

Inequalities in availability of health information from national health examination surveys in EU Member States

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Disclaimer

The views expressed here are those of the authors and they do not represent the Commission's official position.

Acknowledgement

The work on this report has been supported by the funding from the EC/DG SANTÉ through BRIDGE Health project (no. 664691).

We would like to thank all the representatives of the national HESs who have provided information for this report.



Cover illustration and Figure 25 edited by Hanna Tolonen from vector graphics by Freepik.com

October 2017 – Helsinki, Finland

Executive summary

Health examination surveys (HES) provide information on the health, health risks, functional capacity, and the need for health services in the population. Much of the data obtainable from HESs cannot be obtained objectively or at all from other data sources. An increasing number of countries of the European Union are conducting HESs in the adult population in order to get data for informed policy making, planning of prevention activities and public health research. In Finland, France, Germany, Ireland, Italy, the Netherlands, Poland and UK/England there have been a series of national HESs which allow the assessment of trends in health indicators. In the past ten years, national HESs have been carried out also in Czech Republic, Denmark, Greece, Luxembourg, Malta, Portugal and Slovakia. Nevertheless, there are twelve countries with no national HESs in the past ten years or ever and, of these countries, only one (Belgium) has a concrete plan to conduct a national HES within the next five years.

The existence or non-existence of national HESs does not give the full picture of the inequalities between countries: also the scope of the surveys vary substantially. Nearly all of the surveys have measured major preventable risk factors common for many chronic diseases. Many have measured also some or all of the following: lung function, cognitive function, physical activity, fitness and/or included an ultrasound scan of thyroid or bone density. In the European level, there has been interest to monitor infectious disease antibodies and environmental biomarkers using blood samples collected in national HESs.

To ensure the quality of national HESs in Europe, EU provided funds for setting up the European Health Examination Survey Coordinating Centre (EHES CC) in year 2009. This has prepared guidelines for organizing surveys and measurement standards for the major chronic disease risk factors, organized training and external quality assessment, and provided advice to counties planning their HESs. Although the EHES CC has been vastly under resourced since 2012, all national HESs in the EU over the past ten years have been standardized and therefore data on the modifiable risk factors of major chronic diseases are comparable across countries. There is desire to expand the standardization to cover also other important health measurements and to provide standardized protocols also for children and adolescents. The biggest challenge for the quality of the data and representativeness of the results, when using the standardized protocols, is the decrease of participation rates in practically all countries.

The lack of essential health information in many countries sets the European countries in unequal positions in their possibility to monitor and foresee, and hence to improve the health of the population, and to plan and optimise the cost-effectiveness of their health systems. To reduce this inequality, the countries should be encouraged to include HESs in their health monitoring systems. Also the possibilities of financial support from the EU to the countries conducting national HESs and/or EU legislation on HESs should be considered. In order that the results of the national surveys can be comparable and the trend estimates reliable, sustainable funding of the EHES Coordinating Centre should be ensured.

More research on methods to increase participation rates and to adjust for the non-participation in the data analysis will be needed. For the latter, there is potential in linkage between the HES data and data from administrative registers such as health service registers which is becoming increasingly possible in the EU member States.

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Introduction

In the past ten years, national health examination surveys (HES) have been conducted in 14 EU countries in order to assess the health and health risks of the population. The surveys have been deemed to provide essential information for the planning and evaluation of policy decisions and preventive actions. In eight of these countries, HES have been conducted repeatedly in the recent decades in order to have up-to-date data and to monitor trends in the health indicators.

In addition to the individual countries, also international organizations, such as the European Union, World Health Organization (WHO) and OECD, are interested in such data, and also use the available data in their reports when setting priorities for their cross-national activities. For example, WHO's global action plan for the prevention of noncommunicable diseases has set nine global targets for year 2025¹, and the monitoring of many of these targets is based on data from HESs. Yet, many of the EU member states have never conducted national HESs and, to our knowledge, some do not even have concrete plans to conduct them.

Inequalities between countries in the availability of health information from national HESs are not necessarily limited to the availability and unavailability of such surveys. There are also differences in the measurements included in the surveys, coverage of the general population and representativeness with respects to the covered population. In addition, the quality of the measurements may limit at least the assessment of trends and comparability of results between countries. Also differences in the availability of health information from other sources such as health interview surveys and administrative and disease specific registers vary between EU member states.

The purpose of this document is to describe differences in the availability of HES data and to discuss the importance and possibilities to reduce these inequities between countries.

¹ World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. 2013, World Health Organization. http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf

Health examination survey and European Health Examination Survey

Health examination survey – HES

A health examination survey (HES) is a tool to collect objective information about health status, functional capacity and determinants of health in the general population. A HES includes one or several questionnaires, physical measurements and collection of biological samples such as blood and urine. The number and type of different physical measurements in national HESs varies due to national priorities and available funding.

The target population for a HES is general population, not patients in the health care services. HESs are based on probability samples of the population.

HESs provide information for planning and evaluation of policy decisions and prevention activities and the data have also been used widely for epidemiological and public health research.

European Health Examination Survey - EHES

The European Health Examination Survey (EHES)² is a collaboration between organizers of national HESs in the European Union (EU) Member States (MS). It aims to ensure high quality and comparability of the surveys through joint quality assurance, including standardized survey procedures, training, external quality assessment and collaboration in reporting. In addition to these, EHES has an important role in capacity building through sharing experiences between countries, which is particularly important for countries with little earlier experience on national HESs and for countries adding new measurement to their HESs.

The EHES Pilot project³ in 2009-2012 established a Coordinating Centre (EHES CC), prepared a manual of survey guidelines and standardized procedures, prepared training materials and organized training seminars, conducted a pilot survey in twelve countries and created EHES network of potential national survey organizers in all EU MSs and European Economic Area (EEA) countries. Thereafter, EHES coordination has operated with reduced funding, but has been able to maintain the network, provide consultation and do site visits to planned and ongoing national HESs, and to add standardized procedures for some new measurements to the EHES Manuals⁴.

² <http://www.ehes.info>

³ Kuulasmaa K, Tolonen H, Koponen P et al. Arch Public Health 2012;70(1):20 doi: 10.1186/0778-7367-70-20

⁴ <http://www.ehes.info/publications/index.htm>

Table 1. National Health examination surveys in EU Member States in 2007-2017

Country	Name of the surveys	Year(s) when conducted	Age range (years)
Czech Republic	Czech-EHES ⁵	2014-2015	25-64
	HELEN Study ⁶	2009-2010	45-54
Denmark	The Danish Health Examination Survey (KRAM) ⁷	2007-2008	18+
Finland	FINRISK ⁸	2007 and 2012	25-74
	Health2011 ⁹	2011-2012	18+
	FinHealth ¹⁰	2017	18+
France	Étude Nationale Nutrition Santé (ENNS) ¹¹	2006-2007	3+
	ESTEBAN ¹²	2014-2016	6+
Germany	Studie zur Gesundheit Erwachsener in Deutschland (DEGS) ¹³	2008-2011	18-79
Greece	HYDRIA ¹⁴	2013-2014	18+
	National Morbidity and Risk Factor Study (EMENO) ¹⁵	2014-2015	18+
Ireland	SLÁN ¹⁶	2007	45+
Italy	OEC/HES ¹⁷	2008-2012	35-74
Luxembourg	EHES-LUX ¹⁸	2013-2015	25-64
	ORISCAV-LUX 1	2007-2008	18-69
	ORISCAV-LUX2 ¹⁹	2016-2017	25-80
Malta	SAHHTEK	2014-2016	18-70
Netherlands	Nederland de Maat Genomen (NL de Maat) ²⁰	2009-2010	30-70
Poland	WOBASZ II ²¹	2013-2014	20+
Portugal	Inquérito Nacional de Saúde com Exame Físico	2015-2016	25-74

