

Arpo Aromaa
Markku Heliövaara
Paul Knekt
Seppo Koskinen

National Health Examination Surveys in Research

From the Mobile Clinic Health Examination
Survey to the Health-studies of the 2000s

REPORT



REPORT 8/2019

Arpo Aromaa, Markku Heliövaara, Paul Knekt, Seppo Koskinen

National Health Examination Surveys in Research

From the Mobile Clinic Health Examination Survey to the Health-studies
of the 2000s

© The Authors, the National Institute for Health and Welfare and the SII

Photographs: Marianne Stelander, page 41
Jussi Valkeajoki, pages 81, 90, 95, 100

Cover: Riitta Nieminen

Layout: Marja Palander

ISBN 978-952-343-328-1

ISSN 1798-0089

<http://urn.fi/URN:ISBN:978-952-343-328-1>

Helsinki 2019

Abstract

Aromaa A, Heliövaara M, Knekt P, Koskinen S.

National health examination surveys and research

This book deals with the Finnish national health examination surveys carried out over fifty years. It presents their implementation, study populations and methods as well as the opportunities they provide for further research.

The book presents the Social Insurance Institution's Mobile Clinic Health Examination survey (also labelled the Finnish Mobile Clinic Health Examination survey), its follow-up phase, the Mini-Finland Health survey, and the Health 2000 and Health 2011 surveys. In 1966–1972 the Mobile Clinic examined more than 50,000 adults in 30 study communities and re-examined 20,000 of them in 1973–1976. The Mini-Finland Health survey was the first nationally representative study and it examined 7,200 adults aged 30 years and over. Health 2000 and Health 2011 also examined nationally representative samples of the population. Almost 7,000 participated in Health 2000 and almost 5,000 in Health 2011. The participation rates were of the order of 80–90% with the exception of Health 2011 with a lower participation rate.

The Mobile Clinic Examinations were initially implemented as multiphasic screening relying on laboratory automation. Important topics were coronary heart disease, hypertension, diabetes, urinary tract infections and diseases of the thyroid gland. The studies also comprised a dietary history survey of 10,000 persons. The key aim of the follow-up examination was to assess the incidence of diseases and their determinants.

The Mini-Finland survey carried out in 1978–1980 was the first in Europe to assess in a nationally representative population sample the occurrence and treatment situation of common public health problems, their determinants and the population's work ability and functioning. Health 2000 also examined a nationally representative sample. It was implemented in 2000–2001 under the auspices of the National Public Health Institute. Its field work was initiated by a home health interview carried out by Statistics Finland, followed-up by a clinical phase comprising also examinations by doctors and dentists. The Health 2011 survey was based on the Health 2000 sample and it enables individual-level follow-up. The aims comprised assessing the occurrence and incidence of public health problems. However, due to limited funds neither a separate home health interview nor doctor's and dentist's examinations could be carried out, and participation was lower than before.

In the Mini-Finland survey and successive studies the aims and the methods were comprehensive. The questionnaires, interviews, measurements and doctor's examinations concerned the most common diseases, their determinants, the treatment situation and functioning.

Blood samples have been stored from all examinations (beginning with Health 2000 also whole blood samples for DNA). Furthermore, all subjects are being followed-up by national registers such as those on mortality and causes of deaths, cancer incidence, use of medicines, and work disability.

Several hundred scientific articles have been published. The data set can successfully be used for further studies. Guidelines for getting access to data for new studies are provided in this publication.

Contents

Abstract	3
Preface	5
Summary	6
Introduction.....	12
The Finnish Mobile Clinic Health Examination Survey	14
The Mobile Clinic Follow-up Survey	26
The Mini-Finland Survey	39
Health 2000	81
Health 2011	117
The data, their follow-up and use	133
Literature	137

Appendices/links

Appendix 1 [AK29 Invitation to the Mobile Clinic Health Examination](#)

Appendix 2 [AK01 Baseline Questionnaire of the Mobile Clinic Health Examination](#)

Appendix 3 [AU01 Baseline Questionnaire of the Mobile Clinic Follow-up Health Examination Survey](#)

Appendix 4 [MS124 Health Interview of the Mini-Finland Health Survey](#)

Appendix 5 [MS011 Baseline Questionnaire of the Mini-Finland Health Survey](#)

Preface

This book describes the implementation of Finnish national health examination surveys. Its purpose is to support the use of study materials and sample stores in public health research. The first of these surveys was carried out in the latter half of the 1960s (the SII Mobile Clinic Health Examination survey) and the most recent ones in 2011. Recently, part of the information has been published in the Internet-pages of the National Institute for Health and Welfare (THL). This book also contains links to questionnaires and interviews of all these studies. Jointly with the information on the Internet-pages, the book is useful in research based on the population surveys and the related biobanks. The Mobile Clinic Health Examination materials comprising tens of thousands of people and the samples are also an important part of the THL biobanks. The use of the whole blood samples (since the Health 2000 survey) in genetic research is enhanced by the fact that the data sets comprise information on the subjects' health, living conditions and behavior.

