Recommendations for the Health Examination Surveys in Europe

Edited by

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Status of this document

This is a working draft of the document. It has been circulated for comments to the FEHES Network, and it will be discussed at the Workshop on Health Examination Surveys in Luxembourg on 9-11 April 2008.

Comments are expected on issues where relevant aspects may have been missed in the preparation of the draft recommendations, such as better alternative procedures or the inapplicability of the draft recommendations in some countries. You may also point out ambiguities in the description of the recommendations, but you should not spend time on commenting the format of the presentation or errors in the use of English language at this stage. The comments are expected during April 2008.
Contents

1. Introduction 4

2. Role of Health Examination Surveys (Not available in the current version)

3. Core module and additional topics 6

4. Health examination survey models and survey organization 33
   4.1 Health examination survey models 33
   4.2 Survey organization 33
   4.2.1 Organizational responsibilities 33
   4.2.2 Fieldwork 34
   4.2.3 Periodicity and timing of the survey 39

5. Sampling and recruitment 40
   Sampling:
   5.1 The target population 41
   5.2 Sampling frames 41
   5.3 Sampling design 44
   5.4 Sample size and allocation of sample 48
   Recruitment:
   5.5 Record of contact efforts, contact and participation 51
   5.6 Recruitment (enrolment) methods 52
   5.7 Non-response analysis 55

6. Legal and ethical issues 63
   General recommendations on the ethical conduct of a HES 63
   Ethics committee 63
   The safeguarding of privacy, data protection and subjects’ rights 64
   Informed consent 64

7. Measurement protocols 71
   7.1 Introduction 71
   7.2 Height 71
   7.3 Weight 74
   7.4 Waist-hip circumferences 76
   7.5 Blood pressure 79
   7.6 Blood collection 88
   7.7 Laboratory procedures 95
   7.8 Physical functioning 96
   7.9 Ankle arm index 105
   7.10 Quality assurance 107

8. Data management, documentation and reporting 112

9. Needed resources and preparation of the survey budget 114

10. Organizing the international collaboration needed by a system of standardized European HES 119
10.1 Need for European wide collaboration 119
10.2 Organizing the international collaboration 121
1. Introduction

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On of the objectives of the Community Public Health Programme 2003-2008 of the European Union (EU) was to establish and operate a sustainable health monitoring system [Ref. Public Health Programme 2003-2008]. As a part of the implementation of the Programme, the European Health Survey System has been outlined [Ref: EHSS]. It includes a European Health Interview Survey (EHIS), coordinated by EUROSTAT, the European statistical agency, and a European Health Examination Survey (EHES), coordinated by DG Sanco, Directorate General for Health and Consumer Protection of the Commission of the EU.

The Feasibility of a European Health Examination Survey (FEHES) Project of the Public Health Programme has assessed the feasibility of an EHES, or more generally, the feasibility to conduct standardized national HESs in the European countries [Ref: FEHES Review]. It was concluded that it is feasible to carry out some form of a HES in a nationally representative sample in nearly all European countries. Furthermore, it was concluded that the standardization of HESs in the European countries should be started without delay because there are already active plans for a national HES in the next five years in 17 countries. Otherwise, the opportunity for European standardization could be missed.

The purpose of this report is to make recommendations concerning structures that will be needed in order to carry out standardized national HESs in the European countries, and to propose standards for such surveys. Recommendations are made on:

- Measurements to be included in a national HES (Chapter 3);
- Models for organizing a national HES (Chapter 4);
- Sampling and recruitment of the participants (Chapter 5);
- Legal and ethical issues (Chapter 6);
- Standardized measurement Protocols (Chapter 7);
- Data management, documentation and reporting (Chapter 8); and
- Organizing the international collaboration needed by the system of standardized European HESs (Chapter 10).

The report also gives advice to the national decision makers on the role of a HES as a source of health information (Chapter 2) and to the organizers of the HESs on the preparation of the survey budget (Chapter 9).
The recommendations are based mostly on the review of the experience from earlier HES and recent developments in the survey methods, which the FEHES Project has prepared and published separately [Ref: FEHES Review]. Before the recommendations were finalized, drafts were reviewed and discussed in a workshop to which experts were invited from all EU member states, EFTA/EEA countries, EU candidate countries, national HESs of USA and Canada, WHO, OECD, relevant projects of the Public Health Programme, and from relevant agencies and parts of the Commission of EU.

References:

[Public Health Programme 2003-2008]


[FEHES Review]
3. Core module and additional topics

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1University College London, Health and Social Surveys Research Group, London, UK

3.1 Introduction: criteria for identification of ‘core’ topics

The objectives of population Health Examination Surveys are generally to provide an instrument to enable public health policies to be effective. This, as mentioned in Chapter 2, is achieved by evaluating the frequency and the distribution of disease and health determinants in the population, considering the conditions and also their impact on the functional status of the respondent; evaluating trends over time and effectiveness of health services; estimating risk factors distribution and prevalence of high risk conditions. Focusing on general population, surveys may provide a comprehensive picture of the population’s health, highlighting problems areas and suggesting where treatment facilities are most in need of improvement.

The unique HES contribution is represented by clinical/biological measurements that can objectively assess health status and health determinants. As mentioned in the previous chapter, a HES can vary in size and complexity, from an interview with a few measurements and/or blood samples added to it, to a comprehensive health examination taking several hours to complete. The level of complexity can be dictated by different considerations, but ultimately the identification of ‘core’ topics and elements to use to best describe the health status of the population need to be evidence-based, resting on firm epidemiological and public health criteria.

In the Review Report we reviewed the health topics that are included in the national HESs carried out in Europe. This is what the evidence-base element of the recommendations is based upon, because the inclusion in previous national surveys constitutes an important element to consider when choosing those topics that will contribute to form an international survey. Some of the criteria adopted at the national level are largely reflected in those formally expressed in the ECHI project. The ECHI project was set up to develop health indicators (see list in Chapter 2, Appendix 1, Table 1) that could be used to provide comparable information on health in Europe. Using these criteria it is possible to identify core indicators for a European HES. The selection of the ECHI indicators is based on principles stating that the indicators should be:
- Comprehensive;
- Meeting user needs;
- Using earlier work (e.g. WHO, OECD work in the area of indicators selection and definition);
- Being innovative;
- Using Health Monitoring Programme and Public Health Programme results.
Inherent in these criteria is the fact that the identification of indicators cannot be considered a fixed, ‘once and for all’ process. Flexibility needs to be applied so that topics emerging with time can be identified and incorporated in future surveys.

In accordance with the ECHI list the following four key areas are identified for inclusion in a HES aiming at collecting internationally comparable information on health:
- demographic and socioeconomic factors;
- health status/disease;
- health determinants/health related behaviours;
- health interventions/health systems.

According to what described in the Review Report we can conclude that these four key areas also represent the main elements included in the national HESs.

Priorities on core topics to include are based on the objectives and criteria adopted by the Public Health Programme in developing health indicators. Within the four key areas, in accordance with the ECHI shortlist indicators and the review of the most common elements included in previous national HESs, the following indicators should be considered for inclusion:

1. Demographic and socio-economic factors:
   - age, sex, occupation, education.

2. Health status/diseases:
   - perceived general health,
   - limitations in physical functions/usual activities,
   - psychological distress,
   - general musculoskeletal pain,
   - specific disease/conditions: CVD, diabetes, mental health, respiratory disease (asthma, COPD), occurrence of other chronic illnesses.

3. Health determinants/health related behaviour:
   - smoking,
   - alcohol consumption,
   - consumption of fruit and vegetables,
   - physical activity,
   - social support.

4. Health interventions/health systems:
   - use of health services (for specific health conditions and general),
   - medicine use (for specific health conditions and general).

To objectively assess health status and health determinants the unique HES contribution is represented by biological measurements. The measurements need to be supported by the information collected by ways of the questionnaire, and could include: blood pressure, height, weight, waist circumference, blood samples (non-fasting and fasting), a saliva sample (cotinine), a urine sample (cotinine, glucose), respiratory function, ECG, walking speed test, vision test, hand grip test, bone density, physical fitness test.
In order to provide useful information, surveys must use standardized procedures and methods, meeting certain methodological and quality criteria, e.g. validity, sensitivity, timeliness. This allows:
- to identify changes in the natural history of the disease;
- to avoid biases (e.g. from diagnostic fashions and changes in coding practices or in measurement procedures);
- to collect extensive information on events allowing in depth analyses, like monitoring use of treatments, diagnostic tools etc;
- to ensure data comparability between different populations and different time points;
- to ensure data comparability with other surveys.

The criteria that have guided in the identification and prioritisation of the ‘core’ topics to include in a European HES are (in no particular order):
- Inclusion in previous national HESs;
- Availability of international standards;
- Clear interpretation of the results;
- Practicality/easy to administer;
- Acceptability to the respondent;
- Costs.

Ethical acceptability is obviously also a basic criteria. Ethical issues concerning HESs are dealt with in Chapter 6.

Based on the criteria stated above, a basic set of questions and examinations (‘core’ topics) that are considered the first step for an international HES can be proposed; in addition, several modules are proposed on topics that could be of local interest or specifically address population subgroups and could be included increasing layers of complexity on the basis of user needs and available resources.

The ratings (+++, +++, +), according to the criteria listed above, for the HES component of the survey are illustrated in the Table below (Table 3.1).

<table>
<thead>
<tr>
<th></th>
<th>Inclusion in previous national HESs</th>
<th>Practicality</th>
<th>Acceptability</th>
<th>Low cost</th>
<th>International standards availability</th>
<th>Clear interpretation of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Weight</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>WC</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>BP</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Blood sample</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>*</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Physical fitness test</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lung function test</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Physical</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 3.1. Criteria for inclusion in a ‘core’ HES.
### 3.2 ‘Core’ and additional measurements and questions

The Table below (Table 3.2) summarises the elements of a ‘core’ set of topics, based on the criteria illustrated above, and additional topics that can be inserted as modules relevant to specific subgroups (e.g. age, ethnic groups or other subpopulations of regional/local interest).

Practicalities need to be considered about the survey administration, about the length of the questionnaire and the measurements, and about the periodicity of the survey. These are addressed in details in Chapter 4. All these considerations will impact on the definition of the ‘core’ and additional modules for a European HES. A minimum set of questions could be included in a short module, with a long, more detailed module over a longer span of time, for example every 10 years. A health survey cycle could be envisaged, by which each topic of interest is periodically repeated (periodicity may vary according to national/internationally set criteria). Flexibility needs to be built in the process, to allow for new and emerging public health issues to be covered. The model we propose assumes the individual (interviewer-administered, CAPI) questionnaire to take about 1 hour on average to complete; and the measurements to also take about 1 hour. Evidence suggests that longer surveys are less acceptable to respondents. (See Review Report for discussion and references)

Table 3.2. Proposed HES and HIS components of a European Health Examination Survey.
### 3.3 HES measurements: examinations and questions

The concept described below suggests that countries wishing to follow this protocol should definitely have the ‘core’ measurements (section 3.3.1 and 3.3.2) in their survey plan. Section 3.3.3 and 3.3.4 gives the possible other measurements and suggested protocols that can be added to ‘fit’ the focus of the countries survey aim.

**Core measurements suggestions are:**

<table>
<thead>
<tr>
<th>Level of recommendation</th>
<th>HES component</th>
<th>HIS component</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Core’</td>
<td>• Height</td>
<td>• Age</td>
</tr>
<tr>
<td></td>
<td>• Weight</td>
<td>• Sex</td>
</tr>
<tr>
<td></td>
<td>• Waist circumference</td>
<td>• Education</td>
</tr>
<tr>
<td></td>
<td>• Blood pressure</td>
<td>• [Occupation/Income]</td>
</tr>
<tr>
<td></td>
<td>• Blood sample (non-fasting, eg. for total-, HDL-cholesterol…)</td>
<td>• General health/ general health status</td>
</tr>
<tr>
<td></td>
<td>• Fasting blood sample (e.g. for glucose)</td>
<td>• CVD</td>
</tr>
<tr>
<td></td>
<td>• Physical activity</td>
<td>• Hypertension</td>
</tr>
<tr>
<td></td>
<td>• Drinking</td>
<td>• Hyper/dyslipidemia</td>
</tr>
<tr>
<td></td>
<td>• Use of health services (general)/ medication</td>
<td>• Diabetes</td>
</tr>
<tr>
<td></td>
<td>• Social support</td>
<td>• Smoking</td>
</tr>
<tr>
<td></td>
<td>• Psychological distress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Respiratory disease (e.g. COPD, asthma)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of health services (for specific conditions)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of medications (for specific conditions)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of contraception and HRT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Diet: fruit &amp; vegetable consumption*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mental health*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Oral health*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Other items pertaining to research questions at local level</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other additional topics (not listed in order of importance)</th>
<th>HES component</th>
<th>HIS component</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Hip circumference</td>
<td></td>
<td>• Physical activity</td>
</tr>
<tr>
<td>• Ankle/ brachial index</td>
<td></td>
<td>• Drinking</td>
</tr>
<tr>
<td>• Physical fitness test</td>
<td></td>
<td>• Use of health services</td>
</tr>
<tr>
<td>• Lung function test</td>
<td></td>
<td>(general)/ medication</td>
</tr>
<tr>
<td>• Physical performance/ functional test (e.g. walking speed test, vision test, hearing test, hand grip test)</td>
<td></td>
<td>• Social support</td>
</tr>
<tr>
<td>• Cognitive function test</td>
<td></td>
<td>• Psychological distress</td>
</tr>
<tr>
<td>• ECG</td>
<td></td>
<td>• Respiratory disease</td>
</tr>
<tr>
<td>• Urine sample (glucose, cotinine)</td>
<td></td>
<td>(e.g. COPD, asthma)</td>
</tr>
<tr>
<td>• Saliva sample (alternative for cotinine)</td>
<td></td>
<td>• Use of health services (for specific conditions)</td>
</tr>
<tr>
<td>• Bone density</td>
<td></td>
<td>• Use of medications (for specific conditions)</td>
</tr>
<tr>
<td>• Other items pertaining to research questions at local level</td>
<td></td>
<td>• Use of contraception and HRT</td>
</tr>
</tbody>
</table>

*Note: for oral health, nutrition, mental health specific EU working groups are operational.*
3.3.1 Examinations:
- Measured height
- Measured weight
- Measured waist
- Blood pressure
- Blood sample:
  - Fasting
  - Non-fasting

Measurement protocols are illustrated in Chapter 7.

3.3.2 Questions:
This will be based on an administered-questionnaire format. Where available, existing EHIS questions are presented. Otherwise alternative suggestions are presented for areas where it is felt that more detailed questions should be asked.
- Age
- Sex
- Education
- [Occupation/Income]
- General health; general health status
- CVD
- Hypertension
- Hyper/dyslipidemia
- Diabetes
- Smoking

Additional measurements:

3.3.3 Examinations

- Physical fitness test
- Physical performance/functional test (e.g. walking speed test, vision test, hearing test, hand grip test)
- Ankle Brachial Pressure Index
- Hip measurement
- Lung Function
- Cognitive function test
- ECG
- Urine sample (e.g. glucose, cotinine)
- Bone density
- Oral health examination

3.3.4 Questions

- Drinking
- Physical activity
- Nutrition interview
- Psychological distress
- Use of health services (general/for specific conditions)
- Use of medications (general/for specific conditions)
- Mental health
- Oral health
- Social support

### 3.4 CORE RECOMMENDATION
The proposed approach is to include a basic ‘core’ level that we suggest should be measured for all countries. This includes the examinations and questions, based on the review of existing HES/HIS surveys in the EU countries and member states. This proposed model gives suggested methods that already exist in these countries. However, these may be different between countries and will need to be standardised and harmonised at European level to ensure comparability of results. The build-up of the countries HES depends on the research question or survey focus. Some suggestions are given below.

Based on existing HES research questions in European surveys, a theoretical approach could be:

**E.g 1. Risk for cardiovascular disease**
- **CVD focus**
  - ‘Core’ measurements plus:
    - Physical activity
    - ECG
    - Eating habit and fruit and vegetable module

**E.g. 2. The health of older people**
- ‘Core’ measurements plus:
  - Functional tests
  - Physical activity
  - Eating habits

The proposed approach constitutes a model designed to obtain a basic level of health information for all countries. More sections/modules could be added according to local interests in different countries.

Where applicable the EHIS questions should be used for the HIS component of the survey. The EHIS questions are presented in blue in the following sections.

### 3.5 MINIMUM CORE LEVEL

#### 3.5.1 Examinations (and corresponding questions):
1. Height
2. Weight
3. Waist circumference
4. Blood Pressure - Measurement of blood pressure and awareness of hypertension  
5. Non fasting blood sample (e.g. for measurement of cholesterol, glucose and awareness of hypercholesterolemia, high blood glucose). 
6. Fasting blood sample – e.g. glucose. This could be measured in a sub-group of participants only.

3.5.1.1 Height and weight  
Specific information about the measurements (including measurement protocol) is in chapter 7. For height and weight the best method is to get the interviewer/nurse to take the measurement. Using self-reported height and weight should be avoided because of reliability problems.

3.5.1.2 Blood pressure/ Hypertension  
The criterion of the blood pressure/ hypertension section is to focus on awareness and treatment of hypertension. The questions for this section are in chapter 7. (See also Section 1.3.11 on medications).  
Cut offs for hypertension need to be based on international recommendations.

3.5.1.3 Fasting blood sample  
A fasting blood sample is needed for the measurement of triglycerides, LDL cholesterol and glucose. Rational for taking this measurement is given in Chapter 7, with details on methodology for taking blood both fasting and non-fasting.

3.5.1.4 Non fasting blood  
A non-fasting blood sample is the minimum requirement; this will be used to measure total cholesterol, HDL cholesterol and glucose (non-fasting).  
The questions to complement the HES assess awareness and treatment of hypercholesterolemia and diabetes. They are included in Chapter 7.

3.6 ‘Core’ questions.

Some countries may have the possibility to link the survey data with registry data, in which case the information on socio-demographic characteristics may be available through linkage with registry data. However, data linkage is not available in all countries and confidentiality reasons may limit their use. It is therefore recommended that the sections on household income and occupation be included in the HES. The sections below include the recommended questions on demographic, socio-economic factors, and health status, recommended for inclusion in the ‘core’.

3.6.1 Age  

(Modified from EHIS)  
INTERVIEWER: THIS PART WILL BE ASKED TO THE HOUSEHOLD REFERENCE PERSON OR SPOUSE/PARTNER IN CASE OF A SAMPLE OF HOUSEHOLDS OR TO THE SELECTED PERSON IN CASE OF A SAMPLE OF INDIVIDUALS.  
Introduction  
First, I would like to ask you some questions about your household.
HH.1 How many persons live in the household, including yourself?

_____ persons

HH.2 How many of these persons are less than 18 years of age?

_____ persons

3.6.2 Sex
Of the participant.

3.6.3 Education

HH.7 What is the highest education leaving certificate, diploma or education degree you have obtained? Please include any vocational training.
  - no formal education or below ISCED 1 _ 1
  - primary education (ISCED 1) _ 2
  - lower secondary education (ISCED 2) _ 3
  - upper secondary education (ISCED 3) _ 4
  - post-secondary but non-tertiary education (ISCED 4) _ 5
  - first stage of tertiary education (ISCED 5) _ 6
  - second stage of tertiary education (ISCED 6) _ 7

The response categories should be named according to the educational system of the country.

It is recommended that to this question a question from EHRM¹ should be added:
  - How many years in total have you spent in school or in full-time study?

3.6.4 Occupation

Introduction
Now I'm going to ask you some questions about your current labour situation.

HH.8 How would you define your current labour status?
  - working for pay or profit (including unpaid work for a family business or holding, including an apprenticeship or paid traineeship, including currently not at work due to maternity, parental, sick leave or holidays) _ 1 → GO TO FILTER 2
  - unemployed _ 2
  - pupil, student, further training, unpaid work experience _ 3
  - in retirement or early retirement or has given up business1 _ 4
  - permanently disabled² _ 5
  - in compulsory military or community service _ 6
  - fulfilling domestic tasks _ 7
  - other. Please specify: ______ ______ ______ ______ __ 8

HH.9 Have you ever worked for pay or profit?
  - Yes _ 1
  - No _ 2 → GO TO HS.1 (NEXT MODULE)

FILTER 2
INTERVIEWER: IF HH.8 = 1 ASK FOR CURRENT MAIN JOB,
IF HH.9 = 1 ASK FOR PREVIOUS MAIN JOB.
1 Except for disability or health reasons. ² Including longstanding illness or health problem.

HH.10 Are (Were) you an employee, self-employed or working without payment as a
family worker?
  · employee _ 1
  · self-employed _ 2 → GO TO HH.12
  · family worker _ 3 → GO TO HH.12

HH.11 What type of work contract do (did) you have?
  · permanent job/work contract of unlimited duration _ 1
  · temporary job/work contract of limited duration _ 2

HH.12 In your (main) job do (did) you work full-time or part-time?
  · full-time _ 1
  · part-time _ 2

HH.13 What is (was) your occupation in this job?
Job title: ____________
Describe what do (did) you mainly do in your job:
└─┴─┘
(ISCO-88 COM, 2 digits)

HH.14 What does (did) the business/organisation mainly produce or do at the place where you work (worked) (e.g. chemical, fishing, hotel/restaurant, health and social work, etc.)?
DESCRIBE FULLY - PROBE MANUFACTURING OR PROCESSING OR DISTRIBUTING ETC. AND MAIN GOODS PRODUCED, MATERIALS USED, WHOLESALE OR RETAIL ETC.
└─┴─┘
(NACE Rev.2, 2 digits)

3.6.5 Income
Income is a better indicator of socioeconomic status than occupation. It is therefore recommended that the survey include questions on household income. Given the perceived sensitivity of this topic in some countries, these questions could be asked at the end of the survey, or in a self-completion section.

EUROPEAN BACKGROUND VARIABLES MODULE
SECOND PART

INTERVIEWER: NEXT QUESTIONS WILL BE ASKED TO THE:
- HOUSEHOLD REFERENCE PERSON OR SPOUSE/PARTNER IN THE CASE OF A SAMPLE OF HOUSEHOLDS
- INTERVIEWED PERSON IN THE CASE OF A SAMPLE OF INDIVIDUALS

Introduction
I would like to ask some questions about the income of your household.

IN.1 This card shows various possible sources of income. Can you please tell me which kinds of income you and the other members of your household receive?

INTERVIEWER: HAND SHOWCARD 11; THE SOURCES OF INCOME FOR EACH HOUSEHOLD MEMBER SHOULD BE SEPARATELY REPORTED. MULTIPLE ANSWERS ARE POSSIBLE
IN.2 Thinking of the sources you have mentioned before for you and the other members of your household, do you know what is your household's total net monthly income (that is after deductions for tax, National Insurance etc.)?

· Yes _ 1
· No _ 2 → GO TO IN.4
· refusal _ 9

IN.3 What is your household's total net income per month?

· Amount [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] (national currency) → END OF INTERVIEW
· Refuse to answer _ 9999999

INTERVIEWER PROMPT ONLY IF NECESSARY "AN ESTIMATE IS ACCEPTABLE".

IN.4 Perhaps you can provide the approximate range instead. Would you (please look at this card and) tell me which group represents your household's total net monthly income from all these sources after deductions for income tax, National Insurance etc. Is it ...