⁵ <http://www.szu.cz/ehes>

⁶ <http://www.szu.cz/publikace/studie-helen>

⁷ <http://www.niph.dk/Forskning/Sundhedsvaner/KRAM.aspx>

⁸ <https://www.thl.fi/en/web/thlfi-en/research-and-expertwork/population-studies/the-national-finrisk-study>

⁹ <https://www.thl.fi/en/web/thl-biobank/for-researchers/sample-collections/health-2000-and-2011-surveys>

¹⁰ <https://www.thl.fi/en/web/thlfi-en/research-and-expertwork/population-studies/national-finhealth-study>

¹¹ <http://invs.santepubliquefrance.fr//Dossiers-thematiques/Maladies-chroniques-et-traumatismes/Nutrition-et-sante/Enquetes-et-etudes/ENNS-etude-nationale-nutrition-sante>

¹² <http://invs.santepubliquefrance.fr//Dossiers-thematiques/Environnement-et-sante/Esteban>

¹³ http://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/DeGS/degs_w1/degs_w1_node.html

¹⁴ http://www.hhf-greece.gr/hydria-nhns.gr/index_eng.html

¹⁵ <http://emeno.gr/>

¹⁶ <http://www.ucd.ie/issda/data/surveyonlifestyleandattitudestonutritionslan/>

¹⁷ <http://www.cuore.iss.it/>

¹⁸ <http://www.sante.public.lu/fr/publications/e/ehes-lux-notice-information-fr-de-pt-en/index.html>

¹⁹ <http://www.oriscav.lih.lu/Accueil.aspx>

²⁰ http://www.rivm.nl/Onderwerpen/N/Nederland_de_Maat_Genomen

²¹ <http://www.wobasz-projekt.pl/>

Country	Name of the surveys	Year(s) when conducted	Age range (years)
	(INSEF) ²²		
Slovakia	EHES	2011	25-64
UK/England	Health Survey for England ²³	Annually	no age limit

This report will focus on national HESs targeted to adults of the working age. A few countries (e.g. UK/England and France) have also included children and adolescents to their surveys. In Germany, a separate survey on children and adolescents has been conducted. Also many countries have included elderly to their national HESs (see Table 1).

Regional, disease and age-specific HESs

In many countries, also regional or disease specific HESs have been conducted. For example, in the framework of the WHO MONICA Project (Multinational MONItoring of Trends and Determinants in Cardiovascular Disease)^{24,25} and the CINDI (Countrywide Integrated Noncommunicable Diseases Intervention) Programme^{26,27} a series of regional health surveys have been conducted in the past. In some countries, such as Sweden, the MONICA surveys are still conducted in regular intervals in the Northern-Sweden MONICA region.²⁸

The WHO has developed the WHO STEPwise approach to Surveillance (STEPS)²⁹, a standardized method for collecting, analysing and disseminating data in WHO member countries. The STEPwise approach to non-communicable disease risk factor surveillance is targeted for middle and low income countries and has been conducted in 105 countries across all six WHO Regions. In European Region, Armenia, Georgia, Republic of Moldova and Uzbekistan have published the results of their STEPS surveys.³⁰

As another example, the HAPIEE (Health, Alcohol and Psychosocial factors In Eastern Europe) study conducted regional surveys in Russia, Poland, and the Czech Republic in 2002–2005 and few years later in Lithuania.³¹ It is a prospective cohort study designed to investigate the effect of classical and non-conventional risk factors and social and psychosocial factors on cardiovascular and other non-communicable diseases among 45–69 years old participants, with re-examination in Russia and Lithuania of the cohorts in 2006–2008.

²² <http://www.insef.pt/English/Pages/INSEF.aspx>

²³ <http://content.digital.nhs.uk/healthsurveyengland>

²⁴ <http://www.thl.fi/monica>

²⁵ Tunstall-Pedoe H (ed). MONICA Monograph and Multimedia Sourcebook. World's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. World Health Organization, 2003.

²⁶ Protocol and guidelines. Countrywide Integrated Noncommunicable Diseases Intervention (CINDI) Programme. World Health Organization Regional Office for Europe, 1995, EUR/ICP/CIND 94.02/PB04

²⁷ <http://apps.who.int/iris/bitstream/10665/107788/1/E89308.pdf>

²⁸ Eriksson M, Carlberg B, Pennlert J et al. Eur J Prev Cardiol 2017;24(14):1473-1481

²⁹ <http://www.who.int/chp/steps/en/>

³⁰ <http://www.who.int/chp/steps/reports/en/>

³¹ <http://www.ucl.ac.uk/eastern-europe/hapiee-study>

Regarding disease specific HESs, the European Community Respiratory Health Survey (ECRHS) focused on respiratory symptoms, lung function, asthma, atopic status, and allergens.³² The third wave of ECRHS data collection began in 2008, and included 14 mostly European countries, whereas 25 countries took part in wave 1, and 45 in at least part of wave 2. The European Prospective Investigation into Cancer and Nutrition (EPIC) study³³ is one of the largest cohort studies in the world, with more than half a million (521,000) participants recruited across 10 European countries and followed for almost 15 years. Detailed information on diet, lifestyle characteristics, anthropometric measurements, and medical history was collected at recruitment (1992–1999). Biological samples were also collected at baseline from 387,889 individuals and are stored at the International Agency for Research on Cancer – World Health Organization (IARC-WHO).

Furthermore, the Survey of Health, Ageing and Retirement in Europe (SHARE) focused on studying the health, socio-economic status and social and family networks of more than 120,000 individuals aged 50 or older.³⁴ SHARE covers 27 European countries and Israel. However, the data is based mainly on questionnaires, and only a restricted set of physical performance measures and biomarkers from dried blood spots are available. The same age group, individuals aged 50 or older, was targeted also in the English Longitudinal Study of Ageing (ELSA)³⁵, which collected information on the health, social, wellbeing and economic circumstances of the English population. The current sample contains data from up to seven waves of data collection, including interviews, questionnaires, and nurse assessments to collect blood and other measures of physical performance and health.

The COURAGE in EUROPE Project³⁶ collected data on the determinants of health and disability in an ageing population, with specific tools for the evaluation of the role of the built environment and social networks on health, disability, quality of life and well-being. The main survey was conducted in Finland, Poland and Spain in 2012 with the sample size of 10,800 persons.

HES components are also often included to dietary surveys or sometimes also to human biomonitoring (HBM) studies. The collection of accurate and harmonized food consumption data at a European level is considered a primary long-term objective for European Food Safety Agency (EFSA).³⁷ For the ongoing European Human Biomonitoring Initiative HBM4EU³⁸ one of the aims is to explore obstacles and opportunities for linking HBM with HES, and to learn from the experience of countries where this link has implemented. HBM4EU is a joint effort of 28 countries, the European Environment Agency and the European Commission, co-funded under Horizon 2020. The main aim of the initiative is to coordinate and advance human biomonitoring in Europe. Also the European Centre for Disease Prevention and Control

³² <http://www.ecrhs.org/>

³³ <http://epic.iarc.fr/index.php>

³⁴ <http://www.share-project.org/>

³⁵ <https://www.elsa-project.ac.uk/>

³⁶ Leonardi M, Chatterji S, Koskinen S et al. Determinants of health and disability in ageing population: the COURAGE in Europe Project (collaborative research on ageing in Europe). *Clin Psychol Psychother* 2014;21(3):193-8.

doi:10.1002/cpp.1856

³⁷ <http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2014.3944/pdf>

³⁸ <http://www.hbm4eu.eu>

(ECDC) has expressed their interest for developing surveys to monitor communicable diseases³⁹, and this could be implemented within the national HES.