The representative study materials are also a good foundation for new studies. Altogether there is information on about 80,000 subjects and their register-based follow-up and frozen blood samples. Since Health 2000 also whole blood samples have been stored for DNA-analyses.

The basic prerequisites for the studies and the research described herein were created by the SII research initiated with national sickness insurance: the series of sickness insurance surveys led by Tapani Purola began in 1964, and the Mobile Clinic under Olli P. Heinonen began its early detection of diseases activities in 1965. SII Director General Jaakko Pajula played a central role in ensuring the preconditions for these studies. Later the Mobile Clinic activities were divided into field work led by Jouni Maatela and scientific research. For research a social medicine research group was put together and placed into the SII Research Institute for Social Security. Initially, members of the research team were Arpo Aromaa, Markku Heliövaara, Paul Knekt, Kari Puro, Antti Reunanen, Ritva Seppänen and Markku Tamminen, and as of the Mini-Finland health survey Tapani Melkas and Kai Sievers and in the SII Turku Research Centre Olli Impivaara, Matti Joukamaa, Ville Lehtinen and Esko Mälkiä. Led by the group of the research institute first the Mobile Clinic Follow-up survey was carried out in 1973–1976. The next project was the Mini-Finland health survey carried out in 1978–1980. It was the first nationally representative health examination survey in Europe. The research institute in Helsinki was directed by Tapani Purola and, later by Esko Kalimo, and the Turku Research Centre by Veikko Kallio.

In 1995 the SII medical research group and its research materials were transferred to the National Public Health Institute led by Jussi Huttunen. The following national health examinations were the Health 2000 survey in 2000–2001 under the leadership of Arpo Aromaa. The most recent study was Health 2011 led by Seppo Koskinen. Collecting the data and samples and utilizing them was supported by secretaries and planners working in Helsinki and Turku. Of them, the following deserve special credit. Pirkko Alha, Virpi Killström, Ulla Olkkonen, Sirkka Rinne, Harri Rissanen and Pirkko Silanto. Of great importance was also the input of the personnel of the biochemical laboratories, led in Helsinki by Jouko Sundvall and Jaana Leiviskä, and in Turku by Jukka Marniemi and Aila Leino. Further key personnel of Health 2000 comprised Sami Heistaro and of Health 2011 Päivikki Koponen, Ulla Laitinen, Annamari Lundqvist, Tomi Mäki-Opas and Sebastián Peña. During the five decades many other researchers, doctors, nurses, technicians, planners, laboratory and office personnel have implemented the studies. Many of them have been named in previous publications. We thank all of them for their valuable input resulting in the unique research material described in this book.

During the past fifty years other national health surveys have also been carried out by the National Public Health Institute (NPHI) or The National Institute for Health and Welfare (THL). The most extensive of them have been the FINRISK-studies which were initiated in order to evaluate the North Karelia project. A decision has been made to combine all health examination-based health monitoring with the tradition of the Mini-Finland survey and the Health 2000 survey. The first of these combined studies was called FinHealth 2017 and its field work was carried out in spring 2017. The next combined survey will be implemented in 2022.

The Authors

Summary

National health examinations in research

This book summarizes the implementation, and methods of the national health examinations carried out for fifty years, and prerequisites they provide for research. The book describes the research materials, sample stores and follow-up by registers as well as solutions supporting research use. The book also illustrates the development of national health examinations toward a general health monitoring system. With the temporal development also, the contents of the surveys have become more comprehensive. The book also describes the use of the research material in genetic research and the user interfaces enhancing the use of different parts of the material. Finally, the book evaluates the use of these data in future research.

National population health examinations

This book describes the national health examinations beginning in the 1960s with the Mobile Clinic Health Examination survey until the Health 2011-survey. The number of participants and the participation rate for each survey is shown in Table 1.

Table 1. Number of participants, age range (in brackets) and participation rate.

	Mobile Clinic Health Examination	Mobile Clinic Follow-up	Mini-Finland	Health 2000	Health 2011
Examined	51,522 (15+)	19,518 (20+)	7,217 (30+)	9,125 (18+)	6,740 (18+)
Participated (%)	82.5	78.6	90.2	92.4	67.4

In the Mobile Clinic Health Examination survey 1965–1972 more than 51,000 persons were examined, in the follow-up survey 1973–1976 almost 20,000 persons and in the nationally representative Mini-Finland study there were 7,200 examinees aged 30 and over, in the Health 2001 survey close to 6,800 and in Health 2011 almost 4,700. In the Mobile Clinic Health Examination there were almost 18,000 adults aged under 30 years, in the follow-up survey more than 4,000, in Health 2000 some 1,500 and in Health 2011 some 1,600. Both in Health 2000 and in Health 2011 they were interviewed or asked to fill in a postal questionnaire (Health 2011). The participation rates were excellent i.e. 80–90%, but in Health 2011 just below 60%.

