otherwise invited. To obtain representative results on the entire population, the individuals of the over-represented subgroup need to be given smaller weights in the over-all analysis, or the over-represented individuals can be left out from the analysis.

7.2.4.1 SAMPLING TECHNIQUES USED IN RECENT EUROPEAN SURVEYS

Table 7.4 summarizes the sampling designs and procedures of recent European HESs. Most of the surveys used multistage sampling. Only four of the surveys included a stage of selecting households. From the five surveys using a household sample, three included all household members within a certain age and two included only one person per household. Among countries where household was not used as a sampling unit, none reported selecting additional household members.

All national HESs used multistage probability sampling. A household sample was used in England, Scotland, France and Croatia. In England an Scotland, all household members aged 16+ and up to two children aged 0-15 were included, whereas in the other two countries only one household member was selected for the sample. Among the countries with regional HES, Cyprus and Slovakia used multistage probability sampling, while Norway invited all residents within certain age groups to participate. Over-sampling and stratification was applied for age, sex, ethnic groups and geographical area in several surveys.

7.2.5 CONTACT RATES AND PARTICIPATION RATES

To be able to compare participation rates between countries it is of importance to use the same definition of the term “participant”. In a HIS, a participant may be defined as somebody for whom the survey questionnaire or a part of it was filled in. For HES, however, it is more relevant to define a participant as a person who both has at least one valid examination measurement, like measured weight and height, in addition to some questionnaire results.

An issue remains whether the sampling frame should be corrected for people who should not have been in it at the time of HIS or HES. Specially, those who had died before the contact date or had moved permanently abroad or to another area had no chance to be contacted. In fact, they should not have been in the sampling frame. In many surveys these people are removed from the denominator before calculating the true response rate.

In the WHO MONICA study, participants were defined as the sample members who answered the main study questionnaire. Non-participants were all sample members for whom no data were collected because they had died, moved or could not be contacted for other reasons, or were contacted but did not participate (e.g. refusal, temporarily away, medical reasons) [9].

These over-all sample response rates can be described in more detail by two terms according to: *Contact rate* which is the proportion of selected persons (total sample) that received the letter of invitation, phone call, or personal visit. *Non-participants* are selected persons who 1) received a letter (or a visit or telephone call) but did not choose to participate plus 2) those who did not receive the letter of invitation. The latter group would also contain those not found, often resulting in letters returned to the survey administration. For keeping

this subgroup small, the population register (or other sampling frame) should be recently updated prior to the survey.

Enrolment rate is the proportion of the persons contacted who actually participated in the survey. The response rate (participation rate) is the product of the contact rate and the enrolment rate.

Participation rate = (members contacted/ total sample) x (participants/members contacted) = contact rate x enrolment rate

Enrolment rate and contact rate both range from 0-1.0.

Eurostat's "Standard Quality Report Manual" [10] has the following definition of "non-response" and response rates:

Non-response is the failure of a survey to collect data on all survey variables, from all the population units designated for data collection in a sample or complete enumeration. The difference between the statistics computed from the collected data and those that would be computed if there were no missing values is the non-response error.

There are two types of non response: unit non-response which occurs when no data are collected about a designated population unit (the person did not participate at all), and item non response which occurs when data only on some, but not all survey variables are collected about a designated population unit.

The extent of response (and accordingly of non-response) is measured with response rates. They can be of two kinds: unit response rate, which is the ratio of the number of units which have provided data at least on some variables over the total number of units designated for data collection. Item response rate is the ratio of the number of units which have provided data for a given variable (an item) over the total number of designated units or over the number of units that have provided data at least for some variables.

As shown by the two examples above, the response rate can be calculated in different ways, depending on definitions of the numerator and denominator. The numerator, the participants, may be a sample member i) who answered the main study questionnaire, ii) who answered at least one question or iii) who had at least one technically valid examination result.

The denominator may or may not include persons who were selected for HES, but for obvious and known reasons (in retrospect) were unable to attend (permanently moved to nursing homes, died, emigrated or other reasons). In the MONICA example above, persons selected to the sample but who had died or moved out of the survey area between the updating of the sampling frame and the scheduled date of examination were included in the denominator. On the other hand, in MONICA's earlier reports of response rates, such people were considered to be part of the over-coverage, and therefore were excluded from the

denominator [11]. It is a policy issue to decide when a sampling unit (usually a person) is to be accepted in the numerator or the denominator of the response rate.

7.2.5.1 PARTICIPATION RATES IN EUROPEAN COUNTRIES

The definitions of numerator and denominator vary in European HES, and an accurate description is probably available to a different extent in different countries. As examples, information was collected from Italy and Finland for this report. In Italy, the numerator was defined as the number of persons who participated in the survey. The denominator was defined as the total representative sample in the specific region and age group (all selected). In Finland the numerator was defined as the number of persons who participated in the health examinations (for HES): the denominator was all selected persons excluding those who were deceased before the contact. The contact rate was 94% in Italy (electoral register) and 98.6% in Finland (population register). See Table 7.3 for Finland and Italy.

The variation in response rates between countries is large, varying between 21% and 85% in European HESs (as reported in the HIS-HES-database), see Table 7.3.

In the ongoing survey in Nord-Trondelag, Norway, the participation rate is 65-75% among those aged 60-79 and in women aged 50-59, after several extra recruitment efforts, including the establishment of survey clinics at high-schools, university campus and worksites. In the 20-39 age-group, the participation varied from 25% (men 20-29) to 50% (women 30-39): in those aged 80 years and older, 35-40% participation was were obtained (no home or institution visits).

We do not know enough about how response rates have been calculated in each country; therefore the rates are not fully comparable. The achievement of a high response rate is crucial for the usefulness and the generalization of the survey results to the population in each country and the decline in response rates in both HIS and HES is a challenge for planning of future surveys.

7.3 RECRUITMENT TO PARTICIPATION IN HEALTH SURVEYS

7.3.1 INVITATION STRATEGIES IN RECENT HEALTH SURVEYS

In 2007, we asked our FEHES contact persons by e-mail to reply to nine questions regarding recruitment and participation in a recent health survey, if possible, in their countries (Questionnaire on recruitment and participation, Annex 3). After three reminders, we received information from 27 countries. Most contact persons have given answers from their experience with one specific, relatively recent or even ongoing HES. Two contact persons

answered for HES and HIS, respectively in the 1980s, and the answers from three contact persons were based on HIS (Table 7.5). We present the results based on this questionnaire and also results from relevant studies on recruitment and participation.

Most of the contact persons who answered the Questionnaire on recruitment and participation reported that a mailed invitation letter, often without the survey questionnaire, was the first attempt to contact the selected persons or households. In nearly all countries, at least one re-attempt was made in case of non-participation by the first invitation. Home visits or phone calls were most often used as the second recruitment attempt. In some countries only one attempt was made after the first invitation. However, half of the countries routinely made a third recruitment attempt. This could be a letter, a visit or a phone call. Five of the 27 responders to our questionnaire made a fourth attempt, and in some countries five or even more attempts were made (Table 7.5).

In some of the countries special efforts were used for recruitment of minorities. Germany and England used seven foreign languages for the written materials in the surveys reported. In England, this was done only in years when the HES focused on the health of minority ethnic groups [12]. Finland used English as well as Finnish and Swedish versions of the questionnaire, and Estonia used Estonian and Russian. In most of the countries [13], no special efforts were made to include minorities in the survey. Other means that could facilitate participation among linguistic subgroups were interpreter on site, personal assistance, user-friendly layout, culturally adapted materials, trained fieldworkers and phone help line to assist with the questionnaire and other written materials.

A study of how to improve recruitment rates among ethnic minorities in the UK found that audio-recorded methods of obtaining informed consent worked better than written consent in some study populations. Additionally, telephone contact was better than face-to-face contact for recruiting participants to the study [14].

One reason reported for non-participation was difficulty in contacting persons selected to the sample because of incorrect address or no telephone contact.

7.3.2 EFFORTS TO INCREASE PARTICIPATION

Table 7.6 lists the reported efforts to increase the participation in health surveys. Most countries have informed the public about the planned or ongoing survey. Newspapers, radio and television are broadly used, as well as survey websites. Four countries had no information to the public.

Among incentives used for motivating the selected persons to participation, reimbursement of travel expenses was used by three countries and lottery tickets were given by four countries. Small gifts were used by five countries. In the Czech Republic, vitamins were given to the participants, and in Greece the measurements, tests and dietary

recommendations from experts were seen as incentives. No incentives were offered in 14 countries.

Regarding the most effective strategy to increase participation, personal contact (phone or home-visit) with the potential participant was emphasized by many contact persons. One contact person mentioned the use of mobile phone as the most effective strategy, whereas another one suggested a change of interviewer, both pointing at the importance of the direct and personal contact between the participant and the interviewer. Incentives (a small gift or lottery ticket) were mentioned by two countries as the most effective strategy.

7.3.3 STUDIES OF NON-PARTICIPANTS

Reasons for refusal given by non-participants were reported by 14 contact persons (Table 7.7). The most common reasons given were: Not interested, no time, health problems, feeling healthy or too personal (confidentiality issues). “Too many surveys” or “too long questionnaire” were also mentioned.

Only a few countries collected health information from non-participants in the survey they reported from. Finland, Germany and Sweden used short questionnaires for non-participants, by phone or by mail. Denmark and the Netherlands used registers as a source of health information. In the Netherlands, health information was available for those among HES non-participants who had participated in a HIS that preceded and was linked with the HES. Similarly, those being interviewed for the HIS part of the Scottish and English HES were asked to be visited later by a nurse for HES, entailing available HIS-information for the HES non-participants. However, no such knowledge was available for those not participating in the interview part of the survey.

Some basic information about the non-participants was available from the sampling frame in most countries. Macedonia, Latvia, Ireland and Bulgaria did not have this possibility, and in Cyprus the possibility was poor because the sampling frame was not updated.

7.3.4 OTHER EXPERIENCES WITH PARTICIPATION IN HEALTH SURVEYS

Studies of motives for and factors enhancing participation and of recruitment efforts are relevant sources of knowledge on ways to stimulate participation. Studies of potential non-participation bias are important for the awareness of the size and the consequences of the problem. A literature search on PubMed using “Motivation and Participation and Surveys” yielded several studies we considered relevant also for HES [15-20].

In preparation for a Norwegian survey 2006-8 (Nord-Trondelag), some members of the target population were invited to focus groups [15]. Perceived self-interest appeared to be the first motivational factor, and willingness to contribute to research was the next, the latter

mostly in elderly and highly educated persons. Among the elderly, some saw participation as a civil duty. Practical obstacles were seen as the most important barrier. The informants were rather sceptical to incentives, and felt that this could undermine public confidence in the survey. Another study compared the participation rate by use of alternative titles of a cancer research study and found that one of the titles was linked with higher participation [21].

A review published in September 2007 discussed the decreasing participation in epidemiological surveys [22]. This review was not a systematic one, but rather a summary and discussion based on 146 references. One explanation for lower willingness to participate in scientific studies during the last decades is, according to this review, the increasing number of research studies in total together with a proliferation of political polls, marketing by telephone calls and marketing surveys that may look similar to scientific surveys. Information materials, conveyed through the mail or by phone, may well be received by intended participants who are routinely sorting through numerous items of unsolicited mail or phone messages, of which practically all end up as "junk". If so, it means that a barrier builds up in the target group against even considering participation when contacted.

Studies of recruitment to HIS are, to some degree, relevant also for HES. Table 7.8 presents results of a review of published and unpublished controlled recruitment trials in HIS [23]. Most studies included in this review were health related, but some social surveys and marketing studies were also included. It should be noted that results from recruitment to HIS, and in particular marketing surveys, cannot directly be used for HES, as a HES is far more demanding for the participant.

As noted in 7.3.2, nearly all the FEHES contact persons reported that one or more recruitment re-attempt was made in case of non-participation by the first invitation. Among the publications concerning repeated recruitment efforts, few studies included the aspect of costs. One such study investigated the interrelation of recruitment efforts and expense with respect to potential non-response bias based on a HES in Augsburg, Germany, 1999-2001 [24].

In the Augsburg study, telephone calls and home visits were used to contact people for re-invitation. Re-invited HES participants (examined three months or more after the first invitation letter) showed many similarities with a subgroup (49%) of non-participants who responded to a short questionnaire, as both included a higher percentage of people with impaired health and with higher level of behavioural health risks, compared with persons who participated in the HES within three months. However, for the HES non-participants who did not respond to the short non-participant questionnaire, there was no information other than age and sex. It is to be noted that persons recruited by home visits had higher disease prevalence and lower educational level than other participants in this study.

The distribution of total recruitment cost per individual was highly skewed with 50% of the total sum spent on 17% of the sample. The authors conclude, based on their own results plus comparable studies:

1. Expenses for recruitment increased with decreasing age of the invited persons, as more telephone calls were needed to contact them, and, if reached, younger people were less willing to participate.
2. Eliminating home visits seems to be the most cost-effective strategy in terms of saved costs per lost participant, but this strategy also seems to be the most likely to introduce bias.
3. Stopping recruitment efforts after 10 unsuccessful contact attempts by telephone may be the best choice, with respect to cost-benefit and non-participation bias as well.

In summary, according to the above cited papers, the factors found to increase motivation and participation in HES were:

Attitudes of the invited persons:

- the participant's personal interest (free medical examination, interest in tests or other content of the survey)
- general willingness to contribute to research (altruism, volunteerism)
- general understanding of the importance of health surveillance and research
- confidence in "science" and the medical profession
- social support for participation in the participant's environment

Content and presentation of the HES:

- an alert letter in advance
- user-friendly lay-out for all written materials
- starting the questionnaire with the more interesting questions
- incentives (may be motivating, but not unanimously)
- face-to-face recruitment (and data collection) in contrast to less personal contact
- not too large total participant burden (time and commitments)

- data collection by use of “hybrid data collection methods”, such as offering HES by home visit to subgroups or by second recruitment attempts, after first having invited people to visit a clinic.

And factors that counteracted participation were:

- practical obstacles making it difficult to participate
- the volume of the questionnaire and of the informed consent (may represent a barrier, but not necessarily, see chapter 6 on legal aspects)
- the experience of “too many surveys” being offered in total

7.3.5 STUDIES OF POTENTIAL BIAS DUE TO SELECTIVE PARTICIPATION

The group of non-participants consists of persons with many different reasons for not taking part and the health status may differ from the average of the participants. Analyses from different countries have consistently shown that in total the non-participants have lower education, less healthy life style and less good health, and elevated mortality compared to participants. According to calculations based on demographic factors, low participation may not seem to bias the results substantially, given that health and risk factors are similar for non-participants and participants within the categories one can “control for”, like marital status, age and gender. However, available register information does not contain detailed information on current health or risk factors, so adjustment according to demographic factors does not compensate for low participation rates.

Several European surveys can use the sampling frame to compare participants and non-participants by age and sex, and some have experience with the linkage to other data.

A HES in Oslo, Norway 2000-2001 included an evaluation of extra recruitment attempts (reminders) by sending a second and third invitation with the survey questionnaire enclosed [13]. Factors associated with non-participation were male sex, young age (study’s upper age was 76 years), less education, non-married status, disability pension and non-western country of birth. The participation rate increased from 28% to 42% in all men and from 33% to 49% in all women, resulting in an overall 46% attendance. In the 60 years old, participation increased from 39% to 55% and in the 30 years old from 22% to 36%. Prevalence estimates without and with the extra participants was compared. The prevalence of obesity (according to measurements) was higher among the extra participants, but the total prevalence estimates for obesity increased by 0.2-2 %-points only by the reminder efforts. Next, the list of all invited (aged below 70 years) was linked with data on social security benefits. The distribution of socio-demographic variables, including different types of benefits, differed

modestly between participants and all invited. Given that the disease and risk factor prevalence were similar in participants and non-participants within each socio-demographic stratum, most prevalence estimates among participants were valid for the target population [25].

According to the review by Galea and Tracy 2007 [22], most systematic efforts to characterise who does and who does not participate in studies have focused on demographic characteristics, probably due to the relatively easier access to these data than to health registers. Moreover, the health issues that are focused in studies may influence participation in different ways: Studies of environmental or occupational exposure may be more likely to recruit persons with higher levels of exposure, while focus on domestic violence may fail to recruit exposed persons [22].

As European studies are of particular relevance here, some recent European non-responder studies should be noted. A study from Amsterdam [26] found that estimated prevalence figures for health care utilization were higher when based on participant than if based on the total target sample. This was the case for prescription of drugs and for a number of out-patients services, but not for hospitalisation. Of 54 background characteristics for which odds ratio for health care utilization were computed, 11 showed at least 10% difference between participants and the total sample. It may, based on these and similar surveys, be concluded that resources spent on extra recruitment attempts give relatively little value for money. But little is known of the actual health of the non-participants, even with data on use of health services and social security benefits linked to the file.

In a Finnish study, differences between participants and non-participants similar to the Oslo Study have been described [27]. Participants recruited by extra attempts smoked more often and used more psycho-pharmaceutical drugs than the early participants, suggesting similar features as non-participants, but most self-reports on health problems were not significantly different. Here, it was found that elderly persons were less likely to participate. With respect to smoking, a similar pattern was found in an earlier Norwegian study [28]. In a Swedish study of non-response to HIS, smoking prevalence was compared by initial responders (63%) and those who responded by extra attempts (additional 19%). The estimated smoking prevalence increased from 36.1 to 38.7%, and extra recruitment attempts resulted in increased smoking prevalence among participants with higher social status. The authors conclude that a postal questionnaire with high non-response rate may overestimate social status differences and underestimate smoking prevalence [29].

A Dutch study compared participants and non-participants to HES in the setting of a survey that started with HIS and in a next phase invited the HIS participants to examinations. Only 29 % of the HIS attendees were recruited for HES [30]. According to the HIS data, the HES population contained more persons who were healthier, but more likely to be worried about their health (“worried well”). Otherwise no major difference in the HIS data was found by attendance to HES. But this study gives no data at all for nearly half of the total sample, as only 56% participated in the HIS.

Among elderly people invited to the Health 2000 Survey in Finland, it was found that a higher proportion of non-participants suffer from functional limitations [31].

A study of 32 354 participants and 4 890 non-participants in FINRISK 1972, 1977, 1982, 1987 and 1992 found that lower socio-economic groups were under-represented in the surveys [32]. Further, a mortality follow-up for 9.5 years showed that the absolute mortality risk was underestimated when based on participants only, while the relative risk of death associated with socio-economic position was not distorted. In the same HES in Finland a higher mortality (2-2,5-fold) was found among non-participants at eight year follow up by an average participation rate above 80% [33].

The non-participant information collected in the MONICA populations (age 35-64 years by 1985, participation by 43-89 %, in all 32 populations) made it possible to estimate the effect of non-participation on cross-sectional estimates in 27 populations and trend estimates in 17 populations. Cross-sectional estimates from participants were compared with adjusted estimates that took into account the result in non-participants, and in men, the ratios ranged from 1.0 to 1.08 for self-reported BMI, from 0.5 to 1.26 for daily smokers, and from 0.56 to 1.67 for use of antihypertensive medication. In women the ranges of the ratios were rather similar. The effect of non-response on the trend estimates was by far more pronounced, particularly for smoking in men because of decreasing smoking prevalence in participants and in some populations increasing rates in non-participants [34]. The trend estimated changed in each of the 17 populations when information from non-participants was taken into account.

A hypothetical analysis demonstrates the effect of non-participation: the bigger the difference in participation rate between a first and a second survey, the bigger the difference in trend estimate between participants and adjusted population estimates and the lower precision of the estimator [34].

There seem to be agreement among studies that female sex and being married, employed, in higher socioeconomic stratum and highly educated are positively associated with participation. On the other hand, risk behaviour (like smoking) and major health problems are associated with non-participation. In adult age groups, both the young (20-39 years) and the old seem to be difficult to recruit. Interestingly, some of the HESs conducted relatively recently have been limited to the age 45 as the lowest age (Czech Republic 2004, Kaunas 2006-7, and Ireland 2006), Table 7.1.

7.4 CONCLUSION

Earlier European HESs differed regarding the defined target population, but most countries had included the age range 25-64. The sampling frames in 16 of 32 countries in the FEHES project cover the whole population. The sampling frames were continually updated in 19 countries and updated at least annually in six countries. This means that many countries have the possibility to carry out surveys with similar target population and that the quality of

the sampling frames would make it possible to have a well defined sample of households or individuals who can be reached by the survey teams.

Most European HESs had applied multistage probability sampling and most of them had a sample size of 7 000-13 000 persons. The response rates, however, varied between 21% and 85% and there is a trend towards lower response rates over time. This means that the recruitment issue is increasingly important when planning future surveys.

The questionnaire to contact persons on participation and recruitment in European surveys gave answers in line with other knowledge on strategies aiming at high participation rates. The strategies used until now include promotion of the participants' interest and understanding of the value of the survey. In the future, rather personal recruitment attempts seem to be needed, and it seems increasingly important to visualise the difference between a public health survey and other surveys and marketing efforts that people are contacted for. This holds for the first invitation and by the extra attempts. No less important, the total survey content as well as the details need to be considered, aiming at reducing the participant burden, including practical barriers.

European survey experiences as well as other epidemiological research tell a convincing story. Participants in a survey are healthier and socially better off than non-participants, and their behaviour is more health promoting.

It is, at best, uncertain if studies of non-participants and calculations from such can compensate for low participation rates. This means that the participation rate should be at least 70 % and preferably higher.

REFERENCES

[1] Aromaa A, Koponen P, Tafforeau J, Vermeire C, Primatesta P, Marmot M, et al. Health surveys: evaluation and recommendations. Subproject reports of Phase 2 of the project Health surveys in the EU: HIS and HIS/HES Evaluations and Models. Helsinki: National Public Health Institute B16/2003; 2003.

[2] Tolonen H. Towards the High Quality of Population Health Surveys. Standardization and Quality Control. 2005 [cited 12 May 2008]; Available from: http://www.ktl.fi/attachments/suomi/julkaisut/julkaisusarja_a/2005/2005a27.pdf

[3] European Health Interview & Health Examination Surveys Database. 2008 [cited 6 March 2008]; Available from: https://hishes.iph.fgov.be

[4] Lessler JT, Kalsbeek WD. Nonsampling errors in surveys. New York: John Wiley & Sons, Inc. 1992.

[5] Centers for Diseasae Control and Prevention. National Health and Nutrition Examination Survey. 2007 [cited 28 May 2008]; Available from: http://www.cdc.gov/nhanes/pQuestions.htm#How%20%20Participants%20selected

[6] Centers for Diseasae Control and Prevention. Key Consepts About NHANES Survey Design. [cited 28 May 2008]; Available from: http://www.cdc.gov/nchs/tutorials/Nhanes/SurveyDesign/SampleDesign/Info1.htm

[7] Craig R, Mindell J. Health Survey for England 2006. Volume 3. Methodology and documentation. 2008 [cited 20 March 2008]; Available from: http://www.ic.nhs.uk/webfiles/publications/HSE06/HSE06_VOL3.pdf

[8] Postcode Address File (PAF). 2008 [cited 20 March 2008]; Available from: www.royalmail.com/portal/rm/jump2?catId=400084&mediaId=400085

[9] Wolf HK, Kuulasmaa K, Tolonen H, Sans S, Molarius A, Eastwood BJ. Effect of sampling frames on response rates in the WHO MONICA risk factor surveys. European journal of epidemiology. 2005;20(4):293-9.

[10] Eurostat. Quality reporting. [cited 20 March 2008]; Available from: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=2273,1,2273_47143234&_dad=portal&_schema=PORTAL

[11] Wolf HK, Kuulasmaa K, Tolonen H, Ruokokoski E, for the WHO MONICA Project. Participation rates, quality of sampling frames and sampling fractions in the MONICA surveys. 1998 [cited 20 March 2008]; Available from: http://www.ktl.fi/publications/monica/nonres/nonres.htm

[12] Craig R, Mindell J. Health Survey for England 2004. Volume 1. The health of minority ethic groups. 2006 [cited 20 March 2008]; Available from: http://www.ic.nhs.uk/webfiles/publications/healthsurvey2004ethnicfull/HealthSurveyforEnglandVol1_210406_PDF.pdf

[13] Selmer R, Sogaard AJ, Bjertness E, Thelle D. The Oslo Health Study: Reminding the non-responders - effects on prevalence estimates. Norsk Epidemiologi. 2003;13:89-94.

[14] Lloyd CE, Johnson MR, Mughal S, Sturt JA, Collins GS, Roy T, et al. Securing recruitment and obtaining informed consent in minority ethnic groups in the UK. BMC health services research. 2008;8:68.

[15] Antonsen S. The motivation to participate in health studies. Norsk Epidemiologi. 2005;15:99-109.

[16] Brown BA, Long HL, Gould H, Weitz T, Milliken N. A conceptual model for the recruitment of diverse women into research studies. Journal of women's health & gender-based medicine. 2000 Jul-Aug;9(6):625-32.

[17] Eastwood BJ, Gregor RD, MacLean DR, Wolf HK. Effects of recruitment strategy on response rates and risk factor profile in two cardiovascular surveys. International journal of epidemiology. 1996 Aug;25(4):763-9.

[18] Riedel-Heller SG, Busse A, Angermeyer MC. Are cognitively impaired individuals adequately represented in community surveys? Recruitment challenges and strategies to facilitate participation in community surveys of older adults. A review. European journal of epidemiology. 2000;16(9):827-35.

[19] Roberts LM, Wilson S, Roalfe A, Bridge P. A randomised controlled trial to determine the effect on response of including a lottery incentive in health surveys [ISRCTN32203485]. BMC health services research. 2004 Nov 8;4(1):30.

[20] White E, Carney PA, Kolar AS. Increasing response to mailed questionnaires by including a pencil/pen. American journal of epidemiology. 2005 Aug 1;162(3):261-6.

[21] Lund E, Gram IT. Response rate according to title and length of questionnaire. Scandinavian journal of social medicine. 1998 Jun;26(2):154-60.

[22] Galea S, Tracy M. Participation rates in epidemiologic studies. Annals of epidemiology. 2007 Sep;17(9):643-53.

[23] Edwards P, Roberts I, Clarke M, DiGuiseppi C, Pratap S, Wentz R, et al. Increasing response rates to postal questionnaires: systematic review. BMJ (Clinical research ed. 2002 May 18;324(7347):1183.

[24] Holle R, Hochadel M, Reitmeir P, Meisinger C, Wichmann HE. Prolonged recruitment efforts in health surveys: effects on response, costs, and potential bias. Epidemiology (Cambridge, Mass. 2006 Nov;17(6):639-43.

[25] Sogaard AJ, Selmer R, Bjertness E, Thelle D. The Oslo Health Study: The impact of self-selection in a large, population-based survey. Int J Equity Health. 2004 May 6;3(1):3.

[26] Reijneveld SA, Stronks K. The impact of response bias on estimates of health care utilization in a metropolitan area: the use of administrative data. International journal of epidemiology. 1999 Dec;28(6):1134-40.

[27] Korkeila K, Suominen S, Ahvenainen J, Ojanlatva A, Rautava P, Helenius H, et al. Non-response and related factors in a nation-wide health survey. European journal of epidemiology. 2001;17(11):991-9.

[28] Brogger J, Bakke P, Eide GE, Gulsvik A. Contribution of follow-up of nonresponders to prevalence and risk estimates: a Norwegian respiratory health survey. American journal of epidemiology. 2003 Mar 15;157(6):558-66.

[29] Bostrom G, Hallqvist J, Haglund BJ, Romelsjo A, Svanstrom L, Diderichsen F. Socioeconomic differences in smoking in an urban Swedish population. The bias introduced by non-participation in a mailed questionnaire. Scandinavian journal of social medicine. 1993 Jun;21(2):77-82.

[30] Boshuizen HC, Viet AL, Picavet HS, Botterweck A, van Loon AJ. Non-response in a survey of cardiovascular risk factors in the Dutch population: determinants and resulting biases. Public health. 2006 Apr;120(4):297-308.

[31] Sainio P, Koskinen S, Heliovaara M, Martelin T, Harkanen T, Hurri H, et al. Self-reported and test-based mobility limitations in a representative sample of Finns aged 30+. Scandinavian journal of public health. 2006;34(4):378-86.

[32] Harald K, Salomaa V, Jousilahti P, Koskinen S, Vartiainen E. Non-participation and mortality in different socioeconomic groups: the FINRISK population surveys in 1972-92. Journal of epidemiology and community health. 2007 May;61(5):449-54.

[33] Jousilahti P, Salomaa V, Kuulasmaa K, Niemela M, Vartiainen E. Total and cause specific mortality among participants and non-participants of population based health surveys: a comprehensive follow up of 54 372 Finnish men and women. Journal of epidemiology and community health. 2005 Apr;59(4):310-5.

[34] Tolonen H, Dobson A, Kulathinal S. Effect on trend estimates of the difference between survey respondents and non-respondents: results from 27 populations in the WHO MONICA Project. European journal of epidemiology. 2005;20(11):887-98.

Table 7.1 Target population and eligibility criteria in recent European HES (Data sources: [3], FEHES questionnaire on Annex 2.)

Country	Survey	Year	Type of HES	Age group covered	Eligibility criteria
Croatia	Croatian Health Survey	2003	National	18+	Excluding those living in institutions
Cyprus	CINDI Risk Factor Survey on communicable Diseases in Nicosia	2000	Regional	25-64	Survey language: Greek
Check Republic	Health Life Style and Environment (HELEN)	2004	National	45-54	Excluding those living in institutions Survey language: Czech
Finland	Health 2000	2000	National	30+.	Including those living in nursing homes, inst. for psych. and mentally disabled, boarding schools, convents/ monasteries/ prisons.
	FINRISK	2002	National	25-74	Including those living in nursing homes, inst. for psych. and mentally disabled, boarding schools, convents/ monasteries/prisons. Survey languages: Finnish and Swedish
France	National survey on nutrition and health (ENNS)	2006	National	18-74	Survey language: French Excluding those living in institutions
Germany	KiGGS - The German Health Survey for Children and Adolescents	2003-2006	National	0-17	Excluding those living in institutions Survey language: Several
	German National Health Interview and Examination Survey	1998	National	18-79	Excluding those living in institutions

Country	Survey	Year	Type of HES	Age group covered	Eligibility criteria
Ireland	Survey of Lifestyle, Attitudes and Nutrition (SLÁN)	1998, 2002, 2006	National	1998, 2002: 18+ 2006: 45+	1998-survey: Including those living in institutions 2002-survey: Excluding those living in institutions
Italy	Pilot HES Study "Health in Florence"	1999-2000	Regional	35-74	Excluding those living in institutions
Lithuania	MONICA	1992-1993	Regional	35-64	Information not available
	HAPIEE survey	2006-2007	Regional	45-72	Information not available
	CINDI	1983-	Regional	25-64	Information not available
Netherlands	Regenboog-survey	1998-2001	National	12+	Excluding those living in institutions
Norway	Cohort Norway	1994-2000	Regional	30, 40, 45, 60 and 75. In some regions other age groups.	Excluding those living in institutions (in practice) Survey language: Several in the city of Oslo
Poland	Polish National Multicenter Health Survey	2005	National	20-74	Excluding those living in institutions
Slovakia	CINDI Health Examination Survey	2003	Regional	15-64	Including those living in homes for elderly, nursing homes and boarding schools
UK	Health Survey for England	yearly, 2006	National	0-65+	Excluding those living in institutions. Including elderly, children and ethnic minorities

Country	Survey	Year	Type of HES	Age group covered	Eligibility criteria
	The Scottish Health Survey	1995, 1998, 2003	National	16-64 in 1995, 2-75 in 1998, all ages in 2003	Excluding those living in institutions

* Source: HIS-HES-database. Information about Lithuania: FEHES-survey "Questionnaire on HES in Europe". Information about Italy: FEHES Core group.

Table 7.2 Sampling frames available in European countries (Data source: FEHES questionnaire on Annex 2.)

Country	Available sampling frames	Preferred sampling frame	Coverage of population groups in preferred sampling frame	Updating of preferred sampling frame
Austria	No information available	No information available	No information available	No information available
Belgium	National population register	Population register	Covers all	Continually
Bulgari	Population register (national./regional) Census	Population register	Covers all	Annually (or more frequent)
Croatia	Health /social insurance register Electoral rolls Census	Census	Covers all	No information
Cyprus	National population register Census Health /social insurance register Electoral rolls	Census	Covers all except institutional	Annually (or more frequent)
Czech Republic	National population register Health /social insurance register	Population register	Covers all	Annually (or more frequent)
Denmark	National population register	Population register	Covers all	Continually
Estonia	National population register Census Health /social insurance register	Census	Covers all	Annually (or less frequent) updated .New law may allow yearly (or for survey purpose)
Finland	National population register Health /social insurance register Electoral rolls	Population register	Covers all	Continually
France	National population register Health /social insurance register Telephone lists	Census	Covers all	Continually

Country	Available sampling frames	Preferred sampling frame	Coverage of population groups in preferred sampling frame	Updating of preferred sampling frame
Germany	Regional population register List of postal addresses	Population register	Covers all	Continually
Greece	Census Electoral rolls (national./regional)	Electoral rolls (if made available)	Covers all 18+ except non-citizens	Less frequent than annually (prob. every 4 years)
Hungary	Population register (national/regional) Census (national./regional.) Health /social insurance register (national./regional) Electoral rolls (national./regional)	No information	No information	No information
Iceland	National population register Health /social insurance register Electoral rolls	Population register	Covers all	Continually
Ireland	Census Health /social insurance register Electoral rolls	Census	Covers all	Continually
Italy	Electoral rolls Regional population register Census Health /social insurance register	Electoral rolls if adults. Population register or health register if all ages. Health register if non-citizens/ institutional	Different for different frames	Annually (or more frequent)
Latvia	National population register	Population register	Covers all except institutionalised	Continually
Lithuania	Population register (national/ regional) Health /social insurance. register (national/ regional)	Population register	Covers all except institutionalised and non-citizens	Continually

Country	Available sampling frames	Preferred sampling frame	Coverage of population groups in preferred sampling frame	Updating of preferred sampling frame
Luxembourg	National population register Health /social insurance register	Health /social insurance register	Covers all except European Commission personnel (5%)	Continually
Macedonia	Census Health /social insurance register	Census	Covers all	Continually
Malta	Census Electoral rolls	Electoral rolls	Covers all from age 15+	Continually
Netherlands	National population register	Population register	Covers all except non-citizens	Continually
Norway	National population register Census Health/ social insurance register Electoral rolls	Population register	Covers all	Continually
Poland	National /regional population register National /regional census National /regional elect. rolls	No information	No information	Continually
Portugal	Census (national/ regional) Electoral rolls Health/ social insurance register	Census	Covers all except institutionalised	Less frequent than annually
Romania	Population register (national/ regional) Census (national/ regional) Health/ social insurance. register (national/ regional) Electoral rolls (national/ regional)	Population register	Covers all except institutionalised	Periodically

Country	Available sampling frames	Preferred sampling frame	Coverage of population groups in preferred sampling frame	Updating of preferred sampling frame
Slovakia	Population register (national/ register) Census (national/ regional)	Population register	Covers all except non-citizens (not all ages)	Continually from 2007
Slovenia	National population register Census Health/ social insurance register Electoral rolls	Population register	Covers all ages	Continually
Spain	National population register Census Health/ social insurance. register Electoral rolls	Population register	Covers all	Continually
Sweden	National population register	Population register	Covers all	Continually
Turkey	Census		Covers all except institutionalised	Every 10 years
UK/England	Census Electoral rolls Health /social insurance register (regional) Postcode Address File (PAF)	PAF	PAF covers addresses, not people	Annually (or more frequent)
UK/Northern Ireland	No information available	No information available	No information available	No information available
UK/ Scotland	Census Electoral rolls Health /social insurance register (regional) PAF	PAF	PAF covers addresses, not people	Annually (or more frequent)

Table 7.3 Sample size, participation rate and information on non-participation in previous HESs (Data source: [3])

Country	Survey	Year	Sample size		Participation rate %		Non-response information
			Households	Persons	Household	Persons	
Croatia	Croatian Health Survey	2003	10,766	10,766	85%	85%	Information not available
Cyprus	CINDI Risk Factor Survey on communicable Diseases in Nicosia	2000	1,250	1,600	89%	65%	Information not available
Czech Republic	Health Life Style and Environment (HELEN) 2004	2004	Not relevant	9,600	Not relevant	21%	Information available from HIS-part of the survey
Finland	Health 2000	2000	Not relevant	8,028	Not relevant	85%	Short HES protocol, mailed questionnaire, phone interview and registers
	FINRISK	2002	Not relevant	13,500	Not relevant	85%	Short mailed questionnaire
France	National survey on nutrition and health (ENNS)	2006	9,113	Information not available	Information not available	62%	Information available from HIS-part of the survey
Germany	KiGGS - The German Health Survey for Children and Adolescents	2003-2006	Not relevant	28,299	Not relevant	67%	Short interview protocol
	German National Health Interview and Examination Survey	1998	Not relevant	13,222	Not relevant	61%	Short mailed questionnaire
Ireland	Survey of Lifestyle, Attitudes and Nutrition (SLÁN)	1998, 2002	Not relevant	1,400 (2002) 1,035 (1998)	Not relevant	55% (1998)	Information not available

Country	Survey	Year	Sample size		Participation rate %		Non-response information
			Households	Persons	Household	Persons	
Italy	Pilot HES Study "Health in Florence"	1999-2000	Not relevant	625	Not relevant	66% Enrolment rate: 70%**	Information not available
Netherlands	Netherlands Health Examination Survey (Regenboog)	1998-2001	Not relevant	6,979	Not relevant	25%	Information available from the HIS-part of the survey
Norway	Cohort Norway	1994-2000	Not relevant	295,570	Not relevant	58%	Education, income and social security benefits in registers
Poland	Polish National Multicenter Health Survey	2005	Not relevant	22,000	Not relevant	80%	Information not available
Slovakia	CINDI Health Examination Survey	2003	Not relevant	2,600	Not relevant	64%	By short phone interview and from registers
UK	Health Survey for England	2006	Information not available	Information not available	Information not available	Information not available	Short mailed questionnaire
	The Scottish Health Survey	2003	Information not available	Information not available	71%	71%	Information not available

** In a pilot or test questionnaire information about contact rate and enrolment rate was collected from Finland (Health 2000 survey) and Italy (EPIC survey). This information is not available in the HIS-HES-database. National comments on response rates: Italy, EPIC survey: Numerator: Participants. Denominator: Total number 35-74 yrs as in the Florence sample for national HIS. Norway: 90% in the 1970-ies, 50- 60% after year 2000 (in age 40-42 yr).

Table 7.4 Sampling design and procedures in previous HESs (Data source: [3])

Country	Survey	Year	Type of HES	Design	Stratification/ over-sampling
Croatia	Croatian Health Survey	2003	National	Multistage probability sample Households, one individual per household	Stratification for age, sex and geographical area
Cyprus	CINDI Risk Factor Survey on communicable Diseases in Nicosia	2000	Regional	Multistage probability sample. Households are sampled, all persons in the households in certain age	Stratification for geographic area
Czech Republic	Health Life Style and Environment (HELEN)	2004	National	Cross-sectional design Simple probability sample Sample of individuals	Stratification for age, sex and geographical area
Finland	Health 2000	2000	National	Multistage probability sample. Sample of individuals, no other household members. The survey had also a panel component	Over-sampling for age 80+
	FINRISK	2002	National	Simple probability sample. Sample of individuals, no other household members.	250 persons in each age (10 year) and sex group in each region (6)
France	National survey on nutrition and health (ENNS)	2006	National	Multistage probability sample Sample for households, one individual per household.	Stratification for degree of urbanization and geographical area

Country	Survey	Year	Type of HES	Design	Stratification/ over-sampling
Germany	KiGGS - The German Health Survey for Children and Adolescents	2003-2006	National	Multistage probability sample. Individuals are sampled. Cross-sectional with follow-up 1998-survey: cross-sect.	Over-sampling / stratification for East Germany and migrants.
	German National Health Interview and Examination Survey	1998	National	Multistage probability sample. Individuals are sampled.	Over-sampling / stratification for East Germany and migrants.
Ireland	Survey of Lifestyle, Attitudes and Nutrition (SLÁN)	2002, 2006	National	Cross-sectional Multistage probability sample Sample of individuals, no other household members.	2002: Stratification for geographic area and sex
Netherlands	Regenboog-survey	1998-2001	National	Cross-sectional design .Multistage probability sample. Sample of individuals.	Stratification for geographical area
Norway	Cohort Norway	1994-2000	Regional	Cross-sectional design with follow-up. Strategy of non-sampling, but restricting the sample to narrow age groups. All residents in age groups: 30, 40, 45, 60 and 75 years. In some regions also other age groups were sampled. No other household members.	None
Poland	Polish National Multicenter Health Survey	2005	National	Cross-sectional design. Multistage probability sample. Sample of individuals.	Stratification for age, sex, geographical area and degree of urbanization

Country	Survey	Year	Type of HES	Design	Stratification/ over-sampling
Slovakia	CINDI Health Examination Survey	2003	Regional	Design: "Cindy protocol 1995". Cross-sectional. Multistage probability sample. Individuals are sampled, no other members of the household.	Stratification for age and sex
UK	Health Survey for England	yearly, 2006	National	Cross-section design. Multistage prob. sample. All in household. (certain age groups for boost; all adults and up to two children for core sample).	Oversampl./strat for children and young adults (under 24 years) + minority ethnic groups
	The Scottish Health Survey	1995, 1998, 2003	National	Cross-sectional. Multistage probability sample. Household (all adults, up to two children per household)	Oversampl/ strat for overcrowding, male unemployment, low social class

Table 7.5 Contacts to the selected persons/ households and response rate in recent European health surveys (Data source: FEHES questionnaire on Annex 3.)