A national HES can be used as a platform for other studies such as dietary surveys, human biomonitoring studies, and infectious disease studies. All these studies benefit if they can be conducted in a representative random sample of the general population and if they can share the survey infrastructure established for a national HES.

Future prospects

Several countries are planning to conduct either their first national HES (Belgium) or repeated national HES in 2018-2022 (Czech Republic, Finland, Germany, Portugal and UK/England). Many of these HESs are planned to be conducted in connection to the European Health Interview Survey (EHIS) which is mandatory in all EU MSs. The 3rd round of EHIS will take place in 2019.

³⁹ European Centre for Disease Prevention and Control. *The development of a seroprevalence survey for hepatitis C in EU/EEA countries*. 2016. Available from: <https://ecdc.europa.eu/en/about-us/procurement-and-grands/development-seroprevalence-survey-hepatitis-c-eueea-countries>

Health information collected in national HESs

National HESs conducted in 2007-2017 have covered a wide and variable range of physical measurements and questionnaire modules, and collected different types of biological samples (Figures 3-24, countries in blue having the measurement/module). The following evaluation about the scope of health information available through HESs in EU Member States refers to the surveys conducted in 2007-2017 (Table 1).

Physical measurements

In all recent national HESs, at least the recommended EHES core physical measurements, anthropometrics (height, weight and waist circumference) and blood pressure have been included. (Figures 3 and 4) Most of the countries have followed the EHES protocol and therefore the results are also comparable between countries. For anthropometric measurements, many countries have also measured hip circumference and in some countries body composition using bio-impedance device has been measured. Hip circumference measurements have also been added in the updated EHES manual.



Figure 3. Blood pressure measurement



Figure 4. Anthropometric measurements

On top of these EHES core measurements, the most common additional physical measurements have been lung function measurements (Figure 5), cognitive function tests (Figure 6), physical activity/fitness tests and measurements (Figure 7) and ultrasound measurements (Figure 8).



Figure 5. Lung function measurements



Figure 6. Cognitive function tests

For lung function measurements, used spirometry devices and measurement protocols have varied between countries which may affect comparability of the results between the countries. Therefore, there is a need to develop a European level standardized protocol for spirometry.

Similarly, cognitive function tests, physical activity/fitness tests and measurements, and other measurements on physical functioning have varied between countries. For cognitive function tests, the range of included tests has varied as well as the used tools and protocols, e.g. the Mini-Mental State Examination (MMSE)⁴⁰. Some examples of the measurements on cognitive capacity included in national HESs have been verbal fluency, delayed recall, and digital symbol substitution. The assessment of physical functioning has included performance tests on hand-grip strength, chair stand, balance and timed up-and-go. Protocols for hand-grip strength and chair stand tests have been added to the updated EHES manual.

⁴⁰ <http://www.dementiatoday.com/wp-content/uploads/2012/06/MiniMentalStateExamination.pdf>

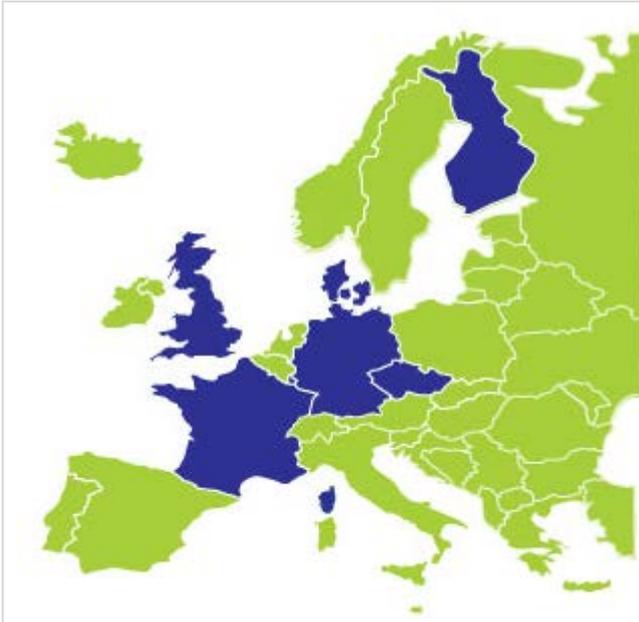


Figure 7. Physical activity and/or physical fitness tests and measurements



Figure 8. Ultrasound measurements (thyroid or bone density)

For physical activity, accelerometry and bicycle ergometry tests have been used. Ultrasound measurements have been used to examine thyroid volume and bone density. Additional to the most commonly included physical measurements, other e.g. electrocardiography (ECG) and clinical dental examinations have been included in some surveys.

Collection of biological samples

Collection of biological samples is common in HESs. They provide objective information about elevated blood cholesterol, diabetes, other diseases and many health related biomarkers.



Figure 9. Blood sample collection

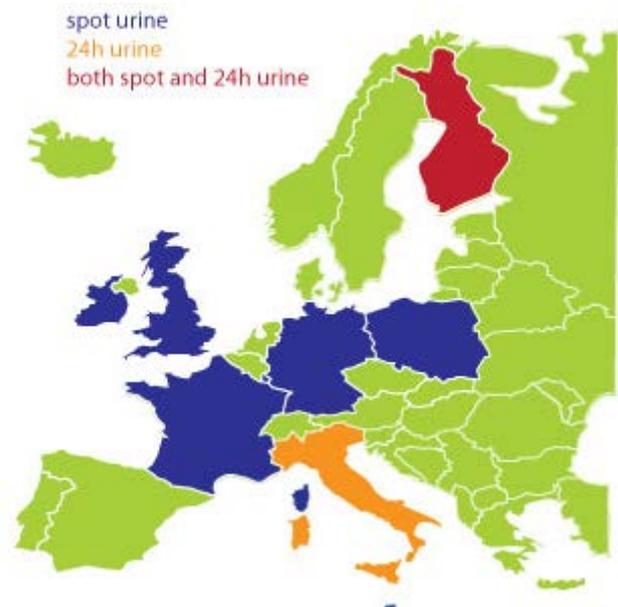


Figure 10. Urine sample collection

Most commonly collected biological samples are blood (Figure 9) and urine (Figure 10). DNA extraction has been done from the biological samples in several countries (Figure 11). In most of the countries, a part of the collected biological samples are stored for future use. (Figure 12)

Lipids and glucose/HbA_{1c} are the most commonly measured biomarkers from blood samples. Additional to these, for example haemoglobin, creatinine, high sensitive C-reactive protein (CRP), calcium, vitamins B and D, ferritin, immunoglobulin E (IgE) and gamma-glutamyl transferase have been measured. The most commonly analysed biomarkers from urine are sodium, potassium, creatinine and micro albumin. Also several infection markers such as hepatitis, salmonella and chlamydia, and environmental markers such as pesticides, cadmium and mercury have been measured in national HESs.

For blood sample collection and handling, the EHES protocol has been followed in most countries. Because of the national survey infrastructure, the handling and analysis of the samples has deviated from the EHES recommendation in some HESs, which may affect the comparability of the results. The key to ensure the comparability between countries is an external quality assurance programme for laboratories, in addition to national quality control programmes and accreditation. For urine collection, a standard protocol has been added to the EHES manual, which should increase comparability in future.