INTERVIEWER: HAND SHOWCARD 12(N.B. THE VALUES OF THE DECILES’ LIMITS FOR EACH MEMBER STATE COULD BE TAKEN FROM A NATIONAL SURVEY ON INCOME, SUCH AS EU-SILC SURVEY)

· below 1st decile _ 01
· between 1st decile and 2nd decile _ 02
· between 2nd decile and 3rd decile _ 03
· between 3rd decile and 4th decile _ 04
· between 4th decile and 5th decile _ 05
· between 5th decile and 6th decile _ 06
· between 6th decile and 7th decile _ 07
· between 7th decile and 8th decile _ 08
· between 8th decile and 9th decile _ 09
· above 9th decile _ 10
· Refuse to answer _ 99

END OF INTERVIEW

3.6.6 General health/health status

EUROPEAN HEALTH STATUS MODULE
Introduction
I would now like to talk to you about your health.

**HS.1 How is your health in general? Is it…**
RUNNING PROMPT
· very good _ 1
· good _ 2
· fair _ 3
· bad _ 4
· very bad? _ 5
· don't know¹ _ 8
· refusal _ 9

**HS.2 Do you have any longstanding illness or [longstanding]² health problem? [By longstanding I mean illnesses or health problems which have lasted, or are expected to last, for 6 months or more]².**
· Yes _ 1
· No _ 2
· don't know _ 8
· refusal _ 9

¹ In all questions, answers such as "don't remember" and "not sure" are covered by the response category "don't know".
² This word / sentence is not part of the MEHM and shall not be considered as included in this question. However, according to the remarks that were received, in some languages it may be necessary to include them. In these languages, it would be useful to test first the effect of this addition to the question. Depending on results, the word / sentence may be added to the
national question or only included in the instructions for the interviewers, etc. However, this has to be done very soon, as the coordination with SILC shall be ensured within a very short time.

HS.3 For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been …

**RUNNING PROMPT**

- severely limited _ 1
- limited but not severely or _ 2
- not limited at all? _ 3
- don't know _ 8
- refusal _ 9

Introduction 2

Here is a list of diseases or conditions.

**HS.4 Do you have or have you ever had any of the following diseases or conditions?**

  - Yes _ 1
  - No _ 2
  - don't know _ 8
  - refusal _ 9

**INTERVIEWER: HAND SHOWCARD 1. RESPONDENT TO READ OUT ONLY THE CATEGORIES THAT APPLY TO HIM/HER, CODE ALL CATEGORIES AND FOR EACH DISEASE / HEALTH PROBLEM REPORTED ASK HS.5 AND HS.6. IF NO DISEASE / HEALTH PROBLEM IS REPORTED (CODES 2, 8 OR 9) GO TO QUESTION HS.7.**

**HS.5 Was this disease/condition diagnosed by a medical doctor?**

  - Yes _ 1
  - No _ 2
  - don't know _ 8
  - refusal _ 9

**HS.6 Have you had this disease/condition in the past 12 months?**

  - Yes _ 1
  - No _ 2
  - don't know _ 8
  - refusal _ 9

Showcard 1 covers: HS.4 HS.5 HS.6

Asthma (allergic asthma included) [] [] []
Chronic bronchitis, chronic obstructive pulmonary disease, emphysema [] [] []
Myocardial infarction [] [] []
Coronary heart disease (angina pectoris) [] [] []
High blood pressure (hypertension) [] [] []
Stroke (cerebral haemorrhage, cerebral thrombosis) [] [] []
Rheumatoid arthritis (inflammation of the joints) [] [] []
Osteoarthritis (arthrosis, joint degeneration) [] [] []
Low back disorder or other chronic back defect [] [] []
Neck disorder or other chronic neck defect [] [] []
Diabetes [] [] []
Allergy, such as rhinitis, eye inflammation, dermatitis, food allergy or other (allergic asthma excluded) 
Stomach ulcer (gastric or duodenal ulcer) 
Cirrhosis of the liver, liver dysfunction 
Cancer (malignant tumour, also including leukaemia and lymphoma) 
Severe headache such as migraine 
Urinary incontinence, problems in controlling the bladder 
Chronic anxiety 
Chronic depression 
Other mental health problems 
Permanent injury or defect caused by an accident

Countries, which for national purposes, might be interested to add new diseases or conditions should include them at the end of the list above.

3.6.7 Smoking

Questions on smoking are relevant to the ‘core’ survey, given the link between smoking and general health and cardiovascular health. In the EHIS information on smoking is collected through a self-completion questionnaire. Depending on the nature of the HES (face-to-face or in the home environment) this information can be collected by an interviewer or a self-completion form. The questions below are referring to the self-completion form.

SELF-COMPLETION FORM

The questions have to be answered personally. Before giving an answer, read attentively the question and its response categories. Place an X in one box that best describes your answer to each question or write figures in the open boxes. Instructions following the sign "→" near a box indicate the question to which you should go after marking the answer into that box. In case that the marked box is not followed by the sign "→", you should go to the next question.

Mark one box per question, unless suggested otherwise (i.e. ‘more answers are possible’). Your answers will remain confidential so please be honest.

Questions on smoking

SK.1 Do you smoke at all nowadays?
· Yes, daily _ 1
· Yes, occasionally _ 2 → GO TO SK.4
· Not at all _ 3 → GO TO SK.4

SK.2 What tobacco product do you smoke each day?
More answers are possible
· Manufactured cigarettes _ 1
· Hand-rolled cigarettes _ 2
· Cigars _ 3
· Pipefuls of tobacco _ 4
· Other _ 5

SK.3 On average, how many cigarettes, cigars or pipefuls do you smoke each day?
Manufactured cigarettes
Hand-rolled cigarettes
Cigars → GO TO SK.5
Pipefuls of tobacco
Other

SK.4 Have you ever smoked (cigarettes, cigars, pipes) daily, or almost daily, for at
least one year?
· Yes _ 1
· No _ 2 → GO TO SK.6

SK.5 For how many years have you smoked daily? Count all separate periods of smoking daily. If you don’t remember the exact number of years, please give an estimate.

_______ years

3.7 LIST OF ADDITIONAL SUGGESTED MEASUREMENTS
Additional suggested measurements could be included, when the main aim of the HES is to investigate a specific health topic, or specific subpopulation of interest (e.g. the elderly). The examinations could cover:

1. Physical fitness test (objective measure e.g. step test)
2. Physical performance/functional test
   I. Walking speed test (objective measure test)
   II. Hand grip strength (objective measure test)
   III. Other objective measure tests, for a particular subgroup of the population e.g. elderly
   IV. Functional capacity
3. Ankle Brachial Pressure Index
4. Urine sample (e.g. glucose, cotinine): spot urine collection or 24-hour
5. Saliva – swab or small collection in tube (alt to cotinine)
6. Hip measurement
7. Lung function
8. Oral health
9. Bone density

Methodology and protocol details are described in Chapter 7.

Additional questions are listed below:

1. Alcohol
2. Physical activity
3. Nutrition interview (e.g. fruit and vegetable consumption)
4. Social support
5. Psychological distress
6. Respiratory disease (e.g. COPD, asthma)
7. Mental health
8. Use of health services (general/for specific conditions)
9. Use of medication (general/for specific conditions)
10. Oral health

3.7.1 Alcohol consumption
This topic may be relevant in some instances, for example in a CVD survey, to assess behaviours and risk factors for obesity, hypertension and CVD.

Questions on drinking alcohol
Introduction
The following questions are about your use of alcoholic beverages during the past 12 months.

AL.1 During the past 12 months, how often have you had an alcoholic drink of any kind (that is beer, wine, spirits, liqueurs or other alcoholic beverages)?
Never _ 1, GO TO QUESTIONS ON USE OF DRUGS
Monthly or less _ 2, GO TO QUESTIONS ON USE OF DRUGS
2 to 4 times a month _ 3, GO TO AL.3
2 to 3 times a week _ 4
4 to 6 times a week _ 5
Every day _ 6

AL.2 How many drinks containing alcohol do you have each day in a typical week when you are drinking? Start with Monday and take one day at a time.

<table>
<thead>
<tr>
<th></th>
<th>No. of drinks</th>
<th>No. of drinks</th>
<th>No. of drinks</th>
<th>No. of drinks</th>
<th>No. of drinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Thursday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Friday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Saturday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
<tr>
<td>Sunday</td>
<td>Beer</td>
<td>Wine</td>
<td>Liqueur</td>
<td>Spirits</td>
<td>Other local alcoholic beverage</td>
</tr>
</tbody>
</table>

Each country has to indicate the meaning of drink^2 for each type of alcoholic beverage, knowing that 1 drink contains 10 g of pure alcohol

^1 Shall be replaced by the name of a specific local alcoholic beverage.
^2 Serve sizes or container sizes, as well as the strength of the beverages might differ from a country to another.

Therefore, it is proposed that each country defines a 'drink' on the basis of typical servings of beer, wine, liqueurs.

AL.3 During the past 12 months, how often did you have 6 or more drinks on one occasion?
· Never _ 1
· Less than monthly _ 2
· Monthly _ 3
· Weekly _ 4
· Daily or almost daily _ 5

3.7.2 Use of medications

EUROPEAN HEALTH CARE MODULE

Introduction 12
I’d now like to ask about your use of medicines or dietary supplements in the past 2 weeks.
MD.1 During the past two weeks, have you used any medicines (including dietary supplements such as herbal medicines or vitamins) that were prescribed or
recommended for you by a doctor – (for women, please also state: include also contraceptive pills or other hormones)?

- Yes _ 1
- No _ 2 → GO TO MD.3
- don't know _ 8 → GO TO MD.3
- refusal _ 9 → GO TO MD.3

**MD.2 Were they medicines for...?**

INTERVIEWER: ASK THE QUESTION AND CODE IT FOR EACH ITEM A TO O.

- Yes _ 1
- No _ 2
- don't know _ 8
- refusal _ 9

*INDIVIDUAL PROMPT*

A. Asthma

B. Chronic bronchitis, chronic obstructive pulmonary disease, emphysema

C. High blood pressure

D. Lowering the blood cholesterol level

E. Other cardiovascular disease, such as stroke and heart attack

F. Pain in the joints (arthrosis, arthritis)

G. Pain in the neck or back

H. Headache or migraine

I. Other pain

J. Diabetes

K. Allergic symptoms (eczema, rhinitis, hay fever)

L. Stomach troubles

M. Cancer (chemotherapy)

N. Depression

O. Tension or anxiety

**3.7.3 Use of health services (general/ for specific conditions)**

**EUROPEAN HEALTH CARE MODULE**

*Introduction 8*

The next set of questions is about time spent in hospital. All types of hospitals are included. Visits to emergency departments or as outpatient only should not be included.

INTERVIEWER: FOR WOMEN UP TO AGE 50 YEARS, ADD:
Also, the time spent in hospital for giving birth should not be included.

**HC.1 During the past 12 months, that is since (date one year ago), have you been in hospital as an inpatient, that is overnight or longer?**

- Yes _ 1
- No _ 2 → GO TO HC.4
- don't know _ 8 → GO TO HC.4
- refusal _ 9 → GO TO HC.4

**HC.2 How many separate stays in hospital as an inpatient have you had since (date one year ago)? Count all the stays that ended in this period.**
stays
· don't know _ 98
· refusal _ 99

HC.3 Thinking of this/these inpatient stay(s), how many nights in total did you spend in hospital?

nights
· don't know _ 998
· refusal _ 999

HC.4 During the past 12 months, that is since (date one year ago), have you been admitted to hospital as a day patient, that is admitted to a hospital bed, but not required to remain overnight?
· Yes _ 1
· No _ 2 → GO TO HC.6
· don't know _ 8 → GO TO HC.6
· refusal _ 9 → GO TO HC.6

HC.5 How many days have you been admitted as a day patient since (date one year ago)?

days
· don't know _ 998
· refusal _ 999

HC.6 During the past 12 months, was there any time when you really needed to be hospitalised following a recommendation from a doctor, either as an inpatient or a day patient, but did not?
· Yes, there was at least one occasion _ 1
· No, there was no occasion _ 2 → GO TO INTRODUCTION 9
· don't know _ 8 → GO TO INTRODUCTION 9
· refusal _ 9 → GO TO INTRODUCTION 9

HC.7 What was the main reason for not being hospitalised?
· Could not afford to (too expensive or not covered by the insurance fund) _ 1
· Waiting list, other reasons due to the hospital _ 2
· Could not take time because of work, care for children or for others _ 3
· Too far to travel / no means of transportation _ 4
· Fear of surgery / treatment _ 5
· Other reason _ 6
· don't know _ 8
· refusal _ 9

NB: EHIS HC Introduction 9 (HC question 8&9) asks about oral health. These questions have been moved to the oral health section (see below, Section 3.7.8).

Introduction 10
The next set of questions is about consultations with your general practitioner or family doctor. Please include visits to your doctor’s practice as well as home visits and consultations by telephone.

HC.10 When was the last time you consulted a GP (general practitioner) or family doctor on your own behalf?
· Less than 12 months ago _ 1
· 12 months ago or longer _ 2 → GO TO INTRODUCTION 11
· Never
  _ 3 → GO TO INTRODUCTION 11
· don't know _ 8 → GO TO INTRODUCTION 11
· refusal _ 9 → GO TO INTRODUCTION 11

HC.11 During the past four weeks ending yesterday, that is since (date), how many times did you consult a GP (general practitioner) or family doctor on your own behalf?

<table>
<thead>
<tr>
<th>times</th>
<th>[NOT AT ALL = 0]</th>
</tr>
</thead>
<tbody>
<tr>
<td>don't know _ 98</td>
<td></td>
</tr>
<tr>
<td>refusal _ 99</td>
<td></td>
</tr>
</tbody>
</table>

Introduction 11
Next questions are about consultations with medical or surgical specialists. Include visits to doctors as outpatient or emergency departments only, but do not include contact while in hospital as an in-patient or day-patient. Also include visits to doctors at the workplace or school.

HC.12 When was the last time you consulted a medical or surgical specialist on your own behalf?
· Less than 12 months ago _ 1
· 12 months ago or longer _ 2 → GO TO HC.14
· Never
  _ 3 → GO TO HC.14
· don't know
  _ 8 → GO TO HC.14
· refusal
  _ 9 → GO TO HC.14

HC.13 During the past four weeks ending yesterday, that is since (date), how many times did you consult a specialist on your own behalf?
ONLY FOR COUNTRIES WHERE THIS MAY CAUSE CONFUSION, ADD: “Visits to dental surgeons should be included. Do not include visits to general dentists”

____ times
  [NOT AT ALL = 0]
· don't know
  _ 98
· refusal
  _ 99

HC.14 Was there any time during the past 12 months when you really needed to consult a specialist but did not?
· Yes, there was at least one occasion
  _ 1
· No, there was no occasion
  _ 2 → GO TO HC.16
· don't know
  _ 8 → GO TO HC.16
· refusal
  _ 9 → GO TO HC.16

HC.15 What was the main reason for not consulting a specialist?
· Could not afford to (too expensive or not covered by the insurance fund)
  _ 01
· Waiting list, don't have the referral letter
  _ 02
· Could not take time because of work, care for children or for others
  _ 03
· Too far to travel / no means of transportation
  _ 04
· Fear of doctor / hospitals / examination / treatment
  _ 05
· Wanted to wait and see if problem got better on its own
  _ 06
· Didn’t know any good specialist
  _ 07
· Other reason
  _ 08
· don't know
  _ 98
· refusal
  _ 99

HC.16 During the past 12 months, that is since (date on year ago), have you visited on your own behalf a…?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>Don't Know</th>
<th>Refusal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical laboratory, radiology centre</td>
<td>_ 9</td>
<td>_ 1</td>
<td>_ 2</td>
</tr>
<tr>
<td>Service</td>
<td>No</td>
<td>Don't Know</td>
<td>Refusal</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>Physiotherapist / kinesitherapist</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Nurse, midwife (excluding when being hospitalised, for home care services or in a medical laboratory or radiology centre)</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dietician</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speech therapist</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiropractor, manual therapist</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Occupational therapist</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Psychologist or psychotherapist</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Other paramedics</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**HC.17 During the past 12 months, that is since (date on year ago), have you visited on your own behalf a …?**

<table>
<thead>
<tr>
<th>Service</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeopath</td>
<td></td>
</tr>
<tr>
<td>Acupuncturist</td>
<td></td>
</tr>
<tr>
<td>Phytotherapist / herbalist</td>
<td></td>
</tr>
<tr>
<td>Other alternative medicine practitioner</td>
<td></td>
</tr>
</tbody>
</table>

**HC.18 During the past 12 months, have you yourself used any of the following care services?**

<table>
<thead>
<tr>
<th>Service</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home care service provided by a nurse or midwife</td>
<td>8</td>
</tr>
<tr>
<td>Home help for the housework or for elderly people</td>
<td>8</td>
</tr>
<tr>
<td>&quot;Meals on wheels&quot;</td>
<td>2</td>
</tr>
<tr>
<td>Transport service</td>
<td>2</td>
</tr>
<tr>
<td>Other home care services</td>
<td>1</td>
</tr>
</tbody>
</table>
3.7.4 Physical Activity

It would be advisable to use an internationally well-validated questionnaire to measure physical activity. There are national experts and survey experience in several European countries, not least from validation projects that aim at comparing questionnaire data with objective measurement of physical activity (e.g. see the Alpha project). But work may still be needed in order to establish a method for comparable data across Europe. The results should be comparable over decades, so that time trends can be studied. Furthermore, it should be noted that all the objective methods are rather resource-demanding and have usually been applied in small materials or subgroups of larger studies. The instrument below is from the EHIS.

EUROPEAN HEALTH DETERMINANTS MODULE

Introduction 22
Now I am going to ask you about the time you spent being physically active in the past 7 days. Please answer each question even if you do not consider yourself to be an active person. Think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. Think about all the vigorous activities which take hard physical effort that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time.

PE.1 During the past 7 days, on how many days did you do vigorous physical activities?

\[\begin{array}{l}
\text{Days per week} \\
\quad \text{don't know} & 8 \\
\quad \text{refusal} & 9
\end{array}\]

INTERVIEWER CLARIFICATION: THINK ONLY ABOUT THOSE PHYSICAL ACTIVITIES THAT YOU DO FOR AT LEAST 10 MINUTES AT A TIME.

INTERVIEWER NOTE: IF RESPONDENT ANSWERS ZERO, REFUSES OR DOES NOT KNOW, SKIP TO QUESTION PE.3. OTHERWISE ASK PE.2.

PE.2 During the past 7 days, how much time did you spend doing vigorous physical activities?

\[\begin{array}{l}
\end{array}\]

INTERVIEWER PROMPT ONLY IF NECESSARY "AN ESTIMATE IS ACCEPTABLE".

\[\begin{array}{l}
\text{hours} & \text{minutes} \\
\quad \text{don't know} & 98 & 98 \\
\quad \text{refusal} & 99 & 99
\end{array}\]

Now think about activities which take moderate physical effort that you did in the past 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking. Again, think about only those physical activities that you did for at least 10 minutes at a time.

PE.3 During the past 7 days, on how many days did you do moderate physical activities?

\[\begin{array}{l}
\end{array}\]
INTERVIEWER CLARIFICATION: THINK ONLY ABOUT THOSE PHYSICAL ACTIVITIES THAT YOU DO FOR AT LEAST 10 MINUTES AT A TIME.

INTERVIEWER NOTE: IF RESPONDENT ANSWERS ZERO, REFUSES OR DOES NOT KNOW, SKIP TO QUESTION PE.5. OTHERWISE ASK PE.4.

PE.4 During the past 7 days, how much time did you spend doing moderate physical activities?

INTERVIEWER PROMPT ONLY IF NECESSARY "AN ESTIMATE IS ACCEPTABLE".

<table>
<thead>
<tr>
<th>Hours</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>98</td>
<td>99</td>
</tr>
</tbody>
</table>

Now think about the time you spent walking in the past 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

PE.5 During the past 7 days, on how many days did you walk for at least 10 minutes at a time?

<table>
<thead>
<tr>
<th>Days per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
</tbody>
</table>

INTERVIEWER CLARIFICATION: THINK ONLY ABOUT THE WALKING THAT YOU DO FOR ATLEAST 10 MINUTES AT A TIME.

INTERVIEWER NOTE: IF RESPONDENT ANSWERS ZERO, REFUSES OR DOES NOT KNOW, SKIP TO INTRODUCTION 23. OTHERWISE ASK PE.6.

PE.6 During the past 7 days, how much time did you spend walking?

INTERVIEWER PROMPT ONLY IF NECESSARY "AN ESTIMATE IS ACCEPTABLE".

<table>
<thead>
<tr>
<th>Hours</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>98</td>
<td>99</td>
</tr>
</tbody>
</table>

3.7.5 Nutrition interview

Conclusions and recommendations from a European project (EFCOSUM) within the European Health Monitoring Programme were published in 2002. A minimum list of dietary indicators was identified. 24 hours’ recall to be conducted twice was found to be the most suitable method. Analysis of biomarkers for folate, vitamin D, iron, iodine and sodium was recommended. The project proposed the establishment of a European coordinating centre.2

A minimum set of questions, to assess fruit and vegetable consumption, from the EHIS, is listed below. These questions do not allow checking whether informants eat 5 or more
portions/day. If local policy focus is on ‘5 a day’ consumption further question to assess attainment of this threshold must be included.

**EUROPEAN HEALTH DETERMINANTS MODULE**

Next questions concern the consumption of fruits and vegetables

**FV.1 How often do you eat fruits (excluding juice)?**

- Twice or more a day _1
- Once a day _2
- Less than once a day but at least 4 times a week _3
- Less than 4 times a week, but at least once a week _4
- Less than once a week _5
- Never _6
- don't know _8
- refusal _9

**FV.2 How often do you eat vegetables or salad (excluding juice and potatoes)?**

- Twice or more a day _1
- Once a day _2
- Less than once a day but at least 4 times a week _3
- Less than 4 times a week, but at least once a week _4
- Less than once a week _5
- Never _6
- don't know _8
- refusal _9

**FV.3 How often do you drink fruit- or vegetable - juice?**

- Twice or more a day _1
- Once a day _2
- Less than once a day but at least 4 times a week _3
- Less than 4 times a week, but at least once a week _4
- Less than once a week _5
- Never _6
- don't know _8
- refusal _9
3.7.6 Social Support

**EUROPEAN HEALTH DETERMINANTS MODULE**

Introduction 24

Next questions concern the environment where you live and work and social support.

**EN.4 How many people are so close to you that you can count on them if you have serious personal problem?**

- None _1
- 1 or 2 _2
- 3 to 5 _3
- More than 5 ___4
- don't know ___8
- refusal ___9

3.7.7 Mental Health

A two-year action project to establish the indicators for mental health monitoring in Europe started in 1999 under the sponsorship of the EC Health Monitoring Programme. A pilot project was performed in five countries. The CIDI-SF indicators for major depression and for generalised anxiety were used, together with instruments covering suicide attempts, psychological distress, sense of mastery, positive mental health, social support, lack of social ties, life events and demand and use of services.

The authors concluded in their publication that the set of indicators “could easily be incorporated into general health surveys, as the interviews conducted were not time-consuming.” However, this pilot did not include population representative samples, as phone number databanks were used for sampling, and the rates of non-contact and of refusal were rather high. With refusal rates of 25% in Germany and 61% in Norway, 68% non-availability or refusal in France and no data on non-response in Greece and Finland, one may question the feasibility not only as a telephone survey but also as part of comprehensive health survey.

A question on mental health is on question H.S.6 of the EHIS.

3.7.8 Oral Health

Dental and oral health is a fundamentally important aspect of public health, representing maintenance of physical condition generally and can be used to gauge the adequacy of service provision.

The two questions below are from the European health care module.