The Mobile Clinic Health Examinations were carried out in different parts of the country in 1966–1972, and topics screened for were e.g. coronary heart disease, hypertension, diabetes, urinary tract infections, iron deficiency anemia and thyroid diseases. In connection of this study also an extensive dietary history interview was carried out (10,000 people), and so was a study of the genetics of Finns, a survey on mental health, and a special study of screening methods for breast cancer. In all 58,000 adults (aged 15+) in 30 regions were examined, and more than 80% of the sample participated.

The Mobile Clinic follow-up survey was carried out in 1973–1976 in four regions initially examined five years earlier. Altogether 20,000 people aged 20 and over were invited. More than 80% participated. The central aims were to study the incidence of diseases, and the impact and changes of their risk factors. The main study topics were coronary heart disease, hypertension and diabetes, and a dietary interview was carried out. Otherwise, the study protocol, especially the questionnaires and interviews, was more comprehensive than before. Much more information was collected on diseases and their treatment and the forms and questionnaires were more extensive than before.

The Mini-Finland Health survey. The next phase was the SII Mini-Finland survey, which for the first time in Europe assessed the occurrence, distribution and treatment situation of common chronic diseases and their risk factors in a sample representing the population. It also assessed the population's work ability and functional capacity. The study comprised an interview and questionnaire phase as well as a clinical phase comprising a doctor's and a dentist's examination. The Mini-Finland sample comprised 8,000 adults aged 30 and over. More than 95% participated in interviews and replied to questionnaires and more than 90% participated in the clinical phase.

The Health 2000 survey. In 2000–2001 the Health 2000 survey was carried out under the auspices of the National Public Health Institute. A representative sample of adults aged 18 and over was examined. Sample size was 8,028 persons in the age group 30 and over. In addition, the Statistics Finland home interview comprised 1,894 persons aged 18–29 years. Just as in the Mini-Finland survey the topics were the most important public health problems, their risk factors and treatment as well as functional limitations. Also in Health 2000 there was an interview and a questionnaire phase and a clinical phase comprising doctor's and dentist's examinations. Of adults aged 30 and over 95% participated in the home interview and more than 90% in the health examination. Of young adults 79% participated in the home interview.

The Health 2011 survey. The Health 2011 examined a representative sample of the population based on the Health 2000 sample. All subjects included in the Health 2000 sample were invited and thus most of the participants were examined twice. At the time of the Health 2011 the sample comprised 8,022 subjects aged 30 and over and 1,981 younger adults. The contents of the study resembled that of Health 2000. However, due to limited funds the interview was carried out in the field examination site and not at home. Also, doctor's and dentist's examinations could not be carried out. Participation was lower than before, and the interview or examination were attended by 59%.

Table 2. Questionnaires and interviews.

	Mobile Clinic Health Examination	Mobile Clinic Follow-up	Mini-Finland	Health 2000	Health 2011
2.1 Baseline forms					
Social and demographic factors	X	X	X	X	X
Behavior (smoking, alcohol use, work strain, physical activity)	(X)	X	X	X	X
Work and work ability			X	X	X
Participation and hobbies			X	X	X
Functional limitations			X	X	X
Chronic conditions and their treatment	X	X	X	X	X
Diet and nutrition	X	X	(X)	X	X
Health promotion				X	X
Use of health care services		X	X	X	X
Use of medicines	X	X	X	X	X
Rehabilitation				X	X
2.2 Symptom questionnaires and interviews					
Chest pain, dyspnea, Intermittent claudication	X	X	X	X	X
Joint symptoms and pain			X	X	X
Mental symptoms			X	X	X
Other symptoms (asthma, eczema, allergies)			X	X	X
2.3 Disease-specific questionnaires					
			X	X	X

Table 3 presents the samples, biochemical determinations, X-ray and ECG examinations. In the first three surveys miniature chest-X-ray and ECG were included, and in the Mini-Finland survey, also X-ray of the hands. Biochemical determinations were carried out on plasma and serum. The determinations mentioned in the table were carried out soon after the field survey. Later, many other determinations have been carried out on frozen samples, often relating to various case-control designs. As of the Health 2000 survey also whole blood samples were stored. They have been used for genetic studies and the whole genome has been determined.

Table 3. Samples, biochemical determinations, X-ray and ECG examinations.

	Mobile Clinic Health Examination	Mobile Clinic Follow-up	Mini-Finland	Health 2000	Health 2011
3.1 Urine sample (albumin, glucose, blood, bacteria)	X	X	X	X	X
3.2 Blood samples					
Plasma	X	X	X	X	X
Serum	X	X	X	X	X
Whole blood				X	X
3.3 Blood pressure, heart rate	X	X	X	X	X
3.4 Height, weight, BMI	X	X	X	X	X
3.5 Skinfolds, abdominal circumference	X	X	X	X	X
3.6 Packed cell volume, Hemoglobin	X	X	X		
3.7 Determinations on blood samples					
S-cholesterol	X	X	X	X	X
S-HDL-cholesterol	X	X	X	X	X
S-LDL-cholesterol				X	X
S-triglycerides		X	X	X	X
P-glucose	X	X	X	X	X
P-creatinine	X	X	X		
S-iron	X	X			
TIBC	X	X			
S-gammaglutamyltransferase			X	X	X
S-rheumatoid factors			X	X	
3.8 X-ray and ECG					
Chest X-ray	X	X	X		
Hand-X-ray			X		
ECG	X	X	X	X	X

In addition to questionnaires and interviews concerning functional capacity since the Mini-Finland survey there were measurements and tests of functioning and clinical and diagnostic examinations described in table 4. In the Mini-Finland survey the examinations concerned respiratory functioning, bio impedance, joint functioning, vision and hearing, cognition and physical performance such as hand grip strength, balance, chair stand speed and walking speed.