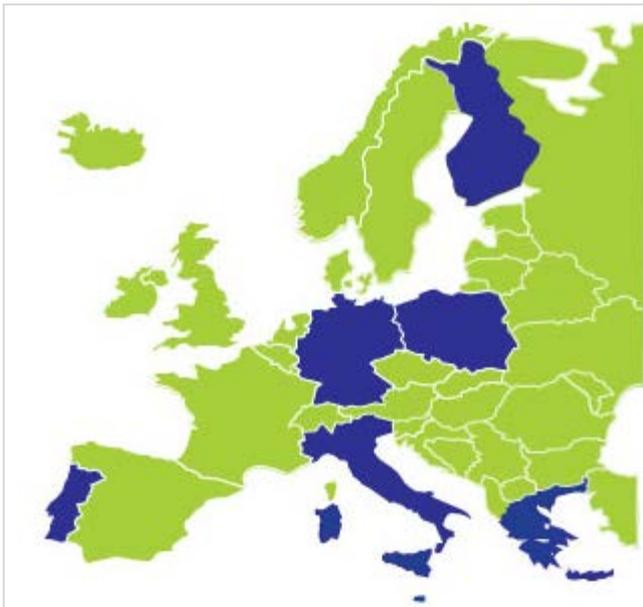


Figure 11. DNA

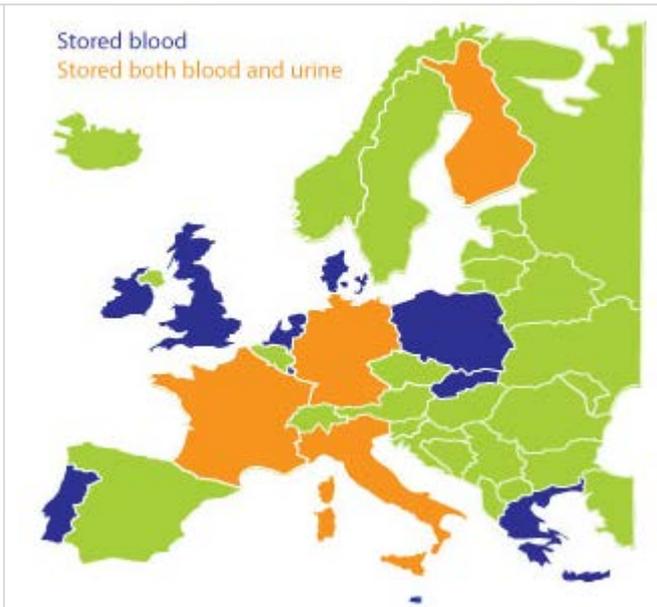


Figure 12. Samples stored for future use

Additional to blood and urine samples, in some surveys also hair and stool samples have been collected.

In most of the HESs, a part of the samples have been stored for future use. A related informed consent has been obtained from the participants allowing the use of the stored samples for public health and epidemiological research purposes. The stored samples make it possible to analyse new arising biomarkers and address new emerging research questions.

Questionnaire items

The scope of the questionnaire(s) has varied extensively across countries and also between surveys within countries (Figures 13-24). In some surveys only short basic questionnaires about socio-demographic background, diagnosed diseases and some key health behaviours are included while in other surveys, a series of extensive questionnaires are used. There may be specific questionnaires on dietary habits (i.e. food frequency questionnaires), questionnaires only for women focusing on reproductive health or questionnaires for elderly focusing on functional capacity, etc. The European Health Interview Survey (EHIS) questionnaire has been used in several countries combining the EHES and EHIS data collection and/or including also other modules/questions from EHIS than those in the EHES core questionnaire.

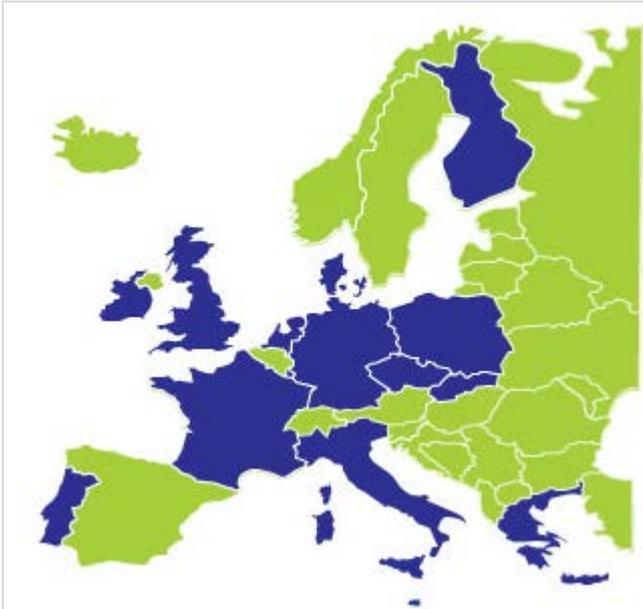


Figure 13. Socio-demographic background characteristics



Figure 14. Diagnosed diseases

In all surveys, questions on some aspects of socio-demographic background information have been included (Figure 13). Usually this covers at least information on education and occupation and in many surveys also marital status and some information about income.

Also diagnosed diseases (chronic conditions) are asked in all surveys (Figure 14). The selection of diseases varies between countries and in some countries also infectious diseases such as hepatitis have been included.



Figure 15. Use of health care services



Figure 16. Use of medicines

Questions on health care services (Figure 15) usually cover latest visit to a doctor, hospital or other health care facility, in some surveys also frequency of visits. For use of medicines (Figure 16), at least the use of prescribed medicines to treat hypertension, high cholesterol and diabetes are commonly asked. In some countries, all medicines (including also over the counter) currently/recently used are recorded with the dosage.



Figure 17. Dietary information



Figure 18. Alcohol consumption

Dietary information (Figure 17) has been collected through specific questions on food habits such as the use of fruit and vegetables, sweets or dietary fats, or through food frequency questionnaires and/or 24h recall. Questions on alcohol use (Figure 18) vary considerably between countries but usually cover the type and frequency of use.

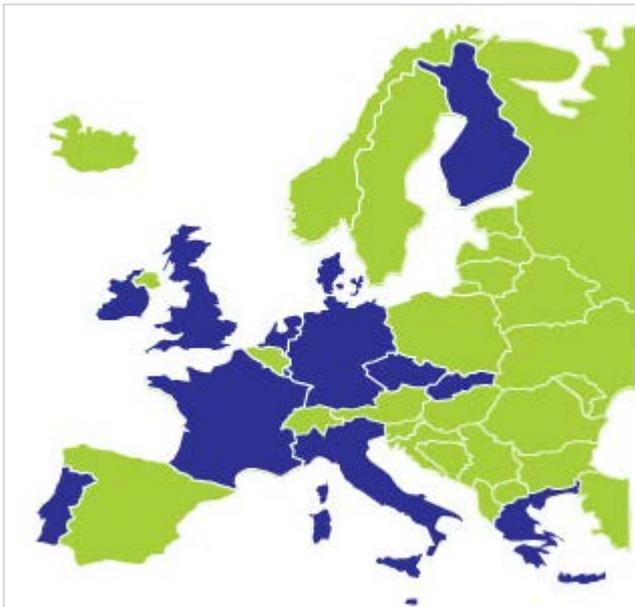


Figure 19. Physical activity



Figure 20. Functional capacity

Physical activity modules (Figure 19) have included questions about leisure time activities, sitting etc. Several international physical activity questionnaires such as IPAQ⁴¹, GPAQ⁴² and RPAQ⁴³ have been used. These questionnaires differ from each other so that it is impossible or very difficult to compare results between surveys using different instruments.

For functional capacity, functional limitations, long term illnesses and disabilities (Figure 20), international questionnaire modules such as activities of daily living (ADL)⁴⁴/Instrumental activities of daily living scale (IADL)⁴⁵ and the Global Activity Limitation Indicator (GALI) from the Minimum European Health Module (MEHM)⁴⁶ have been used. Again, comparability of different instruments is poor.