**EUROPEAN HEALTH CARE MODULE**

Introduction 9

The next set of questions is about visits to dentists, orthodontists or other dental care specialist.

**HC.8 When was the last time you visited a dentist or orthodontist on your own behalf (that is, not while only accompanying a child, spouse, etc.)?**

- Less than 12 months ago _1
- 12 months ago or longer _2 → GO TO INTRODUCTION 10
- Never _3 → GO TO INTRODUCTION 10
HC.9 During the past four weeks ending yesterday, that is since (date), how many times did you visit a dentist or orthodontist on your own behalf?

Times [NOT AT ALL = 0]

· don't know _ 98
· refusal _ 99
References

1. European Health Risk Monitoring (EHRM) accessed at:  
   http://www.ktl.fi/ehrm/documents.htm


4. Health examination survey models and survey organization

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4.1 Health Examination Survey Models

1. Building up a new national HES
   - European standards should be taken into account in the planning and preparation.

2. Incorporating the European HES module(s) into an existing national HES
   - To balance the need to follow national time trends and to ensure European comparability, a specific study may be needed to compare results from examinations carried by different protocols.

3. Incorporating the European HES module(s) into an existing national HIS
   - A HES always includes a questionnaire part, and in some cases this may be very extensive. For example, if the questionnaire part includes the full EHIS questionnaire, then the HES serves also the needs of EHIS. There may also be interest in extending a recently conducted HIS into a HES. If this is done, the invitation to the HES should not depend on the participation in the HIS, because this is likely to make the response rate unnecessarily low and hence decrease the representativeness of the HES. In stead, all who were invited to the HIS should also be invited to the HES regardless their participation to the HIS. In this case, the HIS questionnaire needs to be applied only to the participants of the HES who did not participate the HIS.

4.2 Survey organization

4.2.1 Organizational responsibilities
The organizational responsibilities of a HES can be divided into (adapted from Tolonen et al 2002):

1. Conceptualization and planning: Definition of the objectives and scope of the survey, planning and preparing the fieldwork and other survey operation.

2. Operation: Implementation and operation of systems for data collection (fieldwork) and data processing.

3. Quality control: An authority independent of the logistics operations that monitors performance, provides feedback, and ensures that the results are within predefined quality limits.

There does not have to be an absolute separation of these functions. Conceptualization, planning and operation can be performed by the same agency. However, it is recommended that the quality control should be carried out by an organization without vested interest in the survey. A pilot phase is always recommended, but the aims and content of the pilot(s) depend on the previous experience and frequency of the survey.

- European coordination is considered in Chapter 10.

### 4.2.2 Fieldwork

#### 4.2.2.1 Selection of the survey site

The selection of the survey site has to be based on general requirements and local/national practices and cultural factors.

General requirements for the survey site (adapted from Tolonen et al 2002 and Tolonen 2005):

1. Because of the importance of easy recruitment of the participants, the survey examinations should take place near the subjects’ place of work or residence. As a consequence, the examination centre needs to move often, or several survey teams may be needed. In national surveys, several examination teams are usually needed, and each of them will have to move from place to place. It is then advisable also to rotate the survey teams between different regions. This will minimize the effect of survey teams in the regional comparability of the surveys. Local health centres are often able to provide suitable premises, or specific mobile clinics may be equipped for the surveys.

2. In the selection of survey sites, issues that may affect the measurements and survey results have to be taken into account, such as access of participants with limited functional ability, the room temperature, storage of samples, privacy and possibility to avoid unnecessary distractions.

Specific requirements for each measurement have to be taken into account, e.g. the availability of sound proof environment for audiogram.
The following survey sites may be considered:

1. Home visits may be used as the primary survey site. If other survey sites are used it is recommended to use home visits as an option to persons who are otherwise unable or unwilling to participate (e.g. limited physical, mental or cognitive functional capacity).

   - **Benefits:**
     - easy access to the participants;
     - no travel costs to participants;
     - relaxed environment for the participant;
     - less "clinic effect" to measurements.
   
   - **Disadvantages:**
     - some participants may be unwilling to allow survey personnel access their private home;
     - lack of safety of survey personnel making home visits alone;
     - higher travel costs for survey personnel;
     - time needed for personnel travel;
     - restrictions to the selection of measurement devices and other fieldwork equipment;
     - specific needs to calibration of equipment;
     - no possibility to control the environment: temperature, problems in privacy and distractions may arise if other family members are present.

2. Clinic visits in specific/temporary clinic(s) using survey personnel hired by the survey organizers. The personnel travel from one survey site to another.

   - **Benefits:**
     - less personnel travel costs than in home visits;
     - less restrictions to the selection of measurement devices and other fieldwork equipment than in home visits;
     - possibility to control the environment.
   
   - **Disadvantages:**
     - travel costs and potential problems in access for the participants.
     - Requires more activity from the participant, and therefore may lower the response rate.
     - If specific/temporal clinics are used, setting up the clinic

   - If the examination site is set up in a regular health care clinic, some of the local equipment may be used and therefore less time may be needed to set up the examination site. However, the standardization of the local equipment may be difficult.

3. Clinic visits within the existing health care system using the regular health care personnel who are specifically trained for the survey

   - **Benefits:**
     - less time needed to select personnel and set up the survey site;
     - other benefits as in temporary clinic.
• Disadvantages:
  ▪ difficulties in training the personnel to adapt and change regular practices into following the survey protocols;
  ▪ in countries with free choice of health care providers (e.g. public or private) public attitudes towards the selected health care organization may affect participation;
  ▪ Problems with equipment standardization if existing equipments in the health care clinics are used.

4. Mobile clinics

• Benefits:
  ▪ less travel costs for both participants and personnel;
  ▪ standard environments supporting standardisation of survey protocols.

• Disadvantages:
  ▪ high cost for building and use of mobile units.

4.2.2.2 Selection of fieldwork staff

Selection of fieldwork staff has to be based on general requirements, local/national practices and cultural factors.

General requirements:

1. Legal rights to practice medicine and nursing in each country have to be taken into account as well as the EU directives.
2. Motivation: to ensure reliability and accuracy of the survey results, specific attention should be given to personnel's motivation to strictly follow the survey protocols.
3. General appearance (clean and neat appearance and good manners), friendliness and interest shown towards participants may affect participation. Age, gender, and ethnicity of the fieldwork personnel need to be taken into account in respect to local/national culture.
4. Willingness and possibility to travel around the country with the survey team. For example, this may be problem for persons with small children.

Professional groups which should be considered:

1. Physicians (and dentists) are needed if clinical or diagnostic examinations are carried out and if their presence is required for clinical measurements. This may depend on national regulations.

• Benefits:
  ▪ may increase participation based on higher professional respect/regard among the population;
  ▪ better readiness for acute situations during the fieldwork, and in interpreting test results and informing participants about their test results (better service to participants may affect willingness to participate).
• Disadvantages:
  ▪ high cost;
  ▪ more tendencies to adapt survey protocols and make independent decision;
  ▪ higher "white coat"/observer effect on some measurements.

2. Nurses: registered nurse generalists with training according to the EU directive (2005/36/EY) are recommended for most measurements

• Benefits:
  ▪ better adherence to follow standards in survey protocols;
  ▪ lower cost,
• Disadvantages:
  ▪ differences in professional independency and respect among the population in European countries.

3. Other professional groups: medical-technical assistants, nutritionists, dental assistants need to be considered for specific measurements.

4.2.2.3 Questionnaire administration mode

Interviews and questionnaires can be used before, during and after the health examination. To avoid participant burden and selection bias it may be desirable to consider several phases and modes of administration. As the layout of the questionnaires/interview programmes, timing and mode of data collection may affect the results, these should be standardised for each questionnaire topic.

Survey questionnaires can be completed either by the respondent or by an interviewer. Both alternatives have their advantages and disadvantages (adapted from Tolonen et al 2002 and Tolonen 2005):

1. Self-administration of the questionnaire is cost effective but assumes that respondents are not visually impaired and have a good literacy level. It also requires that all questions are completely self-explanatory. Self-administration eliminates the interviewer effect but may result in missing data as a result of uncertainty about the question. A slight modification to the self-administration process deals with the problem of missing data by having the respondent complete the questionnaire at an examination centre where assistance is available, if required, and immediate review can take place. Self-administration provides more privacy for the respondent and is particularly suitable for sensitive questions. In self-administration the questionnaire format has to be quite short and easy to follow by all participants. It is recommended that self-administered questionnaires are checked and supplemented by survey personnel if needed.

2. Interviews are time consuming and carry additional labour costs, but they eliminate the issues of literacy level and visual impairment and they provide an opportunity for clarification if the questions are not well understood. The protocol for such clarifications has to be precisely prescribed to avoid biased responses. Interviews can be conducted either by telephone or face-to-face. Telephone interviews are less expensive but provide no control over the
environment in which the interview is conducted. There is a risk that interviewers introduce bias by asking leading questions or incorrect prompting. This risk can be reduced, but not fully eliminated, by proper training. If computer assisted interviews are used the format may be longer without additional burden to participants by the use of "jump-rules" (screening questions).

4.2.2.4 Order of the measurements

Order of measurements, general requirements (adapted from Tolonen et al 2002/EHRM). The order of measurements has often constraints because of logistical requirements, such as subject flow and examination duration. The order should be determined as much as possible by:

1. Importance of the measurement; most important measurements should be made early in the session, in case the participant is unable to follow the full examination protocol (time constraints, limitations in functional capacity etc.)
2. Sensitivity of questions; uncontroversial questionnaires should occur early in the interview to allow participants to become relaxed and comfortable with the procedures.
3. Stressfulness of procedure; it is recommended that blood pressure measurement precede venipuncture and other potentially (mentally or physically) stressful tests/interviews.
4. Order in previous surveys; unless good reasons exist for change, it is suggested to maintain the former order of measurements.

4.2.2.5 Instructions to the participants

Instructions given to the participants: the invitation letter should include instructions on activities that may affect the survey results, such as eating, fasting, use of medicines, physical activity and smoking before the appointment. Also instructions on clothing may be needed. It is also important to instruct how to get to the examination site, how long the examination will take, and whether or not travel expenses are covered.

4.2.2.6 Duration of the examinations

It is recommended that the participants are informed about the average and maximum length of the examination and that the waiting times at the survey site are kept as short as possible. These should be tested in the pilots. In case of longer appointments and if fasting is required it is recommended that the comfort/convenience of the participants is taken into account e.g. by offering a pause with a free snack after measurements that are sensitive to meals. (adapted from Tolonen et al 2002)

4.2.2.7 Logistics

The mobility of the survey teams will need to be taken into account in reserving the equipment for the teams, and the logistics of the survey will need to be planned carefully, including the requirements of transportation of the blood samples from the examination site to
the laboratory, and the special needs of data management in order to avoid loss of data and to facilitate prompt data quality control. (adapted from Tolonen et al 2002)

### 4.2.3 Periodicity and timing of the survey

(adapted from Tolonen et al 2002): It is recommended to repeat the HES including the core measurements with an interval of about five years, and possibly less frequently (e.g. every 10 years) for the other measurements. More frequent surveys should be considered if there are specific reasons for that. There is no general rule for the optimal duration of a survey. A survey lasting a full calendar year has the advantage of adjusting the results for seasonal variation. If the survey lasts more than a few months, particular attention needs to be paid to the temporal coverage of quality control, re-testing and re-training of the measurers, and to distributing the dates of examination of all population subgroups (such as defined by age, sex or region) evenly over the whole survey period. A short survey duration usually needs a relatively large temporary staff, whereas long or yearly repeated surveys allow a more stable employment of the core staff.

If the survey covers only a part of the year, it is essential to evaluate the effect of weather and national/regional climate and other issues related to the time of the year (e.g. common cold and flu epidemics) to measurement results. It is recommended that the fieldwork is spread into several months, and preferably exactly the same months are used in each country/region/survey year.

Time of the week and day: to allow easy access to participants and to minimise the effect of timing to measurement results, both morning, day and evening appointments should be available, as well as several weekdays and also weekends, if preferred by the participants. However, measurements that require overnight fasting can be conducted only in the mornings and may therefore be feasible only for a subsample.

### References


5. Sampling and recruitment

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This chapter gives general recommendations concerning the choices that need to be made in order to define the target population for the national HES, and to draw a statistical sample. It also gives proposals and recommendations on ways to recruit the sampled persons to participate in the survey. Some critical points carrying out a survey should be pointed out immediately:

1) The availability of an adequate sampling frame from which to draw a sample. These will differ considerably among the countries that are candidates for carrying out a HES. In particular:
   a) Coverage. The frame must cover the target population well enough.
   b) Timeliness. The frame must not be too old.
   c) The frame should contain relevant stratification and contact information.

2) The participation rate. A high participation rate is of fundamental importance for the validity of the generalised inferences to be made from the HES.

Both issues will be discussed in separate sections where recommendations are given.

The chapter is organised as follows

Part I. Sampling
Section 5.1 gives recommendations concerning the target population
Section 5.2 deals with sampling frames
Section 5.3 gives general recommendations for the sampling design
Section 5.4 provides calculations for sample sizes.

Part II. Recruitment
Section 5.5 Information on contact efforts, contacts and participation
Section 5.6 Recruitment methods
Section 5.7 Non-response analysis
Part I. Sampling

5.1 The target population

In a statistical survey, the target population is the set of units on which we want to draw statistical inferences from the survey.

Koponen and Aromaa (2003) write “It has to be defined if the target population includes only permanent residents or also temporary residents. If any exclusion applies, such as leaving out institutionalised persons or prisoners from the target population, they have to be carefully documented”. Exclusions should be as few as possible. Ideally, all inhabitants in the country within the given age-groups should be included in the target population.

As knowledge on chronic diseases and their risk factors is one of the main reasons for doing HES, young as well as middle-aged adults should be included, if feasible. This is the reason for the core age group being to 25-64 years. However, in some countries HES may not be considered feasible in the young adult, if a high participation is being unrealistic to obtain.

In sum, the target population is characterised by a finite population within a defined area (the country) which is accessible within a defined time frame or at a certain time. The chosen target population has to be described according to age and other demographic characteristics important for the sample to be nationally representative.

Recommendations

1) The geographical coverage of national HES should, usually, be the entire territory of the country.
2) The core target population for a national HES is the set of all persons having permanent residence in the country by 1. January the year of the survey and filling at least 25 years and at most 64 years during the year.
3) Each country can extend the eligible age group with a lower bound of 18 years and with no limitation for the upper bound.
4) The period for the survey is proposed to be one calendar year.

The target population will sometimes be restricted by practical considerations. These considerations include limitations caused by the available sampling frame. Typically, many frames exclude persons living permanently in institutions and illegal residents.

5.2 Sampling frames

The availability of sampling frames in European countries as reported from National experts is discussed thoroughly in the Review paper, chapter 7.2.2. The following table of possible frames is copied for the benefit of the reader.

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 to include non-citizens or institutionalized, but
may be subject to professional secrecy.

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 not 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
Maps of administrative or statistical geographical units along
with reasonably good statistics of their population sizes.

The last item in the list, maps, was not in the review and has been added here. Maps are
relevant for the first stage of the two-stage design presented in section 5.3. The discussion
given in the review around the potential benefits and drawbacks of each of these frames will
not be repeated here. However, some points should be made.

Frames that are frequently or continuously updated and covering the entire target population
are to be preferred. Population registers are usually such, but they are not continually updated
in all countries and miss certain population groups in some countries (under-coverage).
Typically, population registers only cover the legal residents. A population register may also
contain individuals that are no longer members of the population (dead, emigrated) and can
have outdated information concerning place of residence. Nine countries having population
registers want to use this as the sampling frame if carrying out a HES (Ref: Review report).

Population registers usually contain information on age and gender which is useful for
defining the core target population and for demographic stratification. Population registers
provide the most direct access to the eligible persons with contact information.

Postcode address file, as is used as the sampling frame for the English HES, is an alternative
when the quality is good. However, with such frames the sampling units are household
addresses and the frames do not provide information on the individual persons living in the
household. A sampled household has to be visited to see the number of persons it contains, if
any, that are eligible for the survey. Unlike population registers such frames may cover illegal
residents. If postal addresses are sampled with equal probabilities, an equal probability sample
of persons is obtained by inviting all eligible persons in the sampled households to HES. Such
a sample is called a cluster sample. If a HES variable shows positive correlation among
members of the same household this will increase the variance of estimates made from the sample making a larger sample necessary to obtain the same precision. *With a postcode address file it will not be possible to stratify the sample by age, gender, educational level or other individual characteristics.*

*Censuses and electoral rolls* are most often not updated regularly and should only be used as frames if they are updated quite recently. Electoral rolls may only cover persons who have actively registered for voting.

*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 http://www.cdc.gov/nhanes/pQuestions.htm#How%20%20Participants%20selected 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.

None of the other possible frames listed in the table (list from health care providers, telephone directory, address lists etc) have the coverage or qualities needed to be useful as main frames for a national HES. Whether some of them can serve as supplements to catch groups that are missing in a main frame, or if they are useful for supplementary contact information must be decided for each country.

It is of importance to identify population subgroups not or not fully covered by the sampling frame, as the frame determines for whom the results should be considered valid. Subgroups not covered, like people living permanently in institutions, homeless, persons with no legal residence, temporary residents etc should be identified and documented. The target population may even have to be redefined according to population groups not covered by the frame, or if a supplementary sampling frame could be used.

*Both over-coverage and under-coverage in the frame will cause errors in the estimation of totals and may bias survey statistics. Efforts should be made to remove over-coverage and to detect and document under-coverage. In practice, under-coverage is the main problem.*

**Recommendations**

1. Whenever legally and practically available, a file with the most recent and best coverage of the *individual persons* in the target population should be used as sampling frame. This will most often be a population register. If possible, the frame can be supplied with other files to catch parts of the target population not covered by the main frame and other files may be used for supplementary contact information.
2. If a quality frame with individuals is not available, an updated postal address file can be used as an alternative.
3. Countries already carrying out national HES on sample basis with an established frame may continue the use of the same frame in the future. However, all such frames must
be compared and evaluated against the general recommendations and standards proposed for European HES.

4. Countries not having the frames mentioned in items 1 or 2 can use a map-frame of the NHANES type.

5. The list of accessible frames as listed in the Review report may not be complete and not all national health institutes have experience carrying out surveys. If no acceptable frame seems to be available, the national bureau of statistics or other national institutions, public or private, regularly carrying out national sample surveys in other fields should be contacted for assistance. The European HES collaborators should be contacted also, see http://www.ktl.fi/fehes/.

References:
4. US NHANES survey: Design

5.3 Sampling design

In a HES a number of stationary or mobile examination clinics, perhaps as many as 80-100, must be established scattered around each country. Each clinic will have to cover a limited geographical area. These areas should not be too large in extent and people from the area invited to participate in the survey should be able to visit the clinic without too much inconvenience. In case mobile units are used, which may be appropriate in sparsely populated areas, the distances that these clinics need to drive should be kept within reasonable limits.

For this purpose each country must be divided into a set of disjoint potential clinic-areas. If appropriate in population size and extent, administrative units can be used for this purpose. In order to make the clinic-areas sufficiently small, most countries will have to be divided into a much larger number of areas than the number of clinics to be established. This means that we first must take a sample of the clinic-areas and then take a sample of invitees to participate within each clinic-area. This is called two-stage sampling. In the terminology of survey methodology the clinic-areas are then called Primary Sampling Units (PSUs) and the invitees are called Secondary Sampling Units (SSUs).

In MONICA, where the study areas were usually much smaller than whole countries, two-thirds of the populations were allocated to one stage sample, but that will generally not be feasible in HES.

In most countries the PSUs must be grouped into disjoint subsets called strata. PSUs belonging to the same stratum should be as similar as possible with respect to factors affecting the target variables in the survey, but they don’t have to be geographically contiguous. They can vary in population size, but not too much.
In most surveys where the target population consists of individual persons, it is desirable to give every individual the same probability of being drawn to the sample (inclusion probability). However, if separate estimates are desirable for small subpopulations, it may be necessary to over-represent these groups. These is done by defining such groups as separate strata and take a larger sampling fraction in these strata than in other strata.

The estimates and several analyses based on national HESs will be published by gender and age. In order to guarantee sufficiently large sample sizes in all such groups, it is recommended to stratify the population by gender and ten-year age groups before sampling if this is feasible with the given frame and give the groups equal sample sizes. These groups will be called demographic strata. Since the population in the demographic strata differs, sampling the same number of persons in each of them means that the probability that a person will be drawn to the sample (called inclusion probabilities) will differ between the groups. However, in the design suggested in the subsequent, equal probabilities will be maintained within the demographic strata. Furthermore, the demographic groups intersect the primary sampling units and their stratification.

List of concepts:
- Primary Sampling Units (PSUs): Geographical areas, surveys clinic areas
- Secondary Sampling Units (SSUs): Invitees in sampled clinic areas
- PSU-strata: Subgroups of PSUs according to geographic or health related factors
- Demographic strata: Population subgroups by 10-year age and gender
- PPS-sampling: A strategy for giving each PSU a probability of being sampled that is Proportional to its Population Size

Combining demographic stratification with a two-stage sampling design and equal probability sample within each demographic group has some consequences for the possibility to control the sample sizes exactly. But when non-participation is taken into consideration completely fixed sample sizes cannot be maintained anyway.

The text in the box is somewhat technical but is necessary for a proper understanding of the topic.

Consider an arbitrary country. The size of the target population in this country is \( N \) and the PSUs in the country is divided into \( K \) strata numbered \( k = 1, \ldots, K \) with populations \( N_1, N_2, \ldots, N_K \). Each stratum consists of a number of PSUs, say \( M_k \) in stratum no. \( k \). The PSUs in stratum \( k \) are labelled \( k1, k2, \ldots, kM_k \). In stratum \( k \) we want to take a sample of \( n_k \) persons (invitees) by first taking a sample of \( m_k \) PSUs and then a sample of invitees within each sampled PSU so that every potential invitee in the stratum has the same probability of being sampled. At first we ignore the demographic groups when sampling. How should this be done?

First, consider sampling \( m_k \) PSUs in stratum \( k \). The population size of PSU \( j \) in stratum \( k \) is denoted \( N_k_j \). The recommended strategy is to give each PSU a probability of being sampled that is Proportional to its Population Size. This way of sampling PSUs is called PPS-sampling, That is...
Superscript (1) indicates that this is a probability at the first stage of the sampling design. We assume that $m_k$ or $N_{kj}$ are not so large that this probability is larger than 1 for any PSU. If that happens, the actual PSUs must be treated as a separate stratum or split into smaller PSUs. In PSUs treated as separate strata the samples of invitees is drawn in one stage. This can be appropriate in cities with high population density.

Next, the sample size $n_k$ for stratum $k$ should be allocated to the sampled PSUs in such a way that every person (e.g. person no. $i$ in PSU $j$) in stratum $k$ has the same final probability

$$\pi_{kji} = n_k / N_k$$

depending on being sampled after two stages.

If PSU no. $kj$ has been sampled at the first stage, $n_{kij}$ invitees are sampled from the $N_{kj}$ eligible persons in PSU $kj$. Each of these persons will then have the probability $\pi_{kji}^{(2)} = n_{ij} / N_{ij}$ of being sampled at stage 2, the same for all individuals 'i' in the PSU. The final inclusion probability for an arbitrary person in stratum $k$ is therefore

$$\pi_{kji}^{(1)} \pi_{kji}^{(2)} = m_k \frac{N_{kj}}{N_k} \frac{n_{kij}}{N_{kj}} = m_k \frac{n_{ij}}{N_k}$$

But this should be equal to $\pi_{kij} (= n_i / N_i)$, implying that $n_{ij} = n_k / m_k$. In other words: **When sampling the PSUs with probabilities proportional to sizes, an equal probability sample is obtained in stratum $k$ by allocating the stratum sample size $n_k$ evenly on the $m_k$ sampled PSUs.** This is a great advantage which could not be obtained if sampling the PSUs with equal probabilities (a frequent mistake). It guarantees that every examination clinic in the stratum will get the same number of invitees to handle. For the entire country the same can be obtained if the total number $m$ of clinics is allocated to the strata by the same proportions as the total sample size $n$ of invitees.