Clinical examinations were the doctor's and dentist's examinations and psychiatric interviews.

Table 4. Measurements and examinations in the surveys.

	Mobile Clinic Health Examination	Mobile Clinic Follow-up	Mini-Finland	Health 2000	Health 2011
4.1 Examinations of functional capacity					
Respiratory functioning			X	X	X
Bioimpedance				X	X
Joint functioning			X	X	X
Vision				X	
Hearing				X	X
Cognitive tests			X	X	X
Hand grip strength			X	X	X
Balance				X	X
Chair stand speed				X	X
Walking speed				X	X
4.2 Clinical examinations and tests					
Doctor's examination	(X)	(X)	X	X	
Dentist's examination			X	X	(X)
Orthopantomography				X	(X)
4.3 Psychiatric and psychometric examinations					
PSE-interview			X		
CIDI interview				X	X
Psychometric tests			X	X	X
4.4 Home health examination					
				X	X

All samples are frozen in THL freezers (Table 5). Initially, from the Mobile Clinic Health Examination, Mobile Clinic Follow-up survey and the Mini-Finland survey serum and plasma samples were stored at -20 °C. From Health 2000 and Health 2011 also whole blood samples were stored, and the samples have been kept frozen at -70 °C. These samples and their background data comprise part of the THL biobank for which a special user interface has been developed. Also the Health 2000 and Health 2011 web-pages can be found under www.thl.fi/terveys2000, www.thl.fi/terveys2011, or in English under www.thl.fi/health2000 and www.thl.fi/health2011. The Finnish Mobile Clinic web-pages can be found under www.thl.fi/autoklinikka or in English under www.thl.fi/finnish-mobile-clinic.

All population samples have been followed-up annually by national registers. Follow-up concerns mortality and causes of death, work disability pensions by cause, hospital treatments, cancer and use of medicines (SII registers: specially reimbursed and all medicines). Durations of follow-up have been calculated and are available in the data sets.

Table 5. Sample store and follow-up by registers.

	Mobile Clinic Health Examination	Mobile Clinic Follow-up	Mini-Finland	Health 2000	Health 2011
5.1 Sample storage	X	X	X	X	X
5.2 Follow-up by registers (Causes of death, cancer, use of medicines, hospitalizations (treatment), work disability pensions)	X	X	X	X	X

Actions to support the use of data

Checks of existence and logic between data were carried out before including the data into the final data set. Detailed descriptions of the data sets were created, and they also comprised reclassifications such as region, age group, education and smoking.

The descriptions of the research data are in the user interface which can also be used to select the variables. Data can be obtained for specified purposes following a research plan accepted by the THL working group of researchers.

Published research

During the years many books and scientific articles based on these data sets have been published. During the first years' the publications have dealt with baseline results and methods and later they have comprised findings based on follow-up and stored samples. Topics of the publications have been mentioned in this book, and a complete account of the publications can be found in the THL Internet-pages. Since the Health 2000 survey the spectrum of the research has become much broader.

Use of the data for future studies

The data enables cross-sectional studies at different points in time and time series studies. In addition, many follow-up studies on disease occurrence can be carried out. These are on one hand cohort studies employing the classic follow-up design (e.g. risk factors and mortality or disease incidence) and on the other hand nested case-control studies. The special feature of this study series is that it comprises three individual level follow-up data sets: From the Mobile Clinic Health examination to the Mobile Clinic Follow-up survey (observation period about 5.5 years), from Mini-Finland to Health 2000 (observation period about 22 years), from Mini-Finland to Health 2011 (observation period about 33 years) and Health 2000 to Health 2011 (observation period about 11 years). Altogether, these national data sets can be used to study risk factors, diseases and functional limitations both in repeated cross-sections, in time series and in individual follow-up. The sample stores enable new biochemical and genetic determinations and studies on risk factors and genetics influencing disease risk.

Introduction

Introduction

Since the early 1960s comprehensive national health examinations and health interviews have been carried out in Finland. Their traditions were merged in the Mini-Finland health survey (1978–1980) of adults aged 30 and over.

This book describes Finnish population health examinations carried out over a period of 50 years. They were initiated in the 1960s by the SII Mobile Clinic Health examinations of tens of thousands of people, continued to the nationally representative Mini-Finland health survey and led in the 2000s to the Health 2000 and Health 2011 surveys. During the first years the aim was to assess the possibilities for screening provided by the development of laboratory automation. Later the surveys comprised both a comprehensive health interview and health examination. The aim was to gather representative information on health and functional capacity and their determinants. These studies and the whole survey series are forerunners in Europe and, still in 2019, many countries lack a comparable source of health information.