Also for quality of life (Figure 21), there are several international instruments and e.g. the MOS 36-item Short-Form Health Survey (SF-36)⁴⁷, the World Health Organization Quality of Life Assessment (WHOQOL)⁴⁸, the EuroQol (EQ-5D) Instrument⁴⁹ and the McGill Quality of Life questionnaire⁵⁰ have been used in the national HESs.

⁴¹ <http://www.ipaq.ki.se>

⁴² http://www.who.int/chp/steps/resources/GPAQ_Analysis_Guide.pdf

⁴³ Besson H, Brage S, et al. Am J Clin Nutr 2010;91(1):106-14

⁴⁴ <http://chroniccare.rehab.washington.edu/westernwa/geriatrics/resources/katzindeptest.pdf>

⁴⁵ <http://www.alz.org/careplanning/downloads/lawton-iadl.pdf>

⁴⁶ [http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Minimum_European_Health_Module_\(MEHM\)](http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Minimum_European_Health_Module_(MEHM))

⁴⁷ http://www.rand.org/health/surveys_tools/mos/36-item-short-form.html

⁴⁸ http://www.who.int/mental_health/who_qol_field_trial_1995.pdf

⁴⁹ <https://euroqol.org/euroqol/>

⁵⁰ http://www.npcrc.org/files/news/mcgill_quality_of_life.pdf

Questions and international instruments on mental health have covered symptoms of anxiety and depression, and other mental health problems, using e.g. the perceived stress scale (PSS)⁵¹, the WHO Composite International Diagnostic Interview (CIDI)⁵², the five item Mental Health Inventory (MHI-5)⁵³, Patient Health Questionnaire (PHQ9)⁵⁴, Beck Depression Inventory (BDI)⁵⁵, Centre for Epidemiology Studies Depression scale (CES-D scale)⁵⁶, Mood and Feelings Questionnaire (MFQ/SMFQ)⁵⁷, Mood Disorder Questionnaire (MDQ)⁵⁸, and Warwick-Edinburgh mental well-being scale (WEMWBS)⁵⁹. In several surveys, more than one mental health instrument has been used to cover different symptoms or aspects of mental health.



Figure 21. Quality of life



Figure 22. Mental health

⁵¹ <http://www.mindgarden.com/documents/PerceivedStressScale.pdf>

⁵² <http://www.hcp.med.harvard.edu/wmhcdi/instruments.php>

⁵³ Berwick DM, Murphy JM, Goldman PA, et al. *Med Care* 1999;29:169-176

⁵⁴ http://www.cqaimh.org/pdf/tool_phq9.pdf

⁵⁵ https://www.bmc.org/sites/default/files/For_Medical_Professionals/Pediatric_Resources/Pediatrics_MA_Center_for_Sudden_Infant_Death_Syndrome_SIDS_Beck-Depression-Inventory-BDI.pdf

⁵⁶ <http://www.bhevolution.org/public/document/ces-d.pdf>

⁵⁷ <http://devepi.duhs.duke.edu/mfq.html>

⁵⁸ <http://www.dbsalliance.org/pdfs/MDQ.pdf>

⁵⁹ <http://www2.warwick.ac.uk/fac/med/research/platform/wemwbs/>



Figure 23. Self-reported anthropometrics



Figure 24. Participation in screening programmes/activities

In almost all surveys also self-reported height and weight have been asked in the questionnaires allowing comparisons between self-reported and measured values (Figure 23).

Questions on participation to screening programmes and health promotion activities have included participation to colonoscopy, mammography, and cervical cancer screening (pap-test), uptake of vaccinations, and having blood pressure, cholesterol and glucose measured by a health professional.

Representativeness of national HESs

Target population

National HESs are expected to be representative for the general population living in the country. For practical reasons, some population groups such as institutionalized persons are often excluded from the sample. This may be due to lack of information in the sampling frame. For logistic reasons it may be impossible to conduct visits to the institutions or to reach the institutionalized persons in the framework of the survey. Often people who cannot reply to questionnaires in national language(s) of the country are excluded. All exclusion will affect the representativeness of the survey results to the general population.

The age range covered by the national HESs varies from the working age population (25-64/74 years) to all adults 18+ years. Most of the surveys cover at least the EHES minimum recommendation of 25-64 years old. (Table 2)

The sample size varies across the surveys from less than 2,000 to over 10,000 persons. (Table 2) The EHES recommendation is to have a minimum sample size of 4,000 persons to allow estimation of population level means and prevalence at least by sex and 10-year age groups. The sample size of 10,000 persons allows already estimation by regions/areas additional to sex and age groups.

Table 2. Target population, exclusion criteria and sample size in national HESs in 2007-2017

Country	Survey	Target population	Exclusion criteria	Sample size
Czech Republic	Czech-EHES	25-64 years old people with permanent residence	Institutionalized	3,850
	HELEN Study	45-54 years old people with permanent residence	Institutionalized	13,400 (health examinations only on sub-sample of this)
Denmark	The Danish Health Examination Survey (KRAM)	18+ years old living in 13 of 98 municipalities		180,103 (for health examination) 538,497 (for questionnaire)
Finland	FINRISK	25-74 years old people with permanent residence in selected study areas		2007: 11,953 2012: 9,905
	Health2011	18+ years old people with permanent residence in mainland Finland	Province of Åland	10,129
	FinHealth	18+ years old people with permanent residence in mainland Finland	Province of Åland	10,247
France	Étude Nationale Nutrition Santé	3-17 years old children and	Institutionalized, insufficient French	6,267 household for

Country	Survey	Target population	Exclusion criteria	Sample size
	(ENNS)*	18-74 years old adults	knowledge, moved outside the study area	adults 3,158 household for children
	ESTEBAN*	6-17 years old children and 18-74 years old adults with permanent residence in France	Corsica island, person not reached by telephone, insufficient French knowledge, too sick to attend, planning to move outside the study area	Target to obtain: 1,000 children 4,000 adults
Germany	Studie zur Gesundheit Erwachsener in Deutschland (DEGS)	18-79 years old people living in Germany (A new sample and re-invitation of participants from German National Health Interview and Examination Survey 1998 (GNHIES98))	Deceased, insufficient command of German language, no longer living in given address or living outside sample point	
Greece	HYDRIA	18+ years old permanent residents of the Greece	Institutionalized people	*
	National Morbidity and Risk Factor Study (EMENO)	18+ years old people living in Greece		*
Ireland	SLÁN	45+ years old for full health examination 18+ years for more limited examination		18,400 addresses for main study (18+ years)
Italy	OEC/HES	35-74 years old residence	Institutionalized people, prisoners, seriously ill	9,020
Luxembourg	EHES-LUX	25-64 years old residents	Institutionalized people (i.e. hospital, nursing home for more than a month, elderly home and prisons)	6,475
	ORISCAV-LUX 1	18-69 years old	Pregnant women, prisoners, long hospitalized	1,432
	ORISCAV-LUX 2	25-80 years old		1,500

Country	Survey	Target population	Exclusion criteria	Sample size
			(institutionalized subjects), out of age range	
Malta	SAHHTEK	18-70 years old residents	People living abroad temporarily, pregnant women, those that were too sick to attend and those living in institutions and therefore unable to attend	4,000
Netherlands	Nederland de Maat Genomen (NL de Maat)	30-70 years old general population in seven municipalities		10,663
Poland	WOBASZ II	20+ years old Polish residence		15,120
Portugal	Inquérito Nacional de Saúde com Exame Físico (INSEF)	25-74 years old residents in mainland Portugal and in the Autonomous Regions of Azores and Madeira	Invalid contact information, institutionalized people, insufficient Portuguese knowledge, too sick to attend	12,289
Slovakia	EHES	25-64 years old inhabitants in the 36 districts of Regional public health offices in Slovakia		4,032
UK/England	Health Survey for England*	2015: 0-15 years old children (including a child boost) 16+ years old adults living in private households in England	Institutionalized people	2015: 5,714 children 8,034 adults a nurse visit.