But what happens when we try to allocate the total sample size $n$ (or $n_k$) with equal numbers to various demographic groups?

First, the proportions that each demographic group makes of the total population will vary both between strata and between PSUs within each stratum. A set of first stage sampling probabilities $\pi_{i}^{(1)}$ that is right for the elderly may be wrong for the younger ones and vice versa. If a common set of first stage probabilities and first stage sample (of PSUs) is used for all demographic groups, insisting at equal inclusion probabilities within each demographic stratum across PSUs will produce different sample sizes in different PSUs. This applies both for each demographic group and in sum across all demographic groups (Enclosure C).

Furthermore, the total sample size for a demographic group in a stratum will depend on which PSUs have been drawn at the first stage. This generates a randomness in the total sample size that makes it impossible to fix the over all sample size for each group completely. However, it is shown in enclosure C that the sample sizes will be as desired in expectation. We can set the desired sample size for each demographic stratum in each country and PSU-stratum. But this will only in expectation be the sample size we get. Theoretically, the problem can be resolved...
with fixed sample sizes if one allows different PSUs to be drawn for different demographic groups. But this will raise the costs and complexity significantly and is not practical. Anyway, non-participation will induce randomness in the final participation sample.

It should be pointed out that the discussion above related to stage 2 of sampling design applies only when the sampling frame consists of individuals. If the frame is a postal address frame, the sampling units will be household addresses. It will then not be possible to stratify by demographic groups. But it is possible to give all household addresses in a PSU-stratum the same probabilities of being sampled. If all eligible persons in the sampled households are invited to the survey this will produce an equal probability sample of persons. However, the number of persons included in this sample will depend on the number of eligible persons in the sampled households, and this is “take what we get!, i.e. out of control.

However, the discussion concerning stage 1 of the design does apply. To draw a stage-one PPS sample a frame with individual persons is not necessary, only good estimates of the population sizes in each PSU.

In sampling designs based completely on maps there may be more than two stages. In NHANES there were four. The theory above for two stage samples can easily be extended.

Substitution of non-participants with non-sampled individuals which is often used in commercial surveys is not good statistical practice. It does not reduce non-participation bias and may introduce new biases. It is not acceptable in national HES (or HIS).

**Recommendations**

1) The geographical area of a country is divided into Primary Sampling Units (PSUs), each of suitable size to be served by one examination clinic and with acceptable travel distance to the clinic for all persons living in the PSU.

2) The PSUs are stratified into groups that are as homogenous as possible with respect to available variables that are supposed to be relevant to important health indicators (such as educational level, mortality figures etc).

3) A sample of PSUs is taken by Proportional to Population Size (PPS) sampling within each stratum. To secure that this is done the same way in all countries, a special application for doing this in HES has to be developed.

4) If feasible by the sampling frame, the population is stratified in demographic strata by gender and ten-year age groups.

5) Within the sampled PSUs in each PSU-stratum, an equal probability sample is taken for each demographic stratum by the procedure described above and in enclosure C.

6) Substitution of non-participants with non-sampled individuals is not acceptable.

7) If there is interest to focus on social levels, ethnic groups or groups that are assumed to be under high risk for some disease, special samples should be taken for them independent of the general HES. Such groups should not be over-represented within the ordinary HES.

**References:**


### 5.4. Sample size and allocation of sample

There are sample sizes at two levels to be calculated. First, there is a planned total sample size of invitees to the survey, say \( n \). This sample size must (whenever feasible) be allocated to the demographic strata (by 10-year age and gender) and to PSU-strata. We recommend allocating equal sample sizes to each demographic stratum in the core part of HES, but larger samples for some strata can be taken if desired from a national viewpoint. According to the Review Report, the sample size in recent HESs range from 3000 to 12000 persons. Next, the sample size for each group must be allocated to PSU-strata. We recommend that this is done proportional to the population in the group in each PSU-stratum. (That is \( n_{k,l}^{*} \)).

Second, the set of \( m \) examination clinics must be allocated to the PSU-strata. Our recommendation is that this is done proportional to the total (eligible) population size in the strata, although deviations must be allowed here as well. The proportionality can only be up to rounding to an integer number of clinics. The number of clinics allocated to a PSU-stratum equals the number of PSUs to be sampled in that stratum at stage 1. To be able to estimate sampling variance, no PSU-stratum should be given less than two clinics except when one PSU is a stratum alone. Example: a geographical region which differs from the rest of the country by relevant health indicators used for PSU-stratification.

Given the population size \( N_{k,l,j} \) for group \( l \) in PSU \( j \) in stratum \( k \), the number \( m_k \) of PSUs selected in stratum \( k \), and the desired sample size \( n_{k,l}^{*} \) for group \( l \) in stratum \( k \), the actual sample size \( n_{k,l,j} \) in that PSU under the premise of equal inclusion probabilities for every person in group \( l \) in stratum \( k \) is calculated in enclosure C.

Roughly, the sampling variance of an estimate for a population mean in a two-stage design like the one described above can be expressed as

\[
V = \frac{V^{(1)}}{m} + \frac{V^{(2)}}{mn}
\]

where \( \bar{n} \) is the average number of invitees per sampled PSU. For a given variable of interest, \( V^{(1)} \) can roughly be seen as a measure of the variation of its PSU-means across all PSUs while \( V^{(2)} \) can be seen as a measure of its average variation within the PSUs. The formula is only completely correct if sampling is done with replacement at both stages, which we do not in practice. But this will not alter the conclusions below. For a given sample total size \( n = mn\bar{n} \) or a given budget for the survey, what is the optimal values between \( m \) and \( \bar{n} \)?

Assume the total cost \( C \) of the survey can be described by the model

\[
C = c_0 + c_1m + c_2m\bar{n}.
\]
Here, \(c_0\) is the constant cost which is independent of the size of the sample, \(c_1\) is the cost associated to setting up an examination clinic in a PSU and \(c_2\) is the cost associated with inviting a person to the survey and examine this person. How is the variance \(V\) minimised for a given cost? It can be shown that the optimal value of \(\bar{n}\) and \(m\) can be given by the formulae

\[
\bar{n} = \sqrt{\frac{V^{(2)} c_1}{V^{(1)} c_2}} \quad \text{and} \quad m = n / \bar{n}.
\]

Proof of this formula is found in enclosure D.

The above formula means that the larger the variation is within PSUs compared to across PSUs for a variable, the larger is the optimal sample size within PSUs and the smaller the optimal number of clinics. Furthermore, the cheaper it is to examine an extra person compared to setting up an extra clinic, the larger should be the within PSU sample size. The variances \(V^{(1)}\) and \(V^{(2)}\) are variable-dependent and will give different optimal values for different variables.

Notice that the optimal value of \(\bar{n}\) does not depend on the total budget or the total sample size, only the variance and cost ratios. This means that if the total budget or the total sample size is increased, the sample should be increased by increasing the number of sampled PSUs (or clinics), not by increasing the sample size within PSUs. Reliable figures to put into the formulae will be outlined later.

The variance of an estimate of a sample mean is generally larger in a two-stage design than in a one stage design. How much larger depends on the variable under study. Good stratification of the PSUs will alleviate this increase at national level but that will not be taken into attention in the subsequent calculations. If the values of the variable under study are highly correlated within PSUs, meaning that the variance \(V^{(2)}\) within PSUs is large compared to the variance \(V^{(1)}\) across PSUs, the variance \(V\) will tend to be much larger than that of a simple random sample. If \(V\) is the variance of an unbiased estimator of a population mean with the two-stage design and \(V_{srs}\) is the variance of the equivalent estimator with a simple random sample, the ratio of the two variances is called the design effect. Noting that \(V^{(1)} + V^{(2)} \approx S^2\), the population variance, that is

\[
\text{deff} = \frac{V}{V_{srs}} \approx \frac{V^{(1)} / m + V^{(2)} / m\bar{n}}{S^2 / n} = \frac{\bar{n}V^{(1)} + V^{(2)}}{S^2} = 1 + (\bar{n} - 1)\frac{V^{(1)}}{S^2} > 1
\]

For a prevalence \(P, S^2 = P(1-P)\). For a given total sample size \(n\), the design effect also depends on \(m\) and \(\bar{n}\). The smaller \(m\) is (and the larger \(\bar{n}\) is), the larger the design effect. However, doing sample size calculations and not having information that can provide good estimates of the deff, it is quite common to assume a value of 1.5 for deff. deff = 1.5 means that the total sample size of the two-stage sample will have to be increased by 50% compared to a simple random sample to give the same accuracy. To have full effect the increase will have to be come as an increase in number of sampled PSUs (\(m\)), not as an increase in the number of invitees per PSU (\(\bar{n}\)).

In MONICA where most of the samples were taken as one stage samples, it was required that changes in changes in smoking prevalence from 60% to 40%, 3 mmHg in diastolic blood
pressure and 0.3 mmol/l in total cholesterol should be detectable at a significance level of 5%. For this a minimum sample size of 200 was required in each gender and 10-year age group. Blood pressure required the largest sample size. Assessments based on the results from MONICA suggested a sample size of 200-300 for any subgroup of interest to compare, indicating a minimum sample size of around 2000 for the entire sample. With a design effect of 1.5 this will mean perhaps 3000 invitees for a country. This should be on the safe side to make comparisons by 10-year age groups and gender.

*Increasing the sample will reduce the random error but will not reduce selective participation bias. It is important to find a good balance between the optimal and the feasible sample size, and the resources for interviews and examinations and the available funds will restrict the sample size.* Larger samples may be taken if demographic strata in addition to age groups and gender are desired, but resources should be spent on recruitment of the invited persons rather than increasing the gross sample in each stratum.

Depending on the size of the country, 8-10 000 individuals is an upper limit for feasibility to carry out HES surveys. As the field work should be done within one year and because a high participation rate is needed, the resources need to be allocated for data-collection rather than for expanding the survey.

**Recommendations**

1. The total sample size \( n \) for a national HES should at least be between 2500 and 3000 persons unless a larger sample is wanted for national reasons.
2. The number \( \bar{n} \) of persons sample per PSU (clinic) should be decided by optimality formulae.
3. The number of PSUs sampled should be \( m = n / \bar{n} \).
4. The sample \( (n) \) should be allocated with equal sizes to each of eight gender by ten-year age groups.
5. Within each gender by age group the sample should be allocated to PSU-strata proportional to the sizes of the groups in the strata.
6. The number \( m \) of PSUs to be sampled should be allocated to the PSU-strata in proportion to the total population size of each stratum. If the total budget or the total sample size is increased, the sample should be increased by increasing the number of sampled PSUs (or clinics), not by increasing the sample size within PSUs.

**References:**

PART II. Recruitment

5.5 Record of contact efforts, contact and participation

We recommend keeping a record for each invited person on number and type of contact attempts, participation (enrolment) status and reason for non-contact and non-participation.

Contacted person = has in one or another way been in contact with the survey administration by having probably received the letter of invitation, a text message or e-mail or has been contacted by a successful phone call or home visit.

Ideally, one should know whether each invited person has read the invitation. In practice, one has to assume that a letter not returned or a successfully sent e-mail or text message is a contact. If contacted, it should be noted if the person participated, refused or dropped out after having confirmed to participate. If the person refused, the reason should be noted if this is possible to know.

Non-contacted = invitation letter returned to the survey administration and other individual contact not possible or not obtained.

Participant (respondent) = a person who has at least one valid examination measurement, like measured height and weight, in addition to some questionnaire results.
Non-participant (non-respondent) = refused or otherwise not participated when invitation assumed to be received or other contact was considered established.

Contact rate is the proportion of selected persons (total sample) that received the letter of invitation.

Enrolment rate is the proportion of the persons contacted who actually participated in the survey.

The over-all sample participation rate (response rate) should be described as the product of the contact rate and the enrolment rate.

Participation rate = Participants / Gross sample minus not eligible (deceased, moved out of area, or defined as not in the target population)

The denominator of the contact rate, response rate and participation rate should not include persons who were selected for HES, but in retrospect did not belong to the target population (i.e. were over-coverage: died, moved out of the primary sampling unite (PSU), emigrated or were by survey planning defined as non-target population). It should be noted that persons who were temporary absent during the survey period because of work, studies, tourism, non-permanent hospitalisation or for other reasons not available should be included in the denominator, as they are part of the target population.

Recommendations
1. Precise record keeping for each invited person on number and type of contact attempts, participation status.
2. If possible, reasons for non-contact and non-participation should be included in the record.
3. By calculating participation rate (response rate) the denominator should not include persons who were selected for HES, but in retrospect did not belong to the target population (died, emigrated etc.)

References:


5.6 Recruitment (enrolment) methods

In some countries HES may not be considered feasible in the youngest and the oldest adult age groups, if there is evidence for 70 % participation being unrealistic to obtain. Is so, resources are better spent on age groups were sufficiently high participation rates may possibly be reached.

It is crucial to get the response rate as high as possible, even if it is 70-80 % in the first phase. Regardless of the primary response rate, 1-3 re-contacts are recommended.

The group of non-participants consists of persons with many different reasons for not taking part, some with better and some with less good health than the average of the participants. But analyses have shown that in total the non-participants have lower education, less healthy lifestyle 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.

The strategy and methods for recruitment have to be selected nationally, based on national and regional possibilities, culture and survey budget. What is “perfect” in one setting may not be practical or may not give the best result elsewhere. The recommendations noted here, are based on published papers or reported for national experts and should be considered.

Preparations prior to survey:

- National and local health authorities and health professionals should be informed about the survey in advance (why, what is it about, what is in it for the participants).
• Information about the survey to the local government, ensuring support from the environment.
• An internet home page with questionnaires, booking and contact telephone (free) should be prepared.

• Training of the survey personnel for all relevant tasks, including taking care of participants in a professional, friendly, respectful and interested way.

• All written materials should be as short as possible, “user friendly” - with some colour ink, easy to understand and to fill in even by participants with some linguistic or cognitive impairment. It should still look serious and be easily differentiated from advertisement materials. Materials must be prepared in relevant languages.
• The informed consent should notice personal rights by participating, not confidentiality problems only.
• If applied, an announcement letter sent prior to the invitation should inform that the person has been selected and enclose a leaflet with all relevant information about the survey.
• Different versions of lay-out and formulation of text may be considered for younger and older people.
• All written materials should give a link to an internet site with more information and give the number to a free telephone line in case of questions.

• Encourage employers to letting the people participate in the survey during working hours.
• For people invited to the survey, the possibility for drop-in participation should be considered in addition to booked appointment.
• The use of compensations or incentives for participation (financial or other) may be considered. A small incentive, like a project-logo pen with the internet address and phone number, may be sent with the letter of invitation.
• Personal advantage/interest should be emphasized and information about results prepared (rapid feedback on examination and test results) if the participant wants it.

Mass media contact (national and regional)

• A media strategy should include “who to contact on what” on several stages of the project. National, regional and local media, serious and “popular” media should be covered.
• In the first stage: What is this about? Why participate? When and where? Who are invited and how? How long time does it take? What is in it for the participant?
• The public value of the project should be underlined.

• It is of particular importance that the survey is highlighted in mass media in the week the invitation letters are sent out.
• The internet survey site should be included when appropriate.
• A media strategy includes preparations for “what to do, and by whom” by unforeseen occurrences or negative media attention.
Recommended strategy for the primary invitation and participation

It is of great importance to obtain a high participation rate primarily, as response to the first contact, for having a chance to reach high final participation rate. Each person who participates without reminders is cost-saving. Emphasise the importance of the participation of every individual, whether extremely healthy, unhealthy or anything between.

The problems of incorrect address and no telephone contact are well known from all surveys. It would be feasible to spend some resources to trace these persons, perhaps by applying supplementary frames. In young adults who are the most likely to change address often, the use of university and high-school lists etc may be helpful. The most relevant contact may be mobile phones in people below a certain age, and home telephones and home visits in older age groups.

Emphasis has to be given to the quality and user-friendliness of the elements:
- Appointment booking
- Team service
- Flexibility in general, and of opening hours in particular
- Home visit examination should be prepared for as an alternative, in particular for the oldest age group included
- Re-imbursement of travel expenses
- Summaries of personal or general survey results

Recommendations for increasing participation among those not participating by the first invitation

The re-invitations may be done by a letter with or without questionnaire, by phone calls or by home visits. This will depend on culturally acceptability. A personal approach by use of telephone/mobile telephone, home visit or e-mail may be more effective than a “second letter” for re-invitation. Also, it gives the opportunity to offer a “tailored” appointment booking.

The heading, introduction and also who signs the invitation letter has been found to influence participation and should be considered accordingly. Changes may be done, compared to the first invitation. The flexibility of opening hours may be increased (early mornings, evenings, week ends).

Incentives other than those used in the first place should be considered. It seems to be more effective to send the incentive with invitation than to promise such as a lottery ticket when meeting.

Substitution by inviting e.g. a neighbour to replace a non-contact, is not acceptable, see also section 5.4 (Sampling techniques). It should be noted also that information from proxies for the interview part of HES, such as information on health issues from the spouse for a person at work abroad, are not acceptable.

Recommendations

1. All written materials, including a survey website, should be informative, user-friendly, appealing and still serious. Age- and language specific versions may be considered.
2. Health authorities, health care providers and local government should be informed prior to public information and invitations being sent to the selected persons.

3. The public should be informed through mass media prior to the invitation.

4. As the first contact to the sample members, a letter of invitation should be sent, together with relevant information. A suggested appointment time and a telephone number for re-booking should be given in the invitation letter.

5. It should be considered to use compensations or incentives for participation (financial or other, perhaps a logo pen sent with the invitation).

6. Flexibility: re-booking of appointment, prolonged opening hours, easy access to the examination site, home visit.

7. The field personal should be trained, aiming at being professional, polite, interested and friendly in their meeting with the participants.

8. At least one re-invitation should be made, even by a high participation rate, and at least two re-invitations by lower participation than 70%.

9. For re-invitations, it is important to be sure that contact information is relevant and recently updated.

References:

1. Jousilahti P et al 2005
2. Harald K et al 2007

5.7 Non-response analysis

A high participation rate is fundamental for being able to infer valid conclusions when generalising the observation to estimates for entire populations. The different measurements and questionnaire items included in the HES will vary somewhat with respect to vulnerability for selection bias. Evaluations of this problem have resulted in agreement that participation rates of 70% or higher should be achieved in all countries (www.ktl.fi/erhm, Koponen and Aromaa 2003). Ideally, the participation rate should be still higher.

It is, even with a high participation rate, important to collect knowledge for the evaluation of potential bias in disease prevalence and associations. If possible, one of the following forms should be used:

- Some information may be collected from non-participants by means of a short questionnaire by self-report (mailed or electronic form or telephone interview), see enclosure A. A longer version of the questionnaire for non-participants is shown in enclosure B.
- Use of proxy information for non-contact and non-response (enclosure A).

The questionnaires for non-participants or proxy information are based on MONICA manual part III section 1.
In addition, if possible some information could be collected by using register data:

- The sampling frame can be used to compare participants and non-participants by age, sex, region of living, marital status and other factors that are available for all invited.
- If possible, the invitation file should be linked to other health related data, like health care utilization data like hospitalisation, disability benefit, education and income.

**Recommendations**

1. Soon after the survey, a short questionnaire on health and risk factors should be offered the non-participants.

**References:**

3. Koponen and Aromaa 2003
Enclosure A: Non-participant form (short version)

Reference number:
Date of filling out the non-participation information (day, month, year):
Date of birth: Day, month, year:

Sex: 1= male 2=female

Marital status:
1= not married
2= married or cohabitating
3= separated or divorced
4= widowed
5= other
9= insufficient data

Highest level of completed education:
1= university or college or equivalent
2= intermediate between secondary level and university (e.g. technical training)
3= secondary school
4= primary school only (or less)
9= insufficient data

Smoking of cigarettes (at present)
1= yes, regularly
2= yes, occasionally
3= no
9= insufficient data

Reason for non-participation
1= not possible to contact, i.e. not found at the address
2= temporary out from the area during the actual survey
3= not able to respond due to medical reasons:
Hospitalized or too ill to respond during the survey
4= not interested in additional medical assessment
5= other refusal
9= insufficient data

Non-respondent information obtained by
1= home visit
2= postal questionnaire
3= telephone call
4= visit to hospital
5= other
9= information not available

Person giving information to fill out this form
1= person selected into the survey him/herself
2= a family member of the person selected into the survey
3= other
**Enclosure B: Non-participant form (long version)**

Reference number:
Date of filling out the non-participation information (day, month, year):
Date of birth: Day, month, year:

Sex: 1= male 2= female

Marital status:
1= not married
2= married or cohabitating
3= separated or divorced
4= widowed
5= other
9= insufficient data

“What is the highest level of education you have completed?”:
1= university or college or equivalent
2= intermediate between secondary level and university (e.g. technical training)
3= secondary school
4= primary school only (or less)
9= insufficient data

“How many years have you spent at school or in full time study?”
99= insufficient data

“Do you smoke cigarettes now?”
1= yes, regularly
2= yes, occasionally
3= no
9= insufficient data

HIBP: “Have you ever been told by a doctor or other health worker that you have high blood pressure?”
1= yes
2= no
9= insufficient data

DRUGS: “Are you taking (in the last two weeks) drugs for high blood pressure?”
1= yes
2= no
3= uncertain
8 if HIBP = 2
9= insufficient data

Height, centimetres

999= insufficient data
Body weight (100g) to nearest 200 g

9999 = insufficient data

Reason for non-participation
1 = not possible to contact, i.e. not found at the address
2 = temporary out from the area during the actual survey
3 = not able to respond due to medical reasons:
   Hospitalized or too ill to respond during the survey
4 = not interested in additional medical assessment
5 = other refusal
9 = insufficient data

Non-respondent information obtained by
1 = home visit
2 = postal questionnaire
3 = telephone call
4 = visit to hospital
5 = other
9 = information not available

Person giving information to fill out this form
1 = person selected into the survey him/herself
2 = other
Enclosure C: Two stage sample with intersecting demographic samples.