Country	Name of survey	Year	Type of survey	First contact	Further contacts	Max. # of attempts *	Response rate [3]
Austria	CINDI Population Survey	1999	HIS	Invitation letter	Letter with quest./ phone calls	3	
Belgium	Health Interview Survey	2004	HIS	Invitation letter (without questionnaire)	Phone calls/ home visits	5 (day, evening, weekend)	Household: 54% Persons: 56%
Bulgaria	CINDI Health Monitor	2004	HIS	Invitation letter	Home visits		
Croatia	Croatian Health Survey (HIS+HES)/ European Health Interview Survey (not quite clear for which survey it is reported)	1995/ 2002	HES	Phone call	Home visit/ phone calls	1	
Czech Republic	HELEN study (Health, Life style and Environment)	2004-2005	HES	Invitation letter	Home visit/ letter without quest.	2	Persons 21%
Cyprus	Health Survey	2003	HIS	Information letter	Home visits/ phone call	2	
Denmark	Health 2006	2006-2008	HES	Personal letter	Letter with quest./ phone call	2	
Estonia	Estonian HIS	2006-2007	HIS	Invitation letter (without questionnaire)	Home visit/ phone call/ invitation letter	Urban:5 Rural:3	

Country	Name of survey	Year	Type of survey	First contact	Further contacts	Max. # of attempts *	Response rate [3]
Finland	Health 2000	2000	HES	Invitation letter	Phone calls/ home visits/ new invitation	Several, no max number	Persons: 85%
	FINRISK	2007	HES	Invitation. letter (with questionnaire./consent form)	Phone call/ letter with questionnaire	2	
France	ENNS	2006	HES	Invitation letter or a direct phone call if address was not available	Phone calls (from physician) and home visits	20	Persons: 62%
Germany	KIGGS	2003-2006	HES	Invitation letter (without questionnaire)	Remind letter/ phone call/ home visit	2	Persons: 67%
Greece	EPIC Greece, with follow up	1994-1999	HES	Athens: invitation letter (without questionnaire) Other areas: phone/visit	Phone call	1	
Hungary	National Health Interview Survey	2003	HIS	Invitation letter (without questionnaire)	Home visits	3	Persons: 81%
Iceland	The Health and wellbeing of Icelanders	2007	HIS	Introduction letter	Letter with questionnaire/ phone call	3	
Ireland	SLÁN, The National Health & Lifestyle Survey	2003	HES	Invitation letter (with questionnaire)	Phone calls/ home visits/ reminder with questionnaire	3	Persons: 63%
Italy	Health in Florence	2000-2001	HES	Invitation letter	Phone calls (incl. from physician)/ invitation letter	Numerous	

Country	Name of survey	Year	Type of survey	First contact	Further contacts	Max. # of attempts *	Response rate [3]
Latvia	Latvian survey (time of Soviet Union occupation)	1990	HIS	Centralised decision (primary health care providers)	Centralised decision	Unknown	
Luxembourg	Migraine/ Headache national study	2006	HIS	Invitation letter (with questionnaire)	Letter with questionnaire	2	
Malta	First National Health Interview Survey	2002	HIS	Invitation letter (without questionnaire)	Phone calls (incl. from senior staff)/ home visit	4	Persons: 80%
Macedonia	The National Diabetes Study	2005	HES	Home visit/ phone	Phone/ home visit		
Netherlands	Module Endogenous Factors	2005-2006	HIS-HES	Invitation letter	Phone calls/ letter with new appointment	2 or 3	Persons: 25%
Norway	Nord-Trøndelag Health Survey	2006-2008	HES	Invitation letter	Drop in/ letter with questionnaire	1	Persons: 54% (age 20+, ongoing)
Poland	WOBASZ / WOBASZ Senior	2003-2005/ 2006-2007	HES	Invitation letter	Phone call/ home visit	2	WOBASZ: Persons 80% WOBASZ Senior: Persons 74%
Portugal	4th National Health Interview Survey	2005-2006	HIS	Invitation letter (without questionnaire)	Survey compulsory		
Slovakia	CINDI HES	2003	HES	Invitation letter	Letter/ phone call/ home visit	3	Persons: 64%

Country	Name of survey	Year	Type of survey	First contact	Further contacts	Max. # of attempts *	Response rate [3]
Sweden	MONICA survey	2004	HES	Invitation letter	Phone calls/ letter with quest.	3	
UK	Health Survey of England	2005	HIS-HES	Invitation letter	Home visits by interviewer / nurse	Some times	

* Maximum number of attempts, after the first invitation, to contact the person before he/she is considered to be a non-participant

Table 7.6 Efforts to increase response and representativity in health surveys in recent European health surveys (Data source: FEHES questionnaire on Annex 3.)

Country	Information to public	Incentives	Recruitment of minorities	Most effective to increase response
Austria	Newspapers/ radio	No	No	Phone calls
Belgium	Newspapers/radio/ television/ internet (survey websites)	No	No	Direct contact between interviewer and household
Bulgaria	Newspapers/ radio/ television	No	No	Home visits and mass media campaigns
Croatia	Newspapers/ radio/ television/ scientific and professional articles	A small gift with invitation	No	1) Rising awareness of possible risks or problems at ind. level 2) Awareness of resp. that results give a picture of pop health 3) Authority of National Public Health Institute
Czech Republic	Newspapers	Vitamins for participants	No	Personal approach of skilled investigators
Cyprus	No	No	No	Statistical law about obligation to participate (no strategy, high response)
Denmark	No	No	No	No strategy, decisions made by the ethical committee
Estonia	Newspapers/ radio/ television	Lottery	Proxy allowed for disabled/ Russian language	Change of interviewer

Country	Information to public	Incentives	Recruitment of minorities	Most effective to increase response
Finland (Health 2000)	Newspapers/ radio/ television/ internet (survey websites)	Reimbursement of travel exp. when needed/ a pen/ lottery for 18-29 years old	Personal assistance/ written materials in 2 languages + Finnish/ interpreter on site	Personal contact after the invitation letter/ personal appointment for examination/ weekend and evening time/ different site of interview or examination
Finland (FINRISK 2007)	Newspapers/ radio/ television/ internet (survey websites)	A small gift with invitation	No	
France	Newspapers/ internet (survey websites)	No	No	Clear and informative letter / phone call by a physician
Germany	Newspapers/ radio/ television/ internet (survey websites) + other means	Reimbursement of travel exp. to all/ small gift	Immigrants: User-friendly lay-out/ personal assistance/ 7 languages/ cult. adapted materials/ trained staff/ interpreter on site	Personal contact by phone, home visit, telephone hotline
Greece	Newspapers/ radio/ television/ public Speeches/ personal letters to volunteers	Measurements, tests and dietary rec. seen as reward	Monks in monasteries, elders: collaboration with representatives for the groups	Cohort study, not strictly representative. As many as possible were contacted
Ireland		Prise draw for all participants	Phone help line / trained fieldworkers to assist/ interpreter: trained fieldworkers	Phone call to non-participants

Country	Information to public	Incentives	Recruitment of minorities	Most effective to increase response
Latvia	No	No	No	
Malta	Newspapers/ billboards	Small gifts/ lottery ticket	No efforts (sample include prisons and institutions)	Introductory letter by Director General Health/ at interview: small gift and lottery ticket/ courtesy at all times/ repeated reminders
Macedonia	Television/ press conference	No	No	Mailed letter
Netherlands	Newspapers	Reimbursement of travel expenses to all	No	
Norway	Newspapers/ radio/ television/ internet/ other means	No	No	Large willingness to contribute to research/ the ideal medical test (not yet found) would increase response
Poland	Newspapers/ radio/ television	No	No	Phone call, home visits
Sweden	Newspapers/ television	No	No efforts	Mobile phone
UK	GP notification/ GP posters/ engage with the media	Small gift sent with the invitation	7 languages + English in 1999 and 2004	Small gifts

Table 7.7 Collection of information on non-participants and reasons for non-response in recent European surveys (Data source: FEHES questionnaires on Annex 3.)

Country	Was health information collected from the non-participants?	Were the non-participants asked about the reasons for refusal or non-response? If yes, what were the main reasons?	Was basic information about the non-participants collected from the sampling frame or other registers?
Austria	No	No	Information available in the sampling frame
Belgium	No	Not interested/ no time/ health reasons/ age reasons/ too personal/ too long/ not able to answer/ language problem	Information from the sampling frame and other registers
Bulgaria	No	Not interested, feeling healthy	No
Croatia	No	Lack of time/ not interested/ not wanting to talk about themselves	Information available in the sampling frame
Czech Republic	No	No	Information available in the sampling frame
Cyprus	No	Confidentiality issues, lack of time	No. Some information from the sampling frame (Census 2001) but not updated.
Denmark	Information from central registers	No	From other registers: sex, age, education, income, cohabitation, etc
Estonia	No	No time/ too many surveys/ non-location/ temporary absence	From other registers: sex, age, residence etc
Finland (Health 2000)	Short exam. protocol/ short mailed quest./ short phone interview	Too busy/ personal principle of not participating/ severe illness/ good health/ non-location/ temporary absence	Information available in the sampling frame

Country	Was health information collected from the non-participants?	Were the non-participants asked about the reasons for refusal or non-response? If yes, what were the main reasons?	Was basic information about the non-participants collected from the sampling frame or other registers?
Finland (FINRISK 2007)	No	No time/ not interested	Information available in the sampling frame
France	No	No time/ no interest for the topic (nutrition)/ fear to be visited at home	Information available in the sampling frame
Germany	Short non-responder quest. (phone or visit): SES, health status, parents smoking, doctors consult.	Not shown/ cancelled/child didn't agree/ was anxious/ not interested/ child healthy/ refused/ too busy/ person not reached etc	Information available in the sampling frame (age, sex, nationality)
Greece	No	No	Information available in the sampling frame
Ireland	No		No
Latvia	No	No	No
Malta	No	No time/ not important enough/ unable to trace	Inform available in the sample frame
Macedonia	No	No	No
Netherlands	HIS: From the sampling frame. HES: From HIS and the sampling frame.	No	Information available in the sampling frame

Country	Was health information collected from the non-participants?	Were the non-participants asked about the reasons for refusal or non-response? If yes, what were the main reasons?	Was basic information about the non-participants collected from the sampling frame or other registers?
Norway	No, possibly questionnaire will be sent to non-respondents to collect HIS-inform.	"Practical reasons"; work, studies, lack of time. Not allowed to ask for reasons (considered unethical).	Sampling frame, other registers (if allowance)
Poland	No	No	Information available in the sampling frame
Sweden	Short mailed quest. / telephone int.	Yes	Census
UK	No, not permitted	No, not permitted to ask for reasons	No, not permitted

Table 7.8 Results of a systematic review of 292 randomised controlled trials evaluating the effect of strategies to increase response rates in postal questionnaire surveys [23]

Strategy	Surveys, N	OR	95%-CI	p-value for heterogeneity
Monetary incentive vs no incentive	49	2.02	1.79-2.27	.001
Incentive with questionnaire vs by the return	10	1.71	1.29-2.26	.001
Non-monetary incentive vs no incentive	45	1.19	1.11-1.28	.001
Shorter vs longer questionnaire	40	1.86	1.55-2.24	.001
Colored ink vs standard	1	1.39	1.16-1.67	
More personalised questionnaire vs less	38	1.16	1.06-1.28	.001
Recorded delivery vs standard	6	2.21	1.51-3.25	.01
Stamped return envelope vs franked	14	1.26	1.13-1.41	.001
1st class outward mail vs other class	1	1.12	1.02-1.23	
Precontact (“alert letter”) vs not	28	1.54	1.24-1.92	.001
Follow-up (reminder) by non-response vs not	12	1.44	1.22-1.70	.001
Reminder including questionnaire vs without	6	1.41	1.02-1.94	.001
More vs less interesting questionnaire	2	2.44	1.99-3.01	
“User friendly” lay-out vs standard	1	1.46	1.21-1.75	
Factual questions only vs additional questions	1	1.34	1.01-1.77	
More relevant questions first vs later	1	1.23	1.10-1.37	
Sensitive question included vs not	6	0.92	0.87-0.98	
More general question first vs later	1	0.80	0.67-0.96	
Sent from university vs others	13	1.31	1.11-1.54	.001
Reason for not participating requested vs not	1	1.32	1.05-1.66	
Stresses the benefit to society vs other appeal	8	1.00	0.84-1.20	
Response deadline given vs not	4	1.00	0.84-1.20	

8. ELEMENTS FOR A CORE MODULE AND ADDITIONAL TOPICS FOR HES

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A HES can vary in size and complexity, from an interview with a few measurements and/or blood samples, to a comprehensive health examination taking several hours to complete. In order to recommend modules to cover elements of a 'core' (basic) component of a HES, it is important to refer to those measurements that have been included in previous HESs. When reviewing the most recent surveys (as described in Chapter 4) it became evident that certain topics were recurrent in most of the surveys considered over the period, and indeed some of these topics referred to measurements for which a detailed protocol was available and validated at the national/international level, both in terms of examinations (as discussed in further details in Chapter 9) and questions. These measurements are also usually gathering information on diseases or risk factors for diseases with high prevalence (e.g. CVD), that address important public health concern globally.

Additional measurements of a HES can be targeted to specific age groups or specific sub-samples of the participants (e.g. tests on functional capacity carried out for the elderly). This chapter identifies those topics that were most commonly included in HESs, both in terms of examinations and questionnaires, and lists additional topics that can be of importance to selected subpopulations, to obtain data on specific health conditions or to assess specific health services utilisation. These topics were also included in some, albeit fewer, national HESs.

8.1 IMPORTANCE OF HES AS DATA SOURCE

Table 8.1 details the importance of HES as a source of information, at present or potentially in the future, for selected health topics in European countries. The information is derived from the FEHES questionnaire: (total number of countries/contact persons was 32, see details in Chapter 4).

Most FEHES contact persons considered HESs as an important source of information for the risk factors for major chronic diseases, as well as for the prevalence of diabetes, cardiovascular diseases and respiratory diseases (Table 8.1). HESs were considered as an important source of information for the prevalence of musculoskeletal diseases and mental health problems, and on measurements for functional capacity, but a few considered them not important at all.

8.2 MOST COMMON MEASUREMENTS

8.2.1 EXAMINATIONS

A summary of the health examinations that are recurrent in all (or most) of previous national HESs, and the order of these measurements are shown in Table 8.2. Almost all the surveys considered have a 'core' content of anthropometric measurements, blood pressure measurements and blood samples (mainly for lipid analyses, except Croatia). In the countries with extensive comprehensive surveys this set of measurements is targeted to all age groups. The discussion relating to the protocol for these measurements is provided in Chapter 9.

Height was measured in all countries, while weight was measured in all countries with the exception of Croatia where it was self-reported.

The sequence the measurements were taken was also similar in most countries. For example, in all the previous HESs, blood pressure was measured before taking the blood samples. This is due to the recognition that blood taking can be a potentially stressful procedure for some participants, and this could affect their blood pressure levels.

For all the topics described above relevant questions were also asked, for example in the case of blood pressure or blood measurement of lipids to gather information on treatment, awareness and management of the conditions hypertension and hyperlipidemia. (Tables 8.3 and 8.4)

8.2.2 QUESTIONS

The national HESs also collect basic information to characterise the surveyed population.

Table 8.5 summarises those questions (demographics, health status/health disease, health determinants) that recurred more often in previous national HESs. Some were asked face-to-face while in some instances a self-completion questionnaire was used. Table 8.6 shows the relevant questions asked on smoking habits.

8.3 ADDITIONAL MEASUREMENTS

Additional modules can cover additional measurements, as described above. They can be of interest for specific age groups, ethnic groups, and help to collect data on specific health issues. The review of previous national HESs identified examinations and questions used in some countries. Not all but most of the additional modules tended to be included in more comprehensive HESs, of longer duration.

8.3.1 EXAMINATIONS

The Tables 8.7 and 8.8 illustrate additional examinations identified in previous national HESs. The discussion relating to the protocol for these measurements is provided in Chapter 9.

From the review of previous national HESs, lung function appeared one of the examinations recurring more often. Functional tests/tests of physical performance were also carried out in some surveys, but were restricted to older age participants. These examinations included a battery of tests, such as walking speed, hearing and vision test, balance tests.

Other examinations of higher complexity are less often performed in national HESs, given the specific field they cover, for example bone density, which was included only in Finland (Health 2000).

8.3.2 QUESTIONS

The Tables 8.9 and 8.10 illustrate additional questions identified in previous national HESs. These include questions on alcohol consumption, eating habits (including consumption of fruit and vegetables) physical activity, respiratory health and respiratory conditions, mental health, oral health. Some of these questions (e.g. respiratory health and oral health) are in the surveys when the corresponding examinations are included, while other questions can be stand-alone (e.g. physical activity).

Questions on alcohol consumption are relatively common in national HESs, given the important role of alcohol as a risk factor for cardiovascular disease and a health and social problem in its own right in some countries.

For some topics (such as for example eating habits, or mental health), many countries have detailed surveys that cover the topic in great details, and these are therefore not included in the national HES. Chapter 5 lists the international projects that deal with specific recommendations to develop international standards on specific topics.

8.4 CONCLUSIONS

At least height, weight, waist circumference, blood pressure and lipids were measured in most of the previous national HESs. The number of additional measurements varied considerably between surveys but in many surveys physical performance tests, lung function tests, ECG, etc. were included.

Table 8.1 Importance of HES as a sources of information*

	Very important	Somewhat important	Not important at all
Risk factors for major chronic diseases			
Blood pressure	29	3	0
Blood lipids	30	2	0
Body weight and height	28	4	0
Functional capacity			
Hearing	9	17	6
Vision	11	17	4
Mobility	12	15	5
Cognitive capacity	15	15	2
Activities of daily living	13	13	5
Prevalence of specific diseases and public health problems			
Diabetes	26	6	0
Cardiovascular diseases	24	8	0
Respiratory diseases	22	10	0
Musculoskeletal problems	19	9	4
Mental health problems	19	11	2

* Detailed the importance of HES as a source of information (at present or potentially in the future) for selected health topics in European countries (FEHES questionnaire: number of countries/contact persons, total 32)

Table 8.2 HES measurements: common examinations in countries with previous national HES (Keys: The numbers 1,2,3,4,5,6 denote the position the measurement occupied in the sequence of measurements taken for that particular country.

Country	Survey	Year	Height	Weight	Circumfe-rences		Blood pressure	Blood samples		Other Blood measurements
					Waist	Hip		Non-fasting	Fasting	
Croatia	Croatian Health Survey	2003	1.	self reported	2.	not done	3.	none	none	none
Czech Republic	Health, Lifestyle and Environment HELEN	2004	1.	2.	3.	4.	5.	Reflotran analysis: Tot chol	none	none
Finland	Health 2000	2000	2.	5.	3.	4.	1.	Tot chol , c-reactive protein	Tri, LDL , Hb glu , other lipids	This is quite detailed
	FINRISK	2007	1.	2.	3.	4.	5.	6.	6. Tri, LDL	Gamma GTliver, gallbladder, stomach and pancreas function
France	National survey on nutrition and health	2006	1.	2.	3.	4.	5.	6. Tot chol , HDL	Triglyce-ride, LDL, Glucose	Ferritin, B9, B12, vit D, Hb, Kidney Function: Creatinine, Pesticides, Pb, As, Cd, Hg

Country	Survey	Year	Height	Weight	Circumfe-rences		Blood pressure	Blood samples		Other Blood measurements
					Waist	Hip		Non-fasting	Fasting	
Germany	German national health examination and interview survey	1998	1.	2.	3.	4.	5.	Tot chol, HDL,	Tri, Hb glu,	
Ireland	SLAN	2006	2	3	4	5	1.	Tot chol, HDL	Tri, LDL	Haematological system functions Other
Netherlands	Continuous Quality of Life Survey	2001	1.	2.	3.	4.	6.	5. Tot. chol, HDL	Hb Glcose	Other metabolic function
Norway	Cohort Norway	1994-2003	1.	2.	3.	4.	5.	6. Tot chol,, HDL	Tri, Hb glucose	Other metabolic function. Vitamin D and C and other
Poland	WOBASZ	2005	1.	2.	3.	4.	5.	Tot chol , c-reactive protein	Tri , LDL, Hb glucose, other lipids	Other metabolic function, Serum homocysteine,
Slovakia	CINDI Health Examination	2003	1.	2.	3.	none	5.	4. Tot chol, HDL	Tri, LDL	none

Country	Survey	Year	Height	Weight	Circumfe-rences		Blood pressure	Blood samples		Other Blood measurements
					Waist	Hip		Non-fasting	Fasting	
United Kingdom (England)	Health Survey for England	2005	1.	2.	4.	5.	3.	6. Tot chol, HDL,	Not taken	Ferritin, Tot Hb, Glycated Hb, Fibrinogen, Albumin soluable transferrin receptor, vitamin D, Mean cell volume, Vitamin B12
Canada	Canadian Health Measures Survey	2007	1.	2.	3.	4.	5.	6. Tol chol, HDL	Tri, LDL, Hb glu, other lipds	Liver function: alanine aminotransferace (ALT), aspartate aminotrasnferace (AST) Kidney Function: Albumin, alkaline phosphate, creatinine, Total protein Nutritional status: sodium bicarbonate, calcium, chloride, phosphate, potassium, sodium. Other: CVD risk: Homocysteine, high sensitivity CRP, apolipoprotein A1&2, fibrinogen.
USA	NHANES	2005-2006	1.	2.	3.	not done	4.	5.	6.	Very detailed/ extensive measurements

Table 8.3 High blood pressure/ hypertension – Relevant questions asked in national HESs.

Country	Survey	Year	Relevant questions asked
Croatia	Croatian Health Survey	2003	Section: use of health services: from a list of do you have any of the following chronic conditions: Elevated BP. Secondary Prevention examination question
Czech Republic	Health, Lifestyle and Environment	2004	None. Measurement only
Finland	Health 2000	2000	Perceived health: present: have you high BP/hypertension, treatment, current medication, last 12 months have you visited a droctor. Previous measurement
	FINRISK	2007	Diagnosed hypertension in past 12 months, last blood pressure measurement, used medication
France	National survey on nutrition and health	2006	None. Measurement only
Germany	German national health examination and interview survey	1998	Have you ever had any of the following diseases? Where did you seek this health service
Ireland	SLAN	2002	Prevention, current level, promotion and awareness
Netherlands	Continuous Quality of Life Survey	2005	Medication: prescribed for?
Norway	Cohort Norway	1994-2003	Used medications
	Survey on living conditions & health, care and social relations	2002	Have you ever had high BP?
Poland	WOBASZ	2005	Current, awareness, treatment, management
Slovakia	CINDI Health Examination Survey	2003	None. Measurement only
UK	Health survey for England)	2005	Awareness, treatment, control, management of hypertension, current hypertension levels.
	Scottish Health Survey	2003	Treatment and control of hypertension, current hypertension levels. Hypertension
Canada	Canadian Health Measures Survey)	2007	Awareness of high blood pressure, medication

Country	Survey	Year	Relevant questions asked
USA	NHANES	2005-2006	Awareness. What condition/health problem causes you to have difficulty …list current blood pressure status

Table 8.4 Hyperlipidemia - Relevant questions asked in national HESs.

Country	Survey	Year	Relevant questions asked
Croatia	Croatian Health Survey	2003	Section: use of health services: from a list of do you have any of the following chronic conditions Elevated blood cholesterol. This is from a list of chronic conditions
Czech Republic	Health, Lifestyle and Environment	2004	HES only
Finland	Health 2000	2000	Have you during the past 5 years had the following health examination? From list: measurement blood cholesterol
	FINRISK	2007	Awareness of hyperlipidemia, last measurement, treatment
France	National survey on nutrition and health	2006	HES only
Germany	German national health examination and interview survey	1998	Have you ever had any of the following illness/ diseases? From a list High level of fat in blood, high cholesterol levels. This is asked from an extensive list
Ireland	SLAN	2002	When did you last have your blood cholesterol measured, with a list to time periods. What is the level of your cholesterol. Have you ever been told by your doctor you have. From a list: high cholesterol. How do you think the following affect risk of CHD and related diseases? With a list of values for Total, and LDL cholesterol . Questions asked in the General Health Status. Quite detailed questions. Not all the sections of the questions were added into this table
Netherlands	Continuous Quality of Life Survey	2005	Nothing found in this survey
Norway	Cohort Norway	1994-2003	Medication
	Survey on living conditions & health, care and social relations	2002	Nothing found in this survey

Country	Survey	Year	Relevant questions asked
Poland	WOBASZ	2005	Have you ever been told by a doctor you have raised cholesterol level. How old where you when you were doctor diagnosed a raised cholesterol level? Drugs prescribed by your dry to lower cholesterol. Have you been talking lipid lowering drugs within the last 3 days . Are you on any special diet prescribed by your doctor or other medical worker in order to lower your cholesterol level. Have you measured your cholesterol level within the last 12 months? Quite detailed questions in comparison with other surveys listed here
Slovakia	CINDI Health Examination Survey	2003	HES only
UK	Health survey for England	2005	Have you ever had your blood cholesterol level measured by a doctor or nurse? When was the last time your blood cholesterol level was measured by a doctor? Thinking about the last time your blood cholesterol level was measured, were told it was…with a list of ranges. Has a doctor or a nurse told you to lower your cholesterol? Have you done things to lower your cholesterol? Has your doctor or nurse explained high cholesterol in a way you could understand? Have doctors or nurses taken your preferences into account when making treatment decisions about your high cholesterol? The focus of this survey was for those aged 65 and over. These questions were asked from this age
	Scottish Health Survey	2003	Same as for Health Survey for England
Canada	Canadian Health Measures Survey	2007	Has the blood cholesterol measured. Awareness of elevated cholesterol. Medication

Country	Survey	Year	Relevant questions asked
USA	NHANES	2005-2006	Has the cholesterol ever been measured. When was cholesterol last measured. Has ever been told that cholesterol is high. Medication.

Table 8.5 Common questions in countries with previous national HES.

Country	Surveys	Year	Questions about					
			Age	Sex	Education	General health	CVD	Smoking /tobacco use
Croatia	Croatian Health Survey	2003	X	X	X	X	none	X
Czech Republic	Health, Lifestyle and Environment	2004	X	X	none	none	none	none
Finland	Health 2000	2000	X	X	X	X	X	X
	FINRISK	2007	X	X	X	X	X	X
France	National survey on nutrition and health	2006	X	X	none	none	none	none
Germany	German national health examination and interview survey	1998	X	X	X	X	X	X
Ireland	SLAN	2002	X	X	X	X	none	X
Netherlands	Continuous Quality of Life Survey	2005	X	X	X	X (for children only)		X
Norway	Cohort Norway	1994-2003	X	X	X	X	none	X
	Survey on living conditions & health, care and social relations	2002	X	X	X	X	none	X
Poland	WOBASZ	2005	X	X	X	X	X	X
Slovakia	CINDI Health Examination Survey	2003	X	X	none	none	none	none
UK	Health survey for England	2005	X	X	X	X	X	X

Country	Surveys	Year	Questions about					
			Age	**Sex**	**Education**	**General health**	**CVD**	**Smoking /tobacco use**
	Scottish Health Survey	2003	X	X	X	X	X	X
Canada	Canadian Health Measures Survey	2007	X	X	X	X	X	X
USA	NHANES	2005-2006	X	X	X	X	X	X

Table 8.6 Smoking - Relevant questions asked in national HESs.

Country	Survey	Year	Relevant questions asked
Croatia	Croatian Health Survey	2003	Family members or you that smoke. Passive smoking knowledge. Former smoker, current smoker. Stop/ reducing smoking. Advice to stop
Czech Republic	Health, Lifestyle and Environment	2004	No smoking questions
Finland	Health 2000	2000	Have you ever smoked, current and former smoking status, when did you last smoke, have you tried to give up smoking.
	FINRISK	2007	Have you ever smoked, current and former smoking status, age when started smoking, when did you last smoke, amount and type smoked, have you ever tried stop smoking, use of snuff, exposure to environmental tobacco smoke
France	National survey on nutrition and health	2006	No smoking questions
Germany	German national health examination and interview survey	1998	No smoking questions
Ireland	SLAN	2002	Current smoking, Former smoker, Tried to stop, passive smoking. Some of the questions ask about the current and past in the same question
Netherlands	Continuous Quality of Life Survey	2005	No smoking questions
Norway	Cohort Norway	1994-2003	How long have you smoked. Type of tobacco smoked. Daily smoking status. Amount smoked.
	Survey on living conditions & health, care and social relations	2002	Current smoking. How many.
Poland	WOBASZ	2005	Current smoking, daily, at what age started, tried to stop smoking, Former smoker (when did you stop), passive smoker. This is quite detailed
Slovakia	CINDI Health Examination Survey	2003	HES only

Country	Survey	Year	Relevant questions asked
UK	Health survey for England	2005	Have you ever smoked? Current and past. The age you started to smoke, How many smoked in the last week (5 questions in Total), exposure to 2nd hand smoke .Basic smoking section. The questions were asked in CAPI but only web trend tables were shown, No smoking chapter reported
	Scottish Health Survey	2003	Current smoking, exposure to second hand smoke (passive smoking), frequency and pattern of current smoking, the number, type and tar content of cigarettes smoked by current smokers. Past smoking behaviour, desire to give up smoking, medical advice to stop smoking. For women, smoking behaviour during pregnancy
Canada	Canadian Health Measures Survey	2007	Smoking status. Age when started smoking. Type of tobacco smoked. Amount smoked.
USA	NHANES	2005-2006	Current smoking, Stop/reduce smoking, Former smoker (when did you quit, day, week, months), Average amount smoked a day, Past 30 days did you smoke. How old were you when you first started to smoke?

Table 8.7 Additional examinations in countries with previous national HES

Country	Surveys	Year	Respiratory function/ Lung function test	Physical performance/ functional test (e.g. walking, speed test, vision test, hand grip test)	Physical Fitness (e.g. step test)	Cognitive function test	ECG
Croatia	Croatian Health Survey	2003	none	none	none	none	none
Czech Republic	Health, Lifestyle and Environment HELEN	2004	none	none	none	none	none
Finland	Health 2000	2000	Spirometry, respiratory function	vision, hearing, cognitive function, reaction time, muscle strength, hand grip test, , body balance standing balance, , chair stand test, walking speed test	musculoskeletal fitness test	CEREAD & MMSE, M-CIDI Quite detailed tests	yes
	FINRISK	2007	none	yes (balance test)	none	none	none
France	National survey on nutrition and health	2006	none	none	none	none	none
Germany	German national health examination and interview survey	1998	none	none	none	M-CIDI-S questionnaire	none
Ireland	SLAN	2006	spirometry (PEF)	none	none	CIDI-SF for depression & other mental disorder i.e. anxiety	none

Country	Surveys	Year	Respiratory function/ Lung function test	Physical performance/ functional test (e.g. walking, speed test, vision test, hand grip test)	Physical Fitness (e.g. step test)	Cognitive function test	ECG
Netherlands	Netherlands Health Examination Survey	2001	none	walking on ground, walking on tiptoes, walking up stairs, squatting, elevation of the upper arms, extension of the elbow joints, flexion of the elbow joints, volar flexion of the wrists, flexion of the fingers to the palm, opposition of the thumbs	none	none	none
Norway	Cohort Norway	1994-2003	none	none	none	none	none
Poland	WOBASZ	2005	none	none	none	none	none
Slovakia	CINDI Health Examination Survey	2003	none	none	none	none	none
UK	Health Survey for England	2005	none	walking, half and full chair raise, balance, semi and half tandem, hand grip test, balance (all aged 65+ only)	none	In older people	none
	The Scottish Health Survey	2003	spirometry (PEF)	none	none	In older people	ECG (12 lead: Minnesota code)

Country	Surveys	Year	Respiratory function/ Lung function test	Physical performance/ functional test (e.g. walking, speed test, vision test, hand grip test)	Physical Fitness (e.g. step test)	Cognitive function test	ECG
Canada	Canadian Health Measures Survey	2007	spirometry (PEF)	Hand grip strength, partial curl ups, muscle flexibility: sit and reach, physical activity monitoring	Step test	none	none
USA	NHANES	2005-2006	none	Balance test	none	none	none

Table 8.8 Additional examinations in countries with previous national HES - continues.

Country	Surveys	Year	Bone density	Oral Health/ Dental health	Urine sample	Saliva sample	Other examination measurements
Croatia	Croatian Health Survey	2003	none	none	none	none	
Czech Republic	Health, Lifestyle and Environment HELEN	2004	none	none	none	none	
Finland	Health 2000	2000	done	clinical examination and radiological examination (ortopantomography)	bone density & allergy study spot sample	none	Bioimpedance, Other urine sample, clinical cardiovascular examination. M-CIDI covers: depression, psychosis, alcohol/drug dependence and other mental disorders
	FINRISK	2007	none	none	none	none	In HES core table only
France	National survey on nutrition and health	2006	none	none	heavy metals, pesticides (spot test)	none	

Country	Surveys	Year	Bone density	Oral Health/ Dental health	Urine sample	Saliva sample	Other examination measurements
Germany	German national health examination and interview survey	1998	none	none	spot test: glucose (diabetes), kidney, urinary tract and thyroid function (Bilirubin, protein, erythrocyte, ketone, leucocyte, pH	none	Questionnaire on: Depression-mental disorders, mental and cognitive function, Psychosis mental disorders, alcohol/drug dependence other mental
Ireland	SLAN	2006	none	none	common basic: kidney, urinary tract, thyroid function, minerals and trace elements (sodium, potassium)	none	
Netherlands	Netherlands Health Examination Survey	2001	none	none	none	none	
Norway	Cohort Norway	1994-2003	none	none	none	none	Musculoskeletal function
Poland	WOBASZ	2005	none	none	none	none	

Country	Surveys	Year	Bone density	Oral Health/ Dental health	Urine sample	Saliva sample	Other examination measurements
Slovakia	CINDI Health Examination Survey	2003	none	none	none	none	
UK	Health Survey for England	2005	none	none	spot test for salt intake-sodium, potassium, creatinine	Cotinine (aged 4-15 only)	demi span (65+)
	The Scottish Health Survey	2003	none	none	spot test: dietary sodium	Cotinine	Mid-upper arm circumference (MUAC), demi span (65+)
Canada	Canadian Health Measures Survey	2007	none	Simple dental assessment: Dentist checked the condition of teeth, gums and tongue	quite detailed analysis	none	Skin-fold measurements, other cardiovascular: resting heart rate
USA	NHANES	2005-2006	Yes for proximal femur and lumbar spine	Tooth control + questionnaire	Yes	none	Audiometry, upper arm length, triceps skinfold, subscapular skinfold, ophthalmology exam,

Table 8.9 Additional questions in countries with previous national HES

Country	Surveys	Year	Drinking alcohol	Eating habits (diet/ nutrition)	Fruit & vegetable	Physical activity	Social support	Respiratory & lung function
Croatia	Croatian Health Survey	2003	X	X	none	X	X	none
Czech Republic	Health, Lifestyle and Environment	2004	none	none	none	none	none	none
Finland	Health 2000	2000	X	X	X	X	X	X
	FINRISK	2007	X	X	X	X	none	none
France	National survey on nutrition and health	2006	none	none	none	none	none	none
Germany	German national health examination and interview survey	1998	X	X	none	X	X	none
Ireland	SLAN	2002	X	X	X	X	none	None
Netherlands	Continuous Quality of Life Survey	2005	X	X	none	X	X	X
Norway	Cohort Norway	1994-2003	none	none	none	none	none	none
	Survey on living conditions & health, care and social relations	2002	X	none	none	X	X	none

Country	Surveys	Year	Drinking alcohol	Eating habits (diet/ nutrition)	Fruit & vegetable	Physical activity	Social support	Respiratory & lung function
Poland	WOBASZ	2005	X	none	none	X	X	none
Slovakia	CINDI Health Examination Survey	2003	none	none	none	none	none	none
UK	Health survey for England	2005	X	X	X	X	X	X
	Scottish Health Survey	2003	X	X	X	X	X	X
Canada	Canadian Health Measures Survey	2007	X	X	X	X	X	none
USA	NHANES	2005-2006	X	X	X	X	X	X

Table 8.10 Additional questions in countries with previous national HES - continues

Country	Surveys	Year	Mental Health	Oral Health	Use of Health services (general)/ medication	Use of health services (for specific conditions)	Use of medications (for specific conditions)	Diabetes
Croatia	Croatian Health Survey	2003	X	X	X	X	X	none
Czech Republic	Health, Lifestyle and Environment	2004	none	none	none	none	none	none
Finland	Health 2000	2000	X	X	X	X	X	X
	FINRISK	2007	none	X	X	none	X	X
France	National survey on nutrition and health	2006	none	none	none	none	none	none
Germany	German national health examination and interview survey	1998	X	X	X	X	X	X
Ireland	SLAN	2002	X	X	X	X	X	X
Netherlands	Continuous Quality of Life Survey	2005	X	X	X	X	X	none
Norway	Cohort Norway	1994-2003	none	none	none	none	none	none

Country	Surveys	Year	Mental Health	Oral Health	Use of Health services (general)/ medication	Use of health services (for specific conditions)	Use of medications (for specific conditions)	Diabetes
	Survey on living conditions & health, care and social relations	2002	none	none	none	none	none	none
Poland	WOBASZ	2005	X	none	X	X	X	X
Slovakia	CINDI Health Examination Survey	2003	none	none	none	none	none	none
UK	Health survey for England	2005	X	none	X	X	X	X
	Scottish Health Survey	2003	X	none	X	X	X	X
Canada	Canadian Health Measures Survey	2007	none	X	none	none	X	X
USA	NHANES	2005-2006	X	X	X	X	X	X

9. MEASUREMENT PROCEDURES

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In chapter 8, an overview was given of the risk factors and the biological measurements included to the previous health examination surveys (HES) in Europe. The aim of this chapter is to review the state of arts of the measurement procedures, to give an overview of the used measurements and protocols in recent European and other major HESs, and to make conclusions from these. The conclusions should be relevant for the assessment of the feasibility of a HESs in Europe, and from the basis for the preparation of recommendations for future European HES. Where relevant, measurement procedures recommended by other Projects of the Health Monitoring Programme of the Public Health Programme of the EU, such as the European Health Risk Monitor (EHRM) Project [1], will be used as a reference, and their suitability will be assessed.

The information on the procedures used in earlier HESs comes mainly from the European Health Interview & Health Examination Surveys Database [2] and also from specific survey protocols like the EHRM [1], WHO STEPS [3] and WHO MONICA Protocol [4] (See Chapter 4 .1).

9.1 HEIGHT MEASUREMENT

There is evidence from several studies that the use of self-reported weight and height usually lead to underestimations of obesity prevalence rates because on average subjects tend to over-report body height [5]. Therefore, in health surveys, actual weight and height should be measured [6].

9.1.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Critical for the measurement of height are the choice and calibration of the measurement device, clothing and position of the subject, and position of the measurer when reading the

measurement value. Relevant for standardization are also instructions concerning subjects who cannot stand up.

9.1.2 EARLIER RECOMMENDATIONS

The EHRM Project made in year 2002 a review of earlier recommendations and a proposal for the standard procedure for measuring height in a European HES [1, 7]. To avoid rounding bias, it was recommended to record height to the resolution of the height rule. Self-reported height was not considered acceptable in any circumstances.

9.1.3 PROCEDURES USED IN PREVIOUS HESS

In most previous HESs, height was measured using a portable stadiometer (Table 9.1). In most surveys, height was measured to the nearest 0.1 cm but in many surveys also to the nearest 0.5 cm. In many of the surveys, height was not measured if the subject was not able to stand (wheelchair bound). These are all in accordance with the EHRM recommendation.

9.1.4 CONCLUSION

Height is one of the simple measurements, where standardization is needed to ensure the use of the similar procedures between observers and comparability between surveys. The EHRM recommendation is still up-to-date, and is not in conflict between the standards used earlier European HESs.

9.2 WEIGHT MEASUREMENT

There is evidence from several studies that the use of self-reported weight leads to underestimations of obesity prevalence rates because, on average, the subjects tend to under-report their body weight. This concerns especially the obese [5]. Therefore, actual weight should be measured in HESs.

9.2.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Critical for the measurement of weight are the choice and calibration of the measurement device, clothing of the subject and the measurement procedure of the measurer. Relevant for standardization are also instructions concerning pregnant women, wheelchair bound individuals, or persons who have difficulty standing steady.

9.2.2 EARLIER RECOMMENDATIONS

The EHRM Project made in year 2002 a review of earlier recommendations and a proposal for the standard procedure for measuring height in a European HESs [1, 7]. A specific detail of the EHRM standard is that it recommends the use of a traditional beam balance scale which was considered the most reliable instrument. Electronic floor scales have often replaced the beam balance scale in recent HESs because they are easier to obtain and operate, and they are easier to transport. However, they are usually difficult or impossible to calibrate. To avoid rounding bias, it was recommended to record weight to the resolution of the scale. Self-reported weight was not considered acceptable in any circumstances.

The EU directive on medical devices (93/42/EC [8], updated in 2007 [9]) sheds new light to the usability of electronic scales. According to it, scales are acceptable for medical use if they can be calibrated. Such scales also have to be stabilized in each place where they are set up. This is because their reading is dependent on the gravity, which varies slightly between places.

9.2.3 PROCEDURES USED IN PREVIOUS HESS

In many previous HESs weight was measured using an electronic scale and only in few surveys, a balanced beam scale was used (see Table 9.2). In all surveys considered in this review, the respondents were asked to remove their outdoor clothes, shoes and outer garments before measuring weight. In some surveys weight was not measured in pregnant women, wheelchair bounded individuals or persons who have difficulty standing steady. This is in accordance with the EHRM recommendation. In most surveys, weight has been measured to the nearest 0.1 kg but in one survey also to the nearest 0.5 kg.

9.2.4 CONCLUSIONS

Like height, weight is also one of the simple measurements, where standardization is needed to ensure the use of the similar procedures between observers and comparability between surveys. The EHRM recommendation is up-to-date, and is not in conflict between the standards used in most earlier European surveys. However, electronic scales that meet the criteria of the EU directive (see above) can also be used.

9.3 WAIST AND HIP CIRCUMFERENCES

Waist and hip circumference (and the derived waist-to-hip ratio) are widely used as indicators of abdominal obesity. It is getting more evident that the waist circumference may

be a better reflection of the accumulation of intra-abdominal or visceral fat than the waist-to-hip ratio. Because of the postulated role of the visceral fat depot in health risks associated with obesity, waist circumference is now the preferred measure in the context of population studies [10]. Waist to hip ratio and waist circumferences are significantly associated with the risk of incident CVD events and type 2 diabetes [11, 12].

9.3.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

The measurements of waist and hip circumferences are more difficult than those of weight and height because the results are sensitive to the contraction of muscles by the subject and the location and tightness to the measuring tape.

9.3.2 EARLIER RECOMMENDATIONS

The EHRM Project made in year 2002 a review of earlier recommendations and a proposal for the standard procedure for measuring height in a European HESs [1, 7]. According to the EHRM standard, waist circumference should be measured at a level midway between the lower rib margin and iliac crest, and hip circumference should be measured as the maximal circumference over the buttocks. For both measurements, the tape should be in horizontal position all around the body.

9.3.3 PROCEDURES USED IN PREVIOUS HESS

Most surveys have used a measuring tape (metal or plastic) (Table 9.3) and procedures similar to what was recommended by the EHRM Project. All measurements were taken in standing position without any clothing, or with light underwear. The protocols used to measure waist and hip circumferences were the same for almost all the surveys. Subjects were asked to stand with feet little apart, weight evenly on both feet. The distance between feet should be 10-15 cm. Waist circumference was measured between the lower rib margin and iliac crest. The subject was asked to breath gently and the measurement was done while breathing gently out. To ensure that the measurement tape is in one level, in some surveys the subject was asked to turn on place for 90 degrees. EHRM proposed the use of a mirror with horizontal grid lines. Hip circumference was measured over the buttocks. In most surveys, waist and hip circumferences were measured to the nearest 0.1 cm but in some surveys also to the nearest 0.5 cm. One survey measured to the nearest 1 cm. In NHANES, the hip circumference was not measured (only the waist circumference).

9.3.4 CONCLUSIONS

The measurement technique for waist and hip circumferences is more demanding than for weight and height, and therefore the standardization requires more training and quality control. The EHRM recommendation is up-to-date, and is not in conflict between the standards used in most of the earlier European surveys.

9.4 BLOOD PRESSURE

Raised blood pressure is a risk factor for cardiovascular diseases such as coronary heart disease, heart failure, hypertensive renal disease and cerebrovascular disease.

9.4.1 CRITICAL PROCEDURE ISSUES

The possible sources of error in the blood pressure measurement can be divided in to three categories: observer bias, faulty equipment and failure to standardize the techniques of measurement [13]. Critical issues relating to the observer bias like hearing problems, terminal digit preference etc. is discussed in Chapter 10 while issues relating to equipment and their use are discussed in this Chapter.