* Household sample. Only information about number of participants available.

Participation rates

Participation rate is one of the indicators for the representativeness of the survey results. Reported participation rates of the national HESs varied considerably from as low as 10% to almost 70%. (Table 3) These participation rates are indicative as the used definitions of who are considered as eligible for the sample and how participation is defined may vary.

Table 3. Participation rates and available information on non-participants in national HESs in 2007-2017

Country	Survey	Participation rate	Available information on non-participants
Czech Republic	Czech-EHES	32%	EHIS questionnaire from non-participants to the health examination part
	HELEN Study	42%	No available information
Denmark	The Danish Health Examination Survey (KRAM)	10% for health examination 14% for questionnaire	Register information on sex, age, municipality of residence, educational level, income and marital status
Finland	FINRISK 2007 and 2012	2007: 67% 2012: 65%	Age, sex, place of residence from the sampling frame and register based data on socio-economic position and mortality and morbidity through register linkage.
	Health2011	67%	Short non-participant questionnaire and register data on socio-economic position and mortality and morbidity, as well as use of health care services and social benefits through register linkage.
	FinHealth	59% health examination and questionnaire 67% health examination or at least questionnaire	
France	Étude Nationale Nutrition Santé (ENNS)	60% adults 68% children	
	ESTEBAN	Survey fieldwork recently finished, not yet published	
Germany	Studie zur Gesundheit Erwachsener in Deutschland (DEGS)	42% for new sample 62% for re-invited sample from GNHIES98 survey	A short non-response questionnaire and population register data on sex, age, place of residence and citizenship
Greece	HYDRIA	52%*	Sex, age, educational attainment, height, weight, smoking habits, self-reported health status and reason for non-participation
	National Morbidity and Risk Factor Study (EMENO)	*	
Ireland	SLÁN	62% for main study 66% for extensive	

Country	Survey	Participation rate	Available information on non-participants
		health examination	
Italy	OEC/HES	55%	Follow-up of vital statistics, age, sex, and some aspects of social status
Luxembourg	EHES-LUX	24%	Age, sex and district of residence
	ORISCAV-LUX 1	32%	Sex, age group, nationality, professional status, hospital discharge and medication consumption data from the national health insurance registry (i.e. "medical administrative database")
	ORISCAV-LUX 2	Ongoing	
Malta	SAHTEK	49%	
Netherlands	Nederland de Maat Genomen (NL de Maat)	36%	A short non-response questionnaire
Poland	WOBASZ II	46%	
Portugal	Inquérito Nacional de Saúde com Exame Físico (INSEF)	44%	Non-response questionnaire
Slovakia	EHES	49%	
UK/England	Health Survey for England	Children: 62%* Adults: 57%*	

* Household sample. Not possible to calculate comparable participation rate with surveys based on individual based sampling frames due to lack of information on household composition about non-contacted household.

If survey non-participation was completely random, i.e. not dependent on explanatory or outcome variables of interest, it would not make any difference how high or low participation rate is. Unfortunately, non-participation is not completely random. Several studies have shown that survey non-participants are more often men⁶⁰, from younger age groups or among those over 75 years⁶¹, and from lower socio-economic groups^{62,63}. Non-participants have also been found to have worse health behaviours such as smoking⁶⁴ and heavy alcohol consumption^{65, 66} and more health problems such as mental health problems⁶⁷, more hospitalizations^{68,69} and excess mortality compared to survey participants^{70,71}.

⁶⁰ Kjoller M, Thoning H. Eur J Public Health 2005;15(5):528-35

⁶¹ Ekholm O, Gundgaard J, Rasmussen NK, Hansen EH. Scand J Public Health 2010;38(7):699-706

⁶² Reinikainen J, Tolonen H, Borodulin K et al. Eur J Public Health 2017; <https://doi.org/10.1093/eurpub/ckx151>

⁶³ Demarest D, Van der Heyden J, Charafeddine R et al. Eur J Public Health 2012; doi: 10.103/eurpub/cks158

⁶⁴ Kopra J, Härkänen T, Tolonen H, Karvanen J. Stat 2015; diu: 10.1002/sta4.73

⁶⁵ Karvanen J, Tolonen H, Härkänen T et al. J Clin Epidemiol 2016; doi: 10.1016/j.jclinepi.2016.02.026

⁶⁶ Thygesen LC, Johansen C, Keiding N et al. Addiction 2008;103(7):1149-59

⁶⁷ Torvik FA, Tognmo K, Tambs K. Soc Psychiatry Psychiatr Epidemiol 2012;47(5):805-816

⁶⁸ Alkerwi A, Sauvageot N, Couffignal S et al. BMC Med Res Methodol 2010; doi: 10.1186/1471-2288-10-80

⁶⁹ Uuskula A, Kals M, McNutt LA. Eur J Public Health 2010;21(4):538-42

Some studies have estimated the potential non-response bias for outcome indicators. For example, from Swiss health survey it was estimated that among participants, the prevalence of depression was 9.2% while among non-participants the prevalence would be 10.3%.⁷² Another example from Finland has shown how population level estimates can change after adjusting for non-response by multiple imputation.⁷³ In this study, the prevalence of heavy alcohol use was 5.2% among participants and after adjustment for non-response, 6.8%. Similarly for daily smoking, the prevalence changed from 21.8% to 27.1% after non-response adjustment.

⁷⁰ Jousilahti P, Salomaa V, Kuulasmaa K et al. *J Epidemiol Community Health* 2005;59(4):310-315

⁷¹ Larsen SB, Dalton GD, Schuz J et al. *Eur J Epidemiol* 2012;27(11):837-45

⁷² Volken T. *BMC Public Health* 2013;13:167

⁷³ Karvanen J, Tolonen H, Härkänen T et al. *J Clin Epidemiol* 2016;76:209-217

Other sources of health information

Health information (health status, functional capacity and determinants of health) can be obtained from several data sources: health surveys are one and registers, administrative and disease specific, another one. (Figure 25) Health surveys can be classified into health interview surveys (HIS) and health examination surveys (HES). HESs include always a questionnaire, which can be shorter than the questionnaire in a national HIS. In HES there may also be several questionnaires (e.g. administered before and after the examination visit). In a HIS, all data collection is based on self-reported information. The questionnaires can be either self-administered or filled in during an interview. The European Health Interview Survey (EHIS) is based on EU Regulation⁷⁴ and coordinated by the Eurostat. The 2nd wave of the EHIS in 2013-2015 was mandatory in all MSs, and the next round has to be conducted in 2019.

Data sources for health information



Figure 25. Data sources for health information

⁷⁴ No 1338/2008 of the European Parliament and of the Council of 16 December 2008 on Community statistics on public health and health and safety at work

There is no EU Regulation about HESs. The European Health Examination Survey (EHES) initiative coordinated by the National Institute for Health and Welfare (THL), Finland, maintains a network of national HESs in Europe.⁷⁵

Register information can be obtained from national administrative registers or medical records. Medical records have information on patients' medical history including diagnosed diseases and medical care in primary health care and/or in hospitals. The availability and coverage of medical records vary across countries.⁷⁶

Administrative registers such as registers on mortality and hospitalizations are useful data sources on disease incidence, prevalence and on the causes of death. However, there may be inconsistencies in the clinical practice and in coding of the information between countries and sometimes even between regions within the country.

Disease specific registers such as diabetes, acute myocardial infarction and cancer registers are national or regional databases including detailed information on the disease cases in question. There are differences between countries in the disease specific registers that are available as well as in the contents and coding of information in the registers.