In addition to interviews, questionnaires and clinical measurements, there are stored serum and plasma samples and since Health 2000 whole blood samples.

The national Finnish health examination surveys have developed considerably since their beginning in the 1960s. This is shown by methodological developments from the initial laboratory oriented multiphasic screenings to the comprehensive studies of health and functioning in the Mini-Finland survey and more recent surveys. The development is well described by the contents of the questionnaires of the Mobile Clinic health examination survey, the Mobile Clinic follow-up survey and the Mini-Finland health survey (www.thl.fi/finnish-mobile-clinic). A comprehensive health interview was also the basis of the SII sickness insurance survey beginning in the 1960s. The methods of the Mini-Finland health survey and later national surveys were devised based on the Mobile Clinic surveys and the SII sickness insurance interview surveys. The aim of the comprehensive surveys between 1978–2011, was to gather data on the most common chronic conditions. Thus, preference was given to cardiovascular and respiratory diseases, musculoskeletal diseases, mental health problems, and oral diseases. The key feature was that data were gathered by comprehensive methods such as by questionnaires, interviews, measurements and doctors' and dentists' examinations.

The development toward a valid method for assessing the population's health continued until the Health 2000 survey. The aims of Health 2011 were close to those of Health 2000 but due to limited resources restrictions had to be applied to the clinical examinations. The Mini-Finland health survey and the Health 2000 survey gathered comprehensive information on the population's health and most of such data was obtained for the first time in Finland and in Europe.

The information in this publication is mainly a summary of previous publications, which can be found on the THL www-pages. Other sources are also the archival copies of original documents, which can be retrieved from the THL archives, and some data memorized by the authors. For a long time, the www-pages have comprised information on Health 2000 and Health 2011 (www.thl.fi/health2000, www.thl.fi/health2011). In 2014 further information on the earlier Mobile Clinic health examination surveys has been added (www.thl.fi/finnish-mobile-clinic).

The purpose of this book is to describe in a condensed form the national health examination surveys and to create a basis for future research. This book describes the field surveys and their methods, sample storage and register-based information. In addition, the book describes how researchers can obtain data sets for future research.

The book first describes each survey and next it deals with joint information such as that on stored samples and register based follow-up. As a basis for future research there is information on publications and descriptions of how the data can be used.

The Finnish Mobile Clinic Health Examination Survey 1965–1972



The Finnish Mobile Clinic Health Examination Survey

The Social Insurance Institution's Mobile Clinic is an important part of the present and past of Finnish public health research. It emerged because of the promising development of laboratory automation in a country with limited availability of doctor's services. The Mobile Clinic initiated its work on disease prevention and early detection in 1965 (Heinonen 1966). The early years of the Mobile Clinic have been described in the book *Mobile Clinic* (Aromaa et al 2006) published in 2006. A description of the entire study can be found in the THL www-pages (www.thl.fi/finnish-mobile-clinic).

The Mobile Clinic was the SII mobile survey unit which carried out health examinations in different parts of Finland during 1965–1977 and the first ever Mini-Finland health survey (1978–1980) on a representative sample of the population. At its largest the Mobile Clinic comprised four units and the necessary personnel (Figure 1). During its existence the Mobile Clinic examined more than 100,000 people.



Figure 1. The trucks of the Mobile Clinic.

The Mobile Clinic worked in 34 regions in different parts of Finland and performed multiphasic screening examinations on about 55,000 adults (Figure 2). All baseline data (first phase of the two-phase survey) also comprising the blood pressure measurements are available in 30 regions (51,500 adults).