One of the most critical issues is the choice of the blood pressure measuring device. In the last decades the blood pressure has been measured with a mercury sphygmomanometer, which is still being seen as the gold standard. Due to toxicity of the mercury, various mercury containing products have been already banned or their use is restricted in number of countries.[14] Therefore, mercury sphygmomanometers have been widely replaced with non-mercury devices, primarily with automated devices. The very recent Directive 2007/51/EC of the EU [15] states that:

> "Mercury… 1. May not be placed on the market:
>
> (a) in fever thermometers;
>
> (b) in other measuring devices intended for sale to the general public (e.g. manometers, barometers, sphygmomanometers, thermometers other than fever thermometers).
>
> …..
>
> 3. By 3 October 2009 the Commission shall carry out a review of the availability of reliable safer alternatives that are technically and economically feasible for mercury-containing sphygmomanometers and other measuring devices in healthcare and in other professional and industrial uses.

On the basis of this review or as soon as new information on reliable safer alternatives for sphygmomanometers and other measuring devices containing mercury becomes available, the Commission shall, if appropriate, present a legislative proposal to extend the restrictions in paragraph 1 to sphygmomanometers and other measuring devices in healthcare and in other professional and industrial uses, so that mercury in measuring devices is phased out whenever technically and economically feasible."

We also asked the national contact persons of the FEHES network about the regulations and practices in their countries. There were replies from 19 countries (Table 9.4). In all countries, it is still allowed to use the mercury sphygmomanometers. In some countries, it is not possible to buy new mercury sphygmomanometers and also obtaining service and calibration for old devices is getting difficult.

For evaluation of the accuracy and validity of the automated blood pressure measurement devices, three validation protocols have been used:

1. British Hypertension Society protocol from 1990 [16] which was revised in 1993 [17].
2. Association for the Advancement of Medical Instruments protocol from 1987 [18] which was revised in 1992 [19].
3. European Society of Hypertension International Protocol from 2002 [20].

These validation protocols have been developed to assess the accuracy and validity of the blood pressure measurement devices for clinical use as well as for home measurements. All three protocols are rather similar and generally if device passes the validation by one protocol it also does so by the other protocol. Differences between the protocols have been reported elsewhere. [21, 22]

The validation results of the British Hypertension Society (BHS) protocol are reported separately for systolic and diastolic blood pressure with grading from A to D [17]. Both Association for the Advancement of Medical Instruments (AAMI) protocol [19] and International Protocol [20] use grading pass or fail. Grading are based on absolute difference between the mercury sphygmomanometer and the test device (mmHg) falling in categories $\leq$ 5mmHg, $\leq$ 10mmHg, and $\leq$ 15mmHg in the BHS and International Protocols and in categories $\leq$ 5mmHg, and $\leq$ 10mmHg in the AAMI Protocol.

Therefore, the maximum bias they allow for the devices to be considered accurate and valid are way too large for meaningful comparisons on blood pressure mean values and the prevalence of high blood pressure in the population.

The algorithms used by the automated devices are business secrets and under constant development. Therefore, devices from two different manufacture or two different types of same brand from the same manufacture may use different algorithms to determine the blood pressure. This may create serious comparability problems with the results.

When auscultation methods are used for the determination of blood pressure, the use of stethoscope is needed. The use of the bell of the stethoscope is generally recommended to permit more accurate auscultation of the Korotkoff sounds. [23, 24] From studies in the 1980's there is evidence that use of the bell of the stethoscope provides higher systolic blood pressure (2 mmHg) and lower diastolic blood pressure (0-2 mmHg) results than the use of the diaphragm. [24, 25] Later studies have not found any difference in the blood pressure results between bell and diaphragm [26, 27]. There are also results suggesting that new electronic stethoscopes with low-frequency or high-frequency amplification provide 1-2 mmHg higher systolic blood pressure results than conventional acoustic stethoscopes [27].

The used cuff size has shown to affect the blood pressure levels. Too narrow cuff overestimates and too wide cuff underestimates the blood pressure. It has been recommended that the cuff width should be at least 40% of the upper arm circumference. [28-30] The American Heart Association recommendations have also provided correction factors when ideal cuff width is not used [29]. For the length of the cuff, it has also been shown that too short cuff overestimates and too long cuff underestimates the blood pressure. It has been recommended that the cuff length should be at least 80% of the upper arm circumference. [29, 30]

There is evidence that strenuous exercise, eating a meal, drinking of alcohol or caffeine containing beverages and smoking affect the blood pressure levels. Strenuous exercise may decrease systolic blood pressure by 18-22 mmHg and diastolic blood pressure by 7-9 mmHg, the eating generally results only modest decreases in blood pressure and effects of alcohol and caffeine containing drinks depend on persons drinking habits. Smoking creates a peak increase in blood pressure (10 mmHg for systolic and 8 mmHg for diastolic blood pressure) for 30 minutes. [31]

Other persons have tendency to have a higher blood pressure levels when the blood pressure is measured in the physicians' office than at home. Also the blood pressure can be higher when measured by a physician than by a nurse or a medical student. This phenomenon is known as the "white coat hypertension" [32, 33]. Therefore, it is usually recommended that nurses rather than physicians should measure the blood pressure in population surveys.

The posture of the subject during the blood pressure measurement has marked influence to the blood pressure. It has been reported, that systolic blood pressure is on average 3-10 mmHg higher and diastolic blood pressure on average 1-5 mmHg lower in supine posture than in sitting. [34-36] Also, the position of arm in relation to heart has an effect on blood pressure. When the arm is resting on the arm rest of the chair or on the desk which usually is not on the level of heart, the systolic blood pressure may be 10 mmHg and diastolic blood pressure 11 mmHg higher than the when arm is at the level of the heart. [36-39]

Blood pressure in the right arm is often higher than in the left arm. The difference between right and left arm is 1-3 mmHg in systolic and 1 mmHg in diastolic blood pressure. [40, 41]

Blood pressure is affected by physical exercise and stress [31]. Coming to the examination site may require walking and stair climbing. Furthermore, coming to the examination may be a stressful event for the subject. As exercise may cause post-exercise hypertension up to 8 mmHg for systolic blood pressure and 4 mmHg for diastolic blood pressure and also stress may increase blood pressure [31, 42] it is recommended that the subject rests before the blood pressure measurement.

Average drops in the systolic blood pressure of 9 and 14 mmHg, respectively, have been reported after a resting period of four and eight minutes prior to the blood pressure measurement. The decrease was less evident in the diastolic blood pressure, amounting 3 and 4 mmHg, respectively, for the same resting periods. These results are consistent with the results of other studies that also report a decrease of similar magnitude within the first five to ten minutes of rest. [42] It has been recommended that at least five minutes of rest should be allowed before the measurement of blood pressure. [43]

When sequential blood pressure measurements are done in the frequency of few minutes, both systolic and diastolic blood pressure tends to decrease in time. The difference between two sequential measurements disappears after four measurements for diastolic blood pressure and after eight measurements for systolic blood pressure. [40, 41]

9.4.2 EARLIER RECOMMENDATIONS

Because of lack of evidence about the possibility to standardize automated devices in such a way that they can be used to assess long-term trends in blood pressure in the population, the EHRM Project still recommended the use of the mercury sphygmomanometer [1]. The EHRM recommendation continued: *"This may change when the accuracy of future automated devices is found to be sufficient in validation against the simple mercury sphygmomanometer."*

Now, when EU has set the Directive 2007/51/EC which may lead to the total ban of the mercury sphygmomanometers, it is essential to study existing alternatives; automated blood pressure measuring devices and aneroid sphygmomanometers, for the mercury sphygmomanometer.

To avoid bias due to measurement technique, EHRM Project recommended that blood pressure should be measured in sitting position from right arm after 5 minutes rest. The upper arm circumference should be measured for the selection of correct size cuff. Three measurements, one minute apart should be taken using the bell of the stethoscope. [1]

9.4.3 PROCEDURES USED IN PREVIOUS HESS

9.4.3.1 DEVICES

Blood pressure measuring device

From 15 surveys, in six the mercury sphygmomanometer, in eight the automatic device and in one both mercury sphygmomanometer and automated device was used. From three surveys the type of automatic device in not known. From known automated devices, all except one (Dinamap 8100) have passed at least one of the validation protocols. (Table 9.5)

Bell or diaphragm of the stethoscope

In all surveys, where the mercury sphygmomanometer was used, the bell of the stethoscope was used and the blood pressure was measured to the nearest 2 mmHg while in the surveys where automated devices were used, the blood pressure was recorded with the resolution of 1 mmHg. (Table 9.5)

Cuff sizes

In three of the surveys from which we had information about only one cuff size was available. In most of the surveys, at least three different cuff sizes were available with varying lengths. (Table 9.5)

9.4.3.2 PROCEDURES

Instruction for the subject before measurement

In most surveys, subjects received some instructions before coming to the blood pressure measurement. Generally, these instructions told to avoid strenuous exercise, eating, drinking anything else than water, smoking and use of drugs affecting the blood pressure before the blood pressure measurements. (Table 9.6)

Posture of the subject and arm during measurement of blood pressure

In all surveys the blood pressure was measured in sitting position. In surveys from which information is available, the arm was positioned so that the antecubital fossa was at the level of the heart. (Table 9.6)

Right or left arm

In all surveys, except in the Netherlands, the blood pressure was measured from right arm. In five of them, the use of left arm was allowed in predefined situations, when the use of right arm was not possible. In all these cases, the use of left arm instead of right one was recorded. (Table 9.6)

Resting before and between measurements

The resting period before the blood pressure measurement was usually 5-10 minutes, in most cases 5 minutes. Between subsequent measurements of the same person, the resting period varied from 30 seconds to 5 minutes. In most of the surveys, the rest between the measurements was 1 minute. (Table 9.6)

Number of measurements

In six surveys, two measurements were taken while in eight surveys three measurements were taken. In one survey, a total of six measurements were taken. (Table 9.6)

Protocol

In six surveys, MONICA protocol and in two surveys EHRM protocol was used. In some of these surveys, the original protocol was slightly changed. Other surveys used their own blood pressure measurement protocols, which are very similar to the MONICA and ERHM protocols, except in those cases where mercury sphygmomanometer was replaced with the automated blood pressure measurement device. (Table 9.6)

9.4.4 CONCLUSIONS

Blood pressure measurement is one of the difficult measurements to standardize because of the many potential sources of error. EHRM [1] recommended the use of the mercury sphygmomanometer. In many of the recent surveys, mercury sphygmomanometers were replaced by a variety of automated blood pressure measurement devices. This reflects the latest developments in the legislation against the use of mercury containing devices and

increasing availability of alternative devices. However, it is not clear how to ensure comparable results between surveys and in time when automated devices are used.

The stethoscope and cuff questions are already properly taken into account in resent surveys as well as required instructions to the subject before coming to the measurement, posture of the subject and arm, the use of right arm for the measurement and the resting periods before and between measurements. From these points, EHRM recommendations are up-to-date.

EHRM recommended that on three subsequent measurements are taken, and the mean of the second and third are used from reporting the blood pressure. In recent surveys over half already had at least three measurements. Adding the third measurement will increase the time of examination, but will also stabilize the effect of higher results in the first measurement.

9.5 BLOOD COLLECTION

Venous blood samples are usually collected for the measurement of blood lipids and glucose. Many other determinations can be carried out, often on deep frozen samples. Today serum and plasma samples are used also for analyses of fatty acids and lipoproteins, of biomarkers reflecting nutrition (vitamins, flavonoids), of antibodies as infection markers and indicators of inflammation. The past 10 years have seen a surge in analyses of DNA, extracted from whole blood. We will focus mainly on aspects relevant for the measurement of blood lipids and glucose.

The major constituents of plasma lipids are cholesterol and triglycerides. Total cholesterol has since the 1950s been a known risk factor of cardiovascular diseases, particularly coronary heart disease. Cholesterol is synthesized in the liver and transported in the blood mainly in the form of low density lipoprotein (LDL) cholesterol and high density lipoprotein (HDL) cholesterol. A high concentration of LDL-cholesterol and a low concentration of HDL-cholesterol in the blood are associated with an increased risk of cardiovascular disease. Blood lipids can be measured from serum and from plasma. The level of LDL-cholesterol used to be derived from the levels of total cholesterol, HDL-cholesterol and triglycerides using the so called Friedewald formula. In the recent years, direct methods for the analysis of LDL-cholesterol have become available, and the measurement of triglycerides is no longer needed for this.

Glucose is a reducing monosaccharide that serves as the principal fuel of all the tissues. It enters the cell through the influence of insulin. Lack of insulin or resistance to its action at the cellular level causes diabetes. Plasma fasting glucose is determined to assess high blood glucose levels pointing to diabetes.

These considerations are the basis for the current practice of drawing blood samples for relatively immediate separation into plasma and serum, and whole blood samples for later

DNA extraction. Samples are divided into small aliquots. Typically, most of these are stored for later analyses at -70°C or -80°C and as an optimum in liquid nitrogen at around – 200°C. For survey practice this means that a cold chain must be set up.

9.5.1 CRITICAL ISSUES OF THE BLOOD COLLECTION AND STORAGE

There are a number of sources that influence the lipid and glucose concentrations in blood samples. Here is a summary of the review done by the EHRM Project on issues that are critical for the measurement of blood lipids and glucose [1]. For the part of the direct measurement of LDL-cholesterol, the information is not necessarily up-to-date, and more information is expected to emerge in the coming years. Also, some of the information on the processing of samples for glucose analyses has been updated.

Seasonal and daily variation

Several studies have suggested that cholesterol levels are higher in the fall and winter than in spring and summer. There is greater amplitude in seasonal variability in women and in people with hypercholesterolemia [44]. There is no evidence that people would have marked within-day variation [45].

Knowledge of intra individual variability of Fasting Plasma Glucose (FPG) concentration is essential for meaningful interpretation of the survey results. Biological variation includes within- and between-subject variation. In a study from the NHANES III fasting plasma glucose was highest in those examined in the early morning (fasten for 8 hours) and declined throughout the morning. Afternoon fasting glucose values were more stable and were similar to late morning levels. Length of fast (Morning > 8 hours: afternoon > 4 hours) was not an important factor [46], but the population standard deviation was wider for the afternoon than for the morning measurements. Early morning rises in fasting glucose levels and insulin requirements (the “dawn phenomenon”) have been observed in patients with type 2 diabetes and in some, but not all, studies of non-diabetic persons. Nocturnal elevations in growth hormone and early morning increases in cortisol secretion have been explored as contributors to this phenomenon [46].

Fasting before the sample collection

If fasting glucose, lipoprotein fractions and fasting triglycerides are to be measured, the samples should be collected after a fasting period. For glucose alone, 8 hours fasting has been recommended [47, 48]. In practice this means overnight fasting and blood sampling in the mornings. Because of the diurnal variation, it is important that both the fasting period and the time of blood sampling is recorded.

For triglyceride measurement, the fasting period should be minimally 8 hours [49] and maximally 14 hours. Too long fasting causes major changes in energy metabolism with implications for blood triglycerides.

For the measurement of cholesterols, fasting is not considered essential. If fasting blood samples are necessary then the examinations should start early in the morning, and only those examined in the morning are used for the assessment of triglycerides and fasting glucose.

Strenuous exercise and alcohol consumption

There is evidence that strenuous exercise just before blood drawing can decrease the total cholesterol level. Nevertheless, in normal survey situations, it is unlikely that people have strenuous exercise just before the blood drawing. Excess alcohol use and several medications like hypertension drugs and oral contraceptives have an effect on total cholesterol level. [45]

Position of the subject and use of tourniquet

Several studies have reported that the posture of the subject during the blood drawing can have an effect on the total cholesterol level. The total cholesterol levels tend to be lower in supine posture and increase when the subject rises to sitting posture and gets higher again when the subject is standing.

During the blood drawing, use of a tourniquet should be avoided. The prolonged venous occlusion may increase total cholesterol level by 2-5%. [45]

Serum or plasma

There is a difference between total cholesterol levels measured from plasma and serum in the same subject. The difference depends on the anticoagulant used and its concentration. When EDTA is used as the coagulant, plasma cholesterol concentrations are lower than those in serum samples [35, 50]. The glucose metabolism continues in the samples until blood cells have been separated from the serum. For glucose analysis, plasma is preferred (see Centrifuging and storage before centrifuging below).

Centrifuging and storage before centrifuging

For cholesterol analysis: The time, temperature and force of centrifuging should be standardized. For serum this concerns also the time allowed for clotting before centrifuging. For serum samples, in general, blood should be allowed to clot at least half an hour and then be centrifuged at room temperature (15-24°C) and 1500G or more for at least 10 minutes. The

usually recommended upper limit for storage before centrifuging is 2 hours, although even a longer storage does not seem to influence cholesterol levels. For plasma samples, centrifugation can be done immediately.

For glucose analysis: Before centrifuging, the glucose concentration declines on average by 5% during the first half an hour and by 10% over a 2-4 h period. The main decrease occurs during the first hour after blood sampling. Therefore, due to the clotting time, serum has a decreased glucose concentration. Preservatives which stop the glycolysis can be added to the blood samples immediately. In particular citric acid combined with fluoride maintains the glucose level for up to 8 hours in room temperature, and even after that the decline in glucose is very small over 24 hours. [51, 52] To our knowledge, this method is in common use in Finland, but not so in most other countries. For example, the new WHO expert group recommendation [49] does not mention it, and suggests immediate centrifuging as the solution to the decline of glucose in the first hours. The preservative also acts as anticoagulant, and hence centrifuging produces plasma.

Hemolysis

Hemolysis may occur during blood drawing and handling. It will result in higher cholesterol values, if the direct "Liebermann-Burchard" method is used. For enzymatic methods, only a gross hemolysis has an increasing effect on cholesterol. Lipemia can affect the triglyceride measurements by interfering with absorbance measurement. Standard instructions should specify what to do with hemolyzed samples.

Storage after centrifuging

It is usually recommended that isolation of HDL should be done on the day of blood sample collection. Storage of fresh samples for more than three days at +4°C leads to a reduction in HDL cholesterol levels of about 8.2% to 14.9%. Storage of frozen samples for more than 14 days at -20°C leads to a decrease in HDL cholesterol levels, whereas storage at lower temperatures does not produce such modifications.

Storage using refrigeration or at room temperature between centrifuging and analysis of cholesterol and triglycerides does not seem to be crucial if the material is analyzed within a few days and bacterial contamination is avoided. Freezing in appropriate vials is acceptable at a temperature of -20°C for 1 year or at a temperature of -60°C for a longer period.

9.5.2 EARLIER RECOMMENDATIONS

The EHRM Project made in year 2002 a review of earlier recommendations and a proposal for the standard procedure for the collection and storage of blood samples for the measurements of lipids and glucose in a European HES. [1, 7]

9.5.3 PROCEDURES USED IN PREVIOUS HESS

Table 9.8 summarizes the instructions given to the subject before the survey examination, position of the subject during the blood collection, use of tourniquet, types of collected samples and the fasting status of the subjects. Instructions for the subjects before coming to the blood sampling were given in 10 surveys. In almost all surveys the blood drawing was done while the person was sitting. The only exception was in the UK, where the persons were in the supine position during the blood drawing. In all surveys, a tourniquet was used and it was removed or loosened after the blood started to flow in the tube. The amount and type of collected blood samples varied considerably between surveys. Some surveys collected only few tubes while in others 10 tubes were collected with different anticoagulants and preservatives. In 7 surveys the subjects were asked to fast before coming to the examination (4 -12 hours). In 6 surveys the blood collection was done in non-fasting subjects.

Table 9.9 shows the type of blood sample used, and the handling and storage of the samples on the field and before the lipid analysis. In all reviewed surveys, lipids were measured from serum samples. The handling of the samples before centrifugation was quite similar between surveys, i.e. samples were staying in room temperature for 20-30 minutes before they were centrifuged. Centrifuging time was for all the surveys more or less the same (10-12 minutes). The rotational speed was different between the surveys (1600 – 3800 rpm). The storage of the blood samples in the field differed between the surveys. In some surveys the blood samples were stored in the freezer (within 1 hour after the collection) while in other surveys the samples were stored at room temperature for 24 hours before the samples were transported to the laboratory. The long time storage was for almost all surveys in -70 or -80ºC. In one survey the blood samples were kept frozen at -20ºC.

Glucose was measured in 6 surveys, and for 3 surveys information on this is not yet available. Glucose was measured in plasma, using Fluoride Citrate (FLSi), Sodium Fluoride (NaF) or Sodium Citrate (Na Cit) as preservative, or in serum (Table 9.10). Centrifuging time was for all the surveys more or less the same (10-12 minutes). The rotational speed varied between the surveys (2800 – 3800 rpm). The storage of the blood samples in the field differend between the surveys. In some surveys the blood samples were stored in the refrigerator within 1 hour after the collection, and at the end of the day frozen at -20ºC. In some surveys, the samples were immediately frozen and in others they were cooled and sent by courier to the laboratory. The long-time storage was in most surveys in -70ºC or -80ºC, with few exceptions were the samples were stored at -20ºC.

9.5.4 CONCLUSIONS

For lipid and glucose measurements, the organizers of earlier surveys seem to have been aware of good standardizable practices. For many of these there are no good alternatives. Deviation from the optimal procedure usually implies lower quality. The EHRM recommendation is mostly up to date, but needs to be checked for the details for the preparation of glucose samples. The procedures used in the recent surveys are also in accordance with the EHRM procedures. Ideally, the laboratory analyses are done without delay using fresh samples. However, this is not often logistically possible for a national HES. Therefore, the recommendation should provide instructions both for rapid transfer of unfrozen samples to the laboratory and a less rapid transfer and storage of frozen samples.

The scope of valuable uses of the blood samples is much wider than lipids and glucose alone. This should be prepared for in future HESs. Therefore, it is advisable to collect several small aliquots of serum, plasma and whole blood, and store them appropriately for future analyses.

9.6 LABORATORY PROCEDURES

9.6.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Various direct enzymatic methods are nowadays available for the measurement of cholesterols and glucose. Enzymatic assays can be used in automated or manual methods with inexpensive instruments. They allow a good precision provided that they are used with care and the measurement instruments are calibrated properly. Accreditation of the laboratory provides assurance of the ability to operate with care. Particularly important for the calibration is the secondary calibrator, which should be real human serum or plasma, ideally in the same form as the survey blood samples. Only with such calibrators one can get a reasonable assurance that there are no matrix effects, i.e. that there is no interference from substances in the samples which are not being measured. For the reliability of the secondary calibrator, it should be traceable to an internationally recognized reference method.

In addition, to assure comparability between laboratories and the assessment of trends over time, external quality control organized by a common reference laboratory will be needed. In the USA this is organized by the Centres for Disease Control and Prevention (CDC) [53]. CDC also has a certification program for clinical diagnostic products for cholesterols. In Europe, there has been no such external quality control since the activities of the WHO Regional Lipid Reference Centre (WHO-RLRC) in Prague, Czech Republic, stopped in the 1990s.

9.6.2 EARLIER RECOMMENDATIONS

The EHRM Project made in year 2002 a proposal for the standard procedure for the laboratory procedures for the measurement of cholesterol, triglycerides and glucose in a European HES [1, 7]. This included a proposal for the establishment of a reference laboratory for the standardization of the measurements across Europe, but the recommendation has not been implemented so far. Major changes after the EHRM proposal are that direct methods for the analysis of HDL- and LDL-cholesterol have become well established, and therefore have replaced fully the former procedures which were more complex.

9.6.3 PROCEDURES USED IN PREVIOUS HESS

Table 9.11 shows a summary of the analysis methods used for the measurement of total and HDL-cholesterol and glucose in recent HESs. All, from which information is available, used enzymatic methods, except in Czech Republic, where dry chemistry was used in the field. The latter is an alternative method, which uses capillary blood samples, and gives results immediately in the field. We have not considered this method more thoroughly because it is seldom the method of choice in a HES, where venous samples are usually collected anyway for different measurements. None of these surveys, which all were from the 2000s, reported using direct methods for the measurement of HDL-cholesterol.

All surveys, except two, reported the use of a central laboratory to which all samples of the survey were transferred. In the Czech survey, which measured only total cholesterol, dry chemistry was used in the field, and the French survey also used a field laboratory.

9.6.4 CONCLUSIONS

Various good enzymatic laboratory methods are available for the analysis of cholesterols and glucose, and there is a certification program for the cholesterol assays. International standardization is possible, but requires careful calibration and analysis (preferably in an accredited laboratory), and a common reference laboratory for external quality control.

9.7 MEASUREMENT OF PHYSICAL FUNCTIONING

The assessment of level of physical functioning has traditionally relied on administration of questionnaires that collected self-report of proxy information on activities and abilities. In recent years, in an attempt to enhance the ability to quantify the memory and candour influence on self-report, direct physical performance measures have been developed. These tools objectively evaluate specific aspects of physical function by having the individual perform standard tasks.

A growing body of evidence has demonstrated that these physical performance measures add important information in the assessment of older adults [54]. Performance measures have been shown to identify functional problems that the individual or family did not report [55, 56]. In addition performance based measures have been demonstrated to predict strongly outcomes such as mortality [57, 58], falls [59, 60], institutionalisation [57, 58, 61], and other health service utilisation [62, 63]. In non-disable older persons, performance measures have been shown to be predicting subsequent disability onsets [62].

Measures of physical functioning e.g. functional ability, mobility, and physical activities are frequently used in population surveys because they are socially relevant and interpretable. There are only a few standardised tests for assessing physical performance in large populations [64, 65]. However, a variety of performance tests have been developed for use in institutions [66, 67] and also among community-dwelling older persons [57, 60, 64, 68-72].

Due to the current limitations only tests and test batteries designed to describe physical functioning of community dwelling older adults suitable also for large populations and high-function populations are reviewed here. In general, performance based tests may be categorised by either the domain of functioning they assess (e.g., upper extremity versus lower extremity) or the complexity of the functioning they assess (more basic physiologic abilities, such as grip strength, versus more complex tasks, such as putting on a blouse). The test of upper body, low extremity and also some of the best known and most often used performance batteries (combinations of many tests) designed for the community dwelling elderly population and adults are presented here. Attention is focused on instruments developed for clinical or population-based research and highly structured to permit uniform data collection from a number of participants.

In addition to review of performance based instruments of physical functioning the current recommendations and initiatives to develop these recommendations are presented. An overview of the current situation of the used measurements in national HESs in Europe and in USA as well as in Canada will be described. This information is based on the HIS/HES database [2] and the survey manuals/protocols.

9.7.1 TESTS OF UPPER BODY FUNCTIONING

For the upper body performance-based measurement include tests of manual dexterity, physical strength and range of motion. Although impairments in lower body function have been found to be stronger predictors of the initial onset of disability, both lower body and upper body impairments are associated with dysfunction in later years [73, 74]. Upper body function is important in executing many normal everyday activities such as household chores (dressing, bathing, and eating instead of complex, strenuous activities like shopping and housekeeping; [73-75]). Performance tests of upper extremity function have been shown to be an important marker of functional dependency [71]. Older individuals who perform poorly on

tests of manual dexterity tend to use more health care resources [75, 76], including intermediate and long-term care [61, 72]. It has also been found that poor grip strength is a strong predictor of disability [77, 78], morbidity [79] and mortality [80, 81].

9.7.1.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURES

Manual dexterity

Standardized assessment test of manual dexterity include the Pegboard Test or Williams' board with fasteners, however unlike many performance based tests these require special equipments [75].

Strength

Handgrip strength testing has long been used as a tool in the clinical assessment of hand and wrist injury but it is also easy to use in surveys [82, 83]. Hand grip strength is often used as an indicator of overall muscle strength in population studies. It has been shown to be powerful predictor of mortality, but the mechanism remains unclear [81, 84, 85]. In addition there is some evidence that hand grip strength predicts functional limitations and disability [78].

A wide range of instruments is available to measure both static and dynamic grip strength; however, most instruments measure static grip strength. Grip strength measurement devices fall into three basic categories: hydraulic, pneumatic and mechanical [83, 86, 87]. Jamar dynamometer (hydraulic instruments) device is the most widely reported and recommended measure of grip strength [64, 86, 88, 89], and appears to be also the most widely used. It is inexpensive, simple to use, versatile in its applications, and has been found to be accurate [90], reliable [91-95] and reproducible [91, 94] in its measurements.

It is generally agreed that for the measurement of hand grip strength the most critical points are posture of the subject during the measurement and the instructions of device use [86, 96]. There are, however, wide ranges of protocols and positions that have been developed for grip strength testing [83]. Depending on the purpose of the assessment, the testing position may vary. [97] studied the short term reliability of grip strength measurement and the effect of posture (standing, sitting and supine) and grip span. They recommend using interval measurement with a 1-minute rest after each set. In addition the influence of posture and grip span should be considered to maximize data accuracy.

Range of motion

One of the earliest test measuring joint functions was Jefferys et al [98] set of test measuring motor impairment. It consisted of movements for both upper and lower extremities which were scored by the lay interviewer according to the performance of examinee. Keitel [99] and his co-workers have proposed parallel index, Functional Test, intended to reflect the degree of functional limitations of the joints. The items were developed as a clinical tool in rheumatology. However Jette et al [73] have adapted parts of the test in community dwelling elderly including seven movements measuring function of hands and upper extremities and three for lower extremities function. The joint function test conducted in a Finnish National health examination survey [100-102] and Netherlands 2001 has same features as Jettes [73] and Keitels tests and it have also been originally adapted from the field of rheumatology. The joint function test [101, 102] involves 10 separate movements, the first four of which were designed t test lower limb function and the remaining six upper limb function (see Table 9.6.1) The information on reliability and validity of the test is week. For example in the Health 2000 survey the number of cases in the upper limb components of the joint function tests was very low (prevalence less than 5%) as majority of the subjects made no mistakes in the test. [102].

9.7.1.2 EARLIER RECOMMENDATIONS

No recommendations exist for measuring manual dexterity, range of motion or grip strength in the population health survey settings. For testing range of motion or dexterity there are no common recommendations or standards. American Society of Hand Therapists [103] has recommended standard posture for testing hand grip strength. Curb et al [64] recommend to measure grip strength either by strength or handheld dynamometer for high functioning populations.

9.7.1.3 PROCEDURES USED IN PREVIOUS HESS

Four surveys have included examination procedures related to measurement of functioning of upper extremity. In the two Finnish surveys and in the Dutch HES there has been a similar joint function test (Table 9.12); walking on even ground, walking on tiptoes, upstairs walking, squatting, elevation of the upper arms, extension of the elbow joints, flexion of the elbow joints, volar flexion of the wrists, flexion of the fingers to the palm, opposition of the thumbs. In Finland the test was performed only for those over 55 years and over whereas in the Netherlands there were no age limits. The test involved 10 separate movements, the first four of which were designed to test lower limb function and the remaining six upper limb functions: Each of the component tests were performed in sequence following the examiner's demonstration. The subjects' performances were rated as normal (0), degraded (1) or failed (2) on the basis of detailed classification instructions.

Hand grip strength have been measured in the Finnish Health 2000 surveys, Health Survey for England 2005 and Canadian health measures survey 2007 (Table 9.12). In the Health 2000 handgrip strength was measured with a computer-based instrument (Good Strength, IGS01, Metitur Oy, Jyväskylä). The method was developed from that used by Viitasalo et al. [104]. In the British and Canadian surveys the measurement were conducted in by a Gripometer (UK) and Smedley III hand dynamometer (Canada) in a standing position and measurements were repeated three times from both hands.

9.7.1.4 CONCLUSIONS

The measurement of upper extremity functioning is reliable in the population survey settings. As the grip strength measurement have been shown to be relevant measurement from the public health perspective and predict overall mortality it should be included in the measurement procedures of upper extremity in HESs. The hand grip strength measure global functional deficits and appears to be clinically important. As many devices and protocols exist, standardisation is needed to ensure the use of comparable devices and procedures and comparability of between surveys.

Measures of fine motor skill e.g. manual dexterity, upper extremity range of motion and other functions which affect overall ability to accomplish tasks encountered in daily living could easily be added to the national population surveys if finer detail or knowledge of a specific function is needed. However the reliability and the ability of these tests to discriminate between the most highly functioning individuals and individuals who merely have good function need to be future examined.

9.7.2 TESTS OF LOWER EXTREMITY

Good lower extremity functioning is necessary for mobility and is thus a critical element of independence in the community. Tests of gait speed, standing balance and time to rise from a chair have been used to evaluate lower extremity function in a community dwelling elderly [57]. These tests accurately predict disability across populations [105]. In addition they have been found to predict mortality and nursing home admission in representative samples of older adults [57] and indicate disability in non-disabled persons over age 70 years [62]. They have the additional advantage of being quite independent of changing environmental conditions.

Gait speed has been shown to have a graded relationship with mobility and activity of daily living disability in the non-disabled population [62]. It predicts further nursing home admission, morbidity and mortality [57]. Sonn [106] proved that women and men who stayed independent when aged over 70's had significantly higher maximal walking speed than those who became or already were dependent. Further-more lower body function is strongly

associated with incidence of falling: usual walking speed of less than 0.6 meters/ second is associated with increased risk of falls [59].

The ability to under take physically demanding activities of daily living requires an adequate level of aerobic endurance especially during ageing. Walking a certain distance in some time reflects functional capacity and performance, walking ability as well as lower extremity function.

Rising from a chair is a function needed daily, and therefore perquisite for independent living. It requires sufficient strength of lower extremities, although the relationship with strength and chair stand is not linear [107, 108]. Poor performance in chair stand tests is associated with adverse health outcomes in older persons [57, 62]. Lower body muscular strength has been well established as a major factor in maintaining functional mobility and preventing or delaying the onset of disability [57, 62, 74]. As apart of lower extremity performance test battery, multiple chair raises has been shown to be predictive of subsequent disability among non-disable persons [105].

Balance is required to maintain a position, remain stable while moving from one position to another, perform acts of daily living, and move freely in the community.

9.7.2.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURES

Walking and strength related tests

Gait speed is based on the performance of individuals on a timed walk test being computed by dividing the distance a person walks by the time it takes him/her to cover the distance. It is usually measured over a relatively short distance and its measurement does not include endurance as a factor. Guralnik et al [105] believe that a 4-meter walk is a good distance because it has been demonstrated to be feasible in the home as well as in the clinical settings and that a longer distance may (only) improve measurement accuracy.

Regardless of the measurement method, gait speed measurements are considered highly reliable in people without known impairments that should affect gait [109]. Gait speed is a simple performance measure, easily and quickly assessed in the clinical as well as in research settings [105, 110]. In the clinical settings, testing usually takes less than 1 minute. Hoyemans et al [111] have reported the correlation of retest reliability for gait speed to be 0.90 and Jette and colleagues [112] reported that the infraclass correlation coefficient (kappa) for 8-foot walk was 0.76. Guralnik et al [105] have demonstrated that walking speed alone is nearly as good a predictor of disability outcomes as a full performance battery of the lower extremity. In addition it has been stated that walking tests are more reliable than other performance based measures in elderly people, such as timed chair stand and weight lift [112].

It has been suggested that the 2-minute walking test may not discriminate well enough, but the 12-minute test may be unnecessarily long [113]. However, most community-dwelling elderly persons can quickly and safely perform the 6 -minute walking test [114].The purpose of the test is to see how far the participant can walk in six minutes [114]. The 6-minute walk test has been found to be reliable and valid in relation to other performance and self-reported indicators of physical functioning [115]. It is easy to conduct and it can provide reasonably reliable and valid information of physical endurance in older adults. The results moderately reflect overall physical functional performance [116].

Csuka and McCarty [117] developed a timed-stand test. It involves recording the amount of time required to stand up 10 times. Modifications of this test have been developed. The most commonly used version is five-chair stands test [57]. It has relatively high and stable interpreter (retest) reliability. However in the Finnish Health 2000 survey the reliability for the chair stand test was good or moderate [102]. Curb et al [64] have increased the number to 10 rises in order to provide better discrimination in healthy populations. The 10 time rise was found to be feasible, highly reliable (r=84) as well as easy and quick to conduct (2 minutes).

Balance

Balance can be measured either by laboratory tests or performance- based tests. However, there are no generally accepted ways of performing the actual balance test, or analysing data even in the simplest static tests. Era et al [118] have reported that there are discrepancies in balance measures in recording periods from a few seconds up to several minutes, different standards for positions of the feet and arms, and different practices in the use of fixed marks for visual stabilisation, among others [118].

Many of the balance test have been developed for clinical settings. For example The Timed Up and Go Test (TUG) was originally developed as a clinical measure of balance in elderly people. The test measures the time it takes a subject to stand up from an armchair, walk a distance of 3 meters, turn, walk back to the chair, and sit down. The original test has been modified by timing the task and it has been proposed to use it as a short test of basic mobility skills for frail community-dwelling elderly. The test is quick and does not require special equipment or training [119]. Shumway-Cook [120] et al reported that the TUG is a sensitive (87%), specific (87 %) measure for identifying community-dwelling adults who are at risk to fall. However the disadvantage of this test is that it measures only few aspects of balance [121]

One of the best known functional balance tests is the Berg Balance Scal**e** (BBS, [122]). It was developed as a performance–oriented measure of balance in elderly individuals. Items include simple mobility tasks (e.g. transfers, standing unsupported, sit-to stand) and more complex tasks (e.g. Tandem standing, turning 360 degree, single-leg stand). Other similar test includes the Functional independence measures [123] and the continuous scale Physical

Function Performance test [124]. Also Romberg balance test measuring the balance and vestibular system have been modified and used in the population survey settings [125].

Guralnik et al [57] developed a test battery specifically to assess mobility in older adults (see chapter 9.6.3). The test of standing balance includes tandem, semi-tandem, and side-by side stand for 10 seconds [57]. The test has been found to be reliable and valid [57, 102, 126] but it was too easy to discriminate among many individuals, with nearly half of the subjects obtaining perfect scores [57, 126]. The experience of the Finnish Health 2000 Examination survey supports the finding; the test had a ceiling effect up to 60 years of age and in addition its reliability was found fair (kappa=0.45 [102]). Despite these drawbacks the test is widely used also in the population survey settings.

Curb et al [64] recommend one leg stand as a part of performance battery for highly functioning populations (e.g [127, 128]). One leg stand requires minimal equipment and it takes approximately 3 minutes to perform, in addition it was found to be quite reliable (r=0.69) and discriminating between functional levels among persons with 35 to 70 years age range. On leg stand has been shown to be feasible, reliable and valid method for assessing balance also in middle aged persons [128]. Also MacArthur measures included single leg stand, modified by asking the participants to hold the position for up too 30 seconds [57, 126].

To increase the discrimination power there has been initiatives to include measures of Balance that required standing on a foam pad to reduce tactile input [125]. There is also some experience on using force platform electronic techniques in population based settings [64, 102]. The electronic system makes it possible to measure postural control in different static and dynamic testing conditions and it helps to train and analyse balance and postural asymmetry through visual feedback. Although electronic devices offer significantly more information, they are more expensive and less portable than many of the practical measures currently in use [64].

9.7.2.2 EARLIER RECOMMENDATIONS

No recommendations exist for measuring lower extremity strength or balance in the population health survey settings. However there are some initiatives in EU-level to harmonies the assessment of physical functioning. For example European Network for action on ageing and physical activity EUNAAPA [129] aims to get consensus on most appropriate assessment on instruments for elderly aiming at physical activity, physical functioning and functional performance. Prevention of Falls Network Europe ProFaNE [130] is a thematic network with 25 partners focusing on the issue of prevention of falls and improvement of postural stability amongst elderly people. It focuses on assessment of balance function that can be used for fall prediction and the assessment of outcome of fall intervention programmes for older people. The aim is to produce recommendations about balance assessment in the

context of fall interventions for older people. When available these recommendations could be adaptable also for population survey settings.

9.7.2.3 PROCEDURES USED IN PREVIOUS HESS

In the Finnish Health 2000 and Finrisk 1997 as well as in the Dutch national examination survey the joint function test (see table 9.13) included the measurement of range of motion of lower extremities.

The walking speed for over a relatively short distance was measured in the Finnish Health 2000 surveys, and in the health survey for England. In the Finnish survey the measurement was done at 6.1 meters [131] distance using maximal walking speed where as in the UK survey the distance was 2.4 meters conducted at participants own natural pace. In both test the stopwatch was started at the beginning of the test and stopped when the subject crossed the end line. Both in the Finnish Health 2000 survey as well as UKs survey the elderly participants (in Finland above 55 and in UK above 65) conducted timed chair stand test, which is widely applied in assessments of functional capacity in older people. In Finland they used a standard chair with no arm rests and a seat height of 43 cm from the floor. The back of the chair was placed against the wall. The subjects were asked to sit down in the chair, with their hands across their chest and feet slightly apart. From this position, they were asked to stand up once and if succeeded the rise was repeated 5 times as quickly as possible. In England there was no standard chair height but the chair has to be with no arm rest. The test protocol was similar to Finnish one, but the UK HES included also 10 rise chair stand test for a sub-sample of 65 to 69 years old.

Standing balance has been measured in four HESs. The Finnish Health 200 survey was the only survey using electronic equipment for the measurement. Balance was measured in the health examination using a computer-based measurement system (Good Balance, IGB01, Metitur Oy, Jyväskylä) and by following the protocol introduced by Guralnik et al. [57] including four different measurements of balance; 1) Feet side by side, eyes open (30 s), 2) Feet side by side, eyes closed (30 s), 3) Semi-tandem (20s), 4) tandem (20s). At home health examinations and during equipment malfunctions, balance was measured using a simple field test [57], without the computerised system. For this test, the subjects were to remain standing in a semi-tandem position for 10 seconds. If successful, they were then asked to stand in a tandem position again for 10 seconds. If the subjects were unable to stand for 10 seconds in the semi-tandem position, they were asked to take an easier position, with their feet side by side, touching each other (10 seconds).

The Finnish FINRISK 2007 measured and tested a more discriminating balance measurement protocol for a sub sample of 25 to 74 years old participants. Also the Health survey for England used more demanding position for a sub sample of 65 to 69 years old; the balance was measured in full tandem position (30 seconds) and in addition in one leg (30

seconds). The NHANES included measurement of balance and vestibular system trough observing the sway of position applied from Romberg test.

9.7.2.4 CONCLUSION

There exists no general recommendation on how to measure lower extremity function or balance in the population health survey settings. Measurement methods vary considerably. International recommendations and standardisation of methods is required to enable the comparability between surveys.

9.7.3 PHYSICAL PERFORMANCE BATTERIES

Several physical performance test batteries have been designed for the assessment of physical functioning. Many of the upper extremity tests and lower extremity test presented earlier (chapters 9.6.1-9.6.2) are parts of wider test batteries. Although walking speed alone can predict physical functioning quite well (see Chapter 9.6.2), the full battery of lower extremity tests is likely to be a better instrument by which to assess performance and change over time. More accuracy may be gained by using the full battery because measuring a specific construct with multiple measures increases reliability [105].

Physical Performance Test, PPT

Reuben & Sui (1990) developed the Physical Performance Test (PPT). The test assesses several domains of physical functioning, using observed performance of tasks stimulating activities of daily living of various degrees of difficulty. The tasks include upper body strength and dexterity, mobility, balance, co-ordination, and endurance. The test includes specific ADL activities (eating, transferring, and dressing) and IADL activities (upper extremity strength necessary to perform laundering; climbing stairs essential in using public transportation). The test includes writing a sentence, simulated eating, turning 360 degrees, putting and removing a jacket, lifting a book and putting it on a shelf, picking up a penny from the floor, a 50-foot walk test and climbing stairs (scored as two items). The PPT can be also completed by a seven item test (does not include stairs).

A short lower extremity battery- EPESE

A short lower extremity battery- EPESE (Established Populations for Epidemiologic Studies of the Elderly) is a test developed specifically to assess mobility in older adults [105, 132]. The test battery includes a short battery of items to measure strength, balance and gait speed. The total time to perform these tests takes from 10 to 15 minutes [57]. The test of

standing balance includes tandem, semi-tandem, and side-by-side stand for 10 seconds. The walking speed test is performed over an 8-feet (2,44 meters) distance. The ability to rise from the chair includes five rises without the help of the arms. Good to excellent test-retest reliability of these tests has been demonstrated [126, 133].