Table 4 summarizes the basic characteristics of different data sources for health information.

Table 4. Characteristics of different data sources for health information

Quality and feasibility indicators	Health surveys		Registers	
	HIS	HES	National, administrative	Disease specific
Population level coverage	Representative sample of the population. Low participation rate may have an effect on representativeness.		Everyone treated in the specific organizations or the whole health care system.	If national, everyone diagnosed for specific diseases. If regional, only those living in the area and diagnosed for the diseases covered by the register.
Covered health outcomes	Limited list of diseases (chronic and/or infectious) asked in a questionnaire.	Limited list of diseases (chronic and/or infectious) asked in a questionnaire and diseases identified	All health conditions requiring medical attention in health care system (usually coded by	Only disease specific information on one or few diagnoses.

⁷⁵ <http://www.ehes.info>

⁷⁶ Verschuuren M, Gissler M, Kilpeläinen K et al. Public health indicators for the EU: the joint action for ECHIM (European Community Health Indicators & Monitoring). Arch Public Health 2013;71:21. <http://doi.org/10.1186/0778-7367-71-12>

Quality and feasibility indicators	Health surveys		Registers	
	HIS	HES	National, administrative	Disease specific
		during the health examination or by analysis of biological samples.	ICD-codes), uniform coding protocol necessary.	
Requirements for self – reports/coverage	Remembers and is aware that he/she has been diagnosed for a disease and/or has been treated for a disease.	Remembers and is aware that he/she has been diagnosed for a disease and/or has been treated for a disease.	Treatment for a health condition in the health care service(s) covered in the register(s).	
Cost	Relatively low	Much more expensive than HIS	Part of the national administrative data collection. No extra costs.	Some of the data usually available through administrative registers, collection of additional information from patient records

Differences between data sources

Availability of data from different sources varies. Through health interview surveys, information about socio-demographic background, health behaviours, and uses of health care services and diagnosed diseases can be obtained. Since all information is based on self-reporting of the participants, it is subject to recall and awareness bias. Also for some questions, such as use of alcohol, and sexual behaviours, social acceptability may play a role. On the other hand, HIS is relatively fast and cheap to conduct in a large population especially if it is done as a mail survey. Personal interviews, either face-to-face or by telephone, are a more costly and time consuming way to organize a HIS. However, in personal interviews, unclear questions of the participant can be clarified by interviewer.

HES can provide information about same topics as HIS. In addition, HES can provide estimates of undiagnosed diseases or conditions through physical measurements and analysis of collected biological samples. Obviously, measuring blood pressure at one occasion only, for example, is not enough to provide clinical diagnoses of hypertension but it will provide a proxy for undiagnosed cases in the population. HESs are much more expensive and time consuming to organize than HISs.

Data from administrative registers usually cover a wide range of diagnoses including several diseases and health conditions. The data collection is part of the routine clinical work. In registers, there is usually very limited amount of background information such as socio-demographic information and only those who have sought medical care are included. Disease specific registers are usually established to collect more detailed information on specific disease than what is available through administrative registers.

For obesity, measured height and weight will provide golden standard results for overweight and obesity. Many studies have been conducted to compare population level estimates obtained from different data sources. For example, based on the EHES Pilot Project, we know that several health indicators are underestimated by self-reported data. (Table 5)⁷⁷

Table 5. Difference in outcome prevalence between data sources and % missed using self-reported data

	Men		Women	
	Difference in prevalence (self-reported – measured)	% missed if using self-reported data	Difference in prevalence (self-reported – measured)	% missed if using self-reported data
Obesity	-4.4%-points	30	-4.2%-points	26
Hypertension	-10.1%-points	41	3.5%-points	28
High cholesterol	-49.6%-points	68	-43.6%-points	70
Diabetes	-0.8%-points	22	0.9% -points	14

A systematic review⁷⁸ and several other studies^{79, 80, 81} have shown similar results for overweight and obesity to those from the EHES Pilot Project. The reported under-estimation has been little lower than reported from the EHES but still large enough to cause bias to population level estimates of the total number of obese. For example, in the population of 10 million adults, an under-estimation of 2.5 %-points by self-reported data would mean 250.000 obese persons less in the population than obtained by objective measurements.

High cholesterol and high blood pressure have also been underestimated in several other studies comparing self-reported information with measured data from HESs^{82,83,84,85}. Hypertension and elevated total cholesterol are typically asymptomatic for a long time and remain therefore easily unmeasured and undetected. Consequently, the people concerned may not be aware of these conditions.

The under-estimations of high cholesterol and high blood pressure have often been smaller, when self-report has been compared to medical records (i.e. register-based data) instead of measured data from HESs^{86,87}. In a study from the Netherlands, both HES and medical records were included as reference

⁷⁷ Tolonen H, Koponen P, Mindell JS et al. *Eur J Public Health* 2014;24(6):941-8

⁷⁸ Gorber SC, Tremblay M, Moher D, Gorber B. *Obes Rev* 2007;8:307-26

⁷⁹ Ikeda N. *PLoS One* 2016;1(2):e0148297. doi: 10.1371/journal.pone.0148297

⁸⁰ Lassale C, Peneau S, Touvier M et al. *J Med Internet Res* 2013;15:e152

⁸¹ Dijkshoorn H, Ujcic-Voortman JK, Viet L et al. *BMC Public Health* 2011;11: 408. doi: 10.1186/1471-2458-11-408.

⁸² Molenaar EA, Van Ameijden EJ, Grobbee DE et al. *Eur J Public Health* 2007;17(2):199-205.

⁸³ Huerta JM, Tormo MJ, Egea-Caparros JM et al. *Revista espanola de cardiologia* 2009;62(2):143-52.

⁸⁴ Natarajan S, Lipsitz SR, Nietert PJ. *Am J Prev Med* 2002;23(1):13.21.

⁸⁵ Taylor A, Dal Grande E, Gill T et al. *Aust N Z J Public Health* 2010;34(4):394-400.

⁸⁶ Tormo MJ, Navarro C, Chirlaque MD et al. *J Epidemiol Community Health* 2000;54(3):221-6.

material⁸⁸. Higher hypertension prevalence was reported with HES than with medical records (59% and 44%, respectively), which suggests that medical records do not cover all hypertensive subjects. In this study, self-reporting over-estimated hypertension rate, when medical records were used as the reference, which may be due to under-estimation by the medical record data.

For diabetes, the difference between self-reported, measured and register data has usually been smaller than for high cholesterol or high blood pressure^{89,90}.

⁸⁷ Okura Y, Urban LH, Mahoney DW et al. *J Clin Epidemiol* 2004;57(10):1096-103.

⁸⁸ El Fakiri F, Bruijnzeels MA, Hoes AW. *J Clin Epidemiol* 2007;60(12):1291-9.

⁸⁹ Huerta JM, Tormo MJ, Egea-Caparrós JM et al. *Revista española de cardiología* 2009;62(2):143-52.

⁹⁰ El Fakiri F, Bruijnzeels MA, Hoes AW. *J Clin Epidemiol* 2007;60(12):1291-9.

Discussion

Representative and reliable data on health, functional capacity and health determinants of the general population and population sub-groups are needed for evidence-informed policy making, planning and evaluation of prevention programmes and research. The data are used by policy makers, health care professionals, NGOs working on disease prevention and researchers. Health examination surveys (HES), which include questionnaires, objective health measurements and analysis of biological samples, can provide information on many health indicators available not at all or less reliably through administrative registers or health interview surveys.