Let \( U^{(1)}_k \) be the set of the \( M_k \) PSUs in stratum no. \( k \). \( N_k \) is its population size and \( N_{kj} \) is the population of PSU no. \( k \) in that stratum. A sample of \( m_k \) PSUs is taken from \( U^{(1)}_k \) with inclusion probabilities proportional to their sizes (PPS sampling):

\[
\pi^{(1)}_{kj} = m_k N_{kj} / N_k < 1, \quad j = 1, \ldots, M_k; \quad k = 1, \ldots, K
\]

Below, the sample of PSUs will be called \( s_1 \). Let \( N_{kJ} \) be the number of persons in demographic group no. \( l \) in PSU \( j \) in stratum \( k \). \( N_{kJ} = \sum_{j=1}^{L} N_{kJ} \). \( N_{k+l} = \sum_{j=1}^{M_k} N_{kJ} \) is the number of persons in demographic group \( l \) in stratum \( k \). We want to take sample with desired size \( n_{k+l} \) from the \( N_{k+l} \) in two stages giving every person in the same demographic group in the same stratum the same final probability

\[
\pi_{kl} = n_{k+l}^* / N_{k+l}
\]

of being sampled after two stages. The * indicates that \( n_{k+l}^* \) is a “desired” sample size. It will fall out below that this will usually not be the actual sample size obtained, but will be correct “in expectation”. If PSU no. \( k \) is sampled, the proportion sampled and also the probability of each person being drawn in PSU \( k \) at stage 2 is

\[
\pi^{(2)}_{kij} = n_{kij} / N_{kij}
\]

Where the subscript \( i \) indexes the individual persons in the PSU. This probability is the same for every person in the same demographic group \( l \). The combined inclusion probability for the first and second stage is

\[
\pi_{kij} = \pi^{(1)}_{kij} \pi^{(2)}_{kij} = m_k N_{kj} \cdot n_{kij} / N_k / N_{kij}
\]

But this should equal \( \pi_{kl} \) above yielding the equation

\[
\frac{n_{k+l}^*}{N_{k+l}} = \frac{m_k N_{kj} \cdot n_{kij}}{N_k \cdot N_{kij}}
\]

Solving this equation gives

\[
n_{kij} = \frac{n_{k+l}^* \cdot N_k N_{kij}}{m_k \cdot N_{k+l} \cdot N_{kj}}
\]

Let

\[
I_{kj} = \begin{cases} 1 & \text{If PSU no.} k \text{ is sampled} \\ 0 & \text{Otherwise} \end{cases}
\]

The probability of \( I_{kj} \) being 1 and its expectation are both equal to \( \pi^{(1)}_{kj} \). The total sample size for demographic group \( l \) in stratum \( k \) can be expressed as
\[ n_{k+l} = \sum_{j=1}^{N_{k+l}} n_{k+l} = \frac{1}{m_k n_{k+l}} N_{k+l} \sum_{j=1}^{N_{k+l}} N_{k+l} j_{k+l} = \frac{1}{m_k n_{k+l}} N_{k+l} \sum_{j=1}^{N_{k+l}} N_{k+l} j_{k+l} \].

This is not exactly the desired sample size \( n^*_{k+l} \), it will depend on which PSUs have been sampled at the first stage. However, \( n^*_{k+l} \) will be the average of all possible outcomes of the sample size, as can be demonstrated by taking the expectation:

\[ E n_{k+l} = \frac{1}{m_k n_{k+l}} N_{k+l} \sum_{j=1}^{N_{k+l}} N_{k+l} j_{k+l} E I_{k+l} = \frac{1}{m_k n_{k+l}} N_{k+l} \sum_{j=1}^{N_{k+l}} N_{k+l} j_{k+l} m_k N_{k+l} = n^*_{k+l} \]

**Enclosure D. Proof of optimal sample allocation in section 5.4**

Total variance \( V \) of a sample mean in a two-stage design has the form

\[ V = \frac{V^{(1)}}{m} + \frac{V^{(2)}}{m\bar{n}} \]

Given the cost function \( C = c_0 + c_1 m + c_2 m\bar{n} \), minimise \( V \). Use Lagrange multipliers:

(I) \[ \frac{\partial}{\partial m} (V - \lambda (C - c_0 - c_1 m - c_2 m\bar{n})) = -\frac{V^{(1)}}{m^2} - \frac{V^{(2)}}{m^2 \bar{n}} + \lambda (c_1 + c_2 \bar{n}) = 0 \]

(II) \[ \frac{\partial}{\partial \bar{n}} (V - \lambda (C - c_0 - c_1 m - c_2 m\bar{n})) = -\frac{V^{(2)}}{m\bar{n}^2} + \lambda c_2 m = 0 \]

(II) implies \( \lambda = \frac{V^{(2)}}{c_2 m^2 \bar{n}^2} \). Substitute for \( \lambda \) in (I) gives

\[ -\frac{V^{(1)}}{m^2} - \frac{V^{(2)}}{m^2 \bar{n}} + \frac{V^{(2)}}{c_2 m^2 \bar{n}^2} (c_1 + c_2 \bar{n}) = 0 \]

Solving this equation for \( \bar{n} \) provides the result in section 5.4.

**References**

6. Legal and ethical issues

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Introduction

In conducting research involving humans, two of the fundamental concerns, in addition to the ethical conduct of the research itself, are the safeguarding of the participant’s privacy and the acquiring of his/her informed consent. Based on a survey of how Member States have addressed these concerns in the health examination surveys (HES) or similar studies that they have conducted to date, we have developed a series of recommendations to be followed when performing a HES in Europe. In particular, herein we provide some general recommendations on the ethical conduct of a HES, with specific reference to the safeguarding of privacy (or “data protection”); we also provide a model of an informed consent form, which is intended as a guide for creating such a form for use in HESs in Europe.

General recommendations on the ethical conduct of a HES

Any type of research on humans must obviously be conducted according to ethical standards, which are mandated by specific legislation, examples of which include: i) acts regulating the status and/or rights of patients; ii) medical research acts; iii) other national ethical principles of research involving human subjects; and iv) international biomedical research guidelines.

However, this legislation varies by individual country. Thus when planning a HES, it must be ensured that the study protocol comply with the given country’s specific legislation. Internationally, the Declaration of Helsinki, “Ethical Principles for Medical Research Involving Human Subjects”, is considered to be the pillar of ethical standards. Other important reference documents include the Belmont Report (“Ethical Principles and Guidelines for the Protection of Human Subjects of Research”) and two important acts of the Council of Europe: the Recommendation of the Committee of Ministers No. R(90) 3 concerning medical research on human beings and the Oviedo Convention on Human Rights and Biomedicine.

Ethics committee

That research is conducted following appropriate ethical standards is the responsibility of an ethics committee, which can be local, regional, or national. This committee must approve all aspects of the research, including the performance of the research itself, informed consent, the safeguarding of privacy, and the use of data and biological materials, both for the research being conducted and any future purposes.
The safeguarding of privacy, data protection and subjects’ rights

As stated in the Declaration of Helsinki, “…Every precaution should be taken to respect the privacy of the subject [and] the confidentiality of the patient's information…”, which has become increasingly important, given the progress made in information technology and the consequent ease of access to data. That privacy is safeguarded is ensured through legislation (generally a “Data Protection Act”).

Given that performing a HES includes collecting a particular type of personal data (i.e., sensitive data regarding health), the HES protocol should comply with the given country’s Data Protection Act and cover all aspects of data protection, in particular: access to data, the exchange of data, record linkage, and anonymisation procedures. In Europe, the most important document regarding data protection 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”.

Informed consent

Before performing any kind of research involving humans, informed consent must be obtained, which goes beyond merely getting an individual to sign a written consent form. It is a process of communication between an 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.

Below is provided a model of an informed consent form, to be used as a reference for the forms used in European HESs. The model includes an introduction which explains its purpose and provides recommendations for those who will be responsible for this aspect of the HES.
RECOMMENDATIONS FOR CREATING AN INFORMED CONSENT FORM

Before performing any kind of research involving humans, informed consent must be obtained, which goes beyond merely getting an individual to sign a written consent form. It is a process of communication between an 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.

This document is intended to help you to create an informed consent form for the HES in your country. If you feel that another format would be more suited to your HES, then you are free to make any changes deemed necessary. For example, in the present form, candidates are asked to provide a single signature which indicates consent to participate in all parts of the study. However, some countries may want to request that the candidate provide a separate consent and signature for each individual activity that he/she will undergo (e.g., blood taking, linking of data to other databases). Many of the questions on this form are followed by a comment that provides suggestions or considerations which may help you in adapting the form for use in your HES.

Given that the ultimate goal is to ensure that participants are truly informed, the information provided must be complete and clear. You should thus use terminology that is simple and easy to understand, avoiding scientific terms when possible. Moreover, excessively complex or long descriptions can confuse or intimidate study candidates. You may also want to consider such measures as: providing the study candidates with the description of the HES before requesting informed consent (so that study candidates have sufficient time to understand the implications of participation), setting up a telephone help-line for candidates, and translating the form into other languages.

The protocol for conducting the HES in your country, including the informed consent form, will have to be approved by your national, regional, or local ethics committee, so as to ensure that it complies with national legislation and ethical standards. Many of the sections in this form may have to be modified to be consistent with the legislation in your country (e.g., that regarding access to data and storage of samples in biobanks).

If you require any assistance or additional information, you can contact the individual responsible for coordinating the legal and ethical aspects of the European HES.
To the study candidate,

You are eligible to take part in a National Health Examination Survey (or “HES”). [Comment: If the HES includes minors or persons not capable of providing informed consent, the word “you” should be substituted with “your child” or “your legal ward” or with the actual name of the study participant] A HES is a study carried out for obtaining information on general health by interviewing individuals and measuring certain indicators that can be important to health, such as weight, blood pressure, and cholesterol level. This information is used to acquire knowledge on the health status of the population, which can be important in promoting and improving the health of all.

The HES is being conducted by [specify name of organization conducting the HES in your country] among a sample of [specify expected number of participants] individuals in [specify study area, such as the town or province].

[Comment: Information on health concerns that are important in the specific country and for which a HES could be beneficial can be added here. For example “In Italy, obesity is becoming an increasingly important health concern, yet there is little information on what percentage of the population can be considered as obese.” If the candidate feels that the study would be socially useful, then the chances of him/her participating could increase.]

Your name was chosen from among [specify source of the person’s name and the area to which it refers] [Comment: This sentence should specify how the individual was chosen (e.g., from electoral rolls, social insurance registers, population registers), so that he/she is aware of how the research personnel obtained his/her name.]

All aspects of this study have been approved by the Ethics Committee of the…[specify the name or level of the ethics committee (e.g., France’s National Ethics Committee)].

The present form includes important information about the study and a description of what will be asked of you if you decide to participate. In order to participate, you will need to carefully read and sign this form. If any part of this form is not clear to you, you can contact the researchers conducting the study (see information below). [Comment: The wording of this sentence may change according to who is available for providing clarifications or depending on whether or not information aids, such as telephone help-lines, are provided.]

Your participation is important to us, but please be assured that it is voluntary, that you may leave the study at any time, and that your data will be kept confidential.

What will be asked of me if I decide to participate?

If you decide to participate in the HES, you will be contacted [Comment: If known, the name of the person who will contact the participant could be put here, or their profession (e.g., “…a nurse will contact you…”)] to schedule a visit at… [Comment: The site where the study activities will be performed should also be specified (e.g., in the participant’s home, a mobile clinic)]. During this visit, you will be asked to answer
questions on ... [Comment: Specify the topics that the questions will cover. If an interview is not conducted (e.g., if a self-administered questionnaire is used), the wording of this section should be modified accordingly).] Measurements of your height, weight, and blood pressure will be taken; a blood/urine/saliva sample will also be taken. [Comment: If the HES comprises additional modules, then modify accordingly]. The sample will be tested for ... [Comment: To be modified in accordance with the specific objectives of the HES] and other health-related indicators [Comment: It is important to assure study candidates that the samples will not be used to test for other purposes (e.g., HIV testing, drug testing); examples could be provided. If DNA testing is performed, this should be declared].

**How much of my time will be needed to take part in this study?**

To perform the interview and collect the samples needed for the study, approximately __ hours will be needed. These activities will be performed in just one visit. [Comment: Specify the total time in hours, number of visits, amount of time per visit. This is an important consideration for candidates in deciding whether or not to participate, in that an excessive amount of time could discourage participation. However, the researchers should not underestimate the time needed].

**Are there any health risks to participating in this study?**

The taking of a blood sample may pose a minimal risk. [Comment: Given that the risk associated with the taking of blood samples is minimal, this section can be eliminated. However, if any activities that may pose a risk are added to your HES, the potential risks must be disclosed.]

**Will I be paid or given anything for taking part in this study?**

[Comment: If no compensation is to be provided, then it is possible to write “No. You will not be paid for taking part in this study.” or to eliminate this question. If instead it is provided, the description of compensation must be clear. Payment or other forms of incentive may not be allowed in certain countries].

**Would you like to receive the results of the tests performed on the samples taken from you?**

Yes __

No __

[Comment: It is assumed that in the HES no information that could be potentially upsetting to participants will be collected (e.g., HIV test results), though it should nonetheless be considered whether or not the participant could be upset by such information as, for example, obesity. If the participant’s general practitioner is involved in collecting information for the study and is responsible for providing the results to the participant, then this should be specified. It may also be a good idea to specify an approximate time frame for providing the results (e.g., “The results of the tests will be provided to you in approximately 6 months”).]

**Who else will be provided with, or have access to, my data?**
The data collected for this study will be used by the [specify name of institution conducting the HES] for the purposes of studying health-related issues. These data will also be provided to other institutes collaborating on the study, yet no information that can be used to identify you will be provided to these institutions. [Comment: Given that data protection laws may vary by specific country, the entities that will have access to data may differ. For example, in some countries it may be legal to provide data on individuals to general practitioners or insurance companies. It is important that the candidate be aware of who will have access to his/her data.]

Your data will also be stored in a computer database at [specify name of institution conducting the HES], which can only be accessed by the researchers conducting the study. The data will also be combined with data from the HES conducted in other European countries in a centralized database.

The data may also be combined (or “linked”) with other data from different sources [Comment: If you already know which databases will be linked, then this information could be provided here.] For example, if you have a specific health condition and the data on your condition have been recorded in another database, then the researchers may combine these data with the data collected in the present survey, so as to study causes and relationships for certain health conditions, which is important in determining the population’s health status.

Please be assured that anyone with access to data, other than the institution performing this study, will not be provided with your name or address or any other information that can be used to identify you.

The results of this study could be published in an article, presented at a scientific meeting, or placed on a specific website, but they would not include any information that would let others know who you are.

**How will my data be kept confidential and my privacy be protected?** [Comment: Describe procedures that will be followed to keep subject information and specimens secure and confidential. For example: “Records will be kept in a separate research file that does not include names or other information that could be used by anyone but the researchers to identify you.”]

The information collected will be kept strictly confidential. In [specify country], data confidentiality is guaranteed by law [specify data protection act]. In Europe, it is guaranteed by “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”.

In any case, your name or any data that could possibly be used to identify you will only be known to the [specify institution conducting the HES].

At any point during or after the study, if you are concerned about a possible violation of your privacy, you can contact …[Comment: If there is an organisation in your country for reporting violations of privacy, complete contact information should be provided here.]
What happens to information about me after the study is over or if I withdraw from the study?

As mentioned, your data may be used for other studies of health-related issues. However, these data will be kept strictly confidential at all times. If you withdraw from the study, it may be decided that the information collected up to that time will be retained [Comment: Whether or not data from persons withdrawing from the study must be discarded may depend on the specific legislation in your country.] Nonetheless, if you wish all of your data to be eliminated, you can request that this be done.

What will happen to my blood/saliva/urine samples after the study is over?

Your samples may be stored at the [Specify name of organization conducting the HES in your country] or in what is referred to as a “biobank” (that is, a storage space for biological materials) and used at a later time for other health studies. However, as mentioned above, these samples will not be tested for... [specify tests NOT to be performed; see comment above]. [Comment: In your country, there may be legal limitations regarding the storage (including duration) and use of biological materials].

After this study is complete, we may want to contact you for additional studies; would you be willing to be contacted?

Yes __
No __

CONTACT INFORMATION

Who can I contact about this study?

For any questions or concerns, you can contact the researcher(s) listed below. [Comment: It is important that the participant be provided with the possibility to speak with someone for any questions or doubts that he/she may have. Not only can this be reassuring for the study candidate or participant, but it might also increase the participation rate.]

Principal Investigator [specify name of Principal Investigator] [Comment: The person available for providing clarifications may change according to how your HES is organized.]:
Mailing Address:
Telephone:
**SIGNATURES**

**Participant:**

*I understand the information printed on this form. I understand that if I have more questions or concerns about the study or my participation, I may contact the person(s) listed above.*

Signature of participant: ___________________________ Date: -

Name (Print legal name): ____________________________________________________

Participant ID: ________________________ Date of Birth: ________________________

**Legal Representative (if applicable) [Comment: If persons unable to fully consent for themselves are included in the HES, this section should be filled in by the person’s legal guardians.]**

Signature of person legally authorized to give consent

______________________________ Date: _______________

Name (Print name): ______________

Check relationship to participant:

- Parent
- Spouse
- Son/Daughter
- Sibling
- Legal Guardian
- Other:

______________________________

Reason participant is unable to sign for self:

______________________________

**Person receiving the informed consent:**

*I have received the informed consent of (name of participant).*

Signature of person receiving informed consent: ___________________________

Date: __________________

Name (Print legal name): _________________________________________________
7. Measurement protocols

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7.1 Introduction

In this chapter recommended measurement protocols are described. The recommendations are based mostly on the review of the experience from earlier HES and recent developments in the survey methods, which the FEHES Project has prepared and published separately [Ref: FEHES Review]. For the risk factors of major chronic diseases, the recommended measurement protocols are similar to those of the European Health Risk Monitoring project (EHRM), with updates due to recent developments in the measurement technology [REF: EHRM Recommendation]. The protocol for automated blood pressure measurement is taken from the World Health Organisation’s STEPwise approach to Surveillance (STEPS) recommendation [Ref: STEPS].

For each recommended measurement, we will describe the relevance of the measure, the standardized equipment and way to perform and record the measure, exclusion criteria and quality control measures.

This chapter includes currently standard measurement protocols for the core examination measurements, which are expected from all HES, and for a number of optional measurements, primarily on measurements of functional capacity in the elderly. Questionnaire items relevant for these measurements are also included here. Other questionnaire items that can be collected as part of the HES are described in Chapter 6.

This chapter is structured in such a way that protocols for other measurements can be added later.

7.2 Height

Age
Height can be measured in participants (who can stand) aged 4 years and older.

Exclusion criteria
Height is not measured for people in a wheelchair, persons who have difficulty to stand straight, and participants with a hairstyle (e.g. Afro or Mowhawk) that prevents proper use of the height equipment. For the latter group, self reported height is acceptable if recorded on the collection form.

Time of measurement
The measurement of height will take about 3 minutes.
7.2.1 Equipment

*Equipment for height*
- The most reliable device to measure height is the portable stadiometer (and a fixed stadiometer). This device can be used in different settings, including mobile units, and can be adjusted to surfaces that are not completely flat.
- Carpenter's level.
- Calibrated length rods of 150 cm and 200 cm.

7.2.2 Measurement protocol

*Setting up the measurement site*
For measuring height with the stadiometer, the height rule is taped vertically to the hard flat wall surface with the base at floor level. A carpenter’s level is used to check the vertical placement of the rule.
The floor surface next to the height rule must be hard. If no such floor is available a hard wooden platform should be placed under the base of the height rule.

*Calibration of height rule*
At the beginning and end of each examination day, the height rule should be checked with standardized rods and corrected if the error is greater than 2 mm. The results of the checking and recalibrations are recorded in the log book.

*Protocol for measuring height*
1. Participants are asked to remove their shoes, heavy outer garments, and hair ornaments and head dress.
2. The participant is asked to stand with his/her back to the height rule. The back of the head, back, buttocks, calves and heels should be touching the stadiometer, feet together. The top of the external auditory meatus (ear canal) should be level with the inferior margin of the bony orbit (cheek bone). The participant is asked to look straight.
3. The head piece of the stadiometer or the sliding part of the measuring rod is lowered so that the hair (if present) is pressed flat.
4. Height is recorded to the resolution of the height rule (i.e. nearest millimeter/half a centimeter). If the participant is taller than the measurer, the measurer should stand on a platform so that he/she can properly read the height rule.
5. If the person is taller then the maximum height of the stadiometer, the self reported height is acceptable and recorded on the collection form.
6. If a participant is excluded from height measurement, the reason should be recorded in the data collection form (see textbox 6.1).
Textbox 6.1

Example of the height measurement recording form.

<table>
<thead>
<tr>
<th>Height measurement:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant's identification code</td>
</tr>
<tr>
<td>Person measuring height (identification code)</td>
</tr>
<tr>
<td>Date (ddmmyyyy)</td>
</tr>
<tr>
<td>Height (cm)</td>
</tr>
<tr>
<td>If no height measurement was made, give reason:</td>
</tr>
</tbody>
</table>

1 = hairstyle/headgear
2 = wheelchair bound
3 = unsteady stance
4 = height exceeds upper limit of stadiometer (upper limit of the stadiometer: ____|____|____ cm)
5 = refused
6 = other, specify:

If no height was measured, self reported height is: ____|____|____|____|____|

Describe special conditions, if any: ........................................
........................................................................................................

7.2.3 HIS questions for height

No questions are recommended.

7.2.4 Quality control

To be completed.
7.3 Weight

**Age**
Weight can be measured in participants aged 4 years and older.

**Exclusion criteria**
Weight is not measured for wheelchair bound individuals or persons who have difficulty standing steady. For the latter group, self reported weight is acceptable if recorded on the collection form.

**Time of measurement**
The measurement of weight will take about 3 minutes.

7.3.1 Equipment

**Equipment for weight**
- Balanced beam scale or an electronic scale which has been issued an EC type-examination certificate for medical use. Such a scale can be calibrated.
- Several calibrated weights (e.g. 10 kg or 20 kg each) that can be combined to give test weights between 50 kg and 100 kg.

7.3.2 Measurement protocol

**Setting up the measurement site**
The scale should be placed on a hard-floor surface (not on a floor which is carpeted or otherwise covered with soft material). If there is no such floor available, a hard wooden platform should be placed under the scale. A carpenter's level should be used to verify that the surface on which the scale is placed is horizontal.

**Calibration of scale**
Calibration should occur at the beginning and end of each examining day. The scale is checked using the standardized weights and calibration is corrected if the error is greater than 0.2 kg. The results of the checking and the recalibrations are recorded in a log book. The balanced beam scale is balanced with both sliding weights at zero and the balance bar aligned. For calibrating an electronic scale, follow the instructions of the specific scale. Note that the reading of an electronic scale depends on the gravity of each location. Therefore its calibration is particularly important whenever a new examination site is set up.

**Protocol for measuring weight**
1. Participants are asked to remove their heavy outer garments (jacket, coat, trousers, skirts, etc.) and shoes. If subjects refuse to remove trousers or skirt, at least make them empty their pockets and record the fact in the data collection form (see textbox 6.2).
2. The participant stands in the centre of the platform, weight distributed evenly to both feet. Standing off-centre may affect measurement.
3. The weights are moved until the beam balances (the arrows are aligned). (This concerns the balanced beam scale only).
4. If the persons weight exceed the maximum of the scale, the self recorded weight is acceptable and recorded on the collection form.
5. If the participant tells that she is pregnant, the weight before the pregnancy should be asked and noted on the collection form under self reported weight.
6. The weight is recorded to the resolution of the scale (the nearest 0.1 kg or 0.2 kg).
Textbox 6.2

**Example of the Weight measurement recording form.**

**Weight measurement:**
- Participant's identification code
- Person measuring weight (identification code)
- Date (ddmmyyyy)
- Weight (kg)
- If participant is not weighed, give reason:
  1 = pregnant women
  2 = wheelchair bound
  3 = unsteady stance
  4 = weight exceeds upper limit of scale (upper limit of the scale: ___|___|___ kg)
  5 = refused
  6 = other, specify:
- If no weight was measured, self-reported weight is (kg)
- Describe special conditions, if any: ..................................................
  ..............................................................

**7.3.3 HIS questions for weight**

No questions are recommended.

**7.3.4 Quality control**

To be completed.
7.4 Waist and hip circumferences

Age
Measuring the waist and hip circumference is for adult participants in the age of 18 years and older.