Health-related fitness test battery, HRFTB

The health –related fitness test battery has been developed by the UKK Institute in Finland. The battery is designed for middle-aged adults, but it has been proven to be safe also for older adults with minor changes in the test protocol [134]. The test includes the walking test for cardio respiratory fitness (2-km Walk Test), four muscular strength and endurance tests (leg muscular power [jump and reach]), leg strength [one-leg squat], upper-body strength [modified push-ups], and trunk muscular endurance [static back extension]), and two flexibility tests for musculoskeletal fitness (trunk side-bending, knee extension range of motion), a balance test for motor fitness (one-leg standing), and measures of weight and height to calculate body mass index (BMI) [135]. The test has been designed to measure health related fitness of individuals and populations in order to evaluate the amount and type of physical activity needed to promote health.

Functional Fitness Test Battery

Rikli and Jones [65, 136] have developed a functional fitness test battery. The complete battery consists of six tests (and one alternative) designed to assess physiologic parameters associated with independent functioning and physical mobility in older adults. The items of the battery cover lower and upper body strength, aerobic endurance, lower and upper body flexibility and agility/dynamic balance. The body mass index is also included in the test battery to estimate body composition. The lower body strength is measured by a 30-s chair-stand-test. The 30-second time limit makes it possible for all individuals to receive a score (compared to 5 stand chair test). The arm-curl test measures upper body strength and involves determining the number of times a hand weight (5lb for women, 8lb for men) can be curled through a full range of motion in 30 seconds. The 6-minute walk test is used to determine the distance that can be walked in 6 minutes. A 2-minute walk test (the 2-min step in place) can be used as an alternative. In addition to these tests, the flexibility of the lower body is measured trough chair sit- and reach test and the upper back scratch test measures the shoulder range of motion. The modified timed up-and-go test measures the mobility and balance. The distance has been changed to 8 feet.

The Groningen Fitness Test for the elderly (GFE)

The Groningen Fitness Test for the Elderly has been developed for field-based assessment of fitness in healthy people over 55 years of age [137]. The battery consists of six test items for objective measurement of fitness and a questionnaire for subjective evaluation of fitness. It includes measures of walking, strength, flexibility, reaction power, and manual dexterity. The test can be used in studies concerning the relationships between fitness and physical activity, health, and performance in instrumental activities of daily living (IADL).

Continuous-Scale physical functional performance test (CS-PFP)

Continuous-Scale physical functional performance test (CS-PFP) is an instrument designed to measure physical function reflecting abilities in several separate physical domains [110]. The test consists of a battery of 15 everyday tasks, ranging from easy to demanding, that describe the physical domains of upper and lower body strength, upper body flexibility and, balance and co-ordination, and endurance. Tasks include carrying a pan of water a distance of one meter and carrying and then pouring from a jug of water into a cup. In addition to tasks of basic instrumental activities of daily living the tasks include walking as far as possible in six minutes.

9.7.3.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURES

The tasks of the PPT test can be administered and scored by a layperson with minimal training and the test can be completed in less than 10 minutes and requires only a few simple props [68]. PPT was found to be reliable and demonstrated concurrent and construct validity when compared to other measures of functional status.

The EPESE test battery has been shown to have good test-retest reliability over a wide range at least in a fairly old population [112]. The battery has been successful in classifying large populations of community-dwelling older adults into broad categories by functional status, but still there are some problems with the instrument. The problems of balance tests have been already discussed (see chapter 9.6.2) In addition to these problems it was found that approximately 22% of the target population could not complete a 5-time chair-stand test of lower body strength [132].

The HRFTP battery has been evaluated systematically for its reliability, safety, feasibility, and validity. The inter-rated intra-class correlation coefficients (kappa) for one-leg balance, trunk side bending, push-up strength, leg power, and leg strength have been found to be good ranging from .89 to 1.00. and the mean test-retest differences ranged from small to moderate, varying from 0.6% to 12.1 % [138]. In addition test-retest correlation coefficients have been found to be high for dynamic back extension and the 2-km walking test [139].

The Fuctional Fitness Test Battery has been shown to be feasible and safe to complete. The content validity of each test has been demonstrated by literature review and expert opinion [65, 116, 136].

In a pilot study the correlation between instrumental activities of daily living and objective fitness was. It can be concluded that the GFE is a valid contributor of performance of IADL.

Continuous-Scale physical functional performance test is a valid, reliable measure of physical function, applicable to a wide range of functioning. It has minimal floor and ceiling effects and it is suitable for both research and clinical purposes [110, 124, 140].

9.7.3.2 EARLIER RECOMMENDATIONS

No recommendations exist for using a certain physical performance test batteries in the population health survey settings. Curb et all (2006) have proposed and recommended a performance battery for high functioning populations including measurement of balance trough unassisted single leg stand and trough measurement of balance platform 'foam pad, eyes closed test', grip strength measurement with handheld dynamometer or electronic strength measurement, timed 10 chairs stand, 6 minute walking test and rapid 10 foot walk as well as elbow flexion and knee extension strength using strength chair. This initiative is so far the only one aimed to the development of full simple set of test battery suitable for research settings to quickly (31 minutes the whole battery) assess global functional level.

9.7.3.3 PROCEDURES USED IN PREVIOUS HESS

In the pervious HES only Guralnik test EPES test battery have been used partly and modified in the Finnish Health 2000 survey and National Survey for England 2005. (Table 9.11 and 9.12)

9.7.3.4 CONCLUSIONS

Standard recommendations on reliable and discriminating physical performance battery could enable international comparability between countries/ surveys. There is some evidence [64] that several simple tests used today are not particularly reliable, and only few discriminate between different levels of functioning. There is a need to recommend internationally accepted full test battery covering the most important parts of functioning, discriminating different levels of functioning and being reliable.

9.7.4 GENERAL CONCLUSION ON MEASURING PHYSICAL FUNCTIONING IN HES

The use of performance measures in cross-cultural and international studies is not common but it still has obvious advantages. Cultural, language, and social differences between populations may greatly limit the validity of comparisons of self-reported functioning and disability. Cognitive impairments, culture, language and education have much less influence on performance tests, compared to self-report methods. Furthermore, they are essential for understanding time trends in functional capacity. In addition tests on physical functioning are quite safe to conduct. In addition measuring the functional level offers also a convent way to compare the impact of different types of disease on different populations at different times [141]. The measurements can also provide important information about the need for assistance in personal care, ability to live independently and prognosis. From the public health perspective, knowing the health and functional status of the ageing population is important so that interventions can be targeted towards the right population groups [134] as performance measures have been shown to improve with intervention. The evidence on the importance of measurement of physical functioning is strong.

There are already many examples on wide HESs covering the measurement of physical functioning. Health 2000 survey is maybe the most comprehensive health examination survey in Europe in the area of physical functioning. In addition to the tests mentioned above psychomotor reaction time (computer assisted measurement) a musculoskeletal fitness test: back extension for the endurance capacity of the trunk extensor muscles (see Chapter 9.7) was measured. In the recent years also other comprehensive HESs has taken the measurement of functioning in the measurement procedures. Such examples are UK, USA and Canada. However the comparability of the results on physical functioning between surveys is poor. The test protocols vary in the scope and in the meanings of the tests.

There is a growing need to standardise the measurement methods used in different areas of health care and research setting. EUNAAPA [129] and ProFaNE [130] are EU-level examples on the project aiming at recommending standard measures of physical functioning. At national level for example in Finland there is also an initiative to review, evaluate and recommend common measures of functioning for population based survey settings among other [142]. The idea of internationally standardised measurement of physical functioning is commendable, but the work has just being started.

9.8 PHYSICAL FITNESS

Fitness is a strong physiological indicator of health risk, which can be objectively measured. Low fitness and obesity act largely as independent risk factors. A study of 21 925 men, with a follow-up on average of 8 years found that unfit lean men had a higher risk of all-caused and CVD mortality, than men who were fit and obese.[143] A number of studies with

varying methodologies and population composition have confirmed that fitness is at least as important as obesity as a predictor of disease risk [144-146].

The physical fitness tests include tests like Canadian Fitness Test [147], Åstrand-Ryhming step test [148], Harvard step test [149], Queen's College step test [150], Siconolfi's step test [151], YMCA step test [152], Chester Step test [153] and Polar fitness test [154, 155].

9.8.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

The limitation of many of the current instruments of performance based measurement of physical functioning (Chapter 9.7) is that physical impairments often are not detected until late in the disability process. Thus, such instruments are not suitable for younger people e.g. high functioning [136]. Several fitness tests (treadmill and cycle ergometer tests, bench step tests etc.) have been developed and validated for describing physical capacity of younger people. However many of them are inappropriate for older adults (too difficult or even risky). In addition, these protocols often require expensive equipment or extensive training for test technicians and have therefore been judged not to feasible for use in clinical or population survey settings [136]. On the other hand, there are at least some examples of large scale population surveys having successfully employed such methods [82].

9.8.2 EARLIER RECOMMENDATIONS

No recommendations exist for measuring physical fitness in survey settings.

9.8.3 PROCEDURES USED IN PREVIOUS HESS

In 4 previous HES surveys (3 countries) physical fitness was measured. In USA and Canada Cardiovascular fitness was measured by using the sub maximal exercise test (treadmill) and the mCAFT (using a 8 stepping stages). In Finland the Polar Fitness test was used and the musculoskeletal fitness test. (Table 9.14)

9.8.4 CONCLUSIONS

There exists no general recommendation on how to measure physical fitness in the population health survey settings. Measurement methods vary considerably.

9.9 ANKLE BRACHIAL INDEX

The ankle-brachial pressure index (ABI), also known as the ankle arm index, compares the systolic blood pressure of the ankle to that of the arm (brachial). This standard non-invasive test assesses the severity of peripheral arterial occlusive disease (PAOD).

The ankle brachial index is a good predictor of subsequent cardiovascular events and improves on predictions by conventional risk factors alone. It is a simple and accurate and could be included in routine screening of cardiovascular disease. It is concluded that the accuracy of determining ABI in PAOD patients with intermittent claudication was minimally affected by the method chosen to obtain brachial systolic blood pressure [156].

9.9.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Critical for the measurement of the ankle brachial index are the choice and the calibration of the measurement device.

9.9.2 EARLIER RECOMMENDATIONS

Since its introduction in 1950, a variety of methods of measurements and calculation have been used to establish the ankle brachial index. A study was made of analyses of the methods used to assess the ankle brachial index [157]. Based on this analysis, a recommendation was made, that is needed to allow comparison and meta-analysis of future results.

9.9.3 PROCEDURES USED IN PREVIOUS HESS

In the period 2000 – 2007, the ankle brachial index was not included to any of the national HESs in Europe. In USA, the Atherosclerosis risk in communities (ARIC) study has measured ABI [158].

9.9.4 CONCLUSION

For the measurement of ankle brachial index there is no standardized recommendation.

9.10 VISION TEST

Adequate visual function is an important factor for functional ability [68]. Decreased vision increases substantially with age and has a great impact on society as well as on a person's quality of life and sense of independence by increasing the need for health and social services and institutionalization. Causes for visual impairment are largely remediable, especially un-operated cataract and uncorrected refractive errors.

9.10.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Performance-based measurement of visual function supplements self-reported assessment of vision, so it is recommended to evaluate them both. The most widely used and standardized test of visual function is measurement of visual acuity. In seeing tests environment and equipment (calibration) may affect the results obtained. Those responsible for conducting the examination must be trained experts. Good instructions help the subjects to perform as intended. Instruments must be calibrated to yield correct readings.

9.10.2 EARLIER RECOMMENDATIONS

Both distance and near vision have been evaluated by standard card or chart in national survey settings [159]. Although the measurement technique is quite easy, a correct technique is a pre-requisite for correct results. At this moment there is no standardized recommendation to measure vision.

9.10.3 PROCEDURES USED IN PREVIOUS HESS

Only in two previous HESs a vision test has been conducted. In both surveys, the vision was tested while subject was using their own glasses, if had once. Tests included both distance vision (40 meters) and near vision (40 cm). (Table 9.15)

9.10.4 CONCLUSION

Although the measurement technique is easy, it requires trained staff, and calibrated instruments.

9.11 HEARING TEST

Hearing function has been assessed in many health surveys. The tests have been developed mainly in clinical practice settings. Hearing ability is usually measured with an audiometer. Audiometry has to do with an individual's sensitivity or tolerance. It also concerns discrimination levels, the ability to distinguish speech from background noise, or the ability to recognise pitch.

9.11.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURES

In hearing tests environment and equipment (calibration) may affect the results obtained. Those responsible for conducting the examination must be trained experts. Good instructions help the subjects to perform as intended. Instruments must be calibrated to yield correct readings.

9.11.2 EARLIER RECOMMENDATIONS

The hearing test is easy and quick to conduct and there are no known risks associated with the hearing examination. At this moment there is no standardized recommendation to measure hearing.

9.11.3 PROCEDURES IN PREVIOUS HESS

Only in two previous HESs, the hearing test has been conducted. In both surveys, the special sound proof cabin was used for the test. Finnish Health 2000 survey tested 500 and 1000 Hz while NHANES had much broader range of Hz to test. (Table 9.16)

9.11.4 CONCLUSION

Although the measurement is easy and quick to conduct, other important factors are difficult to standardize.

9.12 BONE DENSITY

Osteoporosis is a serious public health issue, affecting up to 1 in 2 women and 1 in 5 men over the age of 50 years. The common osteoporotic fractures occur at the spine, wrist and hip. For the patient affected by osteoporosis, these fractures are associated with significant

morbidity and, in the case of hip and spine fractures, an excess mortality. The treatment of osteoporotic fractures is also associated with a significant healthcare cost for society.

Bone mineral density can be measured with a Single x-ray absorptiometry (SXA) and dual x-ray absorptiometry (DXA).

9.12.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Required trained staff, expensive materials.

9.12.2 EARLIER RECOMMENDATIONS

Currently, measurement of bone mineral density using dual energy X-ray absorptiometry is the gold standard for the diagnosis of osteoporosis [160].

9.12.3 PROCEDURES USED IN PREVIOUS HESS

In three previous HESs a bone mineral density has been measured as well with a SXA as a DXA. The used devices in all three surveys have been different but all of them have been large, non-mobile devices. The location from which the bone mineral density was measured had also varied. (Table 9.17)

9.12.4 CONCLUSION

Although the measurement is easy and quick to conduct, other important factors are difficult to standardize.

9.13 LUNG FUNCTION

Lung function is measured by spirometry. Of main interest are indices of airway obstruction: the FEV_1 (forced expiratory volume in one second), the FVC (forced vital capacity) and the derived ratio FEV_1/FVC. Lung function tests should not be performed within one month of a myocardial infarction, and results are likely to be suboptimal in subjects with chest or abdominal pain of any cause, oral or facial pain exacerbated by a mouthpiece, stress incontinence, dementia or a confusional state.

9.13.1 CRITICAL ISSUES OF THE MEASUREMENT PROCEDURE

Different types of equipment are available for spirometry. Most electronic spirometers contain a device for measuring gas flow. The flow can be measured from the pressure drop across a tube with known resistance to flow (pneumotachograph), by counting the number of revolutions per unit of time of a small turbine (electric turbine) or from ultrasound transit time up and down a tube (ultrasonic). Two types of pneumotachographs are available (Fleisch and Lilly), of which the Fleisch is considered to be more reliable. Pneumotachographs are particularly sensitive to temperature, atmospheric pressure and condensation of water vapour and therefore require very frequent calibration. A potential advantage of using turbine and ultrasonic devices is that they depend less on calibration for reliable results. Well-known manufacturers of spirometric equipment are Vitalograph (pneumotachographs [161]), Micro Medical Ltd (electric turbine devices [162]) and an example of the more recently developed ultrasonic devices is the EasyOne [163].

Besides the method of measuring gas flow, spirometric equipment varies in size and ease of re-location (from hand-held portable devices to office spirometers), in costs of equipment and accessories (for ultrasonic devices a relatively expensive new mouthpiece is required for every subject), whether flow-volume and volume-time curves are displayed during testing, in memory capacity for storing tests and in available software.

To guarantee the accuracy and reliability of the pulmonary function testing system used, the manufacturer has to guarantee that the system meets all specifications issued by the ATS/ERS [164]. The user is responsible for ensuring that the equipment's measurements remain accurate, and results furthermore depend on the cooperation between subject and examiner. For optimal quality control, both flow-volume and volume-time displays are recommended. Many portable spirometers may not meet this recommendation, but have advantages in their relatively low cost and ease of re-location.

9.13.2 EARLIER RECOMMENDATIONS

At this moment there is no standardized recommendation to measure lung function.

9.13.3 PROCEDURES USED IN PREVIOUS HESS

In 5 previous HESs lung function was measured. In all surveys FVC, FEV and PEF was measured. In Ireland only PEF was measured. In 3 surveys the devices they used was a Vitalograph spirometer. (Table 9.18)

9.13.4 CONCLUSION

The measurement is difficult to conduct, and the needed material is expensive. The measurement is difficult to standardize.

REFERENCE

[1] Tolonen H, Kuulasmaa K, Laatikainen T, Wolf H, the European Health Risk Monitoring Project. Recommendations for indicators, international collaboration, protocol and manual of operations for chronic disease risk factor surveys. 2002 [cited 4 February 2008]; Available from: http://www.ktl.fi/publications/ehrm/product2/title.htm

[2] European Health Interview & Health Examination Surveys Database. 2008 [cited 6 March 2008]; Available from: https://hishes.iph.fgov.be

[3] World Health Organization, Noncommunicable Disease and Mental Health. STEPS Manual. [cited 6 March 2008]; Available from: http://www.who.int/chp/steps/manual/en/index.html

[4] MONICA Manual, Part III: Population Survey, Section 1: Population Survey Data Component. 1997 [cited 6 March 2008]; Available from: http://www.ktl.fi/publications/monica/manual/part3/iii-1.htm

[5] Visscher TL, Viet AL, Kroesbergen IH, Seidell JC. Underreporting of BMI in adults and its effect on obesity prevalence estimations in the period 1998 to 2001. Obesity (Silver Spring, Md. 2006 Nov;14(11):2054-63.

[6] McAdams MA, Van Dam RM, Hu FB. Comparison of self-reported and measured BMI as correlates of disease markers in US adults. Obesity (Silver Spring, Md. 2007 Jan;15(1):188-96.

[7] Tolonen H, Wolf H, Jakovljevic D, Kuulasmaa K, European Health Risk Monitoring Project. Review of surveys for risk factors of major chronic diseases and comparability of the results. 2002 [cited 6 March 2008]; Available from: http://www.ktl.fi/publications/ehrm/product1/title.htm

[8] Council Directive 93/42/EEC of 14 June 1993 concerning medical devices. *Iffical Journal L169* 1993:1-43.

[9] Directive 2007/47/EC of the European Parliament and of the Council of 5 September 2007 amending Council Directive 90/385/EEC on the approzimation of the laws of the Member States relating to active implantable medical devices, Council Directive 93/42/EEC concerning medical divices and Directive 98/8/EC concerning the placing of biocidal products on the market *Official Journal of the European Union* 2007.

[10] Seidell JC, Perusse L, Despres JP, Bouchard C. Waist and hip circumferences have independent and opposite effects on cardiovascular disease risk factors: the Quebec Family Study. The American journal of clinical nutrition. 2001 Sep;74(3):315-21.

[11] de Koning L, Merchant AT, Pogue J, Anand SS. Waist circumference and waist-to-hip ratio as predictors of cardiovascular events: meta-regression analysis of prospective studies. European heart journal. 2007 Apr;28(7):850-6.

[12] Snijder MB, Dekker JM, Visser M, Bouter LM, Stehouwer CD, Kostense PJ, et al. Associations of hip and thigh circumferences independent of waist circumference with the incidence of type 2 diabetes: the Hoorn Study. The American journal of clinical nutrition. 2003 May;77(5):1192-7.

[13] Bailey RH, Bauer JH. A review of common errors in the indirect measurement of blood pressure. Sphygmomanometry. Archives of internal medicine. 1993 Dec 27;153(24):2741-8.

[14] Proposal for a directive of the European parliament and of the council, amending Council Derective 76/769.EEC relating to restrictions on the marketing of certain measuring devices containing mercury.: Brussels 21.2.2006.

[15] Directive 2007/51/EC of the European Parliament and of the Council of 25 September 2007 amending council Directive 76/769/EEC relating to restrictions on the marketing of certain measuring devices containing mercury (Text with EEA relevance). 2007.

[16] O'Brien E, Petrie J, Littler W, de Swiet M, Padfield PL, O'Malley K, et al. The British Hypertension Society protocol for the evaluation of automated and semi-automated blood pressure measuring devices with special reference to ambulatory systems. Journal of hypertension. 1990 Jul;8(7):607-19.

[17] O'Brien E, Petrie J, Littler W, de Swiet M, Padfield PL, Altman DG, et al. The British Hypertension Society protocol for the evaluation of blood pressure measuring devices. Journal of hypertension. 1993;11(suppl 2):S43-S62.

[18] Association for the Advancement of Medical Instruments. American National Standard for Electronic and Automated Sphygmomanometers. Washington: Association for the Advancement of Medical Instruments; 1987.

[19] Association for the Advancement of Medical Instruments. Electronic or automated sphygmomanometers. Arlignton, USA: Association for the Advancement of Medical Instruments; 1993.

[20] O'Brien E, Pickering T, Asmar R, Myers M, Parati G, Staessen J, et al. Working Group on Blood Pressure Monitoring of the European Society of Hypertension International Protocol for validation of blood pressure measuring devices in adults. Blood pressure monitoring. 2002 Feb;7(1):3-17.

[21] O'Brien E, Atkins N. A comparison of the British Hypertension Society and Association for the Advancement of Medical Instrumentation protocols for validating blood pressure measuring devices: can the two be reconciled? Journal of hypertension. 1994 Sep;12(9):1089-94.

[22] O'Brien E. Proposals for simplifying the validation protocols of the British Hypertension Society and the Association for the Advancement of Medical Instrumentation. Blood pressure monitoring. 2000 Feb;5(1):43-5.

[23] Perloff D, Grim C, Flack J, Frohlich ED, Hill M, McDonald M, et al. Human blood pressure determination by sphygmomanometry. Circulation. 1993 Nov;88(5 Pt 1):2460-70.

[24] Prineas RJ, Jacobs D. Quality of Korotkoff sounds: bell vs diaphragm, cubital fossa vs brachial artery. Preventive medicine. 1983 Sep;12(5):715-9.

[25] Mauro AM. Effects of bell versus diaphragm on indirect blood pressure measurement. Heart Lung. 1988 Sep;17(5):489-94.

[26] Cushman WC, Cooper KM, Horne RA, Meydrech EF. Effect of back support and stethoscope head on seated blood pressure determinations. Am J Hypertens. 1990 Mar;3(3):240-1.

[27] Kantola I, Vesalainen R, Kangassalo K, Kariluoto A. Bell or diaphragm in the measurement of blood pressure? Journal of hypertension. 2005 Mar;23(3):499-503.

[28] O'Brien E. Review: a century of confusion; which bladder for accurate blood pressure measurement? Journal of human hypertension. 1996 Sep;10(9):565-72.

[29] Frohlich ED, Grim C, Labarthe DR, Maxwell MH, Perloff D, Weidman WH. Recommendations for human blood pressure determination by sphygmomanometers. Report of a special task force appointed by the steering committee, American Heart Association. Hypertension. 1988;11(2):209A-22A.

[30] Russell AE, Wing LM, Smith SA, Aylward PE, McRitchie RJ, Hassam RM, et al. Optimal size of cuff bladder for indirect measurement of arterial pressure in adults. Journal of hypertension. 1989 Aug;7(8):607-13.

[31] Campbell NR, McKay DW, Chockalingam A, Fodor JG. Errors in assessment of blood pressure: patient factors. Canadian journal of public health. 1994 Sep-Oct;85 Suppl 2:S12-7.

[32] Manning G, Rushton L, Millar-Craig MW. Clinical implications of white coat hypertension: an ambulatory blood pressure monitoring study. Journal of human hypertension. 1999 Dec;13(12):817-22.

[33] Owens P, Atkins N, O'Brien E. Diagnosis of white coat hypertension by ambulatory blood pressure monitoring. Hypertension. 1999 Aug;34(2):267-72.

[34] Eser I, Khorshid L, Gunes UY, Demir Y. The effect of different body positions on blood pressure. Journal of clinical nursing. 2007 Jan;16(1):137-40.

[35] Jamieson MJ, Webster J, Philips S, Jeffers TA, Scott AK, Robb OJ, et al. The measurement of blood pressure: sitting or supine, once or twice? Journal of hypertension. 1990 Jul;8(7):635-40.

[36] Netea RT, Lenders JW, Smits P, Thien T. Both body and arm position significantly influence blood pressure measurement. Journal of human hypertension. 2003 Jul;17(7):459-62.

[37] Terent A, Breig-Asberg E. Epidemiological perspective of body position and arm level in blood pressure measurement. Blood pressure. 1994 May;3(3):156-63.

[38] Mariotti G, Alli C, Avanzini F, Canciani C, Di Tullio M, Manzini M, et al. Arm position as a source of error in blood pressure measurement. Clinical cardiology. 1987 Oct;10(10):591-3.

[39] Netea RT, Lenders JW, Smits P, Thien T. Arm position is important for blood pressure measurement. Journal of human hypertension. 1999 Feb;13(2):105-9.

[40] Gould BA, Hornung RS, Kieso HA, Altman DG, Raftery EB. Is the blood pressure the same in both arms? Clinical cardiology. 1985 Aug;8(8):423-6.

[41] Parr GD, Poole PH. Effects of sphygmomanometer type and position of the arm on blood pressure measurement. Journal of human hypertension. 1988 Oct;2(3):153-6.

[42] Mancia G, Casadei R, Groppelli A, Parati G, Zanchetti A. Effect of stress on diagnosis of hypertension. Hypertension. 1991 Apr;17(4 Suppl):III56-62.

[43] 1999 World Health Organization-International Society of Hypertension Guidelines for the Management of Hypertension. Guidelines Subcommittee. Journal of hypertension. 1999 Feb;17(2):151-83.

[44] Ockene IS, Chiriboga DE, Stanek EJ, 3rd, Harmatz MG, Nicolosi R, Saperia G, et al. Seasonal variation in serum cholesterol levels: treatment implications and possible mechanisms. Archives of internal medicine. 2004 Apr 26;164(8):863-70.

[45] Tolonen H, Ferrario M, Kuulasmaa K. Standardization of total cholesterol measurement in population surveys--pre-analytic sources of variation and their effect on the prevalence of hypercholesterolaemia. Eur J Cardiovasc Prev Rehabil. 2005 Jun;12(3):257-67.

[46] Troisi RJ, Cowie CC, Harris MI. Diurnal variation in fasting plasma glucose: implications for diagnosis of diabetes in patients examined in the afternoon. Jama. 2000 Dec 27;284(24):3157-9.

[47] Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes care. 1997 Jul;20(7):1183-97.

[48] World Health Organization. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part1: Diagnosis and classicifation of diabetes mellitus. Geneva: Department of Noncommunicable Disease Surveillance 1999.

[49] World Health Organization. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia. [cited 7 March 2008]; Available from: http://www.who.int/diabetes/publications/Definition%20and%20diagnosis%20of%20diabetes_new.pdf

[50] Cloey T, Bachorik PS, Becker D, Finney C, Lowry D, Sigmund W. Reevaluation of serum-plasma differences in total cholesterol concentration. Jama. 1990 May 23-30;263(20):2788-9.

[51] Uchida K, Matuse R, Toyoda E, Okuda S, Tomita S. A new method of inhibiting glycolysis in blood samples. Clinica chimica acta; international journal of clinical chemistry. 1988 Feb 29;172(1):101-8.

[52] Vaisanen S, Eskelinen S, Halonen T. Preservation of glucose in sampling tubes (in Finnish). Kliin Lab. 2002:48-50.

[53] Centers for Diseasae Control and Prevention. Laboratory Quality Assurance Programs. 2007 [cited 7 March 2008]; Available from: http://www.cdc.gov/labstandards/

[54] Studenski S, Perera S, Wallace D, Chandler JM, Duncan PW, Rooney E, et al. Physical performance measures in the clinical setting. Journal of the American Geriatrics Society. 2003 Mar;51(3):314-22.

[55] Elam JT, Graney MJ, Beaver T, el Derwi D, Applegate WB, Miller ST. Comparison of subjective ratings of function with observed functional ability of frail older persons. American journal of public health. 1991 Sep;81(9):1127-30.

[56] Sager MA, Dunham NC, Schwantes A, Mecum L, Halverson K, Harlowe D. Measurement of activities of daily living in hospitalized elderly: a comparison of self-report and performance-based methods. Journal of the American Geriatrics Society. 1992 May;40(5):457-62.

[57] Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. Journal of gerontology. 1994 Mar;49(2):M85-94.

[58] Reuben DB, Rubenstein LV, Hirsch SH, Hays RD. Value of functional status as a predictor of mortality: results of a prospective study. The American journal of medicine. 1992 Dec;93(6):663-9.

[59] Nevitt MC, Cummings SR, Kidd S, Black D. Risk factors for recurrent nonsyncopal falls. A prospective study. Jama. 1989 May 12;261(18):2663-8.

[60] Tinetti ME, Ginter SF. Identifying mobility dysfunctions in elderly patients. Standard neuromuscular examination or direct assessment? Jama. 1988 Feb 26;259(8):1190-3.

[61] Williams ME. Identifying the older person likely to require long-term care services. Journal of the American Geriatrics Society. 1987 Aug;35(8):761-6.

[62] Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB. Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. The New England journal of medicine. 1995 Mar 2;332(9):556-61.

[63] Penninx BW, Ferrucci L, Leveille SG, Rantanen T, Pahor M, Guralnik JM. Lower extremity performance in nondisabled older persons as a predictor of subsequent hospitalization. The journals of gerontology. 2000 Nov;55(11):M691-7.

[64] Curb JD, Ceria-Ulep CD, Rodriguez BL, Grove J, Guralnik J, Willcox BJ, et al. Performance-based measures of physical function for high-function populations. Journal of the American Geriatrics Society. 2006 May;54(5):737-42.

[65] Rikli RE, Jones J. Assesing Physical Performance in Independent Older Adults: Issues and Guidelines. Journal of Aging and Physical Activity. 1997;5(3):244-61.

[66] Gerety MB, Mulrow CD, Tuley MR, Hazuda HP, Lichtenstein MJ, Bohannon R, et al. Development and validation of a physical performance instrument for the functionally impaired elderly: the Physical Disability Index (PDI). Journal of gerontology. 1993 Mar;48(2):M33-8.

[67] Winograd CH, Lemsky CM, Nevitt MC, Nordstrom TM, Stewart AL, Miller CJ, et al. Development of a physical performance and mobility examination. Journal of the American Geriatrics Society. 1994 Jul;42(7):743-9.

[68] Reuben DB, Siu AL. An objective measure of physical function of elderly outpatients. The Physical Performance Test. Journal of the American Geriatrics Society. 1990 Oct;38(10):1105-12.

[69] Tinetti ME. Performance-oriented assessment of mobility problems in elderly patients. Journal of the American Geriatrics Society. 1986 Feb;34(2):119-26.

[70] Weiner DK, Duncan PW, Chandler J, Studenski SA. Functional reach: a marker of physical frailty. Journal of the American Geriatrics Society. 1992 Mar;40(3):203-7.

[71] Williams ME, Gaylord SA, McGaghie WC. Timed manual performance in a community elderly population. Journal of the American Geriatrics Society. 1990 Oct;38(10):1120-6.

[72] Williams ME, Hornberger JC. A quantitative method of identifying older persons at risk for increasing long term care services. Journal of chronic diseases. 1984;37(9-10):705-11.

[73] Jette AM, Branch LG, Berlin J. Musculoskeletal impairments and physical disablement among the aged. Journal of gerontology. 1990 Nov;45(6):M203-8.

[74] Lawrence RH, Jette AM. Disentangling the disablement process. J Gerontol B Psychol Sci Soc Sci. 1996 Jul;51(4):S173-82.

[75] Williams ME, Hadler NM, Earp JA. Manual ability as a marker of dependency in geriatric women. Journal of chronic diseases. 1982 Feb;35(2):115-22.

[76] Scholer SG, Potter JF, Burke WJ. Does the Williams Manual Test predict service use among subjects undergoing geriatric assessment? Journal of the American Geriatrics Society. 1990 Jul;38(7):767-72.

[77] Nybo H, Gaist D, Jeune B, McGue M, Vaupel JW, Christensen K. Functional status and self-rated health in 2,262 nonagenarians: the Danish 1905 Cohort Survey. Journal of the American Geriatrics Society. 2001 May;49(5):601-9.

[78] Rantanen T, Guralnik JM, Foley D, Masaki K, Leveille S, Curb JD, et al. Midlife hand grip strength as a predictor of old age disability. Jama. 1999 Feb 10;281(6):558-60.

[79] Rantanen T, Masaki K, Foley D, Izmirlian G, White L, Guralnik JM. Grip strength changes over 27 yr in Japanese-American men. J Appl Physiol. 1998 Dec;85(6):2047-53.

[80] Fujita Y, Nakamura Y, Hiraoka J, Kobayashi K, Sakata K, Nagai M, et al. Physical-strength tests and mortality among visitors to health-promotion centers in Japan. Journal of clinical epidemiology. 1995 Nov;48(11):1349-59.

[81] Rantanen T, Harris T, Leveille SG, Visser M, Foley D, Masaki K, et al. Muscle strength and body mass index as long-term predictors of mortality in initially healthy men. The journals of gerontology. 2000 Mar;55(3):M168-73.

[82] Aromaa A, Korkinen S. Health and functional capacity in Finland. Baseline results of the Health 2000 Health Examination Survey. Helsinki: National Public Health Institute B12; 2004.

[83] Ashton LA, SMyers S. Serial grip strength testings - Its role in assessment of wrist and hand disability. The Internet Journal of Surgery. 2004;5(2).

[84] Gale CR, Martyn CN, Cooper C, Sayer AA. Grip strength, body composition, and mortality. International journal of epidemiology. 2007 Feb;36(1):228-35.

[85] Rantanen T, Volpato S, Ferrucci L, Heikkinen E, Fried LP, Guralnik JM. Handgrip strength and cause-specific and total mortality in older disabled women: exploring the mechanism. Journal of the American Geriatrics Society. 2003 May;51(5):636-41.

[86] Richards LG, Olson B, Palmiter-Thomas P. How forearm position affects grip strength. Am J Occup Ther. 1996 Feb;50(2):133-8.

[87] Innes S. Handgrip strength testing: a review of the literature. The Australian Occupational Therapy Journal. 1999;30(2):120-40.

[88] Mathiowetz V. Reliability and validity of grip and pinch strength measurements. Journal of Hand Therapy. 1991;3:195-8.

[89] Fess EE. Guidelines for evaluating assessment instruments. J Hand Ther. 1995 Apr-Jun;8(2):144-8.

[90] Fess EE. A methods for checking Jamar dynamometer calibration. Journal of Hand Therapy. 1987;1:28-32.

[91] Hamilton A, Balnave R, Adams R. Grip strength testing reliability. J Hand Ther. 1994 Jul-Sep;7(3):163-70.

[92] MacDermid JC, Kramer JF, Woodbury MG, McFarlane RM, Roth JH. Interrater reliability of pinch and grip strength measurements in patients with cumulative trauma disorders. J Hand Ther. 1994 Jan-Mar;7(1):10-4.

[93] Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of hand strength evaluations. Journal of Hand Therapy. 1984;9A:222-6.

[94] Niebuhr BR, Marion R, Fike ML. Reliability of grip strength assessment with the computerised Jamar dynamometer. Occupational Therapy Journal of Research. 1994;14:3-18.

[95] Portney LG, Watkins MP. Foundations of Clinical Research: Applications to Practice. East Norwalk: Appleton & Lange 1993.

[96] Mathiowetz V. Effect of three trials on grip and pinch strenths measurements. Journal of Hand Therapy. 1990;3:195-8.

[97] Watanabe T, Owashi K, Kanauchi Y, Mura N, Takahara M, Ogino T. The short-term reliability of grip strength measurement and the effects of posture and grip span. The Journal of hand surgery. 2005;30A(3):603-9.

[98] Jefferys M, Millard JB, Hyman M, Warren MD. A set of tests for measuring motor impairment in prevalence studies. Journal of chronic diseases. 1969 Nov;22(5):303-19.

[99] Keitel W, Hoffmann H, Weber G, Krieger U. [Evaluation of the percentage of functional decrease of the joints using a motor function test in rheumatology]. Das Deutsche Gesundheitswesen. 1971 Oct 1;26(40):1901-3.

[100] Sievers K, Melkas T, Heliovaara M. Survey methods for musculoskeletal diseases (in Finnish with English summary). Helsinki and Turku: Kansaeläkelaitoksen julkaisuja ML:50; 1985.

[101] Aromaa A, Heliovaara M, Impivaara O, Knekt P, Maatela J. The Execution of the Mini-Finland Health Survey (in Finnish, summary in English). Helsinki and Turku: Kansanelakelaitoksen julkaisuja ML: 88; 1989.

[102] Heistaro S, (ed.). Menetelmäraportti: Terveys 200-tutkimuksen toteutus, aineisto ja menetelmät. Helsinki: National Public Health Institute B6; 2005.

[103] ASHT. American Society of Hand Therapists. 2006 [cited 03 June 2008]; Available from: http://www.asht.org/

[104] Viitasalo JT, Luhtanen P, Rahkila P, Rusko H. Electromyographic activity related to aerobic and anaerobic threshold in ergometer bicycling. Acta physiologica Scandinavica. 1985 Jun;124(2):287-93.

[105] Guralnik JM, Ferrucci L, Pieper CF, Leveille SG, Markides KS, Ostir GV, et al. Lower extremity function and subsequent disability: consistency across studies, predictive models, and value of gait speed alone compared with the short physical performance battery. The journals of gerontology. 2000 Apr;55(4):M221-31.

[106] Sonn U, Grimby G, Svanborg A. Activities of daily living studied longitudinally between 70 and 76 years of age. Disability and rehabilitation. 1996 Feb;18(2):91-100.

[107] Bassey EJ, Fiatarone MA, O'Neill EF, Kelly M, Evans WJ, Lipsitz LA. Leg extensor power and functional performance in very old men and women. Clin Sci (Lond). 1992 Mar;82(3):321-7.

[108] Ferrucci L, Guralnik JM, Buchner D, Kasper J, Lamb SE, Simonsick EM, et al. Departures from linearity in the relationship between measures of muscular strength and physical performance of the lower extremities: the Women's Health and Aging Study. The journals of gerontology. 1997 Sep;52(5):M275-85.

[109] Steffen TM, Hacker TA, Mollinger L. Age- and gender-related test performance in community-dwelling elderly people: Six-Minute Walk Test, Berg Balance Scale, Timed Up & Go Test, and gait speeds. Physical therapy. 2002 Feb;82(2):128-37.

[110] Cress ME, Schechtman KB, Mulrow CD, Fiatarone MA, Gerety MB, Buchner DM. Relationship between physical performance and self-perceived physical function. Journal of the American Geriatrics Society. 1995 Feb;43(2):93-101.

[111] Hoeymans N, Wouters ER, Feskens EJ, van den Bos GA, Kromhout D. Reproducibility of performance-based and self-reported measures of functional status. The journals of gerontology. 1997 Nov;52(6):M363-8.

[112] Jette AM, Jette DU, Ng J, Plotkin DJ, Bach MA. Are performance-based measures sufficiently reliable for use in multicenter trials? Musculoskeletal Impairment (MSI) Study Group. The journals of gerontology. 1999 Jan;54(1):M3-6.

[113] Guyatt GH, Pugsley SO, Sullivan MJ, Thompson PJ, Berman L, Jones NL, et al. Effect of encouragement on walking test performance. Thorax. 1984 Nov;39(11):818-22.

[114] Enright PL, McBurnie MA, Bittner V, Tracy RP, McNamara R, Arnold A, et al. The 6-min walk test: a quick measure of functional status in elderly adults. Chest. 2003 Feb;123(2):387-98.

[115] Harada ND, Chiu V, Stewart AL. Mobility-related function in older adults: assessment with a 6-minute walk test. Archives of physical medicine and rehabilitation. 1999 Jul;80(7):837-41.

[116] Rikli RE, Jones J. The reliability and walidity of a 6-minute walk test as a measure of physical endurance in older adults. Journal of Aging and Physical Activity. 1998;6(4).

[117] Csuka M, McCarty DJ. Simple method for measurement of lower extremity muscle strength. The American journal of medicine. 1985 Jan;78(1):77-81.

[118] Era P, Schroll M, Ytting H, Gause-Nilsson I, Heikkinen E, Steen B. Postural balance and its sensory-motor correlates in 75-year-old men and women: a cross-national comparative study. The journals of gerontology. 1996 Mar;51(2):M53-63.

[119] Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. Journal of the American Geriatrics Society. 1991 Feb;39(2):142-8.

[120] Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Physical therapy. 2000 Sep;80(9):896-903.

[121] Whitney SL, Poole JL, Cass SP. A review of balance instruments for older adults. Am J Occup Ther. 1998 Sep;52(8):666-71.

[122] Berg KO, Maki BE, Williams JI, Holliday PJ, Wood-Dauphinee SL. Clinical and laboratory measures of postural balance in an elderly population. Archives of physical medicine and rehabilitation. 1992 Nov;73(11):1073-80.

[123] Bohannon RW, Leary KM. Standing balance and function over the course of acute rehabilitation. Archives of physical medicine and rehabilitation. 1995 Nov;76(11):994-6.

[124] Cress ME, Buchner DM, Questad KA, Esselman PC, deLateur BJ, Schwartz RS. Continuous-scale physical functional performance in healthy older adults: a validation study. Archives of physical medicine and rehabilitation. 1996 Dec;77(12):1243-50.

[125] National Health and Nutrition Examination Survey. Balance procedures manual. 2003 [cited 03 June 2008]; Available from: http://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/BA.pdf

[126] Seeman TE, Charpentier PA, Berkman LF, Tinetti ME, Guralnik JM, Albert M, et al. Predicting changes in physical performance in a high-functioning elderly cohort: MacArthur studies of successful aging. Journal of gerontology. 1994 May;49(3):M97-108.

[127] Simonsick EM, Newman AB, Nevitt MC, Kritchevsky SB, Ferrucci L, Guralnik JM, et al. Measuring higher level physical function in well-functioning older adults: expanding familiar approaches in the Health ABC study. The journals of gerontology. 2001 Oct;56(10):M644-9.

[128] Suni JH. Health-related fitness test battery for middle-aged adutls with emphasis on musculoskeletal and motor tests. Jyväskylä: Univesrity of Jyväskylä; 2000.

[129] EUNAAPA - European Network for Action on Ageing and Physical Activity. [cited 10 March 2008]; Available from: http://www.eunaapa.org/project.php

[130] ProFaNE - Prevention of Falls Network Europe. 2002 [cited 10 March 2008]; Available from: http://www.profane.eu.org/

[131] Fiatarone MA, O'Neill EF, Ryan ND, Clements KM, Solares GR, Nelson ME, et al. Exercise training and nutritional supplementation for physical frailty in very elderly people. The New England journal of medicine. 1994 Jun 23;330(25):1769-75.