One of the six objectives in the WHO global action plan⁹¹ for the prevention and control of noncommunicable diseases 2013–2020 is to monitor the trends and determinants of noncommunicable diseases and to evaluate progress in their prevention and control. The action plan calls for undertaking periodic data collection on cardiovascular and metabolic risk factors. Many of these can only be reliably measured in HES.

Self-reported prevalence of hypertension, elevated cholesterol and diabetes are often under-estimations of true situation due to lack of awareness. Register data on disease prevalence covers only those who have been diagnosed and treated. For functional capacity, registers have very limited information and self-reports may be biased e.g. due to differences in living conditions and subjective interpretations.

Currently, only half of the EU Members States have carried out national HESs, and in that half, the scope of the HESs vary substantially. This puts countries in an unequal situation in relation to available health information from health examination surveys at the population level. In all of these surveys, data from anthropometrics, blood pressure, blood lipids and socio-demographic background, diagnosed diseases and some health behaviours are available. These are in fact the core measurements which EHES recommends to be included in all surveys. In some countries, more extensive sets of physical examinations and laboratory analyses have been carried out. This is well justifiable, and was recommended by EHES. Countries may wish to do their first HESs with a limited number of well standardized measurements, and extend the scope, perhaps in less frequent surveys, when there is more experience in HESs

Standardized data collection is needed to ensure high quality of data and comparability of results between countries and overtime within countries. Benchmarking between countries helps to identify potential topics for improvement. The EHES Manual provides standardization protocols for the EHES core measurements (anthropometrics, blood pressure, collection of blood samples for lipid and glucose measurements) and a few additional measurements (hip circumference, hand grip strength and chair stand tests, and spot and 24h urine collection) were added to the manual in 2016.

Since several other measurements are frequently included in national HESs, it would be important to provide European level standardized protocols for them as well to ensure comparability. These could include at least measurements of lung function, cognitive function, physical function, physical activity and fitness. Several previous projects have provided potential standards for these measurements: For example, the COURAGE⁹², SHARE⁹³ and CHANCES⁹⁴ projects provided protocols for and gained experiences on

⁹¹ World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013–2020. 2013, World Health Organization. http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf

⁹² Leonardi M, Chatterji S, Koskinen S et al. Determinants of health and disability in ageing populations: the COURAGE in Europe Project (collaborative research on ageing in Europe). *Clin Psychol Psychother* 2014;21(3):193-8. doi:10.1002/cpp

measurements of functional capacity among the elderly, and the ECRHS⁹⁵ protocols for lung function measurements should be considered and developed further for the future EHES standards.

For collection and analysis of biological samples, EHES standardized protocols for blood samples have been available since 2012 and for urine since the end of 2016. Following these protocols, pre-analytic variation can be minimised. For the analytic phase, it would be important to have one national laboratory in each country to do all the analysis to avoid unnecessary variation between laboratories, even if several national laboratories had been accredited and participate in a national quality control scheme. Additional to this, experience from large international studies such as the WHO MONICA Project and EUROASPIRE^{96,97} has shown, that joint external quality assurance is needed for the national laboratories to ensure cross country comparability. For other biological samples, such as hair, saliva and stool, we do need European protocols.

For many questionnaire modules, such as functional capacity, quality of life, mental health and physical activity, several international questionnaires/instruments exist and are used in national HESs. Standard instruments/questions for these topics are also included in the EHIS questionnaire. For comparability of results across countries, it would be ideal if, for each health module, one or two international instruments could be recommended to be used. Even though EHIS can be the basis for the questionnaires of national HESs, additional or different instruments may be recommended by EHES because of the need to compare measured and self-reported information or to complement the measured information with corresponding questions. Obviously one has to keep in mind that different instruments often measure different phenomena. Many instruments originally developed for clinical practice may not be feasible for surveys, where often only shorter versions are needed.

It should also be noted, that physical measurements and analysis of biological samples are usually much easier to standardize in cross country settings than questionnaires. Questionnaires require often cultural adaptations and conceptual, not literal translations. Also the questionnaire administration mode, mailed or web- questionnaires and face-to face or telephone interviews, has an effect on questionnaire results. Eurostat develops the EHIS standardized protocols together with national statistical institutes. Therefore, close collaboration with Eurostat on the EHIS questionnaire modules is needed.

The current EHES guidelines and standardized protocols are targeted for the adult population, mainly for adults of the working age. It would be equally important to obtain objective health information about children and adolescents. However, EU level guidelines and standardized protocols for children and adolescents are currently missing. Similarly, more attention should be paid on the measurements targeted for the elderly population, such as measurements of cognitive and physical functioning.

HESs are often criticized because of their high cost and the time it takes to organize them. Also low participation rates are seen as a problem for representativeness of the survey results. Participation rates

⁹³ <http://www.share-project.org>

⁹⁴ Boffetta P, Bobak M, Borsch-Supan A et al. The Consortium on Health and Ageing: Network of Cohorts in Europe and the United States (CHANGES) project – design, population and data harmonization of a large-scale, international study. *Eur J Public Health* 2014;29(12):929-36. doi: 10.1007/s10654-014-9977-1

⁹⁵ <http://www.ecrhs.org/>

⁹⁶ Kotseva K, Wood D, D Bacquer D et al. EUROASPIRE IV: A European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries. *Eur J Prev Cardiol* 2016;23(6):636-48. doi: 10.1177/204787315569401

⁹⁷ <https://www.escardio.org/Research/Registries-&-surveys/Observational-registry-programme/euroaspire-v#>

can be improved through careful planning and implementation of the survey, but this requires attention and resources from the survey organisers throughout the survey process.

Low participation rates in many countries may reduce representativeness of the results to general population. Non-response studies are needed to better understand the characteristics of non-participants and their effects to the potential bias on obtained results. Statistical methods can be used to reduce non-response bias, provided that some information from non-participants can be obtained either through the sampling frame, a non-response questionnaire or linkages to administrative registers. The possibility to link the HES data to data from health registers is becoming increasingly available in the EU MSs. Also research on methods to increase participation rates will be needed.

Both at the national and European level, it should also be noted that a national HES can be conducted in connection with a national health interview survey such as the EHIS, dietary surveys proposed by EFSA and human biomonitoring surveys, such as those proposed under the European Human Biomonitoring Initiative (HBM4EU). National HESs can also serve as bases for more specific studies like those on communicable diseases planned by ECDC.

In addition to the health monitoring purposes, the HESs have an important role in public health practice, professional training and research. Many tools and tests supporting preventive activities have been developed using data from HESs (e.g. risk scores and calculators). HES results can be presented in health promotion campaigns to increase the awareness of risk factors and prevention possibilities among the general population. The research potential of HES data on public health and epidemiological research is wide, especially when some of the collected biological samples are stored for future use in biobanks. They can be used to identify new biomarkers and risk factors for existing public health problems and also to identify new, potential public health problems. The value of HES data for research increases substantially if there is a possibility to link HES data with administrative registers. Unfortunately, strict data protection rules or unavailability of personal identification codes makes this difficult in some EU countries.

EU provided funds for setting up the European Health Examination Survey Coordinating Centre (EHES CC) in Finland in year 2009. This has prepared guidelines for organizing surveys and measurement standards for the major chronic disease risk factors, organized training and external quality assessment and provided advice to counties planning their HESs. The lack of essential health information in many countries sets the European countries in unequal positions in their possibility to monitor and foresee, and hence to improve the health of the population, and to plan and optimise the cost-effectiveness of their health systems. To reduce this inequality, the countries should be encouraged to include HESs in their health monitoring systems. Also the possibilities of financial support from the EU to the countries conducting national HESs and/or EU legislation on HESs should be considered. In order that the results of the national surveys can be comparable and the trend estimates reliable, sustainable funding of the EHES CC should be ensured.