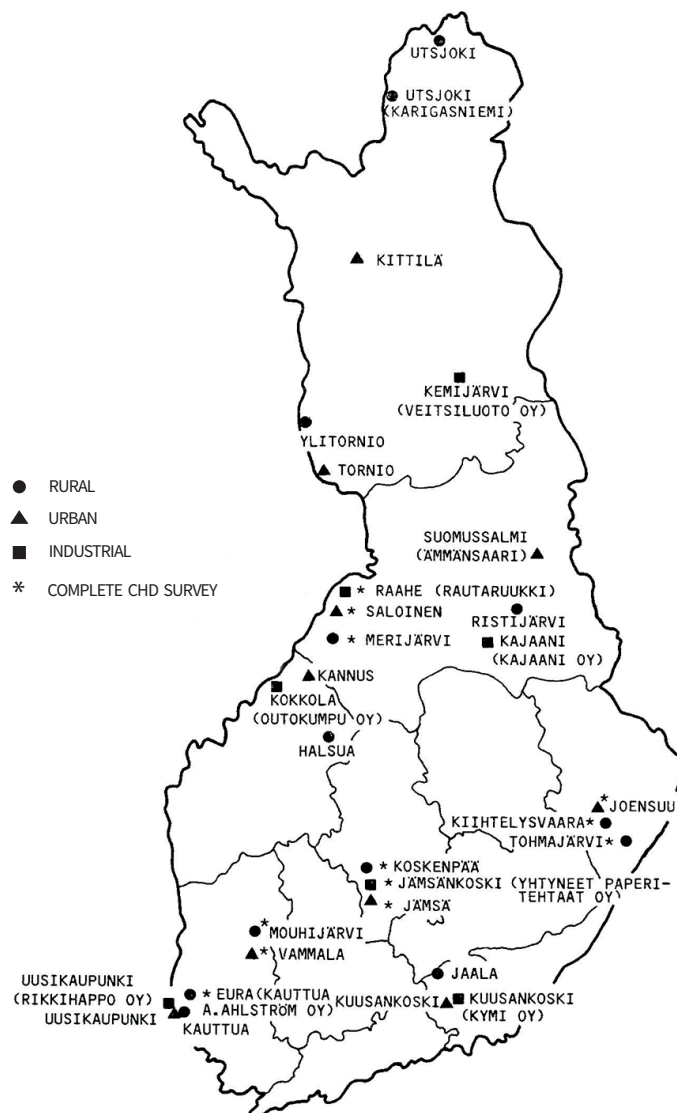


Figure 2. Map of the survey regions.

Initially, a so-called east-west comparison was carried out. The communities examined in the east were Nurmes, Juuka and Pankakoski and in the west Vammala, Mouhijärvi and Eura. In each region an urban, rural and industrial community was studied. Either all inhabitants or a sample of them was invited to the examination.

In addition, the Mobile Clinic carried out examinations directed at diabetes, genetics of Finns and early detection of breast cancer.

The Mobile Clinic provided additional health services to many communities and participation to the examinations was lively (Figure 3).



Figure 3. View from a remote village. Originally published in the Apu-journal in 1966 and later by permission of the artist in the Mobile Clinic book: Aromaa A, Heliövaara M, Knekt P, Reunanen A, Rinne S. Autoklinikka. Kansanterveyslaitos ja Kansaneläkelaitos. Helsinki 2006.

Study population

The lists of those to be invited were drawn up using the SII population register (book of our country) and with help from the local social insurance office. Participation proper was used to complete the information on the examination site, and there also new invitations were presented to non-attendants. An example of the invitation letter is in Appendix 1 ([AK29 Invitation to the Mobile Clinic Health Examination](#)).

Altogether 62,440 adults were invited to the multiphasic screening examination, and 27,341 men and 24,181 women participated (Aromaa 1981). Both the number of participants and the participation rates and by region is presented in Tables 6 and 7. Participation was good: over 80% in the whole study population and over 90% in age group 30–59.

The distribution of the material (regions where all measurements are available) by age and sex is shown in Table 6 and the distribution of examined persons by region in Table 7.

Table 6. Sample and participants by age group.

Age	Men			Women		
	Invited	Participated	%	Invited	Participated	%
15–19	4,177	3,261	78.1	3,942	3,218	81.6
20–29	8,649	6,476	74.9	6,390	5,034	78.8
30–39	6,519	5,761	88.3	4,602	4,180	90.8
40–49	5,733	5,097	87.4	4,907	4,445	90.6
50–59	4,173	3,642	87.3	3,920	3,468	88.7
60–69	2,788	2,273	81.5	3,173	2,625	82.7
70+	1,306	829	63.5	2,117	1,195	56.4
30–59	16,419	14,462	88.1	13,437	12,107	90.1
15–99	33,382	27,341	81.9	29,058	24,181	83.2

Table 7. The distribution of the study population and the examinees by region.

	Men			Women		
	Invited	Participated	%	Invited	Participated	%
Southwest Finland	7,593	6,138	80.8	8,283	6,877	83.0
South Finland	4,362	3,615	82.9	3,020	2,523	83.5
Central Finland	3,045	2,553	83.8	2,644	2,214	83.7
West Finland	6,446	5,404	83.8	3,950	3,180	80.5
East Finland	7,280	6,142	84.4	6,115	5,280	86.3
North Finland	4,656	3,489	74.9	5,046	4,107	81.4
Total	33,382	27,341	80.8	29,058	24,181	83.2

Survey topics

The topics of the Mobile Clinic multiphasic health examination survey were:

- respiratory diseases
- heart diseases
- anemia and iron deficiency
- diabetes mellitus
- renal and urinary tract diseases
- diseases of the thyroid gland
- disturbances of calcium metabolism
- coronary heart disease.

The survey comprised baseline data and disease history (questionnaire), a health examination and a follow-up examination to verify the findings.

Baseline data

The baseline data were gathered by a questionnaire of 100 questions (Appendix 2. [AK01 Baseline Questionnaire of the Mobile Clinic Health Examination](#)). The questionnaire was mailed together with the invitation two weeks before the examination date. The questionnaire gathered data on age, occupation, marital status and diseases and their treatment. The examinees were asked to fast for 12 hours before arrival at the examination site and not to urinate four hours before the study.

Health examination

At the examination site the questionnaire was checked, the examinee was asked to provide a urine sample, an ECG was recorded, blood pressure was measured, a miniature chest X-ray was taken, and finally blood samples were drawn. The examination lasted one hour and a quarter. A flowchart of the examination is shown in Figure 4.