Exclusion criteria
Waist and hip circumferences are not measured for persons in a wheelchair or persons who have difficulty standing straight.
If the participant is immobile or refuses to have his/her waist- or hip circumference measured, this fact should be recorded in the data collection form (see textbox 6.3). Self-reported waist-or hip circumference is not acceptable as a substitute. If the waist- or hip circumference exceeds the length of the tape, this fact should be recorded in the data collection form together with the maximum length of the tape.

Time of measurement
The measurement will take about 5 minutes.

7.4.1 Equipment

Equipment for measuring waist and hip circumference
- Constant tension tape, not stretchable (for example, Figure Finder Tape Measure)
- Full body length mirror with 10cm×10cm grid lines
- Carpenter’s level

7.4.2 Measurement protocol

Setting up the measurement site
A private area is necessary for this measurement. This could be a separate room, or an area that has been screened off from other people.
The full body length mirror is placed against the wall or if the mirror stands on its own feet next to the measurement place. Using the carpenter’s level, it should be verified that the gridlines on the mirror are horizontal.

Checking the tape
The length of the measuring tape is checked with the calibrated length rod (usually the 150 cm one) at least once per month. If the measuring tape is stretched it should be replaced

Protocol for measuring waist and hip circumferences
This measurement should be taken without clothing, that is, directly over the skin.
If this is not possible, the measurement may be taken over light clothing and record this fact in the data collection form. It must not be taken over thick or bulky clothing. This type of clothing must be removed.
If the participant tells that she is pregnant, the measurement will not be executed.
7.4.2.1 Waist circumference

*Position of waist circumference measurement*
Waist circumference should be measured at a level midway between the lower rib margin and iliac crest with the tape all around the body in horizontal position.

*Waist circumference measurement procedure*
1. Participants are asked to remove their clothes, except for light underwear. If this is not possible, for example due to cultural reasons, the alternative is to measure the circumference on the subject without heavy outer garments and record this fact in the data collection form. Tight clothing, including the belt, should be loosened and the pockets emptied.

2. The measurer should stand at the side of the participant in order to have a clear view of the mirror.

3. Participants should be standing with their feet fairly close together (about 12-15 cm) with their weight equally distributed to each leg. Participants are asked to breathe normally; the reading of the measurement should be taken at the end of gentle exhaling. This will prevent subjects from contracting their abdominal muscles or from holding their breath.

4. The measuring tape is held firmly, ensuring its horizontal position. Use the grid lines on the mirror to verify that the tape position is horizontal all around the waist. The tape should be loose enough to allow the observer to place one finger between the tape and the subject's body.

*Waist circumference exceeds the length of the tape*
If the waist circumference exceeds the length of the tape, this fact should be recorded in the data collection form together with the maximum length of the tape.

7.4.2.2 Hip circumference

Measurement of the hip circumference is the same as for waist circumference, except for tape position. Hip circumference should be measured as the maximal circumference over the buttocks. The gridlines on the mirror are used to verify that the tape position is horizontal all around the body.

*Hip circumference exceeds the length of the tape*
If the hip circumference exceeds the length of the tape, this fact together with the maximum length of the tape, should be recorded in the data collection form (textbox 6.3).
Textbox 6.3

Example of the waist hip measurement recording form.

**Waist and hip circumference measurement:**

| Participant's identification code | ___|___|___|___|___|___|
| Person measuring waist and hip (identification code) | ___|___|
| Date (ddmmyyyy) | ___|___|___|___|___|___|___|___|___|___|
| Waist circumference (cm) | ___|___|___|___|___|___|
| Hip circumference (cm) | ___|___|___|___|

If no waist/hip circumference measurement was made, give reason: ___
1 = pregnant woman
2 = wheelchair bound
3 = unsteady stance
4 = circumference exceeds length of tape (length of tape: ___|___|___|___|___ cm)
5 = refused
6 = other, specify: ___

Measurement was done over: ___
1 = light underwear
2 = normal clothes (without heavy garments)
3 = other specify: ..................

Describe special conditions, if any:

---

7.4.3 HIS questions
No questions are recommended.

7.4.4 Quality control

To be completed.
7.5 Blood pressure

Traditionally, blood pressure has been measured using the mercury sphygmomanometer. The EHRM recommendations from 2002 are based on the use of mercury sphygmomanometer. Due to toxicity of the mercury, the mercury sphygmomanometers may in future become banned and therefore we have to look for alternative blood pressure measuring devices. In some of the previous health examination surveys, automated blood pressure measurement devices have been used. In the market, there is also number of aneroid sphygmomanometers but we don’t know any national HES in which they would have been used.

We will describe here the measurement protocol for both the mercury sphygmomanometer and the automated blood pressure measuring device. What is common for both devices is the preparation for the measurement. The actual measurement protocol differs between devices. Preparation for the measurement and the measurement protocol by mercury sphygmomanometer follow the EHRM protocol, while the measurement protocol by automated blood pressure measurement device follows the WHO STEPS protocol.

Age
The blood pressure measurement can be conducted by adult participants 18 years and older.

Exclusion criteria
None

Time of measurement
It will take 15 minutes to measure the blood pressure.

7.5.1 Preparation for the measurement

7.5.1.1 Basic conditions

Before the blood pressure measurement begins the following conditions should be met:

1. Subject should abstain from eating, drinking (anything else than water), smoking and taking drugs that affect the blood pressure one hour before measurement.
2. Because a full bladder affects the blood pressure it should be emptied.
3. Painful procedures and exercise should not occurred within one hour.
4. Subject should be sitting quietly for about 5 minutes.
5. Subject should remove outer garments and all other tight clothes. The sleeve of shirts, blouses, etc. should be rolled up so that the upper right arm is bare. The remaining garments should not be constrictive and the blood pressure cuff should not be placed over the garment.
6. Blood pressure should be measured in a quiet room with comfortable temperature. The room temperature should be recorded.
7. The time of day should be recorded.
8. The blood pressure measurer should be identified on the blood pressure data recording form.
9. Blood pressure measurement device(s) should be numbered and the number of the device should have been recorded.
7.5.1.2 Position of the subject

Measurement should be taken in sitting position so that the arm and back are supported. Subject’s feet should be resting firmly on the floor, not dangling. If the subject’s feet do not reach the floor, a platform should be used to support them. If subject cannot sit and the measurement is taken on supine posture this should be recorded.

7.5.1.3 Position of the arm

The measurements should be made on the right arm whenever possible. If right arm cannot be used for the measurement (arm is amputated or has rashes, adhesive dressing, casts, open sores, hematomas, wounds, arterovenous shunt or any other intravenous access device), the use of the left arm should be recorded.

The subject’s arm should be resting on the desk so that the antecubital fossa (a triangular cavity of the elbow joint that contains a tendon of the biceps, the medial nerve, and the brachial artery) is at the level of the heart and palm is facing up. To archive this position, either the chair should be adjusted or the arm on the desk should be raised, e.g. by using a pillow. The subject must always feel comfortable.

7.5.1.4 Selection of the cuff

The greatest circumference of the upper arm is measured, with the arm relaxed and in the normal blood pressure measurement position (antecubital fossa at the level of the heart) using a non-elastic tape. The measurement should be read to the nearest centimetre. This reading should be recorded.

Select the correct cuff for the arm circumference and record the size of the selected cuff. The width of the bladder of the cuff should be at least 40% of the arm circumference and the length of the bladder at least 80% of the arm circumference. In the EHRM protocol, instructions are given how to determine the correct arm circumference for the different cuff sized. For example:

<table>
<thead>
<tr>
<th>Arm circumference</th>
<th>Width of the bladder of the cuff</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 25 cm</td>
<td>8 cm</td>
</tr>
<tr>
<td>25 cm &lt; arm circumference &lt; 35 cm</td>
<td>12 cm</td>
</tr>
<tr>
<td>≥ 35 cm</td>
<td>16 cm</td>
</tr>
</tbody>
</table>

The cuff should be places 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.

A set of 3-4 cuffs with different size should be available and special attention should be paid to the use of proper cuff width in relation to the size of the arm. The length of the bladder should be enough to encircle at least 75-80% of the arm and the arm circumference should be measured in the middle between the axilla and the antecubital space of the upper arm, with the arm relaxed and in the normal blood pressure measurement position (antecubital fossa at the level of the heart), using a non-elastic tape. The measurement should be read to the nearest centimetre. This reading should be recorded in the data.
7.5.1.5 Number of measurements

Three measurements should be taken one minute apart.

7.5.2 Mercury sphygmomanometer

The measurer should outline the procedure briefly to the subject. In particular, he or she should warn the subject of the minor discomfort caused by inflation and deflation of the cuff and tell the subject that the measurement will be repeated three times.

7.5.2.1 Equipment

For survey blood pressure measurements the following equipment is required:

- simple mercury sphygmomanometer;
- stethoscope;
- 3-4 cuffs;
- non-elastic measuring tape;
- stopwatch.

7.5.2.2 Measurement protocol

The bell of the stethoscope should be used because it gives clearer sounds than the diaphragm.

1. The radial pulse is palpated and the pulse rate is counted for 30 seconds, measured by a digital wrist watch or one with second hand.
2. Record 30-second pulse count and whether pulse was regular.
3. The manometer should be placed so that the scale is at eye level, and the column perfectly vertical. The subject should not be able to see the column of the manometer.
4. Determining the peak inflation level:
   i. The mercury column has to be at 0 level.
   ii. The subject's radial pulse is again palpated.
   iii. The cuff is inflated and the level of the top of the meniscus of the mercury column is noted at the point when the radial pulse disappears. The cuff is immediately deflated by completely opening the valve.
   iv. The peak inflation level is determined by adding 30 mm to the pressure where the radial pulse disappeared.
5. Venous blood pool in the forearm is normalized by waiting at least 30 seconds or by raising the arm for 5-6 seconds.
6. The brachial pulse is located and the bell of the stethoscope is placed immediately below the cuff at the point of maximal pulsation. If it is not possible to feel the brachial pulse, the bell of the stethoscope should be placed over the area of the upper arm immediately inside the biceps muscle tendon. The bell should not touch the cuff, rubber or clothing.
7. The cuff is rapidly inflated to the peak inflation level and then deflated at a rate of 2 mmHg per second.
8. The pressure should be reduced steadily at this rate until the occurrence of the systolic level at the first appearance of a clear, repetitive tapping sound (Korotkoff Phase 1) and diastolic level at disappearance of repetitive sounds (Phase 5) have been observed. Then the cuff should be rapidly deflated by fully opening the valve of the inflation
82

bulb. Note: There may be a brief period (auscultatory gap) between systolic and diastolic pressure, when no Korotkoff sounds are heard. Therefore, the 2mmHg/second deflation should be continued until the diastolic blood pressure is definitely established. If Korotkoff sounds persist until the cuff is completely deflated, a diastolic blood pressure of 0 should be recorded.

9. The measurements should be recorded to the nearest 2 mmHg. If the top of the meniscus falls half way between two markings, the marking immediately above is chosen. The subject is not told the blood pressure values at this point.

10. After one minute of wait to allow redistribution of blood in the forearm a second measurement is made by repeating steps 7 to 9. The subject should not change position during the wait.

11. After another one minute a third measurement is made by repeating steps 7 to 9.

12. The subject may now be told the measurement values.

7.5.3 Automatic blood pressure measurement

7.5.3.1 Equipment

For survey blood pressure measurements the following equipment is required:

- Automated blood pressure measurement device
- 3-4 cuffs
- Non-elastic measuring tape

7.5.2.2 Measurement protocol

1. Insert the air tube of the cuff to the air jack of the machine. The cuff must be airless.
2. Open the battery compartment and insert batteries or use the adapter.
3. Press the ‘On’ button, all the symbols on the display light up for approximately two seconds in order to check the display.
4. Then all the symbols disappear and the air release symbol begins to flash
5. Wrap the cuff around the arm so that the coloured band (indicating the centre of the bladder) is positioned 2 – 3 cm above the elbow joint on the inside of the arm.
6. Close the cuff with the fabric fastener. The green area of the cuff must cover the brachial artery.
7. Push the start button, the device determines automatically the correct level of inflation pressure.
8. When the target inflation values are reached, the air is automatically released. The value in the display counts downwards.
9. As soon as the monitor detects the pulse, the symbol begins to flash.
10. When the monitor no longer detects the pulse whilst the cuff pressure is dropping, the systolic and diastolic pressure are displayed
11. After one minute of wait the second measurement is made by repeating steps 7 – 10. The subject should not change position during the wait.
12. After another one minute the third measurement is made by repeating step 7 – 10.
13. The subject may now be told the values of the measurement.

7.5.4 HIS questions

Questions below are from the European Health Care Module:
Introduction 14
Now I would like to ask you some questions about your blood pressure.

PA.4 Has your blood pressure ever been measured by a health professional?
   • Yes _ 1
   • No _ 2 → GO TO INTRODUCTION 15
   • don't know _ 8 → GO TO INTRODUCTION 15
   • refusal _ 9 → GO TO INTRODUCTION 15

PA.5 When was the last time that your blood pressure was measured by a health professional?
   • Within the past 12 months _ 1
   • 1-5 years ago _ 2
   • More than 5 years ago _ 3
   • don't know _ 8
   • refusal _ 9

As an alternative, the questions below (from EHRM) are based on MONICA.

HBP1 When was your blood pressure last measured by a health professional?
   1 = Within the past 12 months
   2 = 1-5 years ago
   3 = Not within the past 5 years

HBP2 Have you been told by a health professional in the past year (12 months)
   that you have elevated blood pressure or hypertension?
   1 = Yes
   2 = No
   3 = Uncertain

HBP3 Are you currently taking medication prescribed by a doctor to lower
   your blood pressure?
   1 = Yes
   2 = No
   3 = Uncertain

HBP4 Has a doctor in the past year ordered you to change your way of life, in
   order to lower your blood pressure?
   1 = Yes
   2 = No
   3 = Uncertain

7.5.5 Selection and training of the measurers

When recruiting the measurers one should remember:

- Trained nurses and paramedics often are better blood pressure measurers than doctors.
- The work load of measurers should not cause fatigue, which leads to false measurements.
All candidates have to undergo thorough training covering theory and practice of indirect blood pressure measurements. Theory training is same regardless of the used measurement device but for the practical training, there are some device specific features.

During the theoretical lectures the blood pressure measurement protocol is reviewed and discussed in detail. Possible problems during field operation are examined and solutions analyzed. Also, the quality control measures during the survey are presented, e.g. monitoring for terminal digit preference.

The practical training includes test measurements which real subjects.

**Special features for mercury sphygmomanometer**

After persons have been recruited as candidates for the blood pressure measurement by auscultation method, they have to pass a hearing test administered by an audiometrist, to ensure they have no loss of hearing in either ear.

The practical training includes

- Training with tape of recorded Korotkoff sounds.
- Training with actual subjects (Y-tube, repeated measurements).

Before being accepted as blood pressure measurers, the candidates have to pass a certification test that could be based on similar techniques as the training methods, but now a predefined minimal percentage of correct measurements have to be achieved for successful certification.

**Special features for automated device**

No special requirement for the training.

7.5.6 Quality control

7.5.6.1 During the survey

Quality assurance procedures are mainly not dependent on the used device. There are some device specific features which are given separately for mercury sphygmomanometer and automated blood pressure measurement device.

It is important to continuously monitor the performance of blood pressure measurers to avoid an accumulation of data that will have to be discarded because of unreliability. Monitoring every blood pressure measurement onsite is not possible but there are several simple indicators that can be calculated regularly for monitoring purpose. For monitoring to be effective it is desirable that measurements from the field are reviewed regularly, preferably daily.

For each measurer the following information should be checked regularly during the survey:

1. Availability of data for selected cuff width, measured arm circumference, room temperature and time of the day of the blood pressure measurement. This will detect if some measurer is omitting some parts of the protocol.
2. The proportions of identical readings for the first and second measurements, the second and third measurements, and for all three measurements of systolic and diastolic measurements separately. This will detect if a measurer is actually taking three measurements (identity should be rare).

3. Monitor that daily/hourly work load does not exceed agreed limits.

4. Cross-tabulation between used cuff width and measured arm circumference. This will detected compliance with the protocol.

5. Difference between systolic and diastolic blood pressure should be monitored.

If some problems are detected they need to be immediately discussed with the individual measurer and corrective action taken. Just letting the measurer know that he/she has problems with the measurement procedures may suffice. Otherwise, the measurer should be retrained and re-certificated or dismissed.

During extended surveys, a refresher session for all blood measurers every three months is a desirable practice.

The room temperature should be monitored during the survey on a regular basis and adjusted when needed.

External auditor should make surprise visit to the examination sites and observe measurers’ performance by documenting step-by-step compliance with the protocol. Auditors should also act as guest subject and participate actively in all steps of blood pressure measurement.

**Special features for mercury sphygmomanometer**

Measurers should check every day before the first blood pressure measurement are made that the mercury column of the sphygmomanometer is at zero, that the mercury column falls smoothly when the cuff is deflated, and that the column latches properly into vertical position. Any equipment failing these tests has to be replaced. The results of checking should be recorded in a log book.

For each measurer distribution of terminal digits for systolic and diastolic measurements (separately) should be checked regularly. This will detect if

i. some measurers tend to prefer some digits over others (for example zero preference), indicating unreliable detection of Korotkoff sounds;

ii. some measurers use odd digits that, by protocol, should not be used.

For each measurer, means and standard deviations of the systolic and diastolic blood pressure measurements should be checked regularly. This will detect if some measurer produces systematically lower or higher readings than the average of the team.

**Special features for automated device**

Calibration of the equipment before the survey by an official institute and also during the survey at least once a year.

The batteries of the device should be checked every morning before the first blood pressure measurement is made as well as few times during the day.
For each device, the mean and standard deviations of the systolic and diastolic blood pressure measurements should be checked regularly. This will detect if some device produces systematically lower or higher readings than the average.

7.5.6.2 Quality assessment after the survey

After the survey, it is important to assess and document the overall quality of blood pressure measurements. This information can be used to verify that results presented in publications are accurate and comparable with other studies. In addition, the information will also be useful for planning the future surveys and for designing the training of the future blood pressure measurers.

The retrospective quality assessment report for blood pressure measurements no longer focus on the data of individual measurers, but instead concentrates on the pool of all measurements. The report should include the following information:

1. Item response rates for blood pressure measurement.
2. Availability of data on:
   a. used cuff width
   b. measured arm circumference
   c. room temperature
   d. time of the day of the blood pressure measurement
3. Proportion of incomplete measurements
4. Proportion of identical measurements for systolic and diastolic measurements separately
5. Difference between two sequential measurements for systolic and diastolic measurements separately
6. Cross-tabulation between cuff widths and arm circumferences
7. Mean and standard deviation of the room temperature.

And additional if the mercury sphygmomanometers are used:

1. Proportion of odd-valued readings for systolic and diastolic measurements separately.
2. Distributions of terminal digits for systolic and diastolic measurements separately.
## Textbox 6.4

### Cuff selection rules*:

<table>
<thead>
<tr>
<th>Cuff width</th>
<th>12X22 cm</th>
<th>16 X 30 cm</th>
<th>16 X 36 cm</th>
<th>16 X 42 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm circumference</td>
<td>22 cm -26 cm</td>
<td>27 cm - 34 cm</td>
<td>35 cm – 44 cm</td>
<td>45 cm – 52 cm</td>
</tr>
</tbody>
</table>

* It is suggested that the cuff selection rules are printed on the top of the form. The rules shown here are an example, and the numbers should be substituted by those of the cuff sizes actually used in the survey.

### Data recording form blood pressure measurement:

<table>
<thead>
<tr>
<th>Participant's identification code</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Questions to the participant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person measuring blood pressure (identification code)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of measuring device</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = Mercury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = automatic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = other specify:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of blood pressure device</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date (ddmmyyyy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of day (hh:mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room temperature (°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arm used for blood pressure measurement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 = right</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = left</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for measuring on the left arm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position of subject</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1 = sitting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = supine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum arm circumference (cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuff size used</td>
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<td></td>
</tr>
<tr>
<td>1 = 12X22 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = 16x30cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3 = 16 x36cm</td>
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<tr>
<td>4 = 16x42 cm</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Pulse count</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak inflation pressure (mmHg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood pressure measurement</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st measurement</strong>:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2nd measurement</strong>:</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3rd measurement</strong>:</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.6 Blood collection

Venous blood samples are usually collected for the measurement of blood lipids and glucose. For lipid measurements, serum should be used. For glucose measurements, plasma is used. It is often advisable to collect additional serum and plasma samples for possible future analysis of fatty acids and lipoproteins, biomarkers and antibodies, and whole blood for DNA. The collection of samples blood samples for the analysis of blood lipids and glucose are described here.

**Minimal set of blood measurements**
The minimal set of analyses contains the lipid analyses:
- Total Cholesterol
- HDL-cholesterol

Extension of the set of blood samples can be done by taking (citrate + sodium fluoride) samples for measuring:
- Glucose

**Age**
Blood drawing is possible from participants in the age of 4 years and older.

**Exclusion criteria**
Reason for exclusion of participants:
- Participant is on anticoagulation therapy
- Participants with bleeding disorder (e.g. haemophilia, low platelets, etc).

**Time for the measurement**
Drawing blood samples will take about 15 minutes.

7.6.1 Equipment

**Equipment for sample drawing**
- needles (preferably vacutainer needles), size 20G to 22G
- vacutainer tubes
- vacutainer holder
- tourniquet
- micropore tape
- adhesive dressing
- rubber gloves
- pillow or other support
- separate stoppers for opened vacuum tubes and non-vacuum tubes
- needle disposal box

Chemically clean evacuated tubes with appropriately reduced pressure should be used in sample drawing. If plasma specimens are taken, EDTA should be used as anticoagulant. Tubes with liquid EDTA reduce the risk of haemolysis that sometimes occurs with tubes using EDTA in powder form. For glucose determination, tubes with citrate and sodium fluoride are needed. Plastic vacuum tubes are preferred to glass tubes. Plastic vacuum gel tubes are most convenient if available. Plain tubes can be used for determination of lipids (total cholesterol and HDL cholesterol).
If vacuum tubes are not used or tubes are opened for freely flowing samples, stoppers which do not react with blood constituents should be available.

**Equipment for handling, transfer and storage**

For handling, transfer and storage of blood samples the following equipment is needed:

- transfer and storage tubes (note that some of these should be freezable)
- disposable pipettes or pipettes with changeable apex
- centrifuge, capable of 3000g. If gel tubes are used, centrifuge should have swinging bucket rotor
- timer
- racks for tubes
- special boxes for tube transfer and storage
- set of labels with identification codes or other method to mark the tubes (note that these should not be vulnerable to freezing)
- refrigerator
- freezer (as required)

### 7.6.2 Protocol for drawing blood samples

**Fasting before the sample collection**

The serum samples for total cholesterol and high density lipoprotein cholesterol can be taken at any time of the day with the subject non-fasting. In the case of drawing non-fasting samples, blood sample drawing should be spread throughout the day.

If fasting glucose, lipoprotein fractions and fasting triglycerides are to be measured the samples should be collected after a fasting period. The fasting period should be minimally 8 hours (overnight) and maximally 14 hours (too long fasting causes major changes in energy metabolism with implications for blood triglycerides). In practise this means overnight fasting, and that fasting samples can only be taken in the morning, and fasting samples can be expected only from those who are invited to come to the examination in the morning.

**Position of subject**

All blood samples should be drawn in a sitting position. Preferably, blood should not be collected from the arm that is used for blood pressure measurement, i.e. blood should usually be drawn from the left arm.