[132] Guralnik JM, Seeman TE, Tinetti ME, Nevitt MC, Berkman LF. Validation and use of performance measures of functioning in a non-disabled older population: MacArthur studies of successful aging. Aging (Milan, Italy). 1994 Dec;6(6):410-9.

[133] Ferrucci L, Guralnik JM, Salive ME, Fried LP, Bandeen-Roche K, Brock DB, et al. Effect of age and severity of disability on short-term variation in walking speed: the Women's Health and Aging Study. Journal of clinical epidemiology. 1996 Oct;49(10):1089-96.

[134] Malmberg JJ, Miilunpalo SI, Vuori IM, Pasanen ME, Oja P, Haapanen-Niemi NA. A health-related fitness and functional performance test battery for middle-aged and older adults: feasibility and health-related content validity. Archives of physical medicine and rehabilitation. 2002 May;83(5):666-77.

[135] Suni JH, Oja P, Miilunpalo SI, Pasanen ME, Vuori IM, Bos K. Health-related fitness test battery for middle-aged adults: associations with physical activity patterns. International journal of sports medicine. 1999 Apr;20(3):183-91.

[136] Rikli RE, Jones J. Development and validation of a functional fitness test for commonly-residing older adults. Journal of Aging and Physical Activity. 1999;7(2):129-61.

[137] Lemmink KAPM, Van Heuvelen MJ, Rispens P. The Groningen Fitness Test for the Elderly: composition and application in large-scale fitness events. In: Harris S, Heikkinen E, Harris WS, eds. *Physical activity, aging and sports: toward healthy aging: international perspectives Part 2 Psychology, motivation and programs*. Albany, NY: Center for the Study of Aging of Albany 1995.

[138] Suni JH, Oja P, Laukkanen RT, Miilunpalo SI, Pasanen ME, Vuori IM, et al. Health-related fitness test battery for adults: aspects of reliability. Archives of physical medicine and rehabilitation. 1996 Apr;77(4):399-405.

[139] Oja P, Laukkanen R, Pasanen M, Tyry T, Vuori I. A 2-km walking test for assessing the cardiorespiratory fitness of healthy adults. International journal of sports medicine. 1991 Aug;12(4):356-62.

[140] Cress ME, Buchner DM, Questad KA, Esselman PC, deLateur BJ, Schwartz RS. Exercise: effects on physical functional performance in independent older adults. The journals of gerontology. 1999 May;54(5):M242-8.

[141] McDowell I, Newell C. Measuring health: A guide to rating scales adn questionnaires, 2nd edition. New York: Oxford University Press 1996.

[142] TOIMIA - Toimintakyvyn mittaaminen ja arvioinnin kansallinen asiantuntijaverkosto. 2008 [cited 10 March 2008]; Available from: http://www.toimia.fi

[143] Lee CD, Blair SN, Jackson AS. Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. The American journal of clinical nutrition. 1999 Mar;69(3):373-80.

[144] Church TS, Cheng YJ, Earnest CP, Barlow CE, Gibbons LW, Priest EL, et al. Exercise capacity and body composition as predictors of mortality among men with diabetes. Diabetes care. 2004 Jan;27(1):83-8.

[145] Katzmarzyk PT, Church TS, Blair SN. Cardiorespiratory fitness attenuates the effects of the metabolic syndrome on all-cause and cardiovascular disease mortality in men. Archives of internal medicine. 2004 May 24;164(10):1092-7.

[146] Wessel TR, Arant CB, Olson MB, Johnson BD, Reis SE, Sharaf BL, et al. Relationship of physical fitness vs body mass index with coronary artery disease and cardiovascular events in women. Jama. 2004 Sep 8;292(10):1179-87.

[147] Noonan V, Dean E. Submaximal exercise testing: clinical application and interpretation. Physical therapy. 2000 Aug;80(8):782-807.

[148] Astrand PO, Ryhming I. A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during sub-maximal work. J Appl Physiol. 1954 Sep;7(2):218-21.

[149] Broucha L, Graybiel A, Heath CW. The step test. A simple method of measuring physical fitness for hard muscular work in adult man. Revue Canadienne de Biolgic. 1943;2:86-92.

[150] McArdle WD, Katch FI, Pechar GS, Jacobson L, Ruck S. Reliability and interrelationships between maximal oxygen intake, physical work capacity and step-test scores in college women. Medicine and science in sports. 1972 Winter;4(4):182-6.

[151] Siconolfi SF, Garber CE, Lasater TM, Carleton RA. A simple, valid step test for estimating maximal oxygen uptake in epidemiologic studies. American journal of epidemiology. 1985 Mar;121(3):382-90.

[152] Golding LA, Meyers CR, Sinning WE. Y's way to physical fitness: The complete guide to fitness testing and instruction 3rd ed. Champaign, IL: Human Kinetics 1989.

[153] Buckley JP, Sim J, Eston RG, Hession R, Fox R. Reliability and validity of measures taken during the Chester step test to predict aerobic power and to prescribe aerobic exercise. British journal of sports medicine. 2004 Apr;38(2):197-205.

[154] Kinnunen H, Vainamo K, Hautala A, Makikallio T, Tulppo M, Nissila S. Artufucuak neural network in predicting maximal aerobic power. Med Sci Sports Exerc. 2000;32(5):S308.

[155] Borodulin K, Lakka TA, Laatikainen T, Laukkanen R, Kinnunen H, Jousilahti P. Associations of self-reported fitness and different types of leisure time physical activity with predicted aerobic fitness in 5979 Finnish adults. JPAH. 2004;1(2):142-53.

[156] Pan CR, Staessen JA, Li Y, Wang JG. Comparison of three measures of the ankle-brachial blood pressure index in a general population. Hypertens Res. 2007 Jun;30(6):555-61.

[157] Klein S, Hage JJ. Measurement, calculation, and normal range of the ankle-arm index: a bibliometric analysis and recommendation for standardization. Annals of vascular surgery. 2006 Mar;20(2):282-92.

[158] ARIC Atherosclerosis Risk in Communities Study. Manual 6A. Ultrasound Scanning. 1987 [cited 06 June 2008]; Available from: http://www.cscc.unc.edu/aric/visit/Ultrasound_Assessment-_Ultrasound_Scanning.1_6a.pdf

[159] Aromaa A, Koponen P, Tafforeau J, Vermeire C, (eds.). Status and future of health surveys in the European Union. Final report of Phase 2 of the project Health Surveys in the EU: HIS and HIS/HES Evaluation and Models. 2003 [cited 10 March 2008]; National Public Health Institute B15/2003, Helsinki. Available from: http://ec.europa.eu/health/ph_projects/2000/monitoring/fp_monitoring_2000_frep_04_en.pdf

[160] Keen R. Osteoporosis: strategies for prevention and management. Best practice & research. 2007 Feb;21(1):109-22.

[161] Vitalograph. [cited 10 March 2008]; Available from: http://www.vitalograph.com

[162] MicroMedical. 2007 [cited 10 March 2008]; Available from: http://www.micromedical.co.uk

[163] NicheMedical. [cited 10 March 2008]; Available from: http://www.nichemedical.com.au

[164] Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. Eur Respir J. 2005 Aug;26(2):319-38.

[165] WHO Expert Committee. Physical status: the use and interpretation of anthropometry. Geneva: World Health Organization; 1995.

[166] World Health Organization Regional Office for Europe. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) Program. Protocol and Guidelines. 1995 [cited 7 March 2008; Available from: http://whqlibdoc.who.int/hq/1994/EUR_ICP_CIND_94.02_PB04.pdf

[167] Bortolotto LA, Henry O, Hanon O, Sikias P, Mourad JJ, Girerd X. Validation of two devices for self-measurement of blood pressure by elderly patients according to the revised British Hypertension Society protocol: the Omron HEM-722C and HEM-735C. Blood pressure monitoring. 1999 Feb;4(1):21-5.

[168] El Assaad MA, Topouchian JA, Asmar RG. Evaluation of two devices for self-measurement of blood pressure according to the international protocol: the Omron M5-I and the Omron 705IT. Blood pressure monitoring. 2003 Jun;8(3):127-33.

[169] Artigao LM, Llavador JJ, Puras A, Lopez Abril J, Rubio MM, Torres C, et al. [Evaluation and validation of Omron Hem 705 CP and Hem 706/711 monitors for self-measurement of blood pressure]. Atencion primaria / Sociedad Espanola de Medicina de Familia y Comunitaria. 2000 Feb 15;25(2):96-102.

[170] O'Brien E, Atkins N. Inaccuracy of the Dinamap 8100 portable monitor. Lancet. 1997 Apr 5;349(9057):1026.

[171] O'Brien E, Mee F, Atkins N, O'Malley K. Short report: accuracy of the Dinamap portable monitor, model 8100 determined by the British Hypertension Society protocol. Journal of hypertension. 1993 Jul;11(7):761-3.

[172] El Assaad MA, Topouchian JA, Darne BM, Asmar RG. Validation of the Omron HEM-907 device for blood pressure measurement. Blood pressure monitoring. 2002 Aug;7(4):237-41.

[173] Wright JM, Mattu GS, Perry Jr TL, Gelferc ME, Strange KD, Zorn A, et al. Validation of a new algorithm for the BPM-100 electronic oscillometric office blood pressure monitor. Blood pressure monitoring. 2001 Jun;6(3):161-5.

Tavle 9.1 Height measurement protocols, devices and accuracy of the measurement in the previous HESs

Country	Survey	Year	Protocol	Equipment	Accuracy
Croatia	Croatian Health Survey	2003	Measured without shoes against the door frame		
Czech Republic	Health Lifestyle and Environment	2004	MONICA protocol [4]: Measured in standing position without shoes and outer garments	Stadiometer	1 cm
Finland	Health 2000	2000	EHRM protocol [1]: Subject was standing erect, foot side by side, head strait and back on the wall. Height was measured without outer garments.	Stadiometer (wall mounded model	0,5 cm
	FINRISK	2007	Subject is asked to remove their outer garments and shoes. Also all hair gear which could prevent accurate measurement is asked to be removed. Subject stands on hard surface, feet together and back straight on the wall facing front. The level of the stadiometer is then lowered to touch the top of the head. If the measurer is substantially shorter than subject being measured, the measurer should use a stand when reading the measurement scale. *Comment:* If the subject is taller than the measurement scale or subject is immobile, the self reported height is recorded and comment about this is added to the form. If mobile subject refuses from the measurement self reported height is not accepted.	Stadiometer (wall mounded model)	0,1 cm
France	National Survey nutrition and Health	2006	WHO recommendations [165]: Person is on barefoot or in thin socks and wearing little clothing. Person should stand on a flat surface, weight evenly distributed on both feet, heels together, and the head positioned so that the line of vision is perpendicular to the body. The arms hang freely by the side, and the head, back, buttocks, and heels are in contact with the vertical board.	Wall mounted stadiometer	0,5 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
Germany	German national health examination and interview survey	1998	Measured without shoes	Teleskopmessstab	0,5 cm
Ireland	SLAN	2006	EHRM protocol [1]: Measurement position; wall mounted. Clothing; stocking feet *Comment:* Measured from all participants, except wheelchair bound individuals, persons who have difficulty standing steady or straight, and participants with a hairstyle (Afro or Mohawk) or head dress (e.g. Turban).	Seca wall mounted body meter measuring tape	0,1 - 0,5 cm
Netherlands	Netherlands Health Examination Survey	2001	EHRM protocol [1]; Measured without shoes, looking straight forward, heel to heel and foot in an angle of 45^{o}. Measured against the strip.	wall-mounted stadiometer (Used the available devices at the health centre)	0,5 cm.
Norway	Cohort Norway 1994-2003	1994-2003	HUBRO-protocol: without shoes and outer cloths, facing forwards, upright position *Comment:* Measured without shoes and with light clothing.	Electronic Height and Weight Scale	0,1 cm
Poland	WOBASZ	2005	MONICA Protocol [4]: Measured without shoes, feet together, back as straight as possible, facing forwards. Upright position without outer garments and shoes	Height rule	0,5 cm
Slovakia	CINDI Health Examination Survey	2003	Adapted EHRM Protocol [1]: Standing, dressed		0,1 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
UK	Health Survey for England	2005	Measurement position: without shoes, feet flat on the centre of the base plate, feet together, heels against the rod, back as straight as possible (not leaning on the rod), arms hanging loosely by the side, facing forwards. Person should keep their eyes focused on a point straight ahead, to breathe in deeply and to stretch to their fullest height. *Comment:* Not measured from chair bound persons, if person is too unsteady on their feet for the measurement, person finds it painful to stand or stand straight, elderly person is too stooped to obtain a reliable measurement. If person has a hair style which stands well above the top of their head or turban, this should be marked on measurement card.	Portable stadiometer	0,1 cm (if between two millimeters, rounding to the nearest even millimeter)
	Scottish Health Survey	2003	Measurement position: without shoes, feet flat on the centre of the base plate, feet together, heels against the rod, back as straight as possible (not leaning on the rod), arms hanging loosely by the side, facing forwards. Person should keep their eyes focused on a point straight ahead, to breathe in deeply and to stretch to their fullest height. *Comment:* If person has a hair style which stands well above the top of their head or turban, this should be marked on measurement card.	Portable stadiometer	0,1 cm (if between two millimetres, rounding to the nearest even millimetre)
Canada	Canadian Health Measures Survey 2007	2007	Person should remove his/her footwear and move or remove hair ornaments, jewellery, buns and braids from the top of the head. Person stands erect, arms hanging at the sides, feet together, heels, buttocks and back and head in contact with the vertical backboard of the stadiometer. Body weight should be evenly distributed and both feel are flat on the floor. Person looks straight ahead. *Comment:* If person not able to stand unassisted	Digital Stadiometer	0,1 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
USA	NHANES	2005-2006	Person is asked to remove hair ornaments, jewellery, buns, and braids from the top the head. Person stands with heels of both feet together and the toes pointed slightly outward at approx. 60^{o} angle. Body weight is evenly distributed and both feet are flat on the floor. The heels, the buttocks, shoulder blades and the back of the head should be in the vertical contact with backboard. Measurement is takes while person is breathing deeply in. *Comment:* If person has hear piece and he/she refuses to remove it, the height of the hear piece is measured and recorded. Also if person refuses to remove his/her shoes, the height of the heel of the shoes will be measured and recorded. In both of these cases height will be measured.	Fixed stadiometer with a vertical backboard and a moveable headboard	0,1 cm

Table 9.2 Weight measurement protocols, devices and accuracy of the measurement in the previous HESs

Country	Survey	Year	Protocol	Equipment	Accuracy
Croatia	Croatian Health Survey	2003	MONICA Protocol [4]		
Czech republic	Health Lifestyle and Environment	2004	MONICA Protocol [4]: Measured in standing position without shoes and outer garments	Beam-balance scale	0,2 kg
Finland	Health 2000	2000	Subject was barefooted. At first the sole and balms were wiped with special electrolytic towels. Subjects were asked to stand on the device feet on the electrodes and grip hand electrodes so that thumb and balm have proper contact to the electrodes. Subject is standing hands on side, slightly depart from the body. Age and the height in the accuracy to the 1 cm were imputed to the device from the previous height measurement. Measurement took about 2 minutes. *Comment:* Not conducted for the subjects with pacemakers	Body composition analyzer	
	FINRISK	2007	Weight is measured in the light clothing, without outer garments, shoes and dress coats. Make sure that subject does not have keys, wallet or other things in his/her pockets. Subject is standing in the middle of the scale, weight evenly distributed on both feel. *Comment:* If subject is heavier than the maximum weight possible to measure by the scale or subject is immobile, the self reported weight is recorded and the comment is made on the form. If mobile subject refuses from the measurement, self reported weight is not accepted.	Balanced beam scale	0,1 kg

Country	Survey	Year	Protocol	Equipment	Accuracy
France	National Survey on nutrition and health	2006	WHO recommendations [165]. light clothing	Electronic scale	0,1 kg
Germany	German national health examination and interview survey	1998	Measured without shoes , standing and light clothing	Electronic	0,1 kg
Ireland	SLAN	2006	EHRM Protocol [1]; Measured without heavy outer garments (jackets, coats, trousers, skirts etc) and shoes, weight distributed evenly to both feet. Not measured from pregnant women, wheelchair bound individuals or persons who have difficulty standing steady. Comment: Not measured from pregnant women, wheelchair bound individuals or persons who have difficulty standing steady.	Balanced beam scale	0,1 / 0,2 kg
Netherlands	Netherlands Health Examination Survey	2001	Weight is measured in the light clothing, without outer garments, shoes and dress coats. Make sure that subject does not have keys, wallet or other things in his/her pockets. Subject is standing in the middle of the scale, weight evenly distributed on both feet.	Used the available devices at the health centre	0,5 kg
Norway	Cohort Norway	1994-2003	HUBRO; Measured without shoes and with light clothing	Electronic Height and Weight scale	0,1 kg
Poland	WOBASZ	2005	MONICA Protocol [4]; Without outer garments and shoes *Comment:* portable bathroom scales (at home).	Bauer portable balance	0,2 kg

Country	Survey	Year	Protocol	Equipment	Accuracy
Slovakia	CINDI Health Examination Survey	2003	EHRM Protocol [1]; standing, dressed	Calibrated digital weighting machine	0,1 kg
UK	Health Survey for England	2005	Measured without shoes, heavy outer garments, heavy jewellery, loose change and keys. Measurement position: feet together, heels against the bag edge of the scale, arms hanging loosely at their sides, head facing forwards. *Comment:* Not measured from chair bound persons, if person is too unsteady on their feet for the measurement, person finds it painful to stand or stand straight, elderly person is too stooped to obtain a reliable measurement or person is pregnant.	Electronic bathroom scales	0,1 kg
	Scottish Health Survey	2003	Measured without shoes, heavy outer garments, heavy jewellery, loose change and keys. Measurement protocol: feet together, heels against the bag edge of the scale, arms hanging loosely at their sides, head facing forwards. *Comment:* Not measured from pregnant women.	Electronic bathroom scale	0,1 kg
Canada	Canadian Health Measures Survey	2007	Person is asked to remove his/her footwear, any heavy accessories and empty their pockets. Person is asked to step on the center of the scale facing measurer, hand at the side and looking straight ahead. *Comment:* Not measured of person is not able to stand unassisted	Terminal scale	0,1 kg

Country	Survey	Year	Protocol	Equipment	Accuracy
USA	NHANES	2005-2006	Only underwear, women should wear underpants. The person is standing in the center of the scale platform facing the recorder, hands at side, and looking straight ahead (Toledo electronic weight scale). *Comment:* If person is weighing more than 200 kg (440 pounds), weight should be measured using two Seca digital scales	Electronic weight scale and digital scale	

Table 9.3 Waist and hip circumference measurement protocols, devices and accuracy of the measurements in the previous HESs

Country	Survey	Year	Protocol	Equipment	Accuracy
Croatia	Croatian Health Survey	2003	Waist: Measured at the umbilical level	Plastic stripe meter	
Czech Republic	Health Lifestyle and Environment	2004	MONICA Protocol [4]: Measured in standing position in undergarments	belt measure	0,5 cm
Finland	Health 2000	2000	Subject had removed all clothes from the upper body and also outer garments from the lower body. The subject was standing feet little apart. Waist circumference was measured between the lower rib margin and iliac crest. Measurer was sitting in front of the subject. The measurement was taken while subject was breading gently out. Hip circumference was measured from the widest part of the hip. *Comment:* If person was not able to stand or was pregnant (over 20 weeks) the measurement was not conducted.	Measurement tape	0,5 cm
	FINRISK	2007	Subject is asked to remove outer garments, dress coats and sweaters and to empty their pockets as well as to open belts and other possible tide clothes on the waist. Subject stands feet little apart, weight evenly on both feet. The distance between feet is 10-15 cm. Measure is sitting. Waist circumference is measured between the lower rib margin and iliac crest. Subject is asked to breath gently and the measurement is done while breading gently out. To ensure that the measurement tape in on level, the subject can be asked to turn on place for 90 degrees. Hip circumference is measured over the buttocks	Measurement tape	0,5 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
France	National survey on nutrition and health	2006	WHO Protocol [165]: Clothing: no	Measurement tape	1 cm
Germany	German national health examination and interview survey	1998		Not elastic measuring tape	
Ireland	SLAN	2006	Waist EHRM Protocol [1]; Position: Midline of the participant's armpit, at the midpoint between the lower part of the last rib and the top of the hip i.e. at the navel or largest point at which the stomach protrudes to the front. Clothing: Preferably on bare skin, but where preferred by the participant over light clothing *Comment:* No hip measured.	Tape measure	
Netherlands	Netherlands Health Examination Survey	2001	Measured in a standing position without heavy outer garments. Waist: Measured in the middle point of the iliac crest and the lowest rib while the subject was breathing out. Hip: measured from the widest point.	Measurement tape	0,5 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
Norway	Cohort Norway	1994-2003	Measurements made with a flexible steel devise Waist circumference as measured at the umbilicus while subject standing and breathing normally. In obese persons, if umbilicus not on the widest, waist was measured at its maximum between the lower rib and the iliac crest on the widest. Hip circumference was measured at the maximum circumference around the buttocks.	A flexible steel devise with scale until 150 cm.	1 cm
Poland	WOBASZ	2005	MONICA Protocol [4]: Measurement in standing position, without heavy outer garments	Insertion tape	0,5 cm
Slovakia	CINDI Health	2003	CINDI Protocol [166]: Standing	Measure tape	0,1 cm
UK	Health Survey for England	2005	Removing all outer layers of clothing, such as jackets, heavy or baggy jumpers, cardigans and waistcoats, shoes with heels, tight garments intended to alter the shape of the body, such as corsets, lycra body suits and support tights and belts. Pockets should be emptied. Measured while standing erect in a relaxed manner (foots about 20-30 cm apart) and breathing normally, arms hanging loosely at their side. Waist measured while the participant was breathing out gently, from the midway between the iliac crest and the lowest rib. Hip measured from the widest circumference over the buttocks and below the iliac crest. *Comment:* Measurement not taken is person is chair bound, has a colostomy/ ileostomy.	Insertion tape calibrated in mm, with a metal buckle at one end.	0,1 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
	The Scottish Health Survey	2003	Removing all outer layers of clothing, such as jackets, heavy or baggy jumpers, cardigans and waistcoats, shoes with heels, tight garments intended to alter the shape of the body, such as corsets, lycra body suits and support tights and belts. Pockets should be emptied. Measured while standing erect in a relaxed manner (foots about 20-30 cm apart) and breathing normally, arms hanging loosely at their side. Waist measured while the participant was breathing out gently, from the midway between the iliac crest and the lowest rib. Hip measured from the widest circumference over the buttocks and below the iliac crest. *Comment:* Measurement not taken is person is chair bound, has a colostomy/ ileostomy	Insertion tape calibrated in mm, whit a metal buckle at one end.	0,1 cm

Country	Survey	Year	Protocol	Equipment	Accuracy
Canada	Canadian Health Measures Survey	2007	No clothing on the measurement area. Person stands erect in a relaxed manner with arms hanging loosely at the sides. Waist measurement: Landmark both sides of the respondent by palpating the bottom of the rib case and the top of the iliac crest. Make a small mark at each bony landmark and a mark at the mid-point between these two landmarks using a washable marker. Standing on the respondent's side, place the measurement tape around the trunk in a horizontal plane at the level marked on the right side of the trunk. Ensure that tape is horizontal. Apply tension to the tape. Instruct the respondent to breath normally. Take the measurement at the end of a normal expiration. Hip measurement: Wearing only light clothing, the respondent should stand erect in a relaxed manner with arms hanging loosely at the sides and weight evenly distributed on both feet. Standing on the respondent's right side, place the measuring tape around the buttocks. The measurements in taken over the clothing. The tape placed in a horizontal plane at the maximum circumference of the hips or buttocks region. *Comment:* Not measured from pregnant women (> 12 weeks).	Tape measure (150cm)	0,1 cm
USA	NHANES	2005-2006	Person stands so that measurer is standing behind and to the right from the person. Waist circumference, between the uppermost lateral border of the right ilium and the midaxillary line of the body. The correct positioning of the measurement tape is checked from the mirror on the wall. *Comment:* No hip circumference was measured	Insertion tape	0,1 cm

Table 9.4 Legal restrictions and other limitations for the use of mercury sphygmomanometers

Country	Is it allowed to use mercury sphygmomanometers in the country?	Are there any limitations for the use of mercury sphygmomanometers in the country?
Austria	Yes	No
Belgium	Yes	It is getting difficult to find mercury sphygmomanometers on the Belgium market.
Czech Republic	Yes	No
Denmark	Yes	No
Estonia	Yes	No
Finland	Yes	No
France	Yes, but not in all examination centres	No
Germany	Yes	No
Greece	Yes	No
Hungary	Yes	No
Italy	Yes	No
Lithuania	Yes	No
Luxembourg	Yes	No
Macedonia	Yes	No
Malta	Yes	No
Netherlands	Information not available	Information not available
Norway	Yes	Mercury devices not sold in the country any longer and also difficult to obtain service and calibration.
Poland	Yes	No
Slovakia	Yes	No
Sweden	Yes	Mercury sphygmomanometers cannot be any longer cleaned or tested, which makes their use impossible.
UK	Information not available	Information not available

Table 9.5 Blood pressure measurement devices and accuracy of the measurements in the previous HESs

Country	Survey	Year	Device	Bell or diaphragm	Accuracy of the measurement	Validation of automated devices		Cuff size(s)
						Protocol*	Average difference (deviation) for SBP/DBP	
Croatia	Croatian Health Survey	2003	Simple mercury sphygmomanometer	Information not available	Information not available	Not relevant	Not relevant	Standard
Czech republic	Health Lifestyle and Environment	2004	Simple mercury sphygmomanometer	Bell	2 mmHg	Not relevant	Not relevant	Recommended cuff length (12-13 cm): width-ratio >2:1
Finland	Health 2000	2000	Simple mercury sphygmomanometer + automatic (Omron M4) for sub sample	Bell	2 mmHg	BHS A/A [167]	0.76 mmHg (5 mmHg)/ 0.41 mmHg (8 mmHg)	12 cm x 35 cm 15 cm x 43 cm if arm circumference over 35 cm
	FINRISK	2007	Simple mercury sphygmomanometer	Bell	2 mmHg	Not relevant	Not relevant	14 cm x 40 cm
France	National survey on nutrition and health	2006	Automatic validated device OMRON MI5	Not relevant	1 mmHg	International protocol [168]	-0.2 mmHg (4.5 mmHg)/ -2.0 mmHg (-4.8 mmHg)	two sizes (one for obese people)
Germany	German national health examination and interview survey	1998	Simple mercury sphygmomanometer (erkameter)	Bell	2 mmHg	Not relevant	Not relevant	Information not available

Country	Survey	Year	Device	Bell or diaphragm	Accuracy of the measurement	Validation of automated devices		Cuff size(s)
						Protocol*	Average difference (deviation) for SBP/DBP	
Ireland	SLAN	2006	Automatic (brand not known)	Not relevant	1 mmHg	Information not available	Information not available	7,62 cm x 15,24 cm 12 cm x 22 cm 15 cm x 29 cm
Netherlands	Netherlands Health Examination Survey	2001	Omron Hem 711	Not relevant	1 mmHg	BHS B/A, AAMI passed [169]	-3.98 mmHg (6.2 mmHg)/ -0.92 mmHg (6.3 mmHg)	Standard cuff for arm circumference 22-32 cm Large cuff for arm circumference 32-42 cm
Norway	Cohort Norway	1993-2003	Automatic Dinamap 8100/8101 Criticon, Tampa, USA	Not relevant	Information not available	BHS B/D, AAMI failed [170, 171]	-1 mmHg (7 mmHg)/ -6 mmHg (7 mmHg)	12 cm x 37 cm 15 cm x 50 cm 17 cm x 60 cm
Poland	WOBASZ	2005	Automatic Omron M5-1	Not relevant	Information not available	International protocol [168]	-0.2 mmHg (4.5 mmHg)/ -2.0 mmHg (-4.8 mmHg)	12 cm x 26 cm 16 cm x 30 cm 16 cm x 36 cm
Slovakia	CINDI Health Examination Survey	2003	Simple mercury sphygmomanometer	Bell	2 mmHg	Not relevant	Not relevant	2 sizes

Country	Survey	Year	Device	Bell or diaphragm	Accuracy of the measurement	Validation of automated devices		Cuff size(s)
						Protocol*	Average difference (deviation) for SBP/DBP	
UK	Health Survey for England	2005	Omron HEM 907	Not relevant	1 mmHg	International Protocol [172]	-1 mmHg (7 mmHg)/ -5 mmHg (6 mmHg)	Small adult (17-25 cm) Standard adult (22-32 cm) Large adult (32-42 cm)
	Scottish Health Survey	2003	Omron-HEM 907	Not relevant	1 mmHg	International Protocol [172]	-1 mmHg (7 mmHg)/ -5 mmHg (6 mmHg)	Small adult (17-25 cm) Standard adult (22-32 cm) Large adult (32-42 cm)

Country	Survey	Year	Device	Bell or diaphragm	Accuracy of the measurement	Validation of automated devices		Cuff size(s)
						Protocol*	Average difference (deviation) for SBP/DBP	
Canada	Canadian Health Measures Survey	2007	Automatic BP monitor: BpTRUtm BPM-300	Not relevant	1 mmHg	BHS A/A, AAMI passed [173]	-0.16 mmHg (5.13 mmHg)/ -1.41 mmHg (4.67 mmHg)	Small adult: arm circumference 18-26 cm Regular adult: arm circumference 26-34 cm Large adult: arm circumference 32-43 cm Extra-large adult: arm circumference 41-52 cm
USA	NHANES	2005-2006	The Baumanometer Calibrated mercury sphygmomanometer	Bell	1 mmHg	Not relevant	Not relevant	9 cm x 17 cm 12 cm x 22 cm 15 cm x 32 cm 18 cm x 35 cm

* Validation results of the automated blood pressure measurement device by British Hypertension Society (BHS), Association for the Advancement of Medical Instruments (AAMI), or International Protocol.

Table 9.6 Instructions for the subject, posture of the subject and rest periods before and between blood pressure measurements

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
Croatia	Croatian Health Survey	2003	Information not available	Information not available	Information not available	Information not available	10	30 sec
Czech republic	Health Lifestyle and Environment	2004	Subject is instructed to avoid strenuous exercise, eating, drinking anything else than water, smoking and drugs affecting the blood pressure at least one hour before the measurement	Sitting	Arm resting so that the antecubital fossa is at the level of heart.	Right	5	30 sec
Finland	Health 2000	2000	Not to smoke at least 1 hour before coming to the examination, fast at least 4 hours and to avoid any strenuous exercise before examinations.	Sitting		Right. Left arm if right arm was amputated.	5 - 10	2
	FINRISK	2007		Sitting	Balm up on the table	Right	10	1

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
France	National Survey Nutrition and Health	2006	Subject is instructed to avoid strenuous exercise, eating, drinking anything else than water, smoking and drugs affecting the blood pressure at least one hour before the measurement	Sitting	Arm resting so that the antecubital fossa is at the level of heart.	Right	5	1
Germany	German national health examination and interview survey	1998		Sitting	Information not available	Right	10	2
Ireland	SLAN	2006	Subject should abstain from eating, drinking (anything else than water), smoking and taking drugs that affect the blood pressure one hour before measurement	Sitting	Arm resting on the desk so that the antecubital fossa is at the level of the heart and palm is facing up.	Right	5	1

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
Netherlands	Netherlands Health Examination Survey	2001	No special instructions	Sitting	Arm is resting on the table	Left Right arm was used if blood was taken from the left arm, or left arm was broken	5	5
Norway	Cohort Norway	1994-2003	No instructions on beforehand. Rest during 2 minutes before measurement started	Sitting	Arm with fossa cubiti at level of the heart.	Right	2	1
Poland	WOBASZ	2005	Subject is instructed to avoid strenuous exercise, eating, drinking anything else than water, smoking and drugs affecting the blood pressure at least one hour before the measurement	Sitting	Arm resting so that the antecubital fossa is at the level of heart.	Right	10-15	2-3

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
Slovakia	CINDI Health Examination Survey	2003	Subject is instructed to avoid strenuous exercise, eating, drinking anything else than water, smoking and drugs affecting the blood pressure at least one hour before the measurement	Sitting	Arm resting so that the antecubital fossa is at the level of heart.	Right	30 (min/sec ?)	20(min/sec?)
UK	Health Survey for England	2005	Person should not have been eating, drinking alcohol or taking vigorous exercise in the 30 minutes preceding the blood pressure measurement.	Sitting	Arm resting at the level of the antecubital fossa (elbow) to approximately heart level	Right. If left arm used it was code on the form.	5	1
	Scottish Health Survey	2003	Person should not have been eating, drinking alcohol or taking vigorous exercise in the 30 minutes preceding the blood pressure measurement.	Sitting	Arm resting at the level of the antecubital fossa (elbow) to approximately heart level	Right. If left arm used it was code on the form.	5	1

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
Canada	Canadian Health Measures Survey	2007		Sitting	At the level of right atrium	Right. The use of the right arm prohibited e.g. right mastectomy. Blood has been drawn from right arm within the last week. Cast on right arm. Right arm amputation.	5	1

Country	Survey	Year	Instructions for the subject before coming to the measurement	Position of		Arm from which blood pressure measured	Rest period (minutes) in measurements	
				the subject	the arm		Before	Between
USA	NAHANES	2005-2006	Person should not eat, drink alcohol or coffee or smoke 30 minutes preceding the blood pressure measurement.	Sitting	The midpoint of the upper arm at the level of the heart	Right. From left arm if right arm has rashes, small gauze/adhesive dressings, casts, are withered, puffy, has tubes, open sores, hematomas, wounds, arterovenous shunt, or any other intravenous access device. Also, women who have had a unilateral radical mastectomy do not have their blood pressure measured in the arm on the same side as the mastectomy was performed.	5	30 sec

Table 9.7 Used protocols for measuring blood pressure

Country	Survey	Year	Protocol	Number of measurements
Croatia	Croatian Health Survey	2003	Information not available	2
Czech republic	Health Lifestyle and Environment	2004	MONICA	2
Finland	Health 2000	2000	MONICA	2
	FINRISK	2007	EHRM	3
France	National Survey Nutrition and Health	2006	Adapted MONICA	3
Germany	German national health examination and interview survey	1998	MONICA	2
Ireland	SLAN	2006	EHRM, except device *Comment:* Measured without tight clothes, in a quiet room with comfortable temperature	3
Netherlands	Netherlands Health Examination Survey	2001	Select the correct cuff for the arm circumference and record the size of the selected cuff in the blood pressure recording data form. The cuff should be placed on the right arm so that its bottom edge is 2-3 cm above the antecubital fossa. The top edge of the cuff should not be restricted by clothing. Push the start button, the device determines automatically the correct level op inflation pressure. When the target inflation values are reached, the air is automatically released. The value in the display counts downwards.	2

Country	Survey	Year	Protocol	Number of measurements
Norway	Cohort Norway	1994-2003	Measure right over-arm, select cuff size coded 1-4. HUBRO protocol *Comment:* The values of the mean of second and third systolic blood pressure measurements were used in calculating the cardiovascular risk score (CVD risk score)	3
Poland	WOBASZ	2005	MONICA *Comment:* Value of blood pressure was assessed as mean of the 2nd and 3rd measurements	3
Slovakia	CINDI Health Examination Survey	2003	CINDI/adapted MONICA	2
UK	Health Survey for England	2005	Ask person to remove outer garments and expose the right upper arm. Wrap the correct size cuff round the upper right arm and check that the index line falls within the range lines. Locate the brachial pulse just medial to the biceps tendon and position the arm on the cuff over the brachial artery. You should be able to put two finders between cuff and arm. Person should be sitting comfortably, legs uncrossed and feet flat on the floor. *Comment:* Without outer garments (eg jumper, cardigan, jacket.	3
	Scottish Health Survey	2003	Ask person to remove outer garments and expose the right upper arm. Wrap the correct size cuff round the upper right arm and check that the index line falls within the range lines. Locate the brachial pulse just medial to the biceps tendon and position the arm on the cuff over the brachial artery. You should be able to put two finders between cuff and arm. Person should be sitting comfortably, legs uncrossed and feet flat on the floor	3

Country	Survey	Year	Protocol	Number of measurements
Canada	Canadian Health Measures Survey	2007	Upper arm should be bare. Place the correct size cuff on the arm. Respondent should be sitting feet flat on the floor, legs/ankles uncrossed, back against the back rest of the chair and right arm straight on the table at the level of the heart. Start to automated blood pressure device. *Comment:* With both feet resting flat on a sturdy surface (legs should not be crossed).	6
USA	NAHANES	2005-2006	Person is asked to sit in a chair, arm and back supported and the legs uncrossed with both feet flat on the floor. The arm should be bared and unrestricted by clothing with the palm of the hand turned upward and the elbow slightly fixed. The correct size cuff is selected and placed on the arm. The maximum inflation level has been determined. The bell of the stethoscope is positioned over the brachial artery pulsation just above and medial to the antecubital fossa. The cuff is incluated. For systolic blood pressure, phase I is recorded and for diastolic blood pressure, phase V.	3

Table 9.8 Instructions for the subject before and position of the subject during the blood collection, use of tourniquet, type of collected samples and fasting status in the previous HESs

Country	**Survey**	**Year**	**Instructions for the subject before coming to the blood sampling**	**Position of the subject (sitting or supine)**	**Use of tourniquet**	**Type of tube used (SST, NaF, EDTA etc.)**	**Fasting** *If yes, how long?*
Croatia	Croatian Health Survey	2003	not relevant (no blood sample collected)	not relevant	not relevant	not relevant	not relevant
Czech Republic	Health, Lifestyle and Environment	2004	Information not available	Sitting	No	Information not available	no
Finland	Health 2000	2000	EHRM protocol	Sitting	Yes, the tourniquet is loosened right after blood started flowing to the tube	10 tubes in following order: 1. gel-serum for lipids 2. EDTA tube for DNA 3. serum 4. Lithium-heparin tube 5. EDTA tube 6. gel-serum tube 7. lithium-heparin tube 8. gel-serum tube 9. gel-serum tube 10. gel-serum tube	4 hours

Country	**Survey**	**Year**	**Instructions for the subject before coming to the blood sampling**	**Position of the subject (sitting or supine)**	**Use of tourniquet**	**Type of tube used (SST, NaF, EDTA etc.)**	**Fasting** ***If yes, how long?***
	FINRISK	2007	EHRM protocol	Sitting, exceptions marked on the form	Yes, the tourniquet is loosened right after needed is on the vain	6 tubes in following order: 1. plastic gel-serum tube 2. EDTA-whole blood tube 3. EDTA-whole blood tube 4. plastic gel-serum tube 5. EDTA-whole blood tube 6. plastic gel-serum tube	Instructions 4 hours. Number of hours fasted before examination asked before blood collection
France	National survey on nutrition and health	2006	Adapted MONICA	Sitting	Yes	3 plain tubes 1 EDTA tube 1 heparin tube 1 fluoride tube (if home visit)	Yes
Germany	German national health examination and interview survey	1998	Information not available	Sitting	Yes for 2 minutes	Information not available	No
Ireland	SLAN 2006	2006	EHRM protocol	Sitting	Yes	Information not available	No
Netherlands	Netherlands Health Examination survey 2001	2001	Instructions concerning fasting	Sitting	Yes, the tourniquet is loosened right after needed is on the vain	4 tubes in following order: 1 x SST (5 ml) 1 x Citraat (4,5 ml) 1 x SodiumFluoride (4 ml) 1 xSST (5 ml)	At least 8 hours. Time last meal was asked before the blood collection

Country	**Survey**	**Year**	**Instructions for the subject before coming to the blood sampling**	**Position of the subject (sitting or supine)**	**Use of tourniquet**	**Type of tube used (SST, NaF, EDTA etc.)**	**Fasting** ***If yes, how long?***
Norway	Cohort Norway	1994-2003	Hubro protocol	Sitting	Tourniquet is loosened right after blood started flowing	SST vacutainer 10 ml + DTA vacutainer 7 ml	No
Poland	WOBASZ	2005	MONICA protocol	Sitting	Yes	Information not available	Yes, 12 hours
Slovakia	CINDI Health Examination Survey	2003	Adapted MONICA	Sitting	Yes	Information not available	No
UK	Health survey for England	2005	Information not available	Sitting/laying	Yes, tourniquet is used maximum of 2 minutes	3 tubes: plain EDTA Citrate	No
	Scottish health survey	2003	Information not available	Sitting/laying	Yes, tourniquet is used maximum of 2 minutes.	3 tubes: plain EDTA Citrate	No
Canada	Canadian Health Measures Survey	2007	Instructions concerning fasting	Sitting	Yes, the tourniquet is removed after the vein is found	11 tubes:	Yes, 12 hours

Country	**Survey**	**Year**	**Instructions for the subject before coming to the blood sampling**	**Position of the subject (sitting or supine)**	**Use of tourniquet**	**Type of tube used (SST, NaF, EDTA etc.)**	**Fasting** *If yes, how long?*
USA	NHANES	2005-2006	Instructions concerning fasting	Sitting	Yes, the tourniquet is used maximum of 1 minute	7-9 tubes	Yes , 9 hours

Table 9.9 Type of blood sample for lipid analysis and handling and storage of the samples on the field in the previous HESs

Country	**Survey**	**Year**	**Plasma or serum**	**EDTA concentration**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
Croatia	Croatian Health Survey	2003	not relevant	not relevant	not relevant	not relevant	not relevant
Czech Republic	Health, Lifestyle and Environment	2004	Information not available	Information not available	Information not available	Information not available	Information not available
Finland	Health 2000	2000	Serum	not relevant	Serum samples were in room temperature for 20 minutes before centrifuging; also plasma tubes were centrifuged on 1600-1800 G for 10 minutes.	All samples were stored within 1 hour from sample drawing to -20°C. Samples were transferred to the central laboratory in KTL latest in 2 weeks from the sample drawing.	-70°C
	FINRISK	2007	Serum	not relevant	Samples are staying in the tray at least 30 minutes and maximum of 60 minutes before centrifuging. Spinning speed 3800 rpm for 11 minutes.	All samples are placed to the freezer immediately after distribution to the storage tubes. At the end of the day, all samples are transferred to the field center for -20°C freezer. Samples are transferred once a week from field to the KTL central laboratory.	-70°C

Country	**Survey**	**Year**	**Plasma or serum**	**EDTA concentration**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
France	National survey on nutrition and health	2006	Serum	not relevant	Not known	Within max. 4 hours for -20oC or -80oC for aliquots after separation	Not relevant
Germany	German national health examination and interview survey	1998	Information not available	Information not available	Information not available	Information not available	Information not available
Ireland	SLAN	2006	Serum	not relevant	Information not available	Information not available	Information not available
Netherlands	Netherlands Health Examination survey	2001	Serum	not relevant	Serum samples were in room temperature for at least 30 minutes before cooling it in the refrigerator Centrifuged for 10 minutes by 2800 rpm	Samples were sending cooled by courier's service to external lab. Next morning all samples were centrifuged for 10 minutes.	-20^{o}C/ -80^{o}C
Norway	Cohort Norway	1994-2003	Serum		SST-blood: standing for coagulation in 30 min or longer, then centrifugation within 1,5 hours. EDTA: turned 6 times up/down, stored by +4 C until next day.	SST blood was sent to lab same day by courier. EDTA blood sent to biobank next day.	-80^{o}C

Country	**Survey**	**Year**	**Plasma or serum**	**EDTA concentration**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
Poland	WOBASZ	2005	Serum	not relevant	Information not available	Information not available	-20^{o}C
Slovakia	CINDI Health Examination Survey	2003	Serum	not relevant	Information not available	Information not available	-70^{o}C
UK	Health survey for England	2005	Serum	not relevant	Information not available	Samples are mailed to laboratory within 24 hours. Meanwhile samples are stored at room temperature.	-70^{o}C
	Scottish health survey	2005	Serum	not relevant	Information not available	Samples are mailed to laboratory within 24 hours. Meanwhile samples are stored at room temperature.	-70^{o}C
Canada	Canadian Health Measures Survey	2007	Serum	not relevant	Samples are kept in room temperature for 30 minutes, after that they are centrifuged at 3500rp, for 12 minutes at 12^{o}C	Samples are frozen on dry ice and shipped once a week to laboratory.	Information not available
USA	NHANES	2005-2006	Serum	not relevant	Samples are centrifuged at 2900rpm for 15 minutes at 17-25^{o}C	Frozen samples shipped weekly to the laboratory	Information not available

Table 9.10 Type of blood sample for glucose analysis and handling and storage of the samples on the field in the previous HESs

Country	**Survey**	**Year**	**Type of sample**	**Used preservative**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
Croatia	Croatian Health Survey	2003	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
Czech Republic	Health, Lifestyle and Environment	2004	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
Finland	Health 2000	2000				All samples were stored within 1 hour from sample drawing to -20^{o}C. Samples were transferred to the central laboratory in KTL latest in 2 weeks from the sample drawing.	