The re-examination

Within two months the examinee was invited to a re-examination if baseline results called for it. About one in four was invited to the follow-up examination.

Measurements and determinations in order of performance

Every examinee was asked to provide a clean mid-stream urine sample. Albumin, blood and glucose were determined by a reagent strip. For women bacterial growth was determined using a Uricult® slide.

One hour after the glucose load a blood sample was drawn for plasma glucose analysis.

Blood pressure was measured 10–20 minutes after ingestion of the glucose load.

The blood samples were drawn one hour after ingestion of the glucose load:

- An EDTA tube for hematological determinations
- A heparinized tube for plasma glucose determination
- Two large tubes for serum.

The samples were processed and frozen immediately. Serum and plasma samples were sent frozen twice a week to the laboratory and X-rays to the Mobile Clinic office.

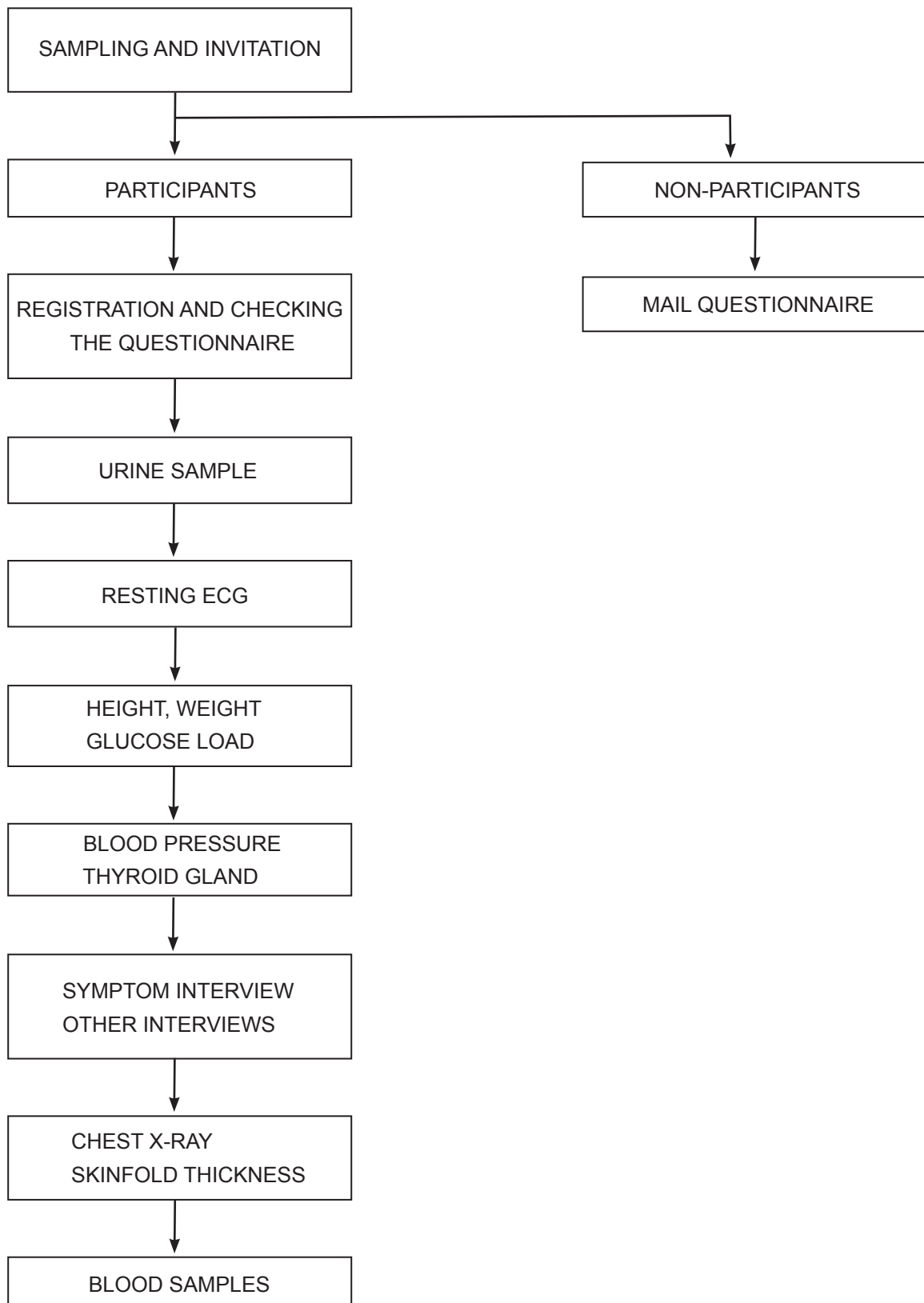


Figure 4. Field survey process.

Measurements and laboratory determinations

Blood pressure and heart rate

Prior to blood pressure measurement the examinees should not eat, drink or smoke. There were four male observers.

Blood pressure was measured using an automated aneroid device (Elag BPM-A). Based on Korotkoff sounds it registered on paper systolic and diastolic blood pressure and heart rate. In research the simultaneously recorded auscultatory results were used. The measurements of the rubber bag were 12.5 x 40 cm.