**Use of tourniquet**

Prolonged venous occlusion can cause changes in concentrations of blood constituents. Therefore, the use of a tourniquet should be minimized. If a tourniquet is used to search for a vein, it should be released before withdrawal of blood begins. In any case, the use of a tourniquet should be limited to less than one minute.

**Sample drawing procedure**

Blood samples should be taken from the vein in the antecubital fossa. Before blood collection, the subject should remove tight clothes that might constrict the upper arm. During blood collection, the arm should rest on a pillow or other supportive prop.

The fieldworker sets the tourniquet around the upper arm of the subject, searches the proper vein by inspecting and palpating. The vein can be anchored by placing the thumb about two centimetres below the vein and pulling gently to make the skin a little taut. After that, the
needle, bevelled upward, should be pushed smoothly and quickly into the vein, to minimize the possibility of haemolysis as a result of vascular damage. Immediately after the insertion, the tourniquet should be released to minimize the effect of hemoconcentration.

The order in which the various tubes are filled is determined by the risk of contamination and coagulation. NCCLS recommended the order: 1. tubes for serum, 2. citrate filled tubes, 3. gel tubes, 4. heparin filled tubes, 5. EDTA filled tubes, 6. fluoride filled tubes. Another consideration that might affect the order of tube filling is the priority of the assay for which the tubes are needed, in case insufficient blood flow cuts the sampling short. Then the order will be: 1. tubes for serum, 2. tubes filled with fluoride.

If there are any problems with blood flow during blood taking (e.g. collapsing vein), the procedure should be discontinued and an attempt should be made on the other arm. If that also fails, no further attempts should be made and the blood collection for this particular participant should be recorded as "failed".

If vacuum tubes are used, the tube is placed into the adapter. When taking several tubes the next tube should be changed immediately after the previous one is filled. In case there is suspicion that not enough blood will be obtained to fill all the tubes, they should be filled in the order of priority of the assay for which they are needed. To assure proper mixing tubes pre-filled with EDTA, gel or fluoride should be inverted smoothly about 8 times towards the stopper while the next tube is filling up (It may simplify the manual of operations to prescribe inverting all tubes, since it does not harm plain tubes).

Before the subject leaves the examination site and before the rack is moved anywhere, all the tubes should be labelled with the subject identification code.

**Clotting**

After the identification of the tubes the timer should be started. The blood samples are allowed to clot at 15-24 °C. If vacuum gel tubes are used, the temperature should be at least 20°C (optimum 20-22°C), because the gel viscosity changes in colder temperature. The clotting time should be minimally 30 minutes and maximal one hour.

**Centrifuging**

If samples (plasma) for glucose measurements are taken, the samples should be centrifuged no later than 20-35 minutes after the sample is drawn.

For serum samples, blood should be centrifuged within one hour after blood collection. Alternatively, they should be cooled in the refrigerator immediately after clotting and centrifuged at the end of the day.

The centrifuge should not be cold and blood specimens should be centrifuged at a temperature 15-24°C. For serum preparation blood should spin for 10 minutes at 1500 g. For plasma, the conditions are 15 minutes at 2000g to 3000g. For all the participants a form should be filled in with information about the handling of the blood samples (see appendix 2).

**Separation of serum or plasma**

After centrifugation, the tubes should be inspected carefully in order to recognize possible hemolysis. If vacuum gel tubes are used, it should be checked that the gel surface is straight, the layers are properly separated, there are no red cells above the gel surface, there are no
fibrin filaments in the sample and the sample is not coagulated after the centrifugation. If the serum samples are pooled the haemolysed samples should be kept separate.

The serum/plasma should be promptly separated from clot or cells and transferred to a clean tube. The white cell layer should not be transferred with the plasma. If the vacuum gel tube is used the separated serum can be poured to a clean tube otherwise the pipette should be used. After all serum/plasma is separated to proper transfer/storage tubes the tubes should be carefully marked with sticker or other method with identification code.

Storage and transfer of serum/plasma samples

It is recommended that the assays for total cholesterol, HDL-cholesterol and triglyceride levels should be done on the day of sample collection. For possible transfer from the examination site to the laboratory the samples should be properly packed and cooled, but not frozen.

(If HDL-cholesterol is analyzed with the precipitation method, analysis should be done on the day of blood collection. However, nowadays it is recommended that HDL cholesterol is analyzed using a direct methods.)

If analysis is not possible on the day of sample collection, but within the next three days, it is recommended that analyses should be carried out from non-frozen samples and samples should meanwhile be stored at +4°C.

If analysis is not possible within three days, the serum or plasma should be immediately frozen at preferably -70°C, but at least -20°C. While transporting frozen samples, care has to be taken to avoid thawing.

For transport, samples should be properly marked with identification codes and transfer lists should be kept in order to check for possible disappearance of samples.

Samples frozen at -20°C should be analyzed within six months. If later analyses will be done, the samples must be frozen at -70°C.

7.6.3 Safety

Medical doctor for back-up
During the examinations, the nurse / medical assistant who is taken the blood samples, should know who they can contact (medical doctor) in case something happens with the participant during or after the blood drawing.

Gloves
For safety reasons, gloves should be used during blood drawing and handling. The use of gloves may depend on local instructions/protocols. If personnel drawing blood samples are not using gloves, they should wash their hands between all the participants.

Vaccination for Hepatitis B for medical personnel
All the medical personnel working with needles should be vaccinated for Hepatitis B. The head of the department / project leader is responsible for the immunisation of the staff.
**Needle stick injuries**

At the place of the examination there should be a protocol for needle stick injuries. Any personnel who sustain a needle stick injury should seek immediate advice from the responsible local health staff.

**What to do after an incident?**

- After the needle injury, let the wound bleed very well and clean it with water or physiological saline.
- Disinfect the wound with disinfectants
- Contact the local health professional who is responsible for infectious diseases.

**Disposal of needles and other materials**

Needle disposal boxes should be available for all personnel drawing blood samples. Needles should be released from adapters directly to needle disposal box. Needles should never be re-sheathed after use. The disposal boxed should not be allowed to become overfull (maximum filled 75%). All the rest materials (needles / rest blood) should be processed in an appropriate way, and following any local rules

**7.6.4 Qualification and training of personnel**

The person performing the blood collection should be a certified phlebotomist. In most countries, this certification is offered through national accrediting agencies for clinical laboratory sciences. Employing a certified phlebotomist for the invasive blood collection procedure provides a measure of safety for the participant, but it also provides some medical-legal protection for the survey organizers, in case something should go wrong.

In preparation for the survey, blood collection personnel should be made familiar with the aims of the survey and the protocol details that pertain to blood collection. The safety measures for protection of participant and technician should be reviewed.

**7.6.5 HIS questions**

The following questions complement the HES, by assessing awareness and treatment of hypercholesterolemia and diabetes:

Introduction 15
Now I would like to ask you some questions about your blood cholesterol.

**PA.6 Has your blood cholesterol ever been measured?**

- Yes _ 1
- No _ 2 → GO TO INTRODUCTION 16
- don't know _ 8 → GO TO INTRODUCTION 16
- refusal _ 9 → GO TO INTRODUCTION 16

**PA.7 When was the last time that your blood cholesterol was measured?**

- Within the past 12 months _ 1
- 1-5 years ago _ 2
- More than 5 years ago _ 3
- don't know _ 8
- refusal _ 9
As an alternative, the questions below are from EHRM (including a question on treatment):

**HCL1** When was your blood cholesterol last measured?
- 1 = Within the past 12 months
- 2 = 1-5 years ago
- 3 = Not within the past 5 years

**HCL2** Have you been told by a health professional in the past year (12 months) that you have raised (elevated) blood cholesterol?
- 1 = Yes
- 2 = No
- 3 = Uncertain

**HCL3** Are you currently taking medication prescribed by a doctor to lower your blood cholesterol level?
- 1 = Yes
- 2 = No
- 3 = Uncertain

**HCL4** Has a doctor in the past year ordered you to change your way of life, in order to lower your total blood cholesterol?
- 1 = Yes
- 2 = No
- 3 = Uncertain

---

**Diabetes**

*Introduction 16*

Now I would like to ask you some questions about your blood sugar (glycaemia).

**PA.8 Has your blood sugar ever been measured?**
- Yes _ 1
- No _ 2 → GO TO FILTER 5
- don't know _ 8 → GO TO FILTER 5
- refusal _ 9 → GO TO FILTER 5

**PA.9 When was the last time that your blood sugar was measured?**
- Within the past 12 months _ 1
- 1-5 years ago _ 2
- More than 5 years ago _ 3
- don't know _ 8
- refusal _ 9

In addition, the following 2 questions from EHRM on awareness and treatment of diabetes are also recommended.

**DIAB1** Have you ever been told by a doctor that you have diabetes?
- 1 = Yes
- 2 = No
- 3 = Uncertain
**DIAB2** Are you currently taking insulin or pills to control diabetes?

1 = Yes  
2 = No  
3 = Uncertain

---

### 7.6.6 Quality control

**Equipment**

Check the expiring date of the vacutainers.

**Procedures**

Field personnel should be observed during surprise visits to the examination sites, to verify compliance with the protocol. A previously agreed upon check list should form the basis for these observations. Blood samples should be traceable to the individual phlebotomist. The compliance of the phlebotomist with the exclusion criteria for blood collection should be checked by cross validation with questionnaire data. Phlebotomists may also be assessed by the number of failed blood collection procedures.
7.7 Laboratory procedures

7.7.1 Laboratories

All laboratory procedures should be carried out only in accredited medical chemistry laboratories.

7.7.2 Analytical procedures

Good direct enzymatic methods are available for a total, LDL and HDL cholesterol assay as well as for glucose. These can be used in automated or manual methods with inexpensive instruments. The Centres for Disease Control and Prevention (CDC) has a certification program for clinical diagnostic products for cholesterols [REF: Web].

7.7.3 Quality control

Internal quality control of laboratory analyses
For each type of assay the laboratory has to obtain quality control material. Particularly important is the secondary calibrator, which should be real human serum or plasma in the same form as the survey blood samples. These secondary calibrators should be traceable to an internationally recognized reference method. Each standard (calibrator) should be run at least in duplicate. The linearity over the usual working range of the assay should be tested and checked repeatedly during the study. The linearity should be checked with at least three standards in each run.

External quality control of laboratory analyses
External quality control is arranged by internationally recognized reference laboratories that distribute batches of samples of various concentrations for each assay. The participating laboratory is blinded to the concentration of the analyte. Bias and standard deviations of the results of the participating laboratory serve as a measure of performance. Laboratories should participate in the external quality control scheme for the duration of the study. (No such external quality control is currently available for the European HESs, but a recommendation for its establishment is made in Chapter 10.)
7.8 Physical Functioning

7.8.1 Upper body functioning

Handgrip strength

Handgrip strength is often used as an indicator of overall muscle strength in population studies. In addition it has been shown to be a powerful predictor of mortality. A wide range of instruments and measurement protocols are available to measure hand grip strength. Hydraulic instruments (dynamometers) are the most widely used and recommended instrument.

Aim of the test
The aim of the hand grip measurement is to measure the strength of the dominant hand (writing hand). This should be asked before the measurement. If the participant is unable to use the dominant hand the test should be performed by using the non-dominant hand. This information and also the reason not to be able to use the dominant hand should be reported.

Age
Handgrip strength is recommended to be measured from all 30 years and older ii.

Exclusion criteria
People with swelling or inflammation, severe pain or injury (e.g. fracture) and those with surgery to the hand in the last 6 months should not take the grip strength test. In addition bad arthritis and rheumatology may prohibit the measurement. Also dementia and some other cognitive problems may prohibit the measurement (e.g. if the participant does not understand the instructions). The reasons not to conduct the test should be reported.

Time of measurement
The measurement of grip strength requires approximately 3 to 5 minutes performing.

Equipment
Standard handheld dynamometer (hydraulic instruments)

Measurement protocol
Testing position
A standard position for testing adapted from the recommendation of the American Society of Hand Therapists is recommended. The participant should
- Sit in a straight-backed chair
- Feet flat on the floor
- Shoulders adducted in neutral
- Arms unsupported
- Elbow flexed at 90 degrees (from the dominant hand)
- Forearm rotation neutral
- Wrist 0-30 degrees dorsiflexion and 0-15 degrees ulnar deviated
- The arm which is not measured can be on the body side or in on one's knees.
The dynamometer should be placed to the hand so that the wrist is in neutral position (slight dorsal flexion). The grasp is some what same as when giving handshake. Variations from this position significantly influence results.

**Adjustment of the device**
Dynamometers are usually variable hand span instruments with different positions for measurement (usually 5 different positions). The device should be adjusted to fit to the size of the hand of the participant so that the second joint of the forefinger should be in 90 degree flexion. If the size of the device is too small the hand will go too fist. Before starting the measurement the participant should be asked that the grasp feels natural size.

**Instructions**
Illustrate the use of the instrument to the participant prior to testing. When the right testing position is found the test can be started.

The participant is asked to squeeze the dynamometer with as much force as possible, being careful to squeeze only once for each measurement. Be sure that the body is not used in the measurement (e.g. the trunk must be in place). The tester needs to encourage the participant the do they best during the measurement.

Say to the participant: ‘The test is to begging...Now! Squeeze! Squeeze! Squeeze! Good you can stop now and rest’.

Each squeeze should stand 3 to 5 seconds. Encouragement affects to the results and thus it should be kept the same for all participants. Three trials should be made with a pause of about 10-20 seconds between each trial to avoid the effects of muscle fatigue.

Record the result of each trial to the nearest pound or kilogram. If the difference in scores is within 3 kgs., the test is complete. If the difference between any two measures is more than 3 kgs., then repeat the test once more after a rest period. Use the best 3 measurements (i.e. the highest three) in your data report.

When a 4th measurement is taken with the hand grip (when any of the 3 measurements are 3 kg apart) be sure the outlier (THE LOWEST VALUE) is crossed off with your initials so that the 3 HIGHEST measurements are clearly indicated for data entry.

**Record also**
Dominant hand right / left
Reasons not to perform the test:
Reason to not to use the dominant hand:

**Open questions**
→ Is it ok to measure only from dominant hand? Or should we measure both hands?
7.8.2 Lower extremity

7.8.2.1 Walking speed test

Walking speed has been shown to be a good predictor of nursing home admission, morbidity and mortality. In addition it has been shown to be a good predictor of disability outcome. Gait speed is simple performance based measurement, easily and quickly assessed in clinical and research settings.

Aim of the test
The aim of the walking speed test is to measure the normal walking speed in the corridor of 4 meters (Guralnik et al 1994; 2000, Simonsick et al 2001) without any check. The starting line and finishing-line of the distance is marked on the floor by tape.

Age
Walking speed is recommended to be measured from all 50 years and older.

Exclusion criteria
Walking speed test is not measured from wheelchair bound individuals or people who have severe difficulty to walk or keep a standing position. NOTISE! Walking aids (canes, walkers etc.) that are used in normal walk in daily activities are allowed. However, the use of these on the test needs to be reported. Also dementia and some other cognitive problems may prohibit the measurement (e.g. if the participant does not understand the instructions). The reasons not to conduct the test should be reported.

Time of measurement
The measurement of walking speed will take approximately 1 minute.

Equipment
Stopwatch is needed to measure the time of the walk and tape to mark the starting- and finishing-lines of the test e.g. mark on the ground the distance that should be walked (4 meteriii).

Measurement protocol
Ask the participant to walk 4 meter distance in normal walking speed. The time will be recorded to the nearest 0,1 second. The timing of the test will be started on when the tester says ‘Now’ and ended when the trunk of the participant over the finishing-line.

If the participant is able to walk normally and the risk of falling or banging into something is minimal the tester can take the time at the finishing-line of the test. If the walk of the participant is unsure or unsecure the tester should walk by the side of participant.

When a walking stick or other devices (cane, walker etc.) are used during the test, this should be recorded.

Instructions
Instruct the participant to ‘Walk to other end of the course at your usual speed, just if you were walking down the street to go to the store. You should start from here (show the line) and walk over the finishing-line of the test. I will take the time it takes to walk. Are you ready?....Go’
Record also
Did the walking speed test
0 succeed without walking aids
1 succeed with the help of walking aids
2 did not succeed, 1 minute overrun
3 did not succeed because of security reasons

The reason why the test was not conducted:

Open questions

→ Should we measure also maximal/rapid walking speed e.g. both normal and maximal walking speed?
→ If only normal walking speed is measured should the test be conducted twice and take the faster of the two to be used for analyses?

7.8.2.2 Test of standing balance

Balance and co-ordination are needed to carry out successfully every day locomotor function at reasonable speeds and to prevent falls.

Aim of the test
The aim of the test is to measure the standing balance in three different positions including semi-tandem, side by side or full tandem stands (Guralnik et al 1994).

Age
Standing balance (Guralnik et al 1994) is recommended to be measured from 60 years and older (Era et al 2006).

Exclusion criteria
Standing balance is not measured from wheelchair bound individuals or people who have severe difficulty keep a standing position (for example fracture in leg). Also dementia and some other cognitive problems may prohibit the measurement (e.g. if the participant does not understand the instructions). The reasons on not to conduct the test should be reported.

Time of measurement
The measurement of semi-tandem and side by side or full tandem stand will take approximately 5 minutes.

Equipment
Stopwatch is needed to measure the time of standing in a certain position.

Measurement protocol
Test of standing balance include semi-tandem and side-by side or tandem stands. For each stand, the tester first demonstrate the task, then support one arm while participant positioned their feet and after that asks if the participant is ready to start the test, then release the support
and start the timing. The timing will be stopped when the participant move their feet or grasp
the tester for support, or when the 10 seconds will be elapsed.

Each participant starts the test from semi-tandem stand in which the heel of one foot is placed
to the side of the first toe of the other foot. The participant can choose which foot to place
forward. Those unable to hold the semi-tandem position for 10 seconds will be evaluated
with feet in side by side position. Those able to maintain the semi-tandem position for 10
seconds will be further evaluated with feet in full tandem position, with the heel of one foot
directly in front of the toes of the other foot (see picture 7.8.3.1).

**Picture 7.8.2.1. Standing balance positions**

1) Semi-tandem  2a) Side by side  2b) Tandem

![](image)

**Instructions**

1) Semi-tandem
   Explain and demonstrate the semi-tandem stand to the respondent. Stand to the side of the
   respondent. Support one arm while participant positioned their feet and after that asks if the
   participant is ready to start the test, then release the support and start the timing. Press the
   start button to start the stopwatch as soon as the respondent gets into the position and is free
   of support. Stop the stopwatch and say ‘Stop’ after 10 seconds or when the participant steps
   out of position or grabs your arm. Record the result succeeded / un-succeeded

2a) Side by side
   Participant unable to hold the semi-tandem position for 10 seconds will be evaluated with feet
   in side by side position. Explain and then demonstrate the side by side stand to the
   respondent. Support one arm while participant positioned their feet if needed and after that asks if the
   participant is ready to start the test, release the support and start the timing. Press the start button to start the stopwatch as soon as the
   respondent gets into the position and is free of support. Stop the stopwatch and say ‘Stop’
after 10 seconds or when the participant steps out of position or grabs your arm. If the
   participant is successful record this.

2b) Tandem
   Those able to maintain the semi-tandem position for 10 seconds will be further evaluated with
   feet in full tandem position, with the heel of one foot directly in front of the toes of the other
   foot. Explain and then demonstrate the full tandem stand to the respondent. Stand to the side
   of the respondent. Support one arm while participant positioned their feet and after that asks if
   the participant is ready to start the test, then release the support and start the timing. Press the
start button to start the stopwatch as soon as the respondent gets into the position and is free of support. Stop the stopwatch and say ‘Stop’ after 10 seconds or when the participant steps out of position or grabs your arm. Record the result succeeded / un-succeeded

In each position if the participant is not capable to do this test does not attempt the movement. If the participant is unable to hold the position for 10 seconds, record the time in seconds. If the respondent did not attempt the measure, record the reason.

**Open questions**

→ Should we use some more discriminating test than Guralnik’s (1994) such as balance platform ‘foam pad, eyes closed’ test (Curb et al 2006). This test has been used also in the EPES and NHANES. It could be recommended to 30 years and elderly?

→ Guralnik’s test has been shown to be eligible only for elderly population (Era 2006)

### 7.8.2.3 Unassisted single-leg stand

**Aim of the test**
The test measures the standing balance as well as multiple domains of functioning of the participant (Curb et al 2006, Simonsick et al 2001)

**Age**
Unassisted single leg stand is recommended to conduct for all 30 years and older

**Time of measurement**
The total measurement will take about 3 minutes.

**Equipment**
Stopwatch

**Exclusion criteria**
One leg stand is not measured from wheelchair bound individuals or people who have severe difficulty keep a standing position (for example fracture in leg). Also dementia and some other cognitive problems may prohibit the measurement (e.g. if the participant does not understand the instructions). The reasons on not to conduct the test should be reported.

**Measurement protocol**
The leg raises should be performed adjacent to a stable surface, e.g. a table or wall near and the nurse should be positioned to the other side of the participant. The participant is expected to keep the one leg standing position up to the 30 seconds. The respondent should take their foot off the floor, and may hold it in any position which does not involve hooking around or touching the other leg for support.

Explain and then demonstrate the side by side stand to the respondent. Stand to the side of the respondent. Support one arm while participant positioned their feet if needed and after that asks if the participant is ready to start the test, release the support and start the timing.

**Instructions**
Now I will show you the NEXT movement. I want you to try to stand on one leg, whichever one you want, and raise the other leg off the ground a few inches e.g. near to your angel. Stand for as long as you can until I said Stop – I will stop you at 30 seconds. You may use your arms, bend your knees or move your body to maintain your balance, but try not to move your feet. Try to hold the position until I tell you to stop. Do you feel that it would be safe to do this?

If the respondent says ‘no’, do not conduct the test. If the respondent says it is safe ask the respondent to stand up. Stand to the side of the respondent. Say: ‘ready, begin.’ Press the start button to start the stopwatch as soon as the respondent raises one foot off the ground and is free of support. Stop the stopwatch and say ‘stop’ either a) when the raised leg touches the floor as the respondent loses their balance or b) after 30 seconds, whichever happens first. Record the outcome on the collection form. If the participant is unable to hold the position for 30 seconds, record the time they held the position for.

Open questions

Open questions

7.8.2.4 Timed Chair stand test

Aim of the test
Timed chair stand test measures the ability to rise from a chair (termed chair stand). It is a test of lower extremity and central strength, although other functional domains are also involved such as endurance. (Guralnik et al 1994, Curb et al 2006). The test involves measuring the time required to stand up from a chair and sit down in a chair five and ten times without using arms.

Age
Timed chair stand test can be conducted for all 30 years and older.

Time of measurement
The total measurement will take approximately 2 to 3 minutes.

Exclusion criteria
Timed chair stand test is not measured from wheelchair bound individuals or people who have severe difficulty keep a standing position or walk and for those unable to stand up without help (for example fracture in leg). Also dementia and some other cognitive problems may prohibit the measurement (e.g. if the participant does not understand the instructions). The reasons on not to conduct the test should be reported. The use of walking aids is not permitted in this test.

Equipment
Timing of the test requires a stopwatch and a standard high armless straight-backed chair (height 45 cm). If an ideal chair is not available, the following criteria for chair selection should be used in the order given:

a) Armless, rather than with arms
b) Firmness; the firmer the better
c) Do not use beds, cots, folding chairs, garden chairs, chairs with wheels or chairs that swivel.
**Measurement protocol**

A straight-backed chair should be placed next to the wall. Participant’s feet should touch the floor when they are sitting (e.g. chair should not be too low or high). Participants are asked to fold their arms across their chest and stand up from the chair one time. If successful, participants will be asked to stand up and sit down five to ten times as quickly as possible. The timing will be started from the sitting position and end to the final standing position at the end of the fifth and tenth stand. Stand next to the participant to be able to provide assistance if they lose their balance.