Country	**Survey**	**Year**	**Type of sample**	**Used preservative**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
	FINRISK	2007	Plasma	Fluoride Citrate	3800 rpm, for 11 minutes	All samples are placed to the freezer immediately after distribution to the storage tubes. At the end of the day, all samples are transferred to the field center for -20°C freezer. Samples are transferred once a week from field to the KTL central laboratory.	-70°C
France	National survey on nutrition and health	2006	Serum or plasma if home visit	SST or fluoride if home visit	Not known	Not relevant	Not relevant
Germany	German national health examination and interview survey	1998	Information not available	Information not available	Information not available	Information not available	Information not available
Ireland	SLAN	2006	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
Netherlands	Netherlands Health Examination survey	2001	Plasma	NaF	10 minutes 2800 rpm	Samples were sending cooled by courier's service to external lab. Next morning all samples were centrifuged for 10 minutes.	- 20°C /-80°C

Country	**Survey**	**Year**	**Type of sample**	**Used preservative**	**Centrifuging** ***(minutes and rotational speed)***	**Storage on the field** ***(separately for each tube)***	**Long time storage** ***(days and temperature)***
Norway	Cohort Norway	1994-2003	Serum, fasting overnight in subsample	SST	10 min, full speed	Sent to lab the same day	-80°C
Poland	WOBASZ	2005	Information not available	Information not available	Information not available	Information not available	-20°C
Slovakia	CINDI Health Examination Survey	2003	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
UK	Health survey for England	2005	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
	Scottish health survey	2003	not relevant (not measured)	not relevant	not relevant	not relevant	not relevant
Canada	Canadian Health Measures Survey	2007	Serum	not relevant	Samples are kept in room temperature for 30 minutes, after that they are centrifuged at 3500rpm, for 12 minutes at 12°C	Samples are frozen on dry ice and shipped once a week to laboratory.	Information not available
USA	NHANES	2005-2006	Plasma	NaCit	Samples are centrifuged at 2900rpm for 10 minutes at 17-25°C	Frozen samples shipped weekly to the laboratory	Information not available

Table 9.11 Analysis methods for total and HDL cholesterol and glucose in the previous HESs

Country	Survey	Year	Analyzing laboratory	Method used for total cholesterol determination	Method used for HDL cholesterol determination	Method used for glucose determination
Croatia	Croatian Health Survey	2003	not relevant (not measured)	Not measured	not measured	not measured
Czech Republic	Health, Lifestyle and Environment	2004	Field laboratory	Reflotron analysis	not measured	not measured
Finland	Health 2000	2000	Laboratory of the Social Insurance Institute (Kela), Research and development unit	CHOD PAP, Olympus System Reagent, Germany	HDL-C Plus, Roche Diagnostics GmbH, Germany	Glucose, Hexokinase, Olumpus System Reagent, Germany
	FINRISK	2007	Laboratory of the National Public Health Institute (KTL)	Enzymatic method, Abbott Laboratories, Abbott Park, Illinois, USA	Homogenous method for direct measurement, Abbott Laboratories, Abbott Park, Illinois, USA	Enzymatic hexokinase method, Abbott Laboratories, Abbott Park, Illinois, USA
France	National survey on nutrition and health	2006	Field laboratory	Cholesterol Oxidase	Polyanion direct technique	Hexokinase
Germany	German national health examination and interview survey	1998	Central laboratory of the Robert Koch Institute (RKI)	Homogen total enzymic	Homogen total enzymic direct moethod	GOD method (glucoseoxydase)
Ireland	SLAN	2006	Centralized laboratory	Information not available	Information not available	not measured
Netherlands	Netherlands Health Examination survey	2001	Lipid Reference Laboratory (LRL) of Erasmus Medical Centre, Rotterdam	CHOD-PAP method from Allain	PEG (polyethylene glycol)-modified enzymes and dextran sulfate	Information not available

Country	Survey	Year	Analyzing laboratory	Method used for total cholesterol determination	Method used for HDL cholesterol determination	Method used for glucose determination
Norway	Cohort Norway	1994-2003	Centralized laboratory. Department of Clinical Chemistry, Ullevål University Hospital, Oslo.	Enzymatic method (Hitachi 737 autoanalyzer, Roche Diagnostic, Switzerland).	Enzymatic method (Hitachi 737 autoanalyzer, Roche Diagnostic, Switzerland)	Enzymatic method Hitachi 737 autoanalyzer, Roche Diagnostic, Switzerland).
Poland	WOBASZ	2005	Centralized laboratory	Enzymatic colorimetric method (GPO/PAP)	Homogencus-colorimetric method	Enzymatic method with hexokinase
Slovakia	CINDI Health Examination Survey	2003	Centralized laboratory	Information not available	Information not available	not measured
UK	Health survey for England	2005	Centralized laboratory. The Royal Victorian Infirmary (RVI), Newcastle	DAX Cholesterol Oxidase assay method, Olympus 640 analyser	Direct method (no precipitation) on an Olympus 640 analyzer	not measured
	Scottish health survey	2003	Centralized laboratory. The Royal Victoria Infirmary (RVI), Newcastle	DAX Cholesterol Oxidase assay method, Olympus 640 analyzer	Direct method (no precipitation) on an Olympus analyzer	not measured
Canada	Canadian Health Measures Survey	2007	Centralized laboratory	Information not available	Information not available	Information not available
USA	NHANES	2005-2006	Lipids: Lipoprotein analytical laboratory/JHU Glucose: NHANES Diabetes Laboratory	Information not available	Information not available	Information not available

Table 9.12 Measurements of manual ability in previous HESs

Country	Survey	Year	Test	Device /protocol	Measurements	Age group
Finland	Health 2000	2000	Joint function test	-	LOWER EXTREMITY walking on even ground, walking on tiptoes, upstairs walking, squatting UPPER EXTEREMITY elevation of the upper arms, extension of the elbow joints, flexion of the elbow joints, volar flexion of the wrists, flexion of the fingers to the palm, opposition of the thumbs	55+
			Grip strength	Good Strength, IGS01, electrical grip strength meter	Measured in sitting position from the dominant (writing) hand and repeated twice (30s interval). The second test was done 30 seconds later. If the difference between the two measurements was greater than 10%, a third test was done again 30 seconds later. Elbow joint angle was adjusted as closely as possible to 110 degrees by adjusting the height of the chair, and the forearm pointed forward in a 45 degree angle, the wrist in neutral position (in light dorsal flexion), fingers in 90 degrees angel.	30+
	FINRISK	1997	Joint function test	_	LOWER EXTREMITY walking on even ground, walking on tiptoes, upstairs walking, squatting UPPER EXTEREMITY elevation of the upper arms, extension of the elbow joints, flexion of the elbow joints, volar flexion of the wrists, flexion of the fingers to the palm, opposition of the thumbs	55+

Country	Survey	Year	Test	Device /protocol	Measurements	Age group
Netherlands	Netherlands Health Examination Survey	2001	Joint function test	_	LOWER EXTREMITY walking on even ground, walking on tiptoes, upstairs walking, squatting UPPER EXTEREMITY elevation of the upper arms, extension of the elbow joints, flexion of the elbow joints, volar flexion of the wrists, flexion of the fingers to the palm, opposition of the thumbs	30+
UK	Health Survey for England	2005	Grip strength	Gripometer	Measured in standing position from both hands three times (alternating hands between trials) starting from non-dominant hand. The forearm should be at right angel to the upper arm.	65+
Canada	Canadian Health Measures Survey	2007	Grip strength	Smedley III hand dynamometer	Measured in standing position from both hands twice (alternating hands between trials). The dynamometer is asked to hold in line with the forearm at the level of the thigh, away from the body at a 45 degree angle.	6-79

Table 9.13 Measurement of lower extremity and balance in previous HESs

Country	Survey	Year	Protocols	Device	Measurements	Age of participant
Finland	Health 2000	2000	Timed 6,1 meter walk [131]	Stopwatch	Maximal walking speed	55 +
			Standing balance	Good Balance, IGB01 computer based meter	Measured with the subject standing 30 sec. with open eyes and with eyes shut, and 20 sec. in a semi-tandem and tandem position	55 +
			Standing Balance [57]	Stopwatch	Semi-tandem, tandem, feet side by side for 20 seconds	Sub-sample 65-74
			Timed chair raise (5)	Stopwatch Chair (43 cm high)	The subjects were asked to get up and sit down 5 times as quickly as possible (if the one time rise was successful), without their hands. A stopwatch was used to time the subject's performance, and the result was recorded in the data collection program.	55+
	FINRISK	2007	Standing balance	Stopwatch Foam pad	Measured with subject standing 20 seconds on tandem and one leg position; eyes open, eyes closed, eyes open on the foam and eyes closed on the foam	Sub-sample of 25-74
UK	Health Survey for England 2005	2005	Time walked	Stopwatch	The aim was measure how long it takes to walk a distance of 8 feet (244cm) at participants natural pace	65+
			Standing balance	Stopwatch	Side by side stand (10s) Semi-tandem stand (10s)	65+

Country	Survey	Year	Protocols	Device	Measurements	Age of participant
			Standing balance	Stopwatch	Full tandem stand (30s) Leg raise (30s): the participant was asked to stand on one leg and rise another leg off from the ground a few inches and hold the position on 30 seconds	65-69
			Timed chair rise (5)	Stopwatch Chair	The subjects were asked to get up and sit down 5 times as quickly as possible (if the one time rise was succesgfull), without their hands. A stopwatch was used to time the subject's performance.	70+
			Timed chair rise (10)	Stopwatch Chair	The subjects were asked to get up and sit down 10 times as quickly as possible (if the one time rise was successful), without their hands. A stopwatch was used to time the subject's performance.	65-69
USA	NHANES	2003	Balance and vestibular testing / Romberg test	Safety belt Stopwatch Foam pad	To maintain standing balance in 4 positions for 15 seconds in a normal support surface with eyes open, normal support surface with eyes closed, compliant support surface with eyes open and compliant support surface with eyes closed. The test room was specially outfitted to ensure the accuracy of the exam results and safety (chair behind the test person). It takes 6 to 7 min. (Romberg Surfaces test of Standing Balance on Firm and Compliant Support)	40-69

Table 9.14 Physical fitness tests in the previous HESs

Country	Survey	Year	Test	Protocol / device	Comments
Finland	Health 2000	2000	Musculoskeletal fitness test		For those aged less than 55: for the endurance capacity of the trunk extensor muscles (the endurance time of the task up to 4 minutes)
	FINRISK	2002	Polar Fitness Test	Polar M-series (M51/M52 and M91ti) or S-series heart rate monitor	5-7 minutes pulse recording (computerized measurement) for those in the physical activity sub sample (those not included in the nutrition sample). Predicts a person's aerobic fitness from the resting heart rate, heart rate variability, gender, age, height, body weight and self-assessment of the long term physical activity Gives also information on cardiovascular function .
Canada	Canadian Health Measures Survey	2007	Cardiovascular fitness	Modified Cardiovascular Fitness Test (mCAFT)	The test consists of 8 stepping stages. Stepping sequences start on double 20.3 cm steps. Fitter (and younger) individuals may use a single step of 40.6 cm. Each respondent starts stepping at a stage where the cadense intensity is 65-70% of the mean aerobic power expected of a person 10 years older than him/her. The respondent completes as many of these progressively more demanding three-minute bouts of exercise as necessary to reach or exeed a ceiling post-exercise heart rate (ceiling heart rate is set at 85% of respondent's age group's predicted maximum heart rate).

Country	Survey	Year	Test	Protocol / device	Comments
USA	NHANES	2003	Cardiovascular Fitness	Sub maximal exercise test	The sub maximal exercise exam (by treadmill) consists of a 2 minute warm up, two 3 minute exercise periods, and a 3 minute recovery period. The grade and speed of the treadmill during exercise are determined by: 1) the participant's physical activity readiness determined by responses to the household interview, 2) age, and 3) BMI. During the first stage of the exercise period, the participant should attain approximately 55-65% of age-predicted maximal heart rate (APMHR). During the second stage, the participant should attain approximately 70-80% APMHR. Eligibility: Sample persons aged 12-49 years who do not meet any of the exclusion criteria.

Table 9.15 Protocols and used devices for the vision tests in the previous HESs

Country	Survey	Year	Name of measurement	With or without glasses	Procedure
Finland	Health 2000	2002	PrecisionVision Letter Chart Acuity Tests, Oriola	With own glasses	4 meter and 40 cm for all respondents Distance Visual Acuity Test (for 4 meters) and Near Vision Test (for 40 centimetres) In at least 350 lux and 9-11 lux lightning.
USA	NHANES	2003	Autorefractor/ Keratometer and Lensmeter	With own glasses	4 meter and 40 cm A) 12 years old and older when glasses are available, the best corrective vision. B) 12 years and older, current prescription. C) 50 years old and older, near visual acuity. Exclusion Criteria: Any evidence of injury (eye patch or bandage) or severe infection (i.e., purulent discharge with redness in eye) in both eyes.

Table 9.16 Protocols and used devices for hearing tests in the previous HESs

Country	Survey	Year	Name of measurement / device	Hz	Room	Comments
Finland	Health 2000	2000	Micromate 304 , Madsen Electronics	Audiometry 500/ 1000/ 2000 hz		The air conduction hearing threshold. Three frequencies 500, 1000 and 2000 Hz tested with 25dB-15dB- 5dB in a silent room. The lowest stimulation level was 5 dB
USA	NHANES	2003	Otoscope, tympanometer, audiometry, bioacoustic Simulator, Sound Level Meter	Audiometry 500-8000, 1000, 2000, 3000, 4000, 5000 Hz	Special sound proof cabine	DEVICES: a) Otoscope: The Welch-Allyn 25020 otoscope b) Tympanometer: The Micro Audiometers Earscan Acustic Impedence tympanometer c) Audiometry: The Interacoustics Model AD226 d) Bioacustic Simulator: The Quest Model BA-201-25 e) Sound Level Meter and Accessories: The Quest Model 1800 Evaluation of hearing sensitivity and physiological function of middle and outer ear.

Talbe 9.17 Used devices and protocols for bone mineral density measurement in the previous HESs

Country	Survey	Year	Name of measurement / device	Location	Comments
Finland	Health 2000	2000	Sahara Clinical Bone Densitometer, Hologic	Heel	Bone mineral density
Norway	Cohort Norway	1994-2003	SXA: Osteometer DTX-100 / DXA: Lunar DPX-L	SXA: distal and ultradistal radius / DXA: hip, total body and calcaneus	
USA	NHANES	2003	Dual-energy X-ray Absorptiometry (DXA), Hologic QDR 4500A	Arm	The participant lies in supine position

Table 9.18 Used devices and protocols for lung functon measurement in the previous HESs

Country	Survey	Year	Type of device	Measurement	Comments
Finland	Health 2000	2000	Vitalograph 2150	FVC FEV PEF	Bronkodilatation if FEV % lower thand 70%
Ireland	SLAN	2006	Microlife PF100 peak flow digital meter	PEF	
UK	Health Survey for England	2002	Portabel spirometer (Vitalograph Escort spirometer)	FVC FEV PEF	For those ages 7-24 years
	Scottish Health Survey	2003	Vitalograph Micro spirometer	FVC FEV PEF	Measured if room temperature between 5-35C. Correct technique demonstrated first, 5 technically satisfactory blows record
Canada	Canadian Health Measures Survey	2007	Koko spirometer	FVC FEV_1	

10. QUALITY ASSURANCE PROCEDURES

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This chapter provides an overview of the quality assurance procedures that have been implemented in previous health examination surveys. Because information on quality control procedures are not always (extensively) reported in papers about the surveys, the information from previous surveys was collected by a specific questionnaire ('Questionnaire of Survey Quality Assurance Procedures', see Annex 4) sent to FEHES country contact persons.

Quality control procedures can be implemented in different stages of the survey. In addition to choosing proper methods for the measurements it is important to take precautions before, during and after the study to ensure the best possible quality for the measurements and to facilitate proper interpretation of the results. It is important to avoid bias in measurements because a systematic bias which can lead to biased estimates. Before the actual study can be started, the selected personnel have to be trained properly. During the survey, performance of the fieldworkers has to be monitored and devices calibrated in regular bases. If needed, the fieldworkers should be retrained. After the fieldwork is completed, is it important to evaluate the collected data by checking possible inconsistent values.

This chapter describes used training protocols, existence of written manuals and quality assurance protocols, and quality assurance procedures for different measurements.

10.1 PROTOCOLS AND MANUALS

10.1.1 CRITICAL ISSUES

Protocols and manuals are the basis of collecting standardized data.

10.1.2 PREVIOUS HESS

In all previous surveys, a written manual was available in the native language of the country. In 3 surveys a protocol for quality assurance was available and also the results of the quality assurance were documented. (Table 10.1) In one survey there was no protocol for quality assurance but the results of the quality assurance were documented.

10.1.3 CONCLUSIONS

In many cases the quality assurance procedures are planned for the survey, but they are not properly documented. Also, the results of the quality assurance procedures are rarely reported.

10.2 TRAINING

10.2.1 CRITICAL ISSUES

Proper use and interpretation of the protocols has to be achieved through extensive training (and re-training) of the fieldworkers, in order to standardize all the measurements between the fieldworkers and between countries. A training seminar has to be conducted to practice all the measurements and get feed back on the performance. Fieldworkers should be aware of the critical issues for each measurement, and have some background knowledge in order to be capable to answer possible questions of the participants.

10.2.2 PREVIOUS HESS

In all previous surveys the personnel followed training varying from 2-15 days (table 10.2). During this training all the topics of the examination were discussed such as the aim, methods and protocols. Training was given by expert people (nurses, doctors, epidemiologist or laboratory analyst).

10.2.3 CONCLUSIONS

The training of the fieldworkers is generally organized, but the extent of the training varies considerably between the countries.

10.3 QUALITY ASSURANCE OF HEIGHT MEASUREMENT

10.3.1 CRITICAL ISSUES

Critical for the quality assurance of the measurement of height is the calibration of the measurement device, before during and after the survey. E.g. when the measurement device is connected to the wall, the proper adjustment has to be checked. Furthermore, fieldworkers have to be instructed on the way how to read the scales, especially when the respondent is much taller than the fieldworker. Relevant for standardization is also site visits during the survey and the quality control of the data after the survey.

10.3.2 PREVIOUS HESS

In all previous HESs the measuring device was checked before the survey by the supplier, or by fieldworkers using a standardized rod (Table 10.3). During the previous surveys the measuring device was checked in almost all surveys. The frequency of the checking varied from daily to once a year. No calibration of the equipment was done in any previous survey after the fieldwork period.

In some of the previous surveys, field visits were conducted during the survey period for quality assurance of the measurement. During these field visits (performed once a month or on an irregular basis), the coordinator of the project or epidemiologist used a checklist to verify the protocols that have been followed. If it was observed that the measurements were not performed according to the protocol, the fieldworkers would be retrained or corrections were made. After the survey the data was checked for extreme values.

10.3.3 CONCLUSIONS

For measuring height, the device was calibrated before and during the survey. During the survey period, performance of the measurements was be checked in the field, and if necessary fieldworkers would be retrained. Also after the survey the data was checked for extreme values.

10.4 QUALITY ASSURANCE OF WEIGHT MEASUREMENT

10.4.1 CRITICAL ISSUES

Critical for the quality assurance of the measurement of weight is the calibration of the measurement device, before during and after the survey. Furthermore, instruction on removing heavy garments and shoes, emptying pockets etc. should be standardized, as well as rules whom to exclude from the measurements (e.g. pregnant women). Relevant for standardization is also site visits during the survey and the quality control of the data after the survey.

10.4.2 PREVIOUS HESS

In some previous HESs, a new device was used for the survey, and it was assumed to be accurate (Table 10.4). In other previous surveys, the devices were calibrated by using a reference weights.

In some of the previous surveys, the scales were not calibrated during the survey period, while in some; the devices were calibrated daily or on irregular basis, by the fieldworkers. Calibration after the survey was not generally conducted.

For quality assurance of the measurement, field visits were conducted in some of the previous surveys during the survey period. During this field visits (once a month or on irregular basis), the coordinator of the project or epidemiologist used a checklist to verify the protocols that were followed. In one survey also double measurements were conducted. If irregularities were observed, the fieldworkers would be retrained or corrections were made. After the survey the data was checked on extreme values in five previous surveys.

10.4.3 CONCLUSIONS

For measuring weight, the device was not always calibrated before and during the survey. During the survey period the measurements were checked in the field by observing the performance of the field workers. Also after the survey the data was checked for extreme values.

10.5 QUALITY ASSURANCE MEASURING WAIST AND HIP CIRCUMFERENCES

10.5.1 CRITICAL ISSUES

Before the survey it is important to train the fieldworkers properly, because waist and hip circumference measurements are extremely sensitive to measurement error. For the measurement of waist and hip circumference the position of the tape round the participants' waist and hip is a critical point in the measurement. Also the position of the participant can have an effect on the outcomes of the measurements. Furthermore, the tapes should be checked for 'stretching' during the course of the study.

10.5.2 PREVIOUS HESS

In almost all previous HESs, new tapes for measuring waist and hip circumference were used, assuming it was accurate (Table 10.5). In one previous survey all the tapes were checked with a calibrated rod. During and after the survey the tapes were not calibrated. In one survey, a new tape was changed every month. Quality assurance during the survey was done by field visits in all previous surveys. During these field visits (once a month or on irregular basis), the coordinator of the project or the epidemiologist used a checklist to verify if the protocols were followed properly. In one survey, also double measurements were conducted. If irregularities were observed, the fieldworkers were retrained or corrections were made. After the survey the data was checked for extreme values.

10.5.3 CONCLUSIONS

The measuring tape was not calibrated. During the survey period the measuring of waist and hip circumference was checked in the field. Also after the survey, the data was checked for extreme values

10.6 QUALITY ASSURANCE OF BLOOD PRESSURE MEASUREMENT

10.6.1 CRITICAL ISSUES

It is important to avoid bias in blood pressure measurement because a systematic bias of a few mmHg can be significant for the interpretation of the results. Important aspects of the

methods are proper equipment and its correct use and proper measurement procedures. The possible sources of error in the blood pressure measurement can be divided in to three categories: observer bias, faulty equipment and failure to standardize the techniques/circumstances of the measurement [1]

Critical issues relating to the observer bias are:

- hearing test,
- training and testing or certification with standardized taped examples of Korotkoff sounds,
- testing or certification using a Y-tube stethoscope,
- repeated measurements of the same subjects, and
- evaluation of terminal digit preference.

Critical issues relating to the equipment are:

- measurement devices should be checked and calibrated on a regular basis

Critical issues relating to the technique/circumstances are:

- use of the proper cuff-size,
- control of room temperature, and
- resting time before and between the measurements.

Quality control during the survey:

- checking terminal digit preference,
- checking intra-measurer variation, and
- regularity of the checks.

10.6.2 PREVIOUS HESS

In the previous surveys, the calibration of the device before the survey was generally done by the manufacturer using a standard procedure (Table 10.6).

In one survey, the mercury sphygmomanometers were checked daily by fieldwork personnel. Automatic devices were calibrated 3 times per year or once in 2 years. Previous surveys did not calibrate the used device after the survey. In a few surveys quality control during the survey was conducted by making field visits or double measurements. In case of any problems the fieldworkers were retrained. In one survey, the fieldworkers rotated between the survey sites. Also the measurement results were checked weekly by the central office. In one survey there was a rotation program for the automatic device. In all previous surveys the data was checked after the survey was finished.

10.6.3 CONCLUSIONS

The level of quality assurance procedures varied considerably between surveys. All surveys had some quality control during the survey and generally fieldwork personnel were re-trained if some problems were observed.

10.7 QUALITY ASSURANCE OF THE BLOOD SAMPLES – COLLECTON AND ANALYSIS

10.7.1 CRITICAL ISSUES

Proper calibration of the measurement instruments is essential for the precision and accuracy of the measurements. In addition to fixing the procedures to be used for the measurements, it is important that the fieldworkers involved in the measurements are fully familiar with the measurements and have the skills to carry them out. Especially, the fieldworkers who draw the blood samples and prepare them for transfer to the laboratory, as well for the laboratory personnel.

10.7.1.1 INTERNAL QUALITY CONTROL (IQC)

The purpose of internal quality control is to check the short and long term stability of measurements. A good performance is necessary for successful participation in an external quality control program and for reliable analysis of the survey samples.

10.7.1.2 EXTERNAL QUALITY CONTROL (EQC)

EQC is a retrospective process of assessment of performance, particularly of inaccuracy or bias with respect to mean values. EQC permits comparison of results between laboratories

measuring the same analyte. An EQC scheme for an analyte or group of analytes distributes aliquots of the same samples to participating laboratories, which are blind to the concentration of the analytes. Samples are assayed shortly after they arrive at the laboratory. Results are returned to the scheme organizers, who issue a laboratory specific report giving at least the following data:

- Mean values, usually for all methods and for method groups;
- A measure of the between-laboratory precision;
- The bias of the results obtained by that laboratory.

10.7.2 PREVIOUS HESS

In previous surveys the procedure for taking blood samples during the fieldwork was checked during the field visits and using checklist on irregular basis. For the quality assessment for analyze lipids, in all surveys an internal quality scheme was used. In most of the surveys also an external quality scheme was used. For the measurement of glucose, all surveys followed an internal quality scheme. In most of the surveys also an external quality scheme was used. (Table 10.7)

10.7.3 CONCLUSIONS

All laboratories which analyzed the lipid and glucose in previous surveys, had a IQC and most also took part to the EQC. Like IQC also the EQC should be taken into account when starting a HES.

10.8 QUALITY ASSURANCE OF PHYSICAL PERFORMANCE AND FITNESS TESTS

10.8.1 CRITICAL ISSUES

No recommendations exist for measuring manual dexterity, range of motion or grip strength in the population health survey settings. For testing the range of motion or dexterity there are no common recommendations or standards. Also there are no quality assurance procedures for these measurements.

10.8.2 PREVIOUS HESS

10.8.2.1 PHYSICAL PERFORMANCE

The physical performance tests were included only into one survey. There was no calibration before the survey. During the survey there was a site visit during which the performance of the fieldworkers was checked against the protocol step by step once per survey period. (Table 10.8)

10.8.2.2 PHYSICAL FITNESS

Physical fitness tests were not included to any of the surveys.

10.8.3 CONCLUSIONS

For the measurement of physical performance and physical fitness, the proper training of the personnel doing the measurements is important.

10.9 QUALITY ASSURANCE OF VISION AND HEARING TESTS

10.9.1 CRITICAL ISSUES

In hearing tests environment and equipment (calibration) may affect the results obtained. The most widely used and standardized test of visual function is measurement of visual acuity. In seeing and hearing tests environment and equipment (calibration) may affect the results obtained. Those responsible for conducting the examinations (hearing and vision) must be trained experts. Good instructions help the subjects to perform as intended. Instruments must be calibrated to yield correct readings.

10.9.2 PREVIOUS SURVEYS

The vision and hearing tests were not included into any of the previous surveys.

10.9.3 CONCLUSIONS

For both hearing and vision tests it is important to monitor the settings on which the measurements are done, to train the personnel well as well as check the used devices regularly.

10.10 QUALITY ASSURANCE OF BONE DENSITY AND LUNG FUNCTION MEASUREMENTS

10.10.1 CRITICAL ISSUES

To guarantee the accuracy and reliability of the pulmonary function testing system used for measuring lung function, the manufacturer has to guarantee that the system meets all specifications issued by the ATS/ERS [2]. The user is responsible for ensuring that the equipment's measurements (lung function, and bone density) remain accurate, and results furthermore depend on the cooperation between subject and examiner.

10.10.2 PREVIOUS SURVEYS

10.10.2.1 BONE DENSITY

The bone density was measured in one survey. The measurement device was calibrated before the survey and daily during the survey. Calibration was done by means of measuring a phantom. This was done by the technician or researcher who performed the measurements. (Table 10.9)

Calibration after the survey was done by comparing the SXA and DXA measured with other comparable devices. Quality control during the survey was done by audits, double measurement and distribution checks by senior researcher. Corrections were made only for the room or water temperature. After the survey all measured (photos) were checked manually for QA.

10.10.2.2 LUNG FUNCTION

The lung function was measured in one survey. The measurement device was calibrated by the manufacture before the survey and by the nurse at the start of each day during the survey. (Table 10.10)

During the survey, results were imputed on computer, which had a build-in system to check extreme values. Site visits were conducted occasionally to see that protocol was followed.

10.10.3 CONCLUSIONS

For the lung function and bone density measurements, it is important to use calibrated equipment and check them regularly during the survey. Personnel should be trained very well.

REFERENCES

[1] Bailey RH, Bauer JH. A review of common errors in the indirect measurement of blood pressure. Sphygmomanometry. Archives of internal medicine. 1993 Dec 27;153(24):2741-8.

[2] Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. Eur Respir J. 2005 Aug;26(2):319-38.

[3] Gregurkova M, Vandasova Z, Skodova Z, Kubinova R, Maly M. [Health status of the population in six cities in the Czech Republic: prevalence and therapy of various chronic diseases]. Casopis lekaru ceskych. 2001 Mar 1;140(4):112-7.

[4] Enviromental Health Monitoring System in the Czech Republic - Specialized report: National Institute of Public Health; 2000.

[5] Das Gesundheitswesen: Sonderhefte; 1998.

[6] Das Gesundheitswesen: Sonderhefte; 1999.

[7] Naess O, Sogaard AJ, Arnesen E, Beckstrom AC, Bjertness E, Engeland A, et al. Cohort profile: cohort of Norway (CONOR). International journal of epidemiology. 2008 Jun;37(3):481-5.

Table 10.1 Survey manuals and protocols

Country	Survey	Year	Written manual / protocol	Quality assurance protocols and results
Czech Republic	Health, Lifestyle and Environment	2004	Written protocol in Czech [3]. Written manual in Czech [4].	No quality protocols and no quality results
Finland	FINRISK	2007	Written manual and protocol but not published.	No quality assurance protocols. Results of quality assurance are documented.
France	National survey on nutrition and health	2006	Written manual and protocol in France but not published	No quality protocols and no quality results
Germany	German national health examination and interview survey	1998	Written protocol in German [5, 6] . Written manual in German but not published.	Quality assurance protocols and results are documented in German.
Netherlands	Netherlands Health Examination survey	2001	Written protocol and manual in Dutch (not published)	Quality assurance protocols and results are documented in Dutch.
Norway	Cohort Norway	1994-2003	Written protocol [7]. Written manual but not published	No complete quality assurance (QA) protocol was made, but there are procedure protocols for each measurement
Poland	WOBASZ	2006	Written protocol and manual (not published)	No quality protocols and no quality results
UK	Health Survey for England	2005	Written and published protocol and manual in English	Documented quality assurance protocols and quality assurance results
	Scottish Health Survey	2003	Written and published protocol and manual in English	Documented quality assurance protocols and quality assurance results

Table 10.2 Length and contents of the training of the fieldwork staff

Country	Survey	Year	Training		
			Number of days	Topics covered	Trainers
Czech Republic	Health, Lifestyle and Environment	2004	Not known		Persons with medical qualification
Finland	FINRISK	2007	9 days	All the different parts of the survey. Blood pressure measurers had to be nurses and had to pass audiogram. At the end of the training, all blood pressure measurers had to measure to the same level with trainer (max. deviation ± 2 mmHg)	Laboratory personnel, medical personnel, computer personnel of National Public Health Institute (KTL)
France	National survey on nutrition and health	2006	1-5 days (depending of the role of the survey)	General aim, methods/ procedures/ data collection/transfer	Epidemiologists, with blood sample authorization
Germany	German national health examination and interview survey	1998	15 days	Interviewing/CAPI, Diet History, all measurements, sampling, treatment of blood	RKI-specialists, trained nutritionist
Netherlands	Netherlands Health Examination survey	2001	2 days	Interviewing, all different parts of the survey	Laboratory analyst, coordinator, epidemiologist on infectious diseases, communicating expert

Country	Survey	Year	Training		
			Number of days	**Topics covered**	**Trainers**
Norway	Cohort Norway	1994-2003	2-5 days, depending on the project days	Measurement issues, CVD risk factors, preventive effort, results of research based on the data, "non-core" modules of coming surveys, and IT procedures when this was introduced for the field teams, "how to communicate better" and sure also other topics	Nurses, doctors, researchers, invited speakers with different qualification
Poland	WOBASZ	2005	5 days	Aim and organization of the survey , all measurements	Coordination team
UK	Health Survey for England	2005	1 day for interviewers and nurses with previous experience, 2 days for new survey nurses	Administration, use of CAPI program, data protection and confidentiality, approaching participants, getting participants' assent or formal consent, following scripts, purpose of the survey, using of the equipment & taking measurements, taking biological samples, labeling and dispatch of samples, calling the survey doctor	NatCen and UCL for nurses
	Scottish Health Survey	2003	1 day for interviewers and nurses with previous experience, 2 days for new survey nurses	Administration, use of CAPI program, data protection and confidentiality, approaching participants, getting participants' assent or formal consent, following scripts, purpose of the survey, using of the equipment & taking measurements, taking biological samples, labeling and dispatch of samples, calling the survey doctor	NatCen and UCL for nurses

Table 10.3 Quality assurance of the height measurement

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Czech Republic	Health, Lifestyle and Environment	2004	According to surgery regulations				
Finland	FINRISK	2007	New devices expected to be correct	The correct position of the stadiometer was checked daily by the fieldworkers	Not done	Audit visits (few times) by project coordinator. If device wrongly placed, corrections were made and discussion with fieldworkers about protocol.	Data checked for extreme values
France	National survey on nutrition and health	2006	No calibration was done, material was verified by the supplier	Not done	Not done	Continuous verification of data by epidemiologist /clinical investigator. If problems noted, request for verification to the centre / nurses	Definition of possible values in children and adults

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Germany	German national health examination and interview survey	1998	With reference measure by RKI	Daily with reference measure by the team	With reference measure by RKI	Field visits and checklists on irregular basis by Fa. Schwertner, RKI staff. Additional training in case of problems with measurement	Checking of the data distributors, rules for extreme or implausible values / outlier considering annotations
Netherlands	Netherlands Health Examination survey	2001	Before the survey by technician of centre	Once per year during the site visit	Not done	During the site visit (once per survey period), checked if measurement was done according the protocol by contact person of health centre. If problems noted, discussion with fieldworker, no corrections were made	All abnormal findings were checked and check extreme data.

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Norway	Cohort Norway	1994-2003	Before survey by producer and national authority by measuring the standard height (176 cm).	Once a year during the survey by technician	Not done	There was a coding system to be used if problems were to be remarked on height measurement: unwilling, physical handicap affecting height measurement, measured with shoes on. This was filled in by the measurer.	Data control was made by the National Health Screening Service. If values fell outside a defined interval, the original papers were checked.
Poland	WOBASZ	2005	Checked with standardized rods by fieldworkers	Once a month, checked with standardized rods by fieldworkers	No calibration	Audits and double measurements for 10 % of the screened sample by a second fieldwork person, auditor. Retraining if there were problems	Outlandish values, consistency with different data items, completeness

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
UK	Health Survey for England	2005	By manufacture	Not done	Not done	Build-in checks in CAPI and occasional supervision of interviewers by Supervisor, inspection of previous month's measurements by data manager. If problems noted, discussion with staff and possibly retraining	None
	Scottish Health Survey	2003	By manufacture	Not done	Not done	Build-in checks in CAPI and occasional supervision of interviewers by Supervisor, inspection of previous month's measurements by data manager. If problems noted, discussion with staff and possibly retraining	None

Table 10.4 Quality assurance of the weight measurement

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Czech Republic	Health, Lifestyle and Environment	2004	According to surgery regulations				
Finland	FINRISK	2007	New devices expected to be accurate	Daily it was checked by fieldwork staff that when weight is 0, the indicators has to be even	Not done	Audit visits at least twice in each site during the survey by project coordinator. If scale was not accurately calibrated, calibration was corrected and procedures were discussed with the personnel.	Data checked for extreme values
France	National survey on nutrition and health	2006	Testing each with 25 kg and 50 kg by epidemiologist and clinical investigator	Not done	Not done	Checking for data distributions by epidemiologist /clinical investigator. If problems noted, request for verification to the centre / nurses	Definition of possible values in children and adults

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Germany	German national health examination and interview survey	1998	With reference weights by RKI	Daily with reference weights by the team	With reference weight by RKI	Field visits and checklists on irregular basis by Fa. Schwertner, RKI staff. Additional training in case of problems with measurement	Checking of the data distributors, rules for extreme or implausible values / outlier considering annotations
Netherlands	Netherlands Health Examination survey	2001	Not done	In case of balance beam scale, the scale was calibrated daily by fieldworkers. In other cases there was no calibration	Not done	During the site visit (once per survey period), checked if measurement was done according the protocol by contact person of health centre. If problems noted, discussion with fieldworker, no corrections were made	All abnormal findings were checked and check extreme data.

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Norway	Cohort Norway	1994-2003	Before survey by producer and national authority by measuring the standard weight (60 kg).	Once a year during the survey by technician	Not done	There was a coding system to be used if problems were to be remarked on weight measurement: unwilling, physical handicap affecting weight measurement, measured with shoes on. This was filled in by the measurer.	Data control was made by the National Health Screening Service. If values fell outside a defined interval, the original papers were checked.
Poland	WOBASZ	2005	Manufacture calibration, new devices were used for this survey	No calibration	No calibration	Audits and double measurements for 10 % of the screened sample by a second fieldwork person, auditor. Retraining if there were problems	Outlandish values, consistency with different data items, completeness

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
UK	Health Survey of England	2005	By manufacture	3 monthly by manufacture	By manufacture	Build-in checks in CAPI and occasional supervision of interviewers by Supervisor, inspection of previous month's measurements by data manager. If problems noted, discussion with staff and possibly retraining	
	Scottish Health Survey	2003	By manufacture	3 monthly by manufacture	By manufacture	Build-in checks in CAPI and occasional supervision of interviewers by Supervisor, inspection of previous month's measurements by data manager. If problems noted, discussion with staff and possibly retraining	

Table 10.5 Quality assurance of the waist and hip circumference measurements

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Czech Republic	Health, Lifestyle and Environment	2004	No calibration				
Finland	FINRISK	2007	New tapes	Changed by one month intervals, not checked mean while	Not done	Audit visits at least twice in each site during the survey by project coordinator	Data checked for extreme values
France	National survey on nutrition and health	2006	Not done	Not done	Not done	Checking for data distributions by epidemiologist /clinical investigator. If problems noted, request for verification to the centre / nurses	Definition of possible values in children and adults

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Germany	German national health examination and interview survey	1998	With standard norm class by manufacturing firm	Not done	Not done	Field visits and checklists on irregular basis by Fa. Schwertner, RKI staff. Additional training in case of problems with measurement	Checking of the data distributors, rules for extreme or implausible values / outlier considering annotations
Netherlands	Netherlands Health Examination survey	2001	All tapes were checked	Not done	Not done	During the site visit (once per survey period), checked if measurement was done according the protocol by contact person of health centre. If problems noted, discussion with fieldworker, no corrections were made	All abnormal findings were checked and check extreme data.
Norway	Cohort Norway	1994-2003	Not done	Not done	Not done		If the circumference exceeded 150 cm this was to be coded as 150+

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Poland	WOBASZ	2005	Manufacture calibration, new devices were used for this survey	No calibration	No calibration	Audits and double measurements for 10 % of the screened sample by a second fieldwork person, auditor. Retraining if there were problems	Outlandish values, consistency with different data items, completeness
UK	Health Survey for England	2005	Not done	Not done	Not done	Build-in checks in CAPI and occasional supervision by nurse	
	Scottish Health Survey	2003	Not done	Not done	Not done	Build-in checks in CAPI and occasional supervision by nurse	

Table 10.6 Quality assurance of the blood pressure measurement

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Czech Republic	Health, Lifestyle and Environment	2004	According to the standard procedure				
Finland	FINRISK	2007	New devices, checked during the training that they work	When open, it was checked that mercury level at 0, and when pumped that decreases evenly. Checked daily by fieldwork personnel	Not done	Measurers rotated between sites (2 weeks per site) to reduce measurer effects, from measurement results last digit preference, means by area and means by measurer, differences in means by measurers, minimum and maximum values were checked at least weekly and at the begging every 2nd day by central office. No problems observed, but if there would have been problems a protocol was followed	Data checked for extreme values

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
France	National survey on nutrition and health	2006	Not done	Not done	Not done	Checking for data distributions by epidemiologist /clinical investigator. Second series of measurements + request for verification to the health examination centers and nurses	Definition of possible values in children and adults
Germany	German national health examination and interview survey	1998	By Office of Weights and Measures in Berlin	By Office of Weights and Measures in Berlin, 3 times per year	By Office of Weights and Measures in Berlin	Field visits and checklists on irregular basis by Fa. Schwertner, RKI staff. Additional training in case of problems with measurement	Checking of data distributions, rules for extreme or implausible values/outlier considering annotations. Variation between the 3 measurements.

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Netherlands	Netherlands Health Examination survey	2001	All automatic devices were calibrated before the survey by Omnilabo	All devices were calibrated after 2 years of using by Omnilabo	Not done	During the site visit (once per survey period), checked if measurement was done according the protocol by contact person of health centre. If problems noted, discussion with fieldworker, no corrections were made	All abnormal findings were checked and check extreme data.

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Norway	Cohort Norway	1994-2003	By General Electric	A protocol exists for controls and eventually adjustments made by GE representative in Norway	Not done	The nurses had a rotation program for the Dinamap equipments. Values were checked regularly for each measurer and for each Dinamap. If deviant mean values were found, the reason was investigated and corrected. Checked before the start of each county and after holiday breaks	Several checks of the data for variation between nurses and between Dinamap devices, and a check for deviance from min and max values. SBP > 90 and > 220, DPB < 50 and > 150 and pulse < 40 and > 140, and DBP> SBP were checked for "clinical probable values", mis-writing etc. A code was used for "corrected value.