The measurement technique followed recommendations (WHO 1962, Rose and Blackburn 1968, Arterial hypertension 1978, Aromaa 1978b).

Casual blood pressure was measured on the sitting subject's right arm. The arm rested on the table so that the cuff was at heart level. The pressure was raised to 30 mm Hg above the estimated systolic blood pressure, the observer listened the Korotkoff sound via a loudspeaker, and recorded the appearance of sounds as systolic pressure and their disappearance (V. Phase) as diastolic pressure.

The validity, differences in levels and reliability: In a 1,000 person experiment the aims were to assess how well a casual measurement describes the prevalence of permanently raised blood pressure. Depending on the threshold values one casual measurement overestimates the prevalence of high blood pressure by 30–35%. However, a threshold value of 160 and 95 overestimates prevalence by only 2% and a threshold value of 170 and 100 mmHg by 13%.

Anthropometric measurements

Height was measured without shoes using a stand.

Weight was measured with a heavy-duty spring scale which was checked by weights at the beginning of each study region. The subject was weighed without shoes in light indoor clothing. In the summer 1 kg and in the winter 2 kg was subtracted.

Skinfold thickness (triceps and subscapular) (Tanner 1959) was measured by the Harpenden Skinfold Caliper (British Indicators Ltd, John Bull), which had a standard jaw pressure of 10 g/mm² over a range of 2–40 mm.

Body Mass Index was calculated as the ratio of weight to height squared.

At this point in time the subject ingested a 20% glucose drink (the volume was determined by body size and it was 250–337 ml, 338–412 ml, or 413–450 ml. The estimation was aided by a table based on height and weight).

Determinations on the urine sample

Albumin, glucose and blood were determined qualitatively by test strips.

In women bacteria in the urine were determined by cultivation. In 1967 and 1968 Drigalski-plates were used and thereafter slides (Uricult®). The Drigalski-plates were kept in a drying oven over night at +37 °C. Fewer than 20 colonies on the plate was interpreted as zero, 20–90 colonies as 10⁴ bacteria per ml and more than 90 colonies as 10⁵ bacteria per ml. Both the plates and the Uricult® slides with a growth over or equal to 10⁴ were sent to the National Public Health Institute for typing the bacteria and determining antibiotic resistance. The diagnosis of bacteriuria was based on two samples which both showed a growth of 10⁵ bacteria per ml or more (Kass 1956, Heinonen et al 1968).

Determinations on blood samples

Hematocrit (Packed cell volume)

A sample drawn into an EDTA-tube was examined by the CLAY ADAMS® microhematocrit method. Duration of centrifugation was 5 minutes and speed 12,500 rounds per minute (Takkunen 1976).

Hemoglobin

Hb was determined by the cyanmethemoglobin method using the Vitatron-R-photometer and Hb-standard solutions of the Finnish Red Cross (Nevanlinna et al 1964).

Determinations in the Central laboratory

Cholesterol

Until 9.1.1967 serum cholesterol (mg/100 ml) was determined by the method of Huang (Huang et al. 1961, Technicon Autoanalyzer Methodology N-24 a, m1965) and between 10.1.1967–31.12.1968 by a further development of that method (Boy 1963). Since 1.1.1969 the methods described in the manual (Technicon AutoAnalyzer Methodology 54) were used. The values recorded as mg/100 ml can be transformed to molar units (100 mg/dl corresponds to 2.83 mmol/l). The coefficient of variation (CV) describing reliability was good i.e. 0.02–0.04.

Compared with reference sera (Kliinisten laboratoriotutkimusten laaduntarkkailu Oy) in 1967–1968 the Central laboratory of the Mobile Clinic obtained 10% lower values than the average of all laboratories in the control circle. In 1969 they were close to that mean. The results on control sera were also compared to those of the U.S. CDC, and on the same samples the Mobile Clinic laboratory results were 5% higher.

Glucose

Plasma glucose was determined by the ferricyanide method (Technicon AutoAnalyzer Methodology N2-b [glucose], 1965), which at the concentration of 160 mg/100 ml gave about 5% higher values than the enzymatic method. Reliability was good i.e. CV was 0.01–0.03. Compared to other laboratories of the control circle the Mobile Clinic Central laboratory at different points in time delivered 3–10% higher values. The U.S. CDC results obtained on the same samples by the enzymatic method were 5% higher than those obtained by the Central laboratory.

Creatinine

The plasma creatinine concentration was determined by a modification of the Jaffe method (Technicon AutoAnalyzer Methodology N-11b, 1965). The results of the Central laboratory were slightly higher than those in other laboratories of the control circle. During the first years the difference was up to +10% but since 1970 only a few percentage units. Reliability was good with the coefficient of variation (CV) between 0.02–0.05

Other determinations

PBI

Serum protein bound iodine was determined by the method described in the manual (Technicon AutoAnalyzer Methodology N-PB/D-a, 1969).

Iron

Serum iron was determined by a colorimetric method (Technicon AutoAnalyzer