If the participant do not completed the single chair rise without using his/her arms, they are not eligible to attempt the repeated chair rises. This and the reason for not to complete the test, should be reported.

**Instructions**

**Single chair stand**

Explain and demonstrate the single chair stand to the participant. If the participant can not rise without using arms say ‘Try to stand up by using your arms’. Record the outcome of single chair stand. If the participant refuses to try the single chair stand or is unable to stand up on his/hers own without using arms to push off, do not attempt the repeated chair stand.

**Repeated chair stand**

Ask the participant to resume the sitting position s/he was in just before standing up, with their feet resting on the floor and their arms folded across the chest. Explain the repeated chair stand. When the participant is properly seated, say ‘ready, begin’. Start the stopwatch as soon as you say ‘ready, begin’. Count out loud as the participant rises each time, up to ten times. A rise is complete when the respondent is fully standing with their back straight. Notice! When respondent completes the fifth rise, press the split timer on the stopwatch. Continue counting out loud. When the respondent has straightened up completely for the tenth time, stop the stopwatch.

Stop if the participant becomes too tired or short of breath during the repeated chair stands. Also stop:

- If the participant uses his/her arms
- After 1 minute, if the participant has not completed all the rises
- At your discretion, if you are concerned for the participant’s safety

If the participant stops and appears to be fatigued before completing the ten stands, ask *Can you continue?* If the participant says “Yes,” continue timing until 60 seconds has elapsed. If she says ‘no’ stop the stopwatch and record the number of completed stands without using arms. Be careful to enter the time from the first five stands first, before retrieving the time for the 10 stands from the stopwatch’s memory.

**Open questions**

→ Is the 5 standing needed? Or is it only enough to do the 10 chair stand?

**References**


7.9 Ankle arm index

Age: 40 years and older
Time measurement: the measurement will take about 5-10 minutes(?).
Equipment:
Protocol.
There is no standardized protocol for measuring the ankle arm index.
Since the introduction of the AAI a wide variety of methods of AAI measurements and
calculation have been used in studies. Klein et al. made an analysis of all the methods used to
asses AAI and its normal range and to recommend a standardized method to asses AAI based
on there analysisiv.

Position of the participant:
The supine position seems to be the position of choice to assess AAI because the influence of
height of the subject and his or her blood column pressure on AAI may be prevented only in
this position.

Cuff
Ideally, the cuff width should be at least 1.5 times the diameter of that part of the extremity
where the pressure is being measured, and the size of the cuff should be adjusted in obese
patients or in patients with odd shaped arms or ankles.

Method of detection of the pulse in arm and leg
The use of a pencil-Doppler should be considered the method of choice to detect the brachial
pulse as this was already done in half of the reviewed studies. Measurements by Doppler
device were proven at high, medium, and low blood pressures to correlate with systolic
pressure measurement obtained by conventional methods.

Choice of arm and leg for measurement
The blood pressure should be taken at both arms and both legs to rule out serious differences
and using that of the left arm to calculate the AAI denominator with the left leg.

Protocol (concept)
1. Systolic blood pressures are obtained using cuffs, a Doppler, and a cuff inflation
device (Sphygmomanometer).
2. Apply cuffs to each arm above the elbow.
3. Apply cuffs to each ankle.
4. Locate an arterial signal in the arm by listening with the Doppler at the brachial, radial
or ulnar area.
5. Inflate the cuff with to a pressure 20 - 30 mmHg above the audible arterial Doppler
signal.
6. Slowly deflate the cuff and listen for the return of blood flow to the distal part of the
limb. Note the pressure reading when the first arterial signal is heard. This is
considered the systolic pressure at the level of the cuff. Record this on the form.
7. Both arm systolic pressures are taken to determine the systemic blood pressure. The
higher of the two pressures will be used in the calculation of the ratios
8. For ankle measurements follow the procedure as described above in steps 4 through 6.
Monitor either the dorsalis pedis or posterior tibial artery, whichever gives the
strongest signal. The peroneal artery may be used if one or both of the previous sites
are not available. Record this on the form.
9. If resting pressure measurements need to be repeated, the cuff should be fully deflated for about a minute prior to each inflation. This is to prevent the effects of induced reactive hyperemia.

**Interpretation**
The ankle / arm index is calculated by the dividing the ankle pressure by the higher of the two arm pressures. (If there were a subclavian stenosis present unilaterally, there would be a systolic pressure difference of 15-20 mmHg or greater, with the affected side being lower.) Compute the ankle/arm index by dividing each ankle pressure by the HIGHEST brachial systolic pressure
7.10 Quality assurance

7.10.1 Training

All fieldworkers will receive a training before the actual work in the field. Training will include an instruction session, in which protocols are reviewed and discussed, and measurement are practised. Possible difficult situations that might arise during the field are presented and solution strategies are discussed. Also the quality control procedures during and after the survey will be presented.

Waist hip circumferences

Practice measurements are made under supervision. The performance may be evaluated on the basis of:

- Placement of tape
- Variability between duplicated measurements of a number of subjects.
- Comparison with repeated measurements of a number of subjects by different measures
- Terminal digit preference

7.10.2 Quality control

For checking the quality of the measures, the distribution of the height, weight, waist and hip circumferences terminal digit should be checked routinely. It is important to avoid digit preference, for e.g. 0 or 5 at the end. If a measure has not been performed, a reason should be mentioned on the form.

If problems are detected, they need to be discussed with the individual measurer immediately. Feedback to the measurers about the quality of their performance can help to improve the quality of the field work. If errors persist, the measurer should be retrained.

During extended surveys, a session to refresh the quality aspects for all measurers every three months is a desirable practice.

Auditors should make surprise visits to the examination sites and observe the measurers, recording the compliance with the protocol in performance evaluation forms that can later be used to review the audit with the measurers. The auditors could also act as guest participants and take part in a number of measurements.

Blood samples should be traceable to the individual measurer. The compliance of the phlebotomist with the exclusion criteria for blood collection should be checked by cross validation with questionnaire data. Phlebotomists may also be assessed by the number of failed blood collection procedures.

7.10.3 Quality assessment after the survey

It is important to check the overall quality of the anthropometric measurement. The quality assessment should include the item response rates for height, weight, and waist-hip circumference. And the distribution of terminal (decimal) digits and the distribution of terminal digits of full kilograms for weight measurement.
The data should be checked as soon as possible after the data collection for:

- outlandish values, i.e. for values which have not been defined, and also for values which are possible but rare (e.g. BMI of 40 kg/m²);
- consistency between the values of different data items e.g. the difference between systolic and diastolic blood pressure);
- Completeness, i.e. that all data items have been recorded and no records have been missed.

A visual checking of the key items can be done at the interview or examination site even if paper forms were used, and extensive checking should take place as soon as the data have been computerized. When potential errors are detected, they should be investigated for correctness, and corrected only if it is found that they really are errors. It is a good practice to authorize only those who have made the errors to correct them, because they are usually in the best position to say if there really is an error, and they are usually the only ones who know the correct value. Each error and its possible correction should be documented.

The frequency of errors, which were not possible to solve should be documented. In addition, the results of the quality control during the data collection, any deviations from the survey protocol, and any other information which may be relevant in the interpretation of the results should be documented too. Knowledge of these issues is essential to those who analyze the data and interpret the results.
Appendix 1 Example of the blood collection recording form.

Participant's identification code

Blood collection

Person taking blood sample(s) (identification code)

Date (ddmmyyyy)

Time of day (hhmm)

Time of the last meal

Position of subject during the blood collection
1 = sitting
2 = supine

Arm used for blood sample (if blood collection failed, code the arm where the last attempt was made)
1 = left
2 = right

Number of tubes received
1 = all
2 = only ___ tubes
3 = none

Reason for no blood collection

- Participant refused
- Vene could not be found / difficult to take a blood sample
Appendix 2 Example of the blood handling recording form.

Participant's identification code

Blood collection

Person handling blood sample(s) (identification code)
Date (ddmmyyyy)
Time of day of centrifuging (hhmm)
Time of day (hmm) blood samples in freezer
Hemolyse?

Yes
No

Number of serum storage tubes
Number of plasma storage tubes
References


8. Data management, documentation and reporting

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Two corner stones of the good health examination surveys are data management and documentation, which are closely linked to each other and in same places overlap. On the other hand, documentation and reporting are also linked to each other. Reporting is an important part of the utilization of the health examination survey results.

8.1 Data management

(Adopted from the Tolonen 2002/EHRM)

A well-organized data management is essential part of the health examination survey. It ensures that the available data are complete, correct and verifiable, and that the data analyses are done using correct data, without errors, and that the confidentiality of the data is secure.

Stages of the data management
  • Planning
  • Sample selection and recruitment
  • Survey measurements
  • Data transfer and keying
  • Error checking, data correction, data documentation, database structure and documentation
  • Backup
  • Confidentiality
  • Correctness of data analysis
  • Analysis documentation

8.2 Documentation

(Adopted from the thesis of Tolonen 2005)

With the proper documentation, the representativeness of the results to the target population, used procedures, data quality and the accuracy of the results is easier to identify and verify.

The survey documentation should cover the entire survey process from the planning to the final report, i.e.:
• the objectives and rational of the survey
• the definition of the target population and the eligibility within the target population
• the description of the used sampling frame and how the actual sample was drawn
• the determination of the sample size
• the original references to the survey instruments which are adopted from other surveys or national/international recommendations
• the description and validation of new survey instruments developed specifically for the survey
• the requirements and selection of the survey personnel
• the training program and results of the evaluation of the personnel
• the actual implementation process of the survey
• the quality control process carried out during the survey and their results
• the methods used for data collection, transfer, coding and editing
• the database structure
• the data analysis
  o Which data set was used
  o What software and which version was used
  o Where are the actual software codes used for the analysis
• the reporting of the results.
  o What has been reported
  o Where it has been published
  o Where are the analysis to which these results are based on

Documentation is a collection of minutes of the meetings, specially prepared documents, original material (questionnaires, etc.), training materials, communication logs between coordinating office and fieldwork teams, data analysis documents including information about the used data sets, used computer programs (software and code), etc.

The documentation should be organized so that it is easily accessible to all who needed it.

8.3 Reporting

(Adopted from the thesis of Tolonen 2005)

Reporting is used to promote the survey results. It is essential to make clear note to which population group results apply.

1. To whom to report?
2. What to report?
3. How to report?
9. Needed resources and preparation of a survey budget

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9.1 Issues affecting to the needed resources

Conducting a national health examination survey (HES) requires resources, which include personnel costs and materials as well as possible travel expenses, accommodations, rents, material shipments, etc. The type and amount of needed resources is dependent on the survey mode and survey size, i.e. what is measured, on what settings and from how many persons has a direct effect on required resources.

The budget puts the actual prize tag for the needed resources and in many cases also gives the direction for the survey mode and size. The preparation of the budget should be started already in the early stages of the planning. Extend of the survey i.e. number of included measurements and number of examined persons effects directly to the required resources and budget. Also the survey model i.e. is survey measurements conducted at the home of the participants, at the fixed examination clinics or on the mobile examination units has an effect to the required resources.

9.2 Needed resources in different stages of HES

Conducting a health examination survey can be divided into 11 stages: (1) planning, (2) coordination, (3) training, (4) piloting, (5) sampling, (6) recruitment, (7) field work, (8) laboratory analysis, (9) data entry and cleaning, (10) quality assurance, and (11) analysis and reporting.

9.2.1 Planning

The planning of the survey sets the foundation to the actual survey and therefore enough resources should be reserved for this task. The planning stage mainly requires personnel resources; senior researchers, advisers, data management, statisticians, and laboratory technicians who have special knowledge how different issues should be taken into account in the actual survey.

9.2.2 Coordination

Personnel requirements:
• Responsible person (usually senior researcher)
• Coordinator
• Possibly secretary

Equipment requirements:
• Computers (usually with internet connection)
• Telephones / mobile phones
• Software licenses
• Office materials (pens, papers, etc.)

Other needed resources:
• Premises for the coordinating office
• Travels and accommodations of the coordinator(s) to the field
• Resources needed for the recruitment of the fieldwork personnel (newspaper adds, etc.)

9.2.3 Training

Personnel requirements:
• Trainers, number and qualifications depend on survey contents

Equipment requirements:
• Depends on included measurements
• See list of needed equipments per measurement in Chapter 7

Other needed resources:
• Travels and accommodations of the trainers
• Travels and accommodations of the trainees
• Premises for the training

9.2.4 Piloting

Personnel requirements:
• Fieldwork personnel (amount dependent on survey mode, and extend)
• Data management person(s)
• Statistician(s)
• Laboratory personnel

Equipment requirements:
• Equipment obtained already for the training can be used in the pilot. There may be need to obtain extras for the pilot.
• Equipment needed for data transfer
• Computers

Other needed resources:
• Premises for the pilot
• Transfer of the materials to and from the pilot site
• Travels and accommodations of the personnel during the pilot

9.2.5 Sampling

Personnel requirements:
• determination of sample size
• selection and/or preparation of sampling frame
• sample selection (may also be bought service from sampling frame owner)
• data management (computer resources, database manager)

Equipment requirements:
• Computers
• Software licenses (database, etc.)

9.2.6 Recruitment

Personnel requirements:
• person(s) preparing the invitation letters, questionnaires, other printed materials
• Person(s) doing recruitment (mailing of invitations, calling the appointments, answering request by phone and mail, etc.)
• data management

Equipment requirements:
• computers
• telephones / mobile phones
• software licenses

Other needed resources:
• printing of the materials
• mailing costs, telephone costs, home visit costs
• reminder costs
• toll-free telephone number for more information and examination time booking
• incentives
• newspaper advertisement, radio advertisement, etc.

9.2.7 Fieldwork

Personnel requirements:
• fieldwork teams (number and qualification of the personnel depends on survey mode and extend)
• data manager

Equipment requirements:
• Equipment obtained already for the training can be used in the pilot. There may be need to obtain extras for the pilot.
• Office materials (pens, papers, etc.)

Other needed resources:
- transfer of the materials to the field examination site
- transfer of personnel to the field examination site
- accommodation of the personnel during the field work period
- storage of the materials on the field
- transfer of the materials from field examination site to the coordination centre/laboratory
- rents of the examination sites
- data transfer connections / phones / faxes etc.

9.2.8 Laboratory analysis

Personnel requirements:
- Number and qualifications of the laboratory personnel depends on laboratory analysis needed and about the number of samples to be analyzed
- Data management

Equipment requirements:
- allocation tubes
- storage tubes
- pipettes
- storage tracks
- storage boxes
- reagents

Other needed resources:
- ??

9.2.9 Data entry and cleaning

Personnel requirements:
- Data entry person(s)
- Statistician
- Data management

Equipment requirements:
- Computers
- Software licenses
- Scanners (if data is not keyed in manually but scanned)

Other needed resources:
- Transfer of the materials (questionnaires) to and from the data entry

9.2.10 Quality assurance

Personnel requirements:
- ..

Equipment requirements:
• Computers
• Software licenses

Other needed resources:
• …

9.2.11 Analysis and reporting

Personnel requirements:
• Statistician(s) for the analysis
• Researcher(s) for the reporting
• Construction of web reports (if done)

Equipment requirements:
• Computers
• Software licenses

Other needed resources:
• Printing of the reports
• Sending the laboratory and other test results to the participants
• Press releases

9.3 Preparation of the survey budget

Preparation of the survey budgets starts with the list of the needed resources. After that, it has to be assessed how many working days for each personnel group is needed, how many of each equipment is needed and how much of the other resources are needed so that the planned survey can be completed. After that the prize of the one unit is determined and then the budget for each needed resource will come as the product of number of units by cost per unit. The total budget is the sum of the resource specific budgets.

Often a lot about the planning and coordination tasks of the survey are done by the public officers who do the work as part of their official duties. In cases like this, it may be difficult to define the personnel costs of their work for the budget.

9.4 Example of the needed resources and budget

A health examination survey is conducted in country A, among 25-64 years old men and women. More to be added later.
10. Organizing the international collaboration needed by a system of standardized European HES

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10.1 Need for European wide collaboration

We believe that whenever possible, the responsibility of planning and conducting a HES should be at the national level. This increases the local motivation for the HES, and is important for the selection of the nationally most important measurements. It is also important for planning the HES in such a way that it fits the national infrastructure and the national habits, attitudes and health information needs. It also represents the first step in training national experts for the proper analysis and interpretation of the survey results.

The review of HES in Europe conducted by the FEHES Project concluded that the only way to obtain standardized data is to use joint protocols and international co-ordination, training and quality control [REF: FEHES review report]. In order that international comparability of the HES data be possible, a responsible body will be needed which:

1. creates and maintains the European standards;
2. organizes training for the use of the standards;
3. conducts external quality control; and
4. evaluates the success of the standardization in each country.

The FEHES review report revealed that international collaboration will be needed also for:

5. providing advice to the countries in planning the national HES;

Furthermore, in order that the success of the standardization can be properly assessed, it is essential that

6. individual level data are collected in a central data repository.

This also facilitates
7. rapid basic reporting and interpretation of the results for European level uses; and
8. easier sharing of the data with research groups for deeper analysis.

The national contact persons of the FEHES Project feel that it is easier to obtain national funding if international coordination and standardization are available.

The eight tasks identified above for international collaboration are elaborated below.

**10.1.1 Creation and maintenance of standards**

Joint protocols have been described in this report for several key measurements in a HES. Although they are good enough so that it is useful to use them in national HES, not all of them are perfect yet. For example, it seems that the use if mercury sphygmomanometers cannot be used long for blood pressure measurement, but there are not yet tested good alternatives. Therefore, constant attention will be needed to follow and promote new developments in measurement and data collection procedures and technology, to update the European standard when this is deemed useful, and to keep the agreed standards available to those who plan and conduct HESs.

This report does not yet describe standard protocols for all measurements that have been taken in HESs in the past, or that will be planned for future HES. Any measurements that will be used on the future should be evaluated and checked if European standard procedures could be fixed for them and made available to other countries planning to include these measurements in their HES.

**10.1.2 Training to use the European standards, quality control and evaluation of the success of the standardization**

Training and quality control should be an integral part of the local operations of the national surveys. To facilitate the standardization between the countries, international collaboration in training and quality control will be necessary, and development of common training material, such as audiovisual tapes for training of blood pressure measurers. This is also well reflected in the views of the national contact persons of the FEHES Project. 31 out of 32 contact persons considered international quality control important [REF: Review report].

A specific area where an international facility is needed is laboratory standardization and quality control. From the 1970s to 1990s, lipid standardization in Europe was carried out by WHO Regional Lipid Reference Centre (RLRC) in Prague, Czech Republic. Now, as WHO RLRC is no longer operating, it is important to establish a replacement to serve European surveys. Such a reference laboratory is needed for providing secondary calibrators for the survey laboratories as well as providing external quality control. For 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. Without a laboratory reference centre with sufficient expertise and established reference methods, there is no way to guarantee the validity of time trends within countries or the comparability of results between countries.

After the surveys, assessment of the quality of the data, the success of the standardization and documentation of country-specific characteristics of the data are prerequisites for meaningful
comparisons of the survey results between countries. This should be done through a centre that is independent of the national surveys. Past experience has shown that many shortcomings found in the data can still be remedied at this stage.

10.1.3 Advice to the countries in planning the national HESs

The review of experience in the countries for conducting a HES revealed that there is generally much more expertise than we anticipated [REF: review report]. Nevertheless, it is also important that the countries can make as much use as possible of the experiences from the other countries. Therefore, it is important that that efficient forums are organized for the open exchange of experiences, and that direct links are established between the countries with past HES and the less experienced countries. In addition to planning the field work and budgeting the surveys, international advice and/or review of the plans are needed for the sampling design and ethical and legal issues. The same concerns the measurement procedures in countries with previous national HES. Even if the measurement procedure used in the past differs from the European standard procedure, it is desirable to achieve international comparability and also to be able to follow trends from the past. An optimal compromise will need to be found in such cases.

Of the 32 national contact persons of the FEHES Project, 29 considered international expert consultation important [REF: Review report].

10.1.4 Pooling individual level data for quality assessment, joint reporting and sharing for deeper analysis

The analysis of survey data for the national purposes should primarily be done locally in each country. The countries should be encouraged to utilize the data as extensively as possible, not only for policy making and public health purposes, but also for research. Although public health would be the main motivation for the monitoring, its use for research helps in creating national expertise in interpreting the data and in improving the quality of the data.

The collection of individual level data from each country to a central database is necessary for the evaluation of the success of the standardization. At the same time it facilitates rapid basic reporting and interpretation of the results for European level uses, such as the Euphix database [Ref: ]. The pooled database also facilitates sharing of the data with research groups that can undertake deeper analysis of the results than is possible in the basic rapid reporting.

Principles and rules for sharing individual level HES data need to be developed, covering the transfer of data from the countries, possible access of third parties for analyzing the pooled data and the publication of the results. The principles must respect the rights and interest of all parties.

10.2 Organizing the international collaboration

A capacity with sufficient expertise should be established with the responsibility to facilitate the national surveys by:

- Creating, maintaining and disseminating the European standards;
• Providing training material and organizing training for the use of the standard procedures for the persons responsible in training of the national survey teams;
• Coordinating external quality control and preparing guidelines for and monitoring of internal quality control;
• Evaluating the success of the standardization in each survey. The results would be discussed with the organizers of the surveys, and made available to all who will be using the data. Summaries would be provided as a part of the basic reports of the survey results;
• Providing advice to the countries in planning a national HES and coordinating a network of the organizers of national surveys for sharing experience and exchanging expertise in organizing surveys, data collection and reporting. It is important that the experience gained by countries from earlier HESs will be available to all other countries;
• Preparation of the data for international reporting, such as the HIEMS system, as well as the preparation of the summary risk factor status statements in collaboration with the countries;
• Collecting individual level data from the countries for quality assessment, basic reporting and sharing with research groups. It is important that the security and confidentiality of such data will be assured. Principles and rules for such data collection, analysis and sharing will need to be developed and agreed by the countries before any data are collected. The rules and principles must respect the rights and interests of all parties;
• Undertake rapid basic reporting and interpretation of the results for European level uses; and
• Manage the sharing of the data with research groups for deeper analysis.

The capacity should be funded by the EU, and operate in collaboration with EU, WHO, OECD and other agencies.

The review conducted by the FEHES Project reveals that there are 17 countries with active plans for a national HES in the next five years, and some of these countries are planning to start their HES already in 2009 [REF: review report]. Therefore, the European infrastructure for a joint standardization of HESs 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. This task fits well with the priority topic of the Work Plan of EU's Health Programme for 2008 to implement a pilot European Health Examination Survey in some member states. This would be funded through a call for tender. Based on the experiences from the pilot, more permanent structures should be established in 2010, to take the responsibility of the tasks specified above for the remaining European countries, and for the next round of surveys in the pilot countries. The total annual costs of such a capacity would be about 2-3 million euro per year.

The required expertise for such a capacity is available primarily at the national public health institutes of a number of European countries with past experience on national HESs. Therefore, we propose that for the time being the capacity is set up as a consortium between a number of such institutes, possibly including other institutes with needed expertise on specific fields, such as on sampling methods. In the longer term a more permanent capacity, possibly covering health monitoring more widely, might be established.