Country	Survey	Year	Calibration of measurement device in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Poland	WOBASZ	2005	Manufacture calibration, new devices were used for this survey	No calibration	No calibration	Audits and double measurements for 10 % of the screened sample by a second fieldwork person, auditor. Retraining if there were problems	Outlandish values, consistency with different data items, completeness
UK	Health Survey for England	2005	Not done	Every 6 months by manufacturer	By manufacturer	Build-in checks in CAPI and occasional supervision by nurse	
	Scottish Health Survey	2003	Not done	Every 6 months by manufacturer	By manufacturer	Build-in checks in CAPI and occasional supervision by nurse	

Table 10.7 Quality assurance for blood samples

Country	Survey	Year	Quality control during fieldwork	Laboratory quality control			
				For lipids		For glucose	
				Internal QC	External QC	Internal QC	External QC
Czech Republic	Health, Lifestyle and Environment	2004		Yes	No		
Finland	FINRISK	2007	Once per site, the outside auditor from KTL did the audit. No problems were observed	Yes, two level internal quality controls were enclosed to every assay	Yes, the laboratory has taken part in Lipid Standardization Program organized by CDC, Atlanta, USA and External Quality Assessment Schemes organized by Lab quality, Helsinki, Finland	Yes, two level internal quality controls were enclosed to every assay.	Yes, the laboratory has taken part in External Quality Assessment Schemes organized by Lab quality, Helsinki, Finland twelve times a year
France	National survey on nutrition and health	2006	Internal quality control of the field laboratories by laboratory managers	Yes		Yes	
Germany	German national health examination and interview survey	1998	Checklist and field visits by Fa Schwertner and RKI-Lab staff on irregular basis	Yes, control test and machine test almost daily	Yes, round robin test with other reference labs	Yes, control test and machine test almost daily	Yes, round robin test with other reference labs

Country	Survey	Year	Quality control during fieldwork	Laboratory quality control			
				For lipids		For glucose	
				Internal QC	External QC	Internal QC	External QC
Netherlands	Netherlands Health Examination survey	2001	During the site visit, once per survey period, checked if measurement was done according the protocol by contact person of the municipal health centre. No corrections were done	Yes	Yes	Yes	Yes
Norway	Cohort Norway	1994-2003	No	Yes	Yes, standardized control sera was sent from the US for calibration	Yes	Yes, Ulleval and probably all laboratories participated in international AQ system.
Poland	WOBASZ	2005	Audits in 10% of screened sample by the auditor. Personnel were re-trained.	Yes, according to international standards	Yes, CDC Lipid standardization program; Randox International Quality Assessment Scheme.	Yes, according to international standards	Yes, CDC Lipid standardization program; Randox International Quality Assessment Scheme.

Country	Survey	Year	Quality control during fieldwork	Laboratory quality control			
				For lipids		For glucose	
				Internal QC	External QC	Internal QC	External QC
UK	Health Survey for England	2005	Occasional supervision by nurse	Yes, low, medium and high control materials assayed at tho-hourly intervals	Yes, UKNEQAS and WEQAS schemes	Not measured	Not measured
	Scottish Health Survey	2003	Occasional supervision by nurse	Yes, low, medium and high control materials assayed at tho-hourly intervals	Yes, UKNEQAS and WEQAS schemes	Not measured	Not measured

Table 10.8 Quality assurance for physical performance tests

Country	Survey	Year	Calibration of measurement device(s) in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Netherlands	Netherlands Health Examination Survey	2001	Not done	Not done	Not done	Site visits once per survey period by a contact person of the municipal health center to go through the protocol with the personnel	Not done

Table 10.9 Quality assurance for bone density measurement

Country	Survey	Year	Calibration of measurement device(s) in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
Norway	Cohort Norway	1994-2003	Yes	Daily by a technician or researcher performing the measurements through measuring a phantom.	Measures compared with other comparable devices	Audit visits by senior researcher. Double measurements and checking of the distribution of the measurements.	All measurements (photos) were checked manually for QA.

Table 10.10 Quality assurance for lung function tests

Country	Survey	Year	Calibration of measurement device(s) in different stages of the survey			Quality control during survey	Quality control after survey
			Before	During	After		
UK	Scottish Health Survey	2003	By manufacturer	By the nurse, at the start of the day, using a calibration syringe and annually by the manufacturer	Not done	Build-in checks in CAPI and occasional supervision by nurse	Not done

11. RESOURCES USED IN AND COST OF PREVIOUS HEALTH EXAMINATION SURVEYS

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11.1 INTRODUCTION

We attempted to get an idea about the resources needed for and the costs of a national health examination survey (HES), and about the relative magnitude of various components of the total cost. A questionnaire (see Annex 5) was sent to contact persons for nine previous national health examination surveys in five countries:

- Finland: Health 2000 [1], FINRISK 2002 [2], FINRISK 2007
- Germany: Bundes-Gesundheitssurvey 1998 (BGS98) [3], Studie zur Gesundheit bei Kindern und Jugendlichen in Deutschland (KiGGS) 2003-2006 [4]
- The Netherlands: Module Endogenous Factors 2005-2006
- Norway: Health Survey among 40-42 years old in 5 counties 1999 (HS40-42) [5]
- UK: Health Survey for England 2004 [6], Scottish Health Survey 2003 [7]

The questionnaire concerned the resources used for the planning, sampling, training, material preparation, equipments, field work, quality control and reporting of the results. For each section, cost (€) was also asked. However, it was evident that budget information was difficult to compare due to different ways of constructing the budget in different surveys. From some surveys (UK) it was not possible to obtain the budget information in detail or at all due to confidentiality of the budgets in cases when the organization carrying out the survey was selected on the basis of a call for tender.

Before drawing conclusions about the similarities and differences between resources used in and costs of the previous surveys, it is important to understand the differences in the survey organization, methods, and field work practices (Table 11.1, see also Chapter 4). The sample size of these nine HESs varied from 1,000 to 49,900 with crude response rates (participants/sample size) between 54% and 84%. In all surveys there were self-administered questionnaires; there were also face-to-face interviews in Finland, Germany and the UK. In the Norwegian survey, the examinations were conducted in mobile unit, while in two UK surveys; all examinations were conducted at the home of the participant. In other surveys, either specially hired premises or existing health care facilities were used as examination clinics.

It is very difficult to compare the surveys, since different combinations of measurements were used in each survey. The average duration of the examinations was used as an indicator to describe the extent of the examinations. It varied from 15 minutes, including only basic anthropometric measurements, blood pressure and simple blood sampling, to 240 minutes of extensive physical measurements, dental examinations, etc.

11.2 PLANNING OF THE SURVEY

The planning stage of the survey takes from a few months to a couple of years, depending on the scope of the survey. If the HES is limited to the few basic measurements (weight, height, blood pressure and total cholesterol), the planning of the survey can be done by a few persons (researcher/senior researcher) but in extensive HESs like the Finnish Health 2000 survey, the planning involved over 100 persons with different fields of expertise. In many countries, the personnel responsible for planning the survey contents, logistics and organization are the staff of the public organizations such as public health institutes. Therefore they plan the survey as part of their other official duties. In such cases, the personnel costs of the planning stage are often omitted from the survey budget. (Table 11.2)

Resources needed for planning depend also on the time interval between the surveys, the scope of previous surveys, and previous experience of the persons doing the planning. E.g. in Finland, the planning of the Health 2000 survey was based on a previous survey carried out 20 years earlier and several changes in the survey methodology and technology had to be taken into account, while assuring comparability between the survey results. However, as the Health Survey for England is carried out continuously (every year) planning involves the overall programme of surveys; the core module of the survey which is repeated every year, and the specific modules and characteristics for each year.

11.3 SAMPLING

One of the important stages of the survey organization is the determination of required sample size and the actual selection of the sample. In this stage, personnel with expertise in sampling are needed to assess the required sample size and to plan and conduct the sample selection. In cases where good, up-to-date sampling frames exist, like in all surveys included in this review, no extra effort is needed for the construction of the sampling frame. We obtained information only from the Finnish, Dutch and Norwegian surveys about the sample selection (Table 11.3). In Finland, another organization drew the sample from the national Population Information System (bought service) while in the Netherlands, the Municipal Health Centres drew their samples from the population registers. In Norway the entire birth cohort was examined, therefore there was no sample selection but information about the birth cohort needed to be obtained from the population register.

11.4 PREPARATION OF THE MATERIALS AND INFRASTRUCTURE NEEDED FOR THE SURVEY

Part of the survey organization is the preparation of the materials (leaflets, questionnaires, feedback letters, etc.) and infrastructure (computers, computer programs for booking, computer aided personal interviews (CAPI), toll-free phone numbers for participants to obtain more information/to change their appointments etc.). Information about the prepared materials and infrastructure was obtained for all surveys except for the German ones. Some printed materials, such as questionnaires, were prepared in all surveys. In most of the surveys, much additional material, such as advanced letters, information leaflets and informed consent forms, were also prepared and printed. The length of the questionnaires (affecting the cost) varied from a few pages to series of booklets. In the Finnish surveys, computer programmers (three persons in Health 2000 and one in FINRISK surveys) were employed to prepare the required computer programmes for the appointment booking system and data entry and to serve as computer support to the survey fieldwork staff. In the budgets obtained, no specific money was allocated for data management. In the Finnish surveys, the data management was done as part of official duties. In the UK surveys, a computer aided personal interview was conducted and a computer program was also used during the health examination/nurse visit, so specific personnel for the preparation and maintenance of CAPI system are required in addition to a data manger. (Table 11.4)

11.5 TRAINING OF THE FIELDWORK PERSONNEL

The training of the fieldwork personnel is one of the crucial steps in the survey organization. In all surveys reviewed, formal training was organized. The scope of the training is very much dependent on the extent of the survey, i.e. what measurements are

conducted in the survey. In Finland, in the Health 2000, which had very large number of different measurements, the training took 15 days while in the FINRISK surveys which are much more limited, the training lasted 10 days. In the Netherlands the training lasted only one day and in the UK two days. In the UK, only updates are needed annually since the staff is permanent. The training was generally organized by researchers and senior nurses with special expertise in the measurements. (Table 11.5)

11.6 HEALTH EXAMINATION FIELDWORK

The actual fieldwork costs cover hiring the personnel needed to conduct the examinations in the field, buying or leasing the needed equipment, and the costs of examination sites, travel and logistics (Table 11.6). This is the most expensive component of the survey (41%-88% of the total costs). Personnel costs in total (including fieldwork personnel, personnel for supporting activities, laboratory personnel, etc.) are the biggest individual cost (52%-71%). These costs are not directly comparable between surveys, due to differences in the preparation of the budget. For example in the Finnish surveys, the laboratory analyses are not included in the main survey budget since handling and analysis of the samples was part of the tasks of the laboratory in the National Public Health Institute, while they are included in the German survey budgets. Furthermore, these percentages may be affected by our interpretations of the budgets. The number of personnel and the length of their working period vary considerably between surveys. This relates to the scope of the survey and survey models. Whenever personal interviews are included in the surveys, the number of personnel (interviewers) needed for fieldwork also increases substantially.

Information about the amount of used equipments (measurement devices, types, ect.) was difficult to obtain. Anyhow, these sources depend on the measurements, persons examined, parallel activities and duration.

11.7 REPORTING THE SURVEY RESULTS

In the Finnish, Norwegian, German and UK surveys, results of the survey have been reported in several scientific articles in local and international journals (Table 11.7). Preparing basic printed reports and their Internet versions is also common. This of course facilitates the dissemination of the results to a larger audience. It is difficult to estimate the actual resources used for the preparation of the basic reports, since these reports are often prepared by the researchers as part of their official duties without separately allocated funding, except for printing costs.

11.8 AVERAGE COST OF THE SURVEYS

The total cost of the surveys varies from slightly over 120,000.00 € to 7,500,000.00 € (Table 11.8). These figures are not comparable, since the number of persons examined in different surveys varied considerably, as did the scope and the model of the survey. There are also major differences in what has been included into the provided budgets (salaries of the persons working in governmental institutes, laboratory analysis, piloting, etc.). In general, the price of the survey increases together with the number of persons examined. Of course, the number of measurements increases the need for additional staff and costs. Surveys with face-to-face interviews are more expensive than those where only questionnaires are filled in by participants (self-administration).

11.9 MAIN SOURCES OF FUNDING

The sources of funding vary (Table 11.9). In general, previous HESs have been funded by governmental organizations. In some countries, there is one funding organization while in some other countries; the funds have been obtained from several different sources, including governmental and non-governmental organizations, such as foundations or associations for HES-related fields. Obtaining funding from commercial sources as well would probably be possible but none of the nine surveys included in this review had used any commercial funding.

11.10 CONCLUSIONS

The resources used in different surveys depend on the size (number of invited persons), scope and model of the survey. The more measurements we include in the survey, the more it will cost. It also costs more if face-to-face or telephone interviews are used instead of self-administration of the questionnaires. These are basic elements depending on the aims and logistics of the survey. They may also affect the quality of the data. Understandably, the resources available will affect both the extent of the survey and its cost.

In all the reviewed surveys, personnel costs were the biggest cost category, followed by laboratory analysis of the blood samples. However, the sample of countries available for this review of costs is not representative of the EU as a whole. Thus, varying salary levels may affect personnel costs and varying prices of the equipment and laboratory analysis the total cost. We hope that this analysis is useful for the planning of future surveys.

REFERENCES

[1] Aromaa A, Korkinen S. Health and functional capacity in Finland. Baseline results of the Health 2000 Health Examination Survey. Helsinki: National Public Health Institute B12; 2004.

[2] Laatikainen T, Tapanainen H, Alfthan G, Salminen I, Sundvall J, Leiviska J, et al. FINRISKI 2002. Tutkimuksen toteutus ja tulokset. 1. Perusraportti (Summary in English). Helsinki: National Public Health Institute; 2003.

[3] Bellach BM, Knopf H, Thefeld W. [The German Health Survey. 1997/98]. Gesundheitswesen. 1998 Dec;60 Suppl 2:S59-68.

[4] Kurth BM. [The German Health Interview and Examination Survey for Children and Adolescents (KiGGS): an overview of its planning, implementation and results taking into account aspects of quality management]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2007 May-Jun;50(5-6):533-46.

[5] Bjartveit K, Stensvold I, Lund-Larsen PG, Gjervig T, Kruger O, Urdal P. [Cardiovascular screenings in Norwegian counties. Background and implementation. Status of risk pattern during the period 1986-90 among persons aged 40-42 years in 14 counties]. Tidsskrift for den Norske laegeforening. 1991 Jun 30;111(17):2063-72.

[6] Sproston K, Mindell J, (eds.). Health Survey for England 2004. The health of minority ethnic groups. Summary of key findings: The Information Centre; 2006.

[7] The Scottish Health Survey 2003. Summary of key findings. 2005 [cited 25 January 2008]; Available from: http://www.scotland.gov.uk/Resource/Doc/924/0019811.pdf

Table 11.1 Basic characteristics of the surveys

Survey		Year	Age group covered	Sample size	Participants	Response rate (%)#	Survey mode		Duration of examinations (excluding interview)
							Questionnaire	Examinations	
Finland	Health 2000	2000	30+	8,028	6,770	84	self-administration + face-to-face interview	clinic + home visit	240 min
	FINRISK	2002	25-74	13,500	9,585	71	self-administration	clinic	90 min
		2007	25-64	10,000	6,734	67	self-administration	clinic	80 min
Germany	BGS98	1998	18-79	13,222	7,124	54	face-to-face interview + self-administration	clinic	30 min
	KiGGS	2003-2006	0-17	17,642	11,820	67	face-to-face interview + self-administration	clinic	120 min
Netherlands	Module Endogenous Factors	2005-2006	20-65	1,000	650	65	self-administration	clinic	15 min
Norway	HS40-42	1999	40- 42	49,900	32,400	65	self-administration	mobile unit	15 min
UK	Health Survey for England	2004	all ages	12,900	8,354	65	face-to-face interview + self-administration	home visit	information not available
	Scottish Health Survey	2003	all ages	13,537	8,148	60	face-to-face interview + self-administration	home visit	information not available

response rate = (participants / sample size) * 100

Table 11.2 Personnel resources used for the planning and length of the planning

Country	Survey	Year	Planning
Finland	Health	2000	*Personnel resources:* Done by about 130 senior researchers from different participating organizations with special expertise. Planning was mainly done by senior researches as part of their official duties. *Length:* Planning took about 18 months.
	FINRISK	2002	*Personnel resources:* Done by senior researchers of the National Public Health Institute as part of their official duties. *Length:* Planning took about one year.
		2007	*Personnel resources:* Done by senior researchers of the National Public Health Institute as part of their official duties. *Length:* Planning took about one year.
Germany	BGS	1998	Information not available.
	KiGGS	2003-2006	Information not available
Netherlands	Module Endogenous Factors	2005-2006	*Personnel resources:* Done by one researcher and one senior researcher. *Length:* Planning took a few weeks.
Norway	HS40-42	1999	*Personnel resources:* Done by one physician researcher, one senior advisor, one advisor and one leading nurse. *Length:* Planning took about 6 months.
UK	Health Survey for England	2004	Information not available
	Scottish Health Survey	2003	Information not available

Table 11.3 Resources used for sampling

Country	Survey	Year	Sampling
Finland	Health 2000	2000	By special organization from the national population register. Two stage sample.
	FINRISK	2002	By special organization from the national population register.
		2007	By special organization from the national population register.
Germany	BGS	1998	Information not available.
	KiGGS	2003-2006	Information not available.
Netherlands	Module Endogenous Factors	2005-2006	By Municipal Health Centre from the population register.
Norway	HS40-42	1999	Whole birth cohort was invited. The information was obtained from the population register.
UK	Health Survey for England	2004	3-stage household sampling with the existing sampling frames. No information about the organization of the sampling available.
	Scottish Health Survey	2003	3-stage household sampling with the existing sampling frames. No information about the organization of the sampling available.

Table 11.4 Prepared materials and computer programs and size of the printed questionnaires

Country	Survey	Year	Material preparation and computer programming	Size of the field questionnaire (excluding CAPI)
Finland	Health	2002	Printed materials: information leaflets, invitation letters, questionnaires, informed consent forms, letters with personal results from the examinations. Computer programs: booking systems, data entry programs done by 3 computer programmers from which some served as computer support personnel during the survey.	3 questionnaires from 4-27 pages
	FINRISK	2002	Printed materials: invitation letters, questionnaires, informed consent forms. Computer programs: booking systems done by one computer programmer who also served as computer support person during the survey.	20 pages
		2007	Printed materials: invitation letters, questionnaires, informed consent forms. Computer programs: booking systems done by one computer programmer who also served as computer support person during the survey.	24 pages
Germany	BGS	1998	Information not available.	44 pages
	KiGGS	2003-2006	Information not available.	16 questionnaires from 6-41 pages
Netherlands	Module Endogenous Factors	2005-2006	Printed materials: invitation letters, questionnaires. Computer programs: data entry programs done by one researcher.	Information not available
Norway	HS40-42	1999	Printed materials: Invitation letters, questionnaires, letters with personal results from the examinations	3 pages

Country	Survey	Year	Material preparation and computer programming	Size of the field questionnaire (excluding CAPI)
UK	Health Survey for England	2004	Printed materials: information letter to the selected households, leaflets, measurement record cards, informed consent forms, questionnaires. Computer programs: CAPI used on field	6 questionnaires with 3-13 pages
	Scottish Health Survey	2003	Printed materials: information letter to the selected households, leaflets, measurement record cards, informed consent forms, questionnaires. Computer programs: CAPI used on field	5 questionnaires with 3-17 pages

Table 11.5 Trainers, trainees and duration of the training

Country	Survey	Year	Training		
			Trainers	**Trainees**	**Duration of the training**
Finland	Health 2000	2000	Senior researchers, computer programmers and administrative personnel.	160 trained interviewers of Statistics Finland, and hired staff of 10 physicians, 5 dentists, 6 dental hygienists and 65 nurses.	15 days + 1 day for interviewers
	FINRISK	2002	Senior researchers, nurses, computer programmers, laboratory technicians and administrative personnel.	Hired staff of 6 nurses, 12 laboratory assistants and 6 practical nurses	10 days
		2007	Senior researchers, nurses, computer programmers, laboratory technicians and administrative personnel.	Hired staff of 5 nurses, 10 laboratory assistants and 10 practical nurses.	10 days
Germany	BGS	1998	Information not available.	Information not available.	Information not available.
	KiGGS	2003-2006	Information not available.	Information not available.	Information not available.
Netherlands	Module Endogenous Factors	2005-2006	One researcher.	Medical receptionist and doctors' receptionist in health centres.	One day
Norway	HS40-42	1998	Information not available	10 nurses, 4 receptionists/technical	3-5 days.
UK	Health Survey for England	2004	Research staff, senior nurses, and /or survey doctor	Interviewers and nurses.	Two days

Country	Survey	Year	Training		
			Trainers	**Trainees**	**Duration of the training**
	Scottish Health Survey	2003	Research staff, senior nurses, and / or survey doctor	Interviewers and nurses.	Two days

Table 11.6 Duration of the fieldwork, number of fieldwork personnel and % of budget for fieldwork and for personnel

Country	Survey	Year	Fieldwork		% of total budget	
			Duration	Number of personnel	Fieldwork[#]	Personnel costs[§]
Finland	Health 2000	2000	The fieldwork personnel were employed for 8 months. The teams travelled from survey site to the other.	160 interviewers 10 physicians 5 dentists 6 dental hygienists 65 nurses	89%	58%
	FINRISK	2002	The fieldwork personnel were employed for 3.5 months. The teams travelled from survey site to the other.	6 nurses 12 laboratory assistants 6 practical nurses	84%	68%
		2007	The fieldwork personnel were employed for 3 months. The teams travelled from survey site to the other.	5 nurses 10 laboratory assistants 10 practical nurses	75%	71%
Germany	BGS	1998	Fieldwork lasted 6 months	Information not available	41%	52%
	KiGGS	2003-2006	Information not available	Information not available	56%	69%
Netherlands	Module Endogenous Factors	2005-2006	The field work personnel were employed for 6 months.	Medical receptionist Doctors' receptionist	44%	58%
Norway	HS40-42	1999	1 year, except in the school holidays (15^{th} of June – 20^{th} of August).	12 nurses 3 receptionists/ bus drivers	Information not available	Information not available

Country	Survey	Year	Fieldwork		% of total budget	
			Duration	Number of personnel	Fieldwork[#]	Personnel costs[§]
UK	Health Survey for England	2004	17 months	Interviewers Nurses	Information not available	Information not available
	Scottish Health Survey	2003	19 months	Interviewers Nurses	Information not available	Information not available

[#] incl. personnel, equipments, examination site rents, logistics, travels

[§] incl. fieldwork personnel, supporting personnel, laboratory personnel, etc.

Table 11.7 Reporting of the results

Country	Survey	Year	Reporting
Finland	Health 2000	2000	Printed basic report also published in pdf-format on the internet prepared by researchers and senior researchers. Later on number of scientific journal articles.
	FINRISK	2002	Printed tabulation report on the key results also in pdf-format on the internet prepared by researchers and senior researchers. Later on number of scientific journal articles.
		2007	Printed tabulation report on the key results also in pdf-format on the internet prepared by researchers and senior researchers. Later on number of scientific journal articles.
Germany	BGS	1998	A number of scientific articles, including special supplements of German journals
	KiGGS	2003-2006	A number of scientific articles, including special supplements of German journals.
The Netherlands	Module Endogenous Factors	2005-2006	Previously reported in Public Health Forecasts.
Norway	HS40-42	1999	Basic report with comparison to the earlier surveys.
UK	Health Survey for England	2004	Basic reports: Key findings and Methodology and documentation prepared by researchers and senior researchers (also available on the internet) Later on number of scientific journal articles.
	Scottish Health Survey	2003	Basic reports: Key findings and Methodology and documentation prepared by researchers and senior researchers (also available on the internet) Later on number of scientific journal articles.

Table 11.8 Total cost of the survey and an average cost per invited and per participated person (costs adjusted for annual inflation, reference to year 2007)

Country	Survey	Year	Total cost (€)	Average cost (€)	
				per invited	per participant
Finland	Health 2000	2000	4,954,155.00	617.00	702.00
	FINRISK	2002	749,990.00	55.00	78.00
		2007	812,900.00	81.00	121.00
Germany	BGS98	1998	3,628,948.00	275,00	510.00
	KiGGS	2003-2006	7,516,074.00	456,00	681,00
Netherlands	Module Endogenous Factors	2005-2006	128,528.00	129,00	197.00
Norway	HS40-42	1999	5,593,752.00	113,00	173.00
UK	Health Survey for England	2004	Information not available	Information not available	Information not available
	Scottish Health Survey	2003	3,673,463.00	271,00	450.00

Table 11.9 Main sources of funding

Country	Survey	Year	Main source of funding
Finland	Health 2000	2000	The Ministry of Social Affairs and Health, National Public Health Institute (KTL), Social Insurance Institute of Finland (KELA), Finnish Institute of Occupational Health (TTL), Finnish Centre for Pensions, National Research and Development Centre for Welfare and Health (STAKES), The Local Government Pensions Institute, The Finnish Work Environment Fund, Finnish Dental Association
	FINRISK	2002	National Public Health Institute (KTL) for main component, for additional component from different organizations like the Finnish Academy
		2007	National Public Health Institute (KTL) for main component, for additional component from different organizations like the Finnish Academy
Germany	BGS	1998	Ministry of Health, Ministry of Research and Education, Ministry of Agriculture and Nutrition
	KiGGS	2003-2006	Ministry of Health, Ministry of Research and Education, Ministry of Agriculture and Nutrition
Netherlands	Module Endogenous Factors	2005-2006	Ministry of Public Health, Welfare and Sports
Norway	HS40-42	1999	Governmental funds
UK	Health Survey for England	2004	NHS Health and Social Care Information Centre
	Scottish Health Survey	2003	Scottish Executive

12. SUMMARY AND DISCUSSION: FEASIBILITY OF A EUROPEAN HEALTH EXAMINATION SURVEY

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The purpose of this report was to document and assess the existing experience and knowledge on conducting health examination surveys (HESs). This was done in order to assess the feasibility of carrying out a European HES. Important in this assessment was the help of the FEHES network of contact persons in 32 countries. This included all EU member states, candidate countries, and EFTA/EEA countries (except Liechtenstein). The contact persons were mostly people with expertise in HESs. Therefore they reflect the expert view rather than the official view of the countries. Other important information sources were the literature and databases on literature and on surveys, such as the European Health Interview and Health Examination Survey Information Database (see Chapter 4).

The topic for the assessment was a national HES in the adult population. Both "national" and "population" are important attributes to specify when the intention is to assess the health status of the population for the planning of prevention policies or the need and optimal allocation of health care resources.

12.1 WHAT TO MEASURE IN A HES

HES measurements should fulfil the following criteria:

- The measurements must address important health topics, such as major modifiable risk factors of common diseases and functional limitations, or the prevalence of diseases and health conditions relevant for the planning and evaluation of health and other policies or health care;

- Reliable and standardizable instruments and procedures that are suitable for national population surveys must be available for the measurements;
- The instruments and procedures should be acceptable to participants; and be ethically acceptable.
- The information provided by the measurements should not be much more easily available from other data sources, such as registers or health interview surveys.

In the past, in Europe, all national and major regional HESs have included the measurement of height, weight and blood pressure, and nearly all have also included waist and hip circumference (see Chapter 8). Most have collected blood samples for the measurement of lipids, in particular total and HDL cholesterol, and about half of them have measured blood glucose. These all fulfil the above criteria (see Chapter 9). The blood samples have also been used for a large number of other disease or risk markers. Other measurements often used that fulfil the above criteria include full respiratory function (spirometry) or peak expiratory flow (PEF), electrocardiography for cardiovascular function, tests for physical fitness, functional capacity, and mental and cognitive function. A number of other measurements have been used less frequently.

All of the contact persons considered HESs important as sources of data on blood lipids, blood pressure, body weight, diabetes, cardiovascular diseases and respiratory diseases (see Chapter 4). More than half the contact persons considered HESs very important also for mental health problems and musculoskeletal problems. All contact persons considered international standardization of the measurements important, suggesting that it is considered important also from the national point of view that the countries can compare their results with those of other countries. Furthermore, countries that have experience from internationally standardized HESs, value the feedback obtained from external quality control and the ability to exchange their plans and experiences with colleagues conducting surveys in other countries. Lack of funding was considered to be the main obstacle for a national HES, but it was felt that it is much easier to obtain national funding if international coordination and standardization are available.

12.2 TECHNICAL IMPLEMENTATION OF A HES

Concerning the technical implementation of a HES, there are, in some countries, serious challenges to obtaining representative samples of the general population and in achieving sufficiently high participation rates. These are essential so that the potential response bias does not undermine the value of the whole survey. About half of European countries have up-to-date population registers covering practically the entire resident population. These are ideal

sampling frames. Where these are not available, the best sampling frames are census lists, electoral rolls or postcode address lists. It is usually possible to get good representative samples from these sources, but the sampling may become more tedious and complex. For example, when the sampling frame covers only persons living in private households, supplementary sampling frames should be sought for institutionalized persons. If sampling is based on a census, it may be wise to plan the year of the HES in such a way that a fresh census can be used.

It is essential that a sincere effort is made to obtain true samples of the whole population, and to secure high participation rates. Participation rates below 80 or 90% are too low to assess the prevalence of some diseases and functional limitations in the elderly. On the other hand in young adults and middle-aged persons findings on health behaviour and symptoms may be reasonably correct even at participation rates of 70 %. There has been a general tendency towards decreasing response rates over the past couple of decades. However, there are good examples from the past decade that the response rate can be kept high, although this requires a serious effort, and additional allocation of funds for effective recruitment approaches (see Chapter 7). Young adults tend to have particularly high non-response, and in some cases this may even be the reason for considering the exclusion of the youngest adult age group (below 25 years, or sometimes even below 35) from the target population. One reason for this is that many young adult people are working, studying or travelling far away from their registered address.

The health examinations are usually carried out in clinics with specially trained personnel. As the clinics cannot be located far from the survey participants, a national survey must in practice be conducted in a limited number of locations. This can be possible in a representative survey by the use of a multi-stage sampling method. The clinics are established in the selected localities, usually in one or a few at a time, and the trained survey teams move from one locality to the next. In the NHANES surveys in the United States, mobile clinics are established in trailers, and these are moved from municipality to municipality. In the English and Scottish surveys, the measurements are done in participants' homes, but then the selection of measurements has to be fairly simple. It is possible that different approaches, depending on the national characteristics, will be adopted for the European HES in different countries.

Of the measurements mentioned above for which standardized methods are available, there is specific concern about the measurement of blood pressure (see Chapter 9). The current gold standard of blood pressure measurement is based on the use of the mercury sphygmomanometer, but there are pressures against the use of mercury and there are practical advantages of automated measurement. For the time being there is no proven alternative to the mercury sphygmomanometer. It is especially problematic that no alternative method that would ensure comparability over time is available. However, there is rapid development of automated blood pressure measurement devices, and it can be expected that reliable alternatives will be available before the mercury sphygmomanometer must be abandoned for use in HESs. Another concern is about blood glucose. This must be measured from samples

taken after overnight fasting. Therefore, it is usually practical to do it only in the subgroup of the subjects that are measured in the mornings.

12.3 EXPERTISE AND EXPERIENCE IN THE COUNTRIES

There appears to be more expertise in carrying out a HES in the European countries than we first anticipated. Some form of a national HES has been implemented in the past or is currently ongoing in 13 of the 32 countries (see Chapter 4). According to the FEHES contact persons, in 22 of the countries there is no difficulty at all in finding the necessary expertise in national research or public health organizations, and in no country was this seen to be very difficult. Nevertheless, receiving international expert advice for HESs was considered important in 30 countries (see Chapter 4).

It is advisable that countries without earlier experience of large HESs keep the number of different measurements limited in their first HES. This is because a HES is a complex process, where the quality tends to suffer if all relevant aspects are not given sufficient attention throughout the survey, or if the examinations take too long for the participants.

Another challenge to cross-European standardization concerns the countries which already have an established HES system. When the locally used standard differs from the agreed European standard (whatever it will be), the country may have to choose between comparability between countries and the ability to monitor trends over time. In each case, specific attention will be needed to find a satisfactory solution to dealing with this problem.

12.4 INTERNATIONAL COORDINATION

Past experiences suggest that the only way to obtain comparable data is to use joint protocols and international co-ordination, training and quality control. In order that international comparability of the HES data be possible, a responsible body will be needed which develops and maintains European standards, organizes training for the use of the standards, conducts external quality control, and evaluates the success of the standardization in each country. Currently, the most recent internationally widely comparable HES data come from the WHO MONICA Project, which collected data on the classic risk factors for cardiovascular disease (weight, height, blood pressure and blood cholesterol). These data are now over 10 years old; no internationally comparable population level data even on these measurements are available in Europe from the past ten years.

12.5 ETHICAL AND LEGAL ISSUES

Ethical and legal issues in HESs concern the rights and the protection of the survey participants, but there may also be legislation and ethical obligations for those responsible of health policies to monitor the public health. There are both similarities and differences between countries in the requirements for safeguarding privacy and obtaining informed consent. It is important that the national requirements are met, but also that sufficient internationally agreed measures are taken in all countries. Therefore, it is advised that international advice be made available for those planning and conducting national HESs, and that the measures taken nationally will be subject to international quality control.

12.6 COST OF A HES

We attempted to collect comparable estimates of the cost of recent HESs in Finland, Germany, the Netherlands, Norway and England (see Chapter 11). The attempt was not very successful because the components of the costs were not comparable between the countries. For example, there were differences in the way the salaries of contributing public officials, laboratory costs and piloting were reported. Nevertheless, it was obvious that the cost per participant of the most expensive surveys was many times higher than in the cheapest survey. Of course, costs were directly affected by the contents of the survey and the number of persons examined. Face-to-face interviews compared with self-administered questionnaires also increased the cost. In all cases, personnel costs were more than half of the total budget, and the laboratory analyses constituted the second biggest component. In some surveys, all of the funding came from the Ministry of Health (or equivalent), but often also from other governmental bodies, which were stakeholders of the HESs. In the Health 2000 survey in Finland, which was the most comprehensive of those conducted in Europe, nine governmental or non-governmental organizations were involved.

The total benefit from a HES is impossible to quantify, and therefore it would be very difficult to do a reliable cost-benefit analysis. However, countries that have established HES systems, such as England, Finland and the United States, consider HESs an integral part of their health system, and to our knowledge have not considered giving up the regular HESs. In addition to the planning and evaluation of health policies and health care, HES data are widely used also for other research in these countries.

12.7 CONCLUSIONS

We conclude that it is feasible to carry out some form of a HES, including at least some core measurements, in a nationally representative sample in nearly all European countries. A key prerequisite for this is that sufficient funding will be available for conducting the surveys,

including also proper planning of the survey and the analysis, interpretation and reporting of the results. Another key prerequisite for comparability between countries is that standardization and advice in planning the surveys is organized internationally. We think that this should be organized by knowledgeable Public Health Institutes and financed by EU/DG Sanco. If the two above conditions are met, we believe that most countries have the local expertise and other capacities to organize a national HES.

We also believe that whenever possible, the responsibility of planning and conducting the HES should be at the national level. This increases the local motivation for high quality of the HES, and is important for the selection of the nationally most important measurements. The national infrastructure and other national aspects such as habits, public and professional attitudes and health information needs can be taken into account. This approach also facilitates the training of national experts for the proper analysis and interpretation of the survey results.

The motivation for carrying out a collaborative HES is high in Europe. There are active plans for a national HES in the next five years in 17 countries (see Chapter 4). This finding gives a unique opportunity for creating a European HES. The other side of this coin is that many countries seem to be taking steps toward national HESs now so it is possible that the opportunity for European standardization will be missed. Therefore, the European infrastructure for a joint standardized HES should be established as soon as possible. The first task is to facilitate the planning and the standardization of national HESs in the countries that plan to start their HESs in the next few years. The full-size HESs in these countries would constitute a set of pilots for the European HES.

It would be wise to include in the first round both countries with little recent experience on HESs and countries with an existing HES system. In countries with little experience, the focus would be on setting up the HES. In countries with earlier experience, the focus could be on harmonizing older and newer procedures and also supporting the new countries.

Our experience suggests that one to two years are needed to set up a HES. To achieve international standardization, two years is probably a better estimate. After running the field work of the HES, one needs to reserve at least two to three years for data editing and basic reporting. Again, European aspects may cause some additional time demands.

The FEHES Project is preparing a separate report on specific recommendations for the European HES in adults. The feasibility of a European HES in children and adolescents should be assessed separately, probably when there is more experience on such surveys.

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ANNEX 2. QUESTIONNAIRE ON HES IN EUROPE

Previous and planned HES in your country

By "**Health Examination Survey " (HES),** we mean a sample survey of the general population at the national or major regional level for the purpose of health monitoring and possibly epidemiological research. A HES includes at least some clinical measurements or procedures, such as anthropometric measurements, blood pressure measurements and/or blood samples. Usually, a HES also includes an interview and/or a self-administered questionnaire.

We have already carried out a review of previous and planned HESs, with the aim of evaluating the level of previous experience and expertise in each country. The draft review is available at http://www.ktl.fi/fehes/internal/WP4/review_draft1.htm. If you have forgotten the name and/or password for the FEHES internal website, please contact us.

You may wish to look at the draft review before filling in this questionnaire.

In the review we have identified the following HES(s) in (country name):

Name of the survey	Year	Type of survey: National/regional	Reference

1. Are you aware of other HESs in your country in the past 10 years?

Name of the survey	Year	Institute responsible for this survey	Name of contact person(s)	E-mail address

2. Please provide the name(s) of all of the organisations/institutions that in your opinion have the necessary expertise to conduct national HESs in your country (e.g. national or regional public health institutes, universities and other research organizations):

3. Are there currently plans for a national or major regional HES(s) in (country name)?

☐ No plans at all (go to question 5)

☐ Yes there are some preliminary plans, but no decisions yet

☐ Yes, a decision has been made to carry out a survey(s)

4. For each planned survey, please specify the following aspects, if available:

A. Survey name , year(s)

Organisation(s) responsible for the planning and coordination of this survey:

Name(s) and address(es) of contact person(s), including e-mail addresses:

Geographic area:

☐ Entire country

☐ Region(s), specify

Age range: from years to years

Sample size: **persons** **households**

Will the survey be targeted to cover:

☐ The general population

☐ Specific population groups, please specify

B. Survey name **, year(s)**

Organisation(s) responsible for the planning and coordination of this survey:

Name(s) and address(es) of contact person(s), including e-mail addresses:

Geographic area:

☐ Entire country

☐ Region(s), specify

Age range: from min **years to** **years**

Sample size: **persons,** **households**

Will the survey be targeted to cover:

☐ The general population

☐ Specific population groups, please specify

C. Please copy the above template if needed for additional surveys

Additional comments to previous and planned HES in your country:

Availability of sampling frames

5. What sampling frames of the general population are available in your country? (By "sampling frame" we mean a list of people from which the sample is selected.)

	Yes, national	**Yes, regional or local**	**Not available**
Population register	☐	☐	☐
Census data	☐	☐	☐
Health or social insurance register	☐	☐	☐
Electoral rolls	☐	☐	☐
Other sampling frame, please specify:	☐	☐	☐

6. If more than one sampling frame is available, which of them would be the most suitable for a HES?

7. Specify the coverage of the sampling frame in Question 6?

	Yes	**No**
All ages	☐	☐
All persons, regardless of employment status	☐	☐
Institutionalised persons	☐	☐

All residents, including non-citizens	☐	☐

8. How frequently is this sampling frame updated for e.g., deaths, births, migration and address information?

☐ Continually

☐ Periodically, at least once a year

☐ Less frequently, specify

Additional comments on the availability of sampling frames:

General aspects affecting the feasibility of conducting a HES in your country

9. How would you assess the level of difficulty in addressing the following issues before a national HES could be conducted in your country?

	Not difficult at all	**Somewhat difficult**	**Very difficult**
Availability of national funding	☐	☐	☐
Recognising the need to improve health information	☐	☐	☐
Accepting the value of health information obtainable only by HES	☐	☐	☐
Availability of expertise in national research and public health organizations	☐	☐	☐
Raising interest of these organisations to carry out HES	☐	☐	☐
Raising interest in HES among the general population (e.g., willingness to participate)	☐	☐	☐

Additional comments on general aspects affecting the feasibility of HES in your country:

10. How important do you consider HES as a source of information for the following topics in your country (at present or potentially in the future)?

	Not important at all	Somewhat important	Very important
Risk factors for major chronic diseases:			
Blood pressure	☐	☐	☐
Blood lipids	☐	☐	☐
Body weight and height	☐	☐	☐
Functional capacity:			
Hearing	☐	☐	☐
Vision	☐	☐	☐
Mobility	☐	☐	☐
Cognitive capacity	☐	☐	☐
Activities of daily living	☐	☐	☐
Prevalence of specific diseases and public health problems:			
Diabetes	☐	☐	☐
Cardiovascular diseases	☐	☐	☐
Respiratory diseases	☐	☐	☐
Musculoskeletal problems	☐	☐	☐
Mental health problems (e.g., depression)	☐	☐	☐
Other topics, specify	☐	☐	☐

Ethical and legal aspects of HESs

11. An important aspect of HESs is the protection of personal data, and the rights of the survey participants. In your country, which laws, decrees and guidelines have to be taken into account when conducting a HES?

	Relevance for HES in your country	
	No	**Yes, specify the name(s) and the year(s) that the law(s)/guideline(s) were created**
Data protection act	☐	☐
Medical research act	☐	☐
Act regulating the status and/or rights of patients	☐	☐
National ethical principles of research involving human subjects	☐	☐
International biomedical research guidelines	☐	☐
Other, specify	☐	☐

12. In your country is there a commonly accepted or recommended informed consent form that should be used in HESs, or specifications regarding issues that should be covered in the consent form for HESs?

☐ Yes

☐ No

13. When conducting a HES in your country, does the study protocol have to be approved by:

	Yes	No
A national ethics committee	☐	☐
Regional or local ethics committees	☐	☐
Other committees or bodies, specify	☐	☐

Additional comments on ethical and legal issues in your country:

Practical aspects of HESs

14. How feasible would it be to conduct the fieldwork for a HES in your country in the following environments?

	Not feasible at all	Fairly/somewhat feasible	Very feasible
Home visits	☐	☐	☐
Mobile units (e.g., buses or trailers)	☐	☐	☐
Normal health care facilities/offices (e.g., health centres, GP surgeries, hospital clinics)	☐	☐	☐
Rented premises for temporary clinics	☐	☐	☐

15. In many countries, the following measurements are carried out by specially trained nurses or laboratory technicians, whereas in others a physician is needed to carry out the measurements. What is the situation in your country?

	Needs to be carried out by a physician	**Needs to be carried out in the presence of a physician or a physician needs to be available during the examinations**	**No physician is needed**
Blood pressure measurement	☐	☐	☐
Drawing blood samples	☐	☐	☐
Measurement of lung function by spirometry	☐	☐	☐
Electrocardiogram (ECG)	☐	☐	☐

Additional comments on practical aspects:

International aspects of HESs

16. International standards and protocols are developed to increase the comparability of data. This also enhances implementation in countries with less experience in national HESs. However, a possible drawback in countries that already have a tradition of national surveys is that the application of international standards and protocols could impede the assessment of time trends. How would you rate the importance of the following for a national HES in your country?

	Not important at all	Important	Very important
Adoption of international standards	☐	☐	☐
Continued use of national standards to follow national time trends	☐	☐	☐
International collaboration for quality control	☐	☐	☐

17. Assuming that there would be two alternatives for a European HES, i.e., conducted as a part of a national survey or a totally separate survey, how do you consider these approaches for your country?

	Not at all likely	Somewhat likely	Very likely
A national survey incorporating some topics/modules to meet the international needs	☐	☐	☐
Participation in a separate internationally standardised survey	☐	☐	☐

18. Assuming that the international co-ordination and much of the international standardisation would be funded by an outside source (e.g., by the European Commission or research funds), do you think that national funding could be found for the local fieldwork in your country?

☐ No, not at all likely

☐ Yes, somewhat likely

☐ Yes, very likely

19. How important would you consider receiving international expert consultation for a HES in your country?

☐ Not important at all

☐ Somewhat important

☐ Very important

Additional comments on international aspects:

Any other additional comments

Please provide any other comments concerning the feasibility of a HES in your country.

Thank you very much for your collaboration!

Return to:

Päivikki Koponen

paivikki.koponen@ktl.fi

National Public Health Institute

Department of Health and Functional Capacity

Mannerheimintie 166

00300 Helsinki

FINLAND

ANNEX 3. SOME QUESTIONS ON RECRUITMENT AND PARTICIPATION

If Health Examination Surveys (HES) have been conducted in your country, please answer for the most recent HES (national or regional):

Survey name:

Year:

If no HES, but Health Interview Surveys (HIS) have been conducted, please answer for the most recent HIS (national or regional):

Survey name:

Year:

IT IS POSSIBLE TO CHECK MORE THAN ONE ANSWER FOR MOST QUESTIONS:

1. **How was the general public informed?**

   □ newspapers

   □ radio

   □ television

   □ internet (survey websites)

   □ other means, please specify

2. **How were the selected persons/households contacted?**

   □ mailed invitation letter

   □ Visit

   □ Phone

   □ other means, please specify _____

(Which of these was the first contact: First contact by letter, phone, or visit? If the first contact was by mail, did it contain a survey questionnaire in addition to the invitation letter?)

3. **Did participants receive any compensation, reimbursement or gift?**

- □ No
- □ reimbursement of travel expenses to all participants
- □ reimbursement of travel expenses to participants with certain criteria (please specify the criteria)
- □ a small gift (pen with logo, lottery ticket, telephone card etc) sent with the invitation
- □ other (specify) _____

4. **Did you make particular efforts to recruit certain minorities (e.g. ethnic, people with intellectual disability, or other disabled or illiterate persons)?**

- □ no
- □ “user-friendly” lay-out of written materials
- □ personal assistance (by telephone__? on site?___)
- □ written materials in ___ languages
- □ culturally adapted written materials
- □ staff trained or selected for examination of minorities
- □ interpreter on site
- □ collaboration with authorities or representatives for relevant groups
- □ other efforts, please specify _____

Please specify which groups were addressed by the above specific means

_____

5. **In case of non-response (to the first invitation): were the subjects re-contacted?**

□ No

□ mailed letter, only

□ mailed letter with the full survey questionnaire

□ mailed letter with a shortened questionnaire

□ Telephone_call

□ Home visit(s)

□ other means, please specify _____

Could you please briefly describe the process of attempting to contact the person before he/she was considered to be a definite non-respondent? (eg. first an invitation letter, then phone call, and finally a visit to address etc.)

What was the maximum number of attempts after the first invitation?

6. **Which were, in your opinion, the most effective strategies to increase the response rate?**

7. **Did you collect any health information from the non-respondents?**

□ no

□ a shortened examination protocol (e.g. home visit if not attending the clinic visit)

□ a short mailed questionnaire

□ a short telephone interview

8. **Did you ask why people refused to participate?**

□ no

□ yes, please list the main reasons

Do you have other information on reasons for non-response?

Please specify _____

9. **Was any basic information (e.g. sex, age, marital status…) collected from the definite non-respondents?**

□ No.

□ information available in the sampling frame

□ information from other registers. Please specify _____

If the response or recruitment issues have been documented, could you please give the reference(s) or attach a copy?

Thank you for spending your time on sharing this important information with us!

ANNEX 4. QUESTIONNAIRE OF SURVEY QUALITY ASSURANCE

Questionnaire of Survey Quality Assurance Procedures

Instructions

Please, fill in the questionnaire for the survey indicated in the first page of the questionnaire. We have already filled in all the information we were able to obtain from the data sources we had. Please, check the correctness of this information.

In case the measurement in question is not done in the survey in question, please mark that information to the questionnaire.

You can find the filled questionnaire for Finnish Finrisk 2007 survey from the FEHES internal web site at http://www.ktl.fi/fehes/internal/WP6/quality_questionnaire_Finrisk07.pdf if you want to see the level of details we would like to get from you.

Survey information

Country:

Survey name:

Year(s) of the survey:

Months when the survey was conducted:

- ☐ January
- ☐ February
- ☐ March
- ☐ April
- ☐ May
- ☐ June
- ☐ July
- ☐ August
- ☐ September
- ☐ October
- ☐ November
- ☐ December

Days of the week when the survey was conducted:

- ☐ Monday
- ☐ Tuesday
- ☐ Wednesday
- ☐ Thursday
- ☐ Friday
- ☐ Saturday
- ☐ Sunday

Hours of day when the examinations were conducted: -

Selection and training of the fieldwork personnel

Was there a special selection criterion for the fieldwork personnel?

☐ Yes

☐ No

If yes, please specify:

Type and number of fieldwork personnel:

Profession	Number
Doctor/ physician	
Nurse	
Laboratory technician	
Physiotherapist	
Dentist	
Dental hygienist	
Psychologist	
Interviewer	
Nutritionist	
Medical receptionist	

Training:

Duration: days

Trained by:

Which topics did the training cover:

Was the specific certification of personnel required (for example for blood pressure measurement)?

☐ Yes

☐ No

If yes, please specify:

Written manual and protocols

Did the survey have a written description (document including background of the survey, measurements included, information about the parties involved, ect.)?

☐ Yes

☐ No

If yes, has the description been published?

☐ Yes, where: and on which language:

☐ No

Did the survey have a written manual (a detailed, step by step instructions for each measurement)?

☐ Yes

☐ No

If yes, has the manual been published?

☐ Yes, where: and on which language:

☐ No

Quality assurance protocols and results

Has the used quality assurance protocols been documented?

☐ Yes

☐ No

If yes, how: and on which language:

Has the results of the quality assurance been documented?

☐ Yes

☐ No

If yes, how: and on which language:

Quality assurance of the measurements

Height

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey:

How:

By whom:

Calibration during the survey:

How:

By whom:

Frequency:

Calibration after the survey:

How:

By whom:

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Weight

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey:

How:

By whom:

Calibration during the survey:

How:

By whom:

Frequency:

Calibration after the survey:

How:

By whom:

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values)* after the survey:

Waist and hip circumference

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey:

How:

By whom:

Calibration during the survey:

How:

By whom:

Frequency:

Calibration after the survey:

How:

By whom:

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Blood pressure

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey:

How:

By whom:

Calibration during the survey:

How:

By whom:

Frequency:

Calibration after the survey:

How:

By whom:

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:)

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Blood samples (for lipids and glucose)

Was the blood sample(s) collected?

☐ Yes, proceed to next question

☐ No, proceed to next measurement

Sample collection

Was blood sample collected after fasting?

☐ Yes

☐ No

If yes, length of the fasting period

Position of the subject during the sample collection:

☐ Sitting

☐ Supine

Was the blood sample collected before blood pressure measurement?

☐ Yes

☐ No

Was the tourniquet used during the blood sample collection?

☐ Yes

☐ No

If yes, for how long period:

Sample handling on the field

Were samples centrifuged on the field?

☐ Yes

☐ No

If yes, please describe the procedure:

How samples were stored on the field?

Temperature:

Duration:

Quality control on the field

Describe the fieldwork quality control procedures during the survey (*for example audits, ect.*):

How frequently the fieldwork quality of the measurements was checked:

By whom the fieldwork quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Laboratory analysis

Lipids

Was the total cholesterol determined?

☐ Yes

☐ No

Was the HDL cholesterol determined?

☐ Yes

☐ No

Laboratory doing cholesterol analysis:

Did the analysing laboratories have internal quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Did the analysing laboratories participate to the external quality assessment schemes?

☐ Yes

☐ No

If yes, please describe:

Cholesterol determined from

☐ Plasma

☐ Serum

If plasma, used anticoagulant:

Methods used for total cholesterol determination:

Method used for HDL cholesterol determination:

Glucose

Was the glucose determined?

☐ Yes

☐ No

Laboratory doing glucose analysis:

Did the analysing laboratories have internal quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Did the analysing laboratories participate to the external quality assessment schemes?

☐ Yes

☐ No

If yes, please describe:

Glucose determined from

☐ Plasma

☐ Serum

If plasma, used preservative:

Method used for glucose determination:

Physical performance tests

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

What measurements tests included:

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Physical fitness tests

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

What measurements tests included:

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Lung function

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

What measurements tests included:

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Hearing

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

Vision

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (*for example how data was checked or correct values*) after the survey:

ECG

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (for example how data was checked or correct values) after the survey:

Bone density

Was the measurement done in the survey?

☐ Yes, proceed to the next question

☐ No, proceed to the next measurement

Device:

Type:

Model:

Calibration

Calibration before the survey (how and by whom):

Calibration during the survey (how, by whom and frequency):

Calibration after the survey (how and by whom):

Quality control during the survey

Describe the quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently quality of the measurements was checked:

By whom the quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Quality assessment after the survey

Describe the quality assessment protocols (for example how data was checked or correct values) after the survey:

Urine samples

Was the urine sample(s) collected?

☐ Yes, proceed to next question

☐ No, proceed to next measurement

Sample collection

How the sample was collected:

Sample handling on the field

How samples were handles and stored on the field:

Quality control on the field

Describe the fieldwork quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently fieldwork quality of the measurements was checked:

By whom the fieldwork quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Laboratory quality control

What was analysed from the urine samples:

Laboratory doing the analysis:

Did the analysing laboratory have internal quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Did the analysing laboratory participate to the external quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Saliva samples

Was the saliva sample(s) collected?

☐ Yes, proceed to next question

☐ No, proceed to next measurement

Sample collection

How the sample was collected:

Sample handling on the field

How samples were handles and stored on the field:

Quality control on the field

Describe the fieldwork quality control procedures during the survey (*for example audits, double measurements, checking of the data distributions, ect*.):

How frequently fieldwork quality of the measurements was checked:

By whom the fieldwork quality of the measurements was checked:

What was done if it was observed that there was some problems with measurements:

Laboratory quality control

What was analysed from the saliva samples:

Laboratory doing the analysis:

Did the analysing laboratory have internal quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Did the analysing laboratory participate to the external quality assessment scheme?

☐ Yes

☐ No

If yes, please describe:

Comments

Thank you for your help!

Please,

return this questionnaire to

Hanna Tolonen (hanna.tolonen@ktl.fi)

by 8 February 2008

ANNEX 5. EVALUATION OF THE COST OF THE PREVIOUS HESS IN THE EU MEMBER STATES

Basic information about the survey

Country:

Year of the survey:

Name of the survey:

Responsible organization(s):

Geographical area covered:

Sample size:

Brief description of the sampling procedures:

Sample age range:

Included institutionalized persons: YES / NO

Questionnaire items were filled in

1. During the home interview
1. During the interview at the examination site
2. Self-administered questionnaire, mailed to sampled persons
3. Self-administered during the home visit
4. Self-administered at the examination site
5. Other, specify

How the sampled persons were invited to the survey (examination)

1. By mail
2. By telephone
3. During the home visit
4. Other, specify

Physical measurements were conducted

1. At HOME during the same visit as interview
2. At HOME during different visit than interview
3. In non-mobile EXAMINATION SITE
4. In mobile EXAMINATION unit
5. Other, specify

Main sources of funding (if possible give the proportion of total costs funded by the organization)

Cost categories

(All person years should be reported using EU calculations bases 1 year = 200 days)

General planning and fund-raising

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Other costs (specify the type of cost)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Planning of the operations and logistics

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Other costs (specify the type of costs)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Design and construction of computer programs (for example appointment system, data entry during the interview, database, ect.) specify the type of costs	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Sampling

Specify possible subcomponents if relevant	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Personnel recruitment

Specify possible subcomponents if relevant	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Training of the personnel

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Other costs (specify the type of cost)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Equipment (for field work, for example blood pressure device, ect.)

Specify	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Printing costs

Invitation letters	Total cost (€)	Number of letters	Pages per letter	Black&white / Color printing
Actual survey				
Pilot study				

Questionnaires	Total cost (€)	Number of letters	Pages per letter	Black&white / Color printing
Actual survey				
Pilot study				

Other material	Total cost (€)	Number of letters	Pages per letter	Black&white / Color printing
Actual survey				
Pilot study				

Mailing costs

	Actual survey		Pilot study	
	Total cost (€)	Number of letters	Total cost (€)	Number of letters
Invitations				
Questionnaires				
Feedback letters				
Other material				

Field work costs

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Accommodation and daily allowances	Actual survey		Pilot study	
	Total cost (€)	Number of person nights/days	Total cost (€)	Number of person nights/days
Accommodation				
Daily allowances				
Transportation costs	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units
Field work personnel				
Equipment and materials				
Collected samples				

Incentives or other compensations paid for the participants (specify)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Other costs (specify, for example sample storage)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Rents for examination sites

Specify	Actual survey		Pilot study	
	Total cost (€)	Number of days	Total cost (€)	Number of days

Central coordination during the survey

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Other costs (for example computer facilities, office space, ect.) Specify	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Data management

Personnel costs (if possible specity the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Equipment (specify)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Other costs (specify)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

External quality control (during the survey)

Specify relevant subcategories is possible	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

Laboratory analysis

Specify	Actual survey		Pilot study	
	Total cost (€)	Number of analyzed samples	Total cost (€)	Number of analyzed samples

Basic report (analysis and reporting)

Personnel costs (if possible specify the type of personnel)	Actual survey		Pilot study	
	Total cost (€)	Person years	Total cost (€)	Person years

Printing costs	Total cost (€)	Number of letters	Pages per letter	Black&white / Color printing
Actual survey				
Pilot study				

Other costs (specify)	Actual survey		Pilot study	
	Total cost (€)	Number of units	Total cost (€)	Number of units

ANNEX 6. PREVIOUS AND PLANNED HESS IN EUROPEAN COUNTRIES

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Austria	No	Province of Voralberg: Voralberg Health Monitoring and Promotion Programme [1] /CINDI [2] 1985-1999 Other topic-specific surveys, e.g. ECRHS I in Vienna [3]	No plans	National HIS: 1999. Labour Force Surveys with health module in 2002 [4]. Voralberg is the only area with experiences in HESs. It covers only 5% of the Austrian population.

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Belgium	No	Belgian Interuniversity Research on Nutrition and Health 1979/84 [5] MONICA [6]: three populations: Ghent and Chaleroi, population surveys in 1985-1987, 1987-1990, 1990-1993, and Luxembourg province, population survey in 1983-1985 ECRHS I & II in Antwerp [3] Several other local, regional and topic-specific surveys since 1960s and in 1980s and 1990s Few recent surveys with limited examinations e.g. the National food consumption survey in 2004 included a waist circumference measurement.	The national HIS in 2008 will include an oral health examination component organised by an interuniversity consortium for oral health. National nutrition survey in 2009 (age <15 years)	National HIS: 1997, 2001 and 2004 [4].
Bulgaria	No	Three national nutrition surveys since 1997, latest in 2004 Epidemiological study on health and stress A few small scale local and topic-specific surveys (occupational health and environmental health surveys in 1980s and 1990s, CVD risk factor surveys in 1960s)	National Survey on Health Risk Factors in 2007 covering the entire country (age 25-64, N=4000) CINDI Health Monitor survey in 2007 in seven areas (age 25-64, N= 11200)	National HIS: 1996 and 2001 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Croatia	Croatian Health Survey [4] 2003		Croatian Health Survey planned for 2007 or 2008 (age 18 +, N=9000)	National HIS: 2001 [4]
Czech Republic	Health, Life Style and Environment Survey (HELEN) conducted in 1998-2002 and 2004-2005 [4]	MONICA [6]: six districts representing the middle, south, east and west of Bohemia, Population surveys in 1985, 1988, 1992. Czech Post-MONICA study 1997/1998 and 2000/2001 The HAPIEE Study [7] in six towns: baseline examinations in 2002-2005 (N=8856, response rate 55%)	Czech Post-MONICA study 2006-2008 (in 9 districts) HELEN survey in 2009-2010 (in 25 cities)	National HIS: 2002 [4]
Cyprus	No	Risk Factor Survey (CINDI) in the Nicosia District in 2000 [4] Several other recent topic specific surveys: Survey on thyroid disease in Cyprus 2001-2002, An Epidemiologic Study on the Prevalence of Diabetes, Glucose Intolerance, and Metabolic Syndrome in the Adult Population of the Republic of Cyprus 2003-2005, Diet, lifestyle and hypercholesterolemia in elderly men and women in Cyprus 2004-2005	Some preliminary plans for a national HES in 2011 and 5 -yearly onwards	National HIS: 2003 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Denmark	No	The Copenhagen/Glostrup CVD risk factor surveys since 1960s (10,11) MONICA [6]: Glostrup area population surveys in 1982-84, 1986/87, 1991/92 (Copenhagen County Centre for Preventive Medicine) EPIC** in Århus & Copenhagen [8] , ECRHS I in Århus [3] Several other local, regional and topic specific surveys since 1960s National Dental health survey in 1981-82 The Inter99 study, a population based primary prevention study on cardiovascular disease in 1999-2006 (N=12934) [9]	Health 2006-2008 (Copenhagen area) A new HES, the KRAM study, a municipality based survey with focus on diet, smoking, alcohol and physical activity in 13 municipalities, about 1500 subjects in each (National Institute of Public Health, Morten Grønbæk et al.). Pilot was carried out in March-April 2007, actual survey for September 2007-November 2008.	National HIS: 1994, 2000, 2004 and 2005 [4]
Estonia	No	ECRHS in Tartu [3] and a few other local and/or topic-specific surveys (e.g. a local HES (CVD) in Tallinn 1999-2001 [10], and CVD risk factor surveys on male population in Tallinn 1981/82, 1984/85 and in 1992/94 [11], and a respiratory health survey (FinEsS-study) in 1997-2000	No plans	National HIS: 1996, 2004 and 2005 [4]. Finbalt Health Monitor since 1990.

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Finland	SII Mobile clinic 1965-1977 Mini-Finland Health Survey 1978-1980 Health 2000 [4, 12] 2000-2001	Finrisk/FINMONICA [13]: originally three areas, latest survey with six areas (North Karelia, North Savo, Helsinki-Vantaa, and Provinces of Oulu and Lapland), population surveys in 1972, 1982, 1992, 1997, 2002(3) Seven Countries Study/FINE [14], and several other local, regional and topic specific surveys since 1960s	Finrisk 2007 in five areas National survey Health 2012 (year not confirmed) New national survey on children and adolescents, pilot in 2007	National Health Behaviour Surveys yearly since 1978

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
France	National Survey on Nutrition and Health 2006 (ENNS)	MONICA [6]: three populations (Lille community population surveys in 1986-89, 1995/96, Strasbourg/Bas-Rhin district surveys in 1985-87 and 1995-97, and Tolouse/Hoaute-Garonne region surveys in 1985-87, 1988-91, 1994-96) EPIC** [8] in Paris, ECRHS I & I [3]in Paris, Montpellier, Bordeaux, Grenoble Several other local, regional and topic-specific surveys, e.g. the PAQUID [15] study on aging, disability and dependence, baseline survey in 1988/90 Epidemiologic studies carried out at occupational health settings [16]. Estimates e.g. on diabetes prevalence and CVD risk factors have also been made based on data collected from health examinations covered by the medical insurance system [17]	Next National Survey on Nutrition and Health planned in 2011	National HIS (National Survey on Health and National Health Insurance): 2002, 2004 [4], in addition Health Barometer surveys with 5 year intervals and several other health related surveys at regular intervals, e.g. Disability Surveys and Living Conditions Surveys with health modules

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Germany	German National Heath Interview and Examination Survey 1984, 1987, 1990, 1997-1998 [4, 18]	MONICA [6]: Four populations (Population surveys in Augsburg city + surrounding area in 1984/85, 1989/90, 1994/95, city of Bremen in 1984, 1988, 1991/92, East Germany in 1982-84, 1988, 1993-94, and Rhein-Nackar Region population survey in 1983-87)	Active plans for a new national HES in 2008-2010, no final decisions Plans for a new dental health survey	National HIS: 2004-2005 [4]
	The German Health Survey for Children and Adolescents KiGGS 2003-2006 [4, 19]	EPIC ** [8]: (Heidelberg, Potsdam), ECRHS I and II [3]: (Hamburg, Erfurt) and several other local, regional and topic-specific surveys National Dental Health Surveys (DMSI-III) in 1989 (west), 1992 (east) and 1997		
Greece	No	Seven Countries Study [14] EPIC ** [8]: Athens, ECRHS I [3]:Athens, and a few other local, regional and topic-specific surveys in the 1990s a few other local, regional and topic specific surveys, e.g. the ATTICA study, a health and nutrition survey in the Athens area in 2001-2002 [20, 21]	Active plans for a new national HES, no final decisions	National HIS (Psychosocial Factors and Health): 1998, 2004 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Hungary	No	Initial MONICA [6] surveys: Budapest and Pecs 1982/94, 1987/89 (dropped out later) A few small scale local and topic-specific surveys (e.g. elderly, obesity, oral health), and national dietary/nutrition surveys including physical measurements	No plans	National HIS: 2000, 2003 [4]
Iceland	No	Reykjavik Study [22] (prospective CVD population study) since the 1960s, later joined the MONICA [6] study: population surveys in 1983, 1988/89, 1993/94, 2001 ECRHS I and II [3]: Reykjavik Other local, regional and topic-specific surveys, e.g. the Age, Gene/ Environment Susceptibility Study - Reykjavik Study of Healthy Aging for the New Millenium, ongoing since 2002	No plans	National HIS: 2001, 2003 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Ireland	Survey of Lifestyles, Attitudes and Nutrition (SLAN) 1998, 2002 [4, 23]	ECRHS I [3]: Dublin and a few local, regional and topic specific surveys, e.g. Kilkenny County Health project(25, 26,27,28) (CVD) population surveys in 1985/86, 1990/91	SLAN 2006/2007: a new consortium of the Royal College of Surgeons are carrying out the survey (age 18+, N=1500)	National HIS: Disability modules in Labour Force Surveys in 2002 and 2004 [4]
		North/South Food Consumption Survey and the National Children's Food Survey 1999 and 2003/2004	TILDA - The Irish Longitudinal Study on Ageing (aged 55+, N=10 000) 2006/2007 and after 5 and 10 years	
			Growing up in Ireland - National Longitudinal Study of Children (9 months and 9 years only, N=10 000 + 8000) 2007 and every 4 years	

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Italy	No	Seven Countries Study/FINE [14] MONICA :[6] Brianza /73 municipalities in Northern Italy population surveys in 1986/87, 1989/90, 1992, 1993/94, Friuli/three provinces surveys in 1986, 1989, 1994, Area Latina 1982-85 the Cardiovascular Epidemiological Observatory study 1998 in 37 Cardiology centres covering all regions in Italy [24] Italian Longitudinal Study on Aging (ILSA) 1992/93, 1995 [25] ECRHS I and II [3]: Turin, Pavia and Verona), EPIC** [8] :Florence, Milan, Naples, Ragusa a Turin, other local, regional and topic-specific surveys since the early 1950s.	Plans for a study in 2007-2009 with a new Italian sub-sample similar to that of the Cardiovascular Epidemiological Observatory (12 000 individuals aged 35-80 years), new topics/measurements to be included in addition to CVD risk factors and prevalence (e.g. spirometry and bone densitometry are considered)	National HIS: 1999 and 2005 [4], annual Aspects of Daily Living surveys, with a health module
Latvia	The survey on Epidemiologic Research of Most Common Non-infectious Diseases in 1991 [26] .	A few disease specific surveys	No plans	National HIS: 2003 [4], Finbalt Health Monitor since 1998 [27]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Lithuania	No	MONICA:[6] Kaunas city population surveys in 1983/84, 1987, 1992/93 The HAPIEE Study [7] in Kaunas: baseline examinations started in 2006 (N= approx. 7000) CINDI started in 1983	CINDI 2006-2007 in five rural regions (age 25-64, N=4000)	National HIS: General HIS in 2005 [4], Finbalt Health Monitor since 1994 [27]
Luxembourg	No	A few topic specific surveys (e.g. on asthma, migraine and obesity in children)	ORISCAV survey on cardiovascular risk factors in 2007/2008 covering the entire country (age 18-65, N=4 300) Survey on Mild Cognitive Impairment in 2007/2008 covering the entire country (age 65 and over, N=1200)	No national HIS
Macedonia (FYROM)	No	National Diabetes Study in 2005	No plans	National HIS: 1999, 2001 and 2004 [4]
Malta	No	MONICA [6]: Population survey in the island of Malta 1984 and 1987	Active plans, no final decisions	National HIS: First national survey in 2002 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
the Netherlands	The MORGEN project (the Monitoring Project on Risk factors for Chronic Diseases) 1987-1997 Regenboog -survey 1998-2001 [4]	Seven Countries Study/FINE [14] HES module (Module Endogenous Factors) developed by RIVM, applied in two health centre-regions in 2005-2006 Doetinchem study (longitudinal Risk Factor Survey) 1998-2002 National Mental Health Survey (NEMESIS) in 1996-97, 199931 National Dental Survey 1986 [28] EPIC** [8]: Bilthoven, Utrecht, ECRHS I and II [3]: Groningen, Bergen-op-Zoom, and Geleen other local, regional and topic-specific surveys	HES module developed by RIVM to be applied in more regions connected to HIS HES in 5 towns, spread over the country in 2008-2010 (age 16-80+, N=ca. 15 000)	HIS situation: regional surveys with common methods and modules, and pooling of data into a national database at RIVM. HES module was developed to be linked with these within the Local and National Monitor Public Health [28] Continuous Quality of Life Survey (POLS) since 1981 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Norway	Cohort Norway [4, 29] 1994-2000, 2002	The Cardiovascular Disease study in several regions since 1970s (34) EPIC** [8]: Tromso , ECRHS I and II [3] : Bergen Several other local, regional and topic-specific surveys since 1960s	Health Survey in Nord-Trondelag (HUNT) 2006-2008 Health Survey in Tromsø (TROMSØ VI) 2007 Some preliminary plans for national HES covering all age groups (N=20 000)	National HIS: Survey on living conditions & health, care and social relations since 1968, latest in 2002 and 2004 [4]
Poland	Polish national Multicenter Health Survey (WOBASZ) 2005 [4]	MONICA [6]: Tarnobrzeg Voivoidship Provice population surveys in 1983/84, 1987/88, 1992/93, city of Warsaw surveys in 1984, 1988, 1993 Health Survey of Warsaw and Tarnobrzeg Population Pol_MONICA Bis in 2001 NATPOL PLUS - Hypertension and Lipids in Poland study in 2002 The HAPIEE Study [7] in Krakow: baseline examinations in 2002-2005 (N=10 728, response rate 61%) A few regional and topic-specific surveys, e.g. on the health of the rural population [30]	A new national survey for the elderly, WOBASZ SENIOR in 2007 (age 75-100, N=1800) Next WOBASZ in 2010-2011	National HIS: 1996 and 2004 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Portugal	No	CINDI [2] baseline survey in the district of Setubal 1987 ECRHS I [3] ·Oporto and other local, regional and topic-specific surveys A few other regional and topic specific surveys, e.g. a national survey on hypertension in 2003, Prevalence of obesity in a representative sample of the portuguese population in 2005, National Serological Surveys in 1980 and 2001/2002	National Nutrition Survey 2007 and national HES planned for a subsample of HIS in 2010/2011, no final decisions yet	National HIS: 1987, 1995, 1999 and 2005/2006 [4]
Romania	Health Medical survey 1959, 1964, 1983, 1989, 1997	MONICA [6] Population survey 1986/87 Bucharest CINDI Survey in 1999 CVD risk factor survey (URZIENI HES) 2001-2005, 2005-2006	CINDI 5 year follow up in 2007 in Neamt county Some preliminary plans for a national HES	National HIS: 2000 [4] , planned for 5 year intervals
Slovakia	CINDI Health Examination Survey 1993, 1998 and 2003 [4]	MONICA 2002	New CINDI HES planned for 2008 in 9 districts (age 15-64) Plans for a national HES covering the entire country (age 15-64, N=3000)	National HIS: Labour Force Survey with a module on health problems in 2002 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Slovenia	No	CINDI Surveys in 1996/1997 and 2002/2003	CINDI survey planned for 2008 in three regions (age 25-64, N=ca. 2500)	National HIS: CINDI Health Monitor Questionnaire 2001 [4] National Survey on Health and Health Systems in 2005
Spain	No	MONICA [6]: Catalonia (CRONICAT) population surveys in 1986-88, 1990-92, 1994-96 ECRHS I and II [3]; Barcelona, Galdakao, Albacate at both, Seville at phase I, Oviedo and Huelva at phase II Regional Nutritional Surveys with anthropometric measurements [31] Several other local, regional and topic specific surveys, e.g. on blood pressure [32], musculoskeletal diseases [33] and CVD risk factors [34]	HES in Catalonia planned for 2007 IMCAII project with a HES pilot considered as a feasibility study for future national HES EPIRCE 2006-2007 (prevalence of kidney disease and CVD risk factors) ENRICA 2007-2008	National HIS: 2001 and 2003, planned for 2 year intervals [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Sweden	No	MONICA [6]: Population surveys in the City of Gothenburg in 1985/86, 1990/91, 1994-96, in Northern Sweden (Norrbotten and Västerbotten counties) in 1986, 1990, 1994, 1998, 2004 The Swedish National Study on Ageing and Care (SNAC) baseline studies in four regions in 2001-2003 [35] EPIC ** [8]: Malmö, Umeå, ECRHS [3] : Umeå, Uppsala, Göteborg Several other local, regional and topic-specific surveys since the 1960s (e.g. the Stockholm Health of the Population Study, the Göteborg Primary Prevention Study, Malmö Prevenitive Project) [36-38],and the Vesterbotten Intervention Project (VIP) since 1985	MONICA survey in Norrbotten and Västerbotten in 2009 (age 25-74, N=2500) VIP survey in Västerbotten every year (all persons aged 40, 50 and 60)	National HIS: Health module within the Living Conditions Survey every second year, latest in 2005 [4] First National Survey of Public Health in 2004, second in 2005
Switzerland	No	Bus Sante (47) [39] risk factor surveillance system in the city and canton of Geneva, annual since 1993 ECRHS in Basel [3]		National HIS: 1997, 2002 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
Turkey	No	A large population study The Healthy Nutrition for Healthy Heart Study [40] in 2000-2003 with 14 study centers in the seven main regions of Turkey The Turkish Diabetes Epidemiology Study (TURDEP) in 1997-1998 with 540 centers across the nation [41] A few other local, regional and topic specific surveys	Some preliminary plans	National HIS: 2003 [4]

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
UK		National Psychiatric Morbidity Surveys in 1993/94 and 2000 (England, Scotland and Wales) [42] Adult Dental Health Survey in 1968, 1978, 1988, 1998 [43] Medical Research Council Cognitive Function and Ageing Study 1991/92 (England and Wales) [44] EPIC ** [8]: Cambridge and Oxford, ECRHS I and II [3]: Ipswitch and Norwich in both, Cambridge at phase I and Cardiff at phase II Several other local, regional and topic-specific surveys such as CVD Risk factor surveys, e.g. the British Regional Heart Study [45], since the 1960s		General Household Survey with a health module continuously since 1971, and several additional surveys, e.g. National Diet and Nutrition Surveys [46]
UK/England	Health Survey for England [4, 47] yearly since 1991		Health Survey for England to be continued yearly, current contract covers the years 2006-2008 (all ages, N=16 000).	A 'core' which is repeated each year and each survey year has one or more modules on subjects of special interest.

Country	Previous national HES	Regional and/or topic specific HES*	Plans for future HES	Remarks and other surveys (HIS)*
UK/Scotland	The Scottish Health Survey [4, 48]1995, 1998, 2003	MONICA [6]: Glasgow city, population surveys in 1986, 1989, 1992, and 1995, also in Edinburgh 1986 Scottish Heart Health Study 1983/84(53) (later linked to MONICA)	Scottish Health Survey in 2008-2011 (year not confirmed)	
UK/Northern Ireland	The Health and Social Wellbeing Survey for Northern Ireland 1997 (54)	MONICA [6]: Belfast city and three health districts, population surveys in 1983/84, 1986/87, and 1991/92		The Health and Social Wellbeing Surveys for Northern Ireland in 2001 and in 2006 were carried out only as HIS, no HES part
UK/Wales				National HIS: 2005

* Note: For these surveys the list is not intended to be comprehensive, rather including some examples indicating previous experiences on HES methodology and survey data collection in the country (source HIS/HES database and the inventory of HIS covering all countries/surveys carried out in 2000-2005)

**Note: Some of the local EPIC participants have been selected by probability sampling, others are groups of volunteers (see chapter 4)

REFERENCES

[1] Ulmer H, Kelleher C, Diem G, Concin H. Long-term tracking of cardiovascular risk factors among men and women in a large population-based health system: the Vorarlberg Health Monitoring & Promotion Programme. European heart journal. 2003 Jun;24(11):1004-13.

[2] World Health Organization Regional Office for Europe. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) programme. 2008 [cited 05 June 2008]; Available from: http://www.euro.who.int/CINDI

[3] ECRHS. European Community Resporatory Health Survey. 2007 [cited 28 May 2008]; Available from: http://www.ecrhs.org/default.htm

[4] European Health Interview & Health Examination Surveys Database. 2008 [cited 6 March 2008]; Available from: https://hishes.iph.fgov.be

[5] The Belgian Interuniversity Research on Nutrition and Health (B.I.R.N.H.). Acta cardiologica. 1989;44(2):89-194.

[6] Tunstall-Pedoe H, World Health Organization. MONICA Project. MONICA, monograph, and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva: World Health Organization 2003.

[7] Health, Alcohol and Psychosocial factors in Eastern Europe (HAPIEE Study). 2008 [cited 05 June 2008]; Available from: http://www.ucl.ac.uk/easteurope/hapiee.html

[8] International Agency for Research on Cancer. EPIC Project. 2008 [cited 05 June 2008]; Available from: http://epic.iarc.fr/

[9] Glumer C, Carstensen B, Sandbaek A, Lauritzen T, Jorgensen T, Borch-Johnsen K. A Danish diabetes risk score for targeted screening: the Inter99 study. Diabetes care. 2004 Mar;27(3):727-33.

[10] Shiplova T, Pshenichnikov I, Kaik V, Volozh O, Abina E, Solodkaia E, et al. Heart rate and QT-interval dispersion with consideration of left ventricular geometry in a population study of men and women agedn 35-59 years (in Russian, abstract in English). Kardiologiia. 2005;45(11):55-9.

[11] Volozh O, Deev A, Solodkaya E, Abina J, Kalyuste T, Kaup R, et al. Assessment of the general health profile trends in the male population of Tallinn, Estonia. Public health. 1998 Sep;112(5):303-8.

[12] The Health 2000 survey. [cited 05 June 2008]; Available from: http://www.ktl.fi/terveys2000/index.uk.html

[13] The National FINRISK Study. 2008 [cited 05 June 2008]; Available from: http://www.ktl.fi/finriski

[14] Blackburn H. Overview: The Seven Countries Study in Brief. 2008 [cited 05 June 2008]; Available from: http://www.epi.umn.edu/research/7countries/overview.shtm

[15] Dartigues JF, Gagnon M, Barberger-Gateau P, Letenneur L, Commenges D, Sauvel C, et al. The Paquid epidemiological program on brain ageing. Neuroepidemiology. 1992;11 Suppl 1:14-8.

[16] de Gaudemaris R, Lang T, Chatellier G, Larabi L, Lauwers-Cances V, Maitre A, et al. Socioeconomic inequalities in hypertension prevalence and care: the IHPAF Study. Hypertension. 2002 Jun;39(6):1119-25.

[17] Lecomte P, Vol S, Caces E, Lasfargues G, Combe H, Laurent S, et al. Impaired fasting glycaemia and undiagnosed diabetes: prevalence, cardiovascular and behavioural risk factors. Diabetes & metabolism. 2002 Sep;28(4 Pt 1):311-20.

[18] National Health Survey 1998. Das Gesundheiswesen. 1999 [cited 05 June 2008]; Available from: http://www.rki.de/cln_100/nn_216482/EN/Content/Health__Reporting/NationalSurvey/the__health__care__system,templateId=raw,property=publicationFile.pdf/the_health_care_system.pdf

[19] KiGGS - The German Health Interview and Examination Survey for Children and Adolescents. 2007 [cited 05 June 2008]; Available from: http://www.kiggs.de/service/english/index.html

[20] Pitsavos C, Panagiotakos DB, Chrysohoou C, Stefanadis C. Epidemiology of cardiovascular risk factors in Greece: aims, design and baseline characteristics of the ATTICA study. BMC public health. 2003 Oct 20;3:32.

[21] Efstratopoulos AD, Voyaki SM, Baltas AA, Vratsistas FA, Kirlas DE, Kontoyannis JT, et al. Prevalence, awareness, treatment and control of hypertension in Hellas, Greece: the Hypertension Study in General Practice in Hellas (HYPERTENSHELL) national study. Am J Hypertens. 2006 Jan;19(1):53-60.

[22] Sigurdsson E, Thorgeirsson G, Sigvaldason H, Sigfusson N. Prevalence of coronary heart disease in Icelandic men 1968-1986. The Reykjavik Study. European heart journal. 1993 May;14(5):584-91.

[23] SLÁN Survey of Lifestyle, Attitudes and Nutrition. [cited 05 June 2008]; Available from: www.slan06.ie

[24] The Italian Cardiovascular Epidemiological Observatory. Ital Heart J. 2004;5(Suppl 2):49S-93S.

[25] Maggi S, Zucchetto M, Grigoletto F, Baldereschi M, Candelise L, Scarpini E, et al. The Italian Longitudinal Study on Aging (ILSA): design and methods. Aging (Milan, Italy). 1994 Dec;6(6):464-73.

[26] Centers for Diseasae Control and Prevention. International Health Data Reference Guide 2003. 2005 [cited 12 May 2008]; Center for Disease Control and Prevention, National Center for Health Statistics. Available from: http://www.cdc.gov/nchs/data/misc/ihdrg2003.pdf

[27] FINBALT Health Monitor. 2008 [cited 05 June 2008]; Available from: http://www.ktl.fi/portal/287

[28] van't Hof M, Truin GJ, Kalsbeek H, Burgersdijk R, Visser R, Heling G. The problem of participation in the Dutch National Dental Survey. Community dentistry and oral epidemiology. 1991 Apr;19(2):57-60.

[29] Engeland A, Sogaard AJ. COHOR (COhort NORway) en oversikt over en unik forskningsdatabank. Norsk Epidemiologi. 2003;13(1):73-7.

[30] Schabowski J. Selected socio-economic features and the prevalence of peptic ulcer among Polish rural population. Ann Agric Environ Med. 2002;9(1):79-84.

[31] Aranceta J, Perez-Rodrigo C, Serra-Majem L, Ribas L, Quiles-Izquierdo J, Vioque J, et al. Influence of sociodemographic factors in the prevalence of obesity in Spain. The SEEDO'97 Study. European journal of clinical nutrition. 2001 Jun;55(6):430-5.

[32] Banegas JR, Rodriguez-Artalejo F, de la Cruz Troca JJ, Guallar-Castillon P, del Rey Calero J. Blood pressure in Spain: distribution, awareness, control, and benefits of a reduction in average pressure. Hypertension. 1998 Dec;32(6):998-1002.

[33] Carmona L, Ballina J, Gabriel R, Laffon A. The burden of musculoskeletal diseases in the general population of Spain: results from a national survey. Annals of the rheumatic diseases. 2001 Nov;60(11):1040-5.

[34] Schroder H, Ferrandez O, Jimenez Conde J, Sanchez-Font A, Marrugat J. Cardiovascular risk profile and type of alcohol beverage consumption: a population-based study. Annals of nutrition & metabolism. 2005 Mar-Apr;49(2):100-6.

[35] Lagergren M, Fratiglioni L, Hallberg IR, Berglund J, Elmstahl S, Hagberg B, et al. A longitudinal study integrating population, care and social services data. The Swedish National study on Aging and Care (SNAC). Aging clinical and experimental research. 2004 Apr;16(2):158-68.

[36] Romelsjo A, Haglund BJ, Diderichsen F, Hallqvist J, Holland S, Nordstrom G, et al. Participation of primary health care personnel in the Stockholm Health of the Population Study--a preliminary report. Scandinavian journal of primary health care. 1988;1:97-103.

[37] Wilhelmsen L, Berglund G, Elmfeldt D, Samuelsson O, Svardsudd K. The Multifactor Primary Prevention Trial in Goteborg, Sweden. Comparison with a previously untreated population sample. Drugs. 1986;31 Suppl 1:47-51.

[38] Nilsson PM, Nilsson JA, Berglund G. Population-attributable risk of coronary heart disease risk factors during long-term follow-up: the Malmo Preventive Project. Journal of internal medicine. 2006 Aug;260(2):134-41.

[39] Galobardes B, Costanza MC, Bernstein MS, Delhumeau C, Morabia A. Trends in risk factors for lifestyle-related diseases by socioeconomic position in Geneva, Switzerland, 1993-2000: health inequalities persist. American journal of public health. 2003 Aug;93(8):1302-9.

[40] Sanisoglu SY, Oktenli C, Hasimi A, Yokusoglu M, Ugurlu M. Prevalence of metabolic syndrome-related disorders in a large adult population in Turkey. BMC public health. 2006;6:92.

[41] Satman I, Yilmaz T, Sengul A, Salman S, Salman F, Uygur S, et al. Population-based study of diabetes and risk characteristics in Turkey: results of the turkish diabetes epidemiology study (TURDEP). Diabetes care. 2002 Sep;25(9):1551-6.

[42] Melzer H, Gill B, Petticrew K, Hinds K. The prevalence of psychiatric morbidity among adults living in private households. OPCS Surveys of Phychiatric Morbidity in Great Britain. Report 1. London: HMSO Publications; 1985.

[43] Todd JE, Lader D. Adult Dental Health 1988, United Kingdom. London: Office of Population Censuses and Surveys, HMSO 1991.

[44] Cognitive function and dementia in six areas of England and Wales: the distribution of MMSE and prevalence of GMS organicity level in the MRC CFA Study. The Medical Research Council Cognitive Function and Ageing Study (MRC CFAS). Psychological medicine. 1998 Mar;28(2):319-35.

[45] Shaper AG, Pocock SJ, Walker M, Cohen NM, Wale CJ, Thomson AG. British Regional Heart Study: cardiovascular risk factors in middle-aged men in 24 towns. British medical journal (Clinical research ed. 1981 Jul 18;283(6285):179-86.

[46] National Statistics. General household survey. 2003 [cited 05 June 2008]; Available from: http://www.statistics.gov.uk/ssd/surveys/general_household_survey.asp

[47] Department of Health. Health Survey for England. [cited 05 June 2008]; Available from: http://www.dh.gov.uk/en/Publicationsandstatistics/PublishedSurvey/HealthSurveyForEngland/index.htm

[48] The Scottish Government Statistics. Scottish Health Survey. 2008 [cited 05 June 2008]; Available from: http://www.scotland.gov.uk/Topics/Statistics/Browse/Health/scottish-health-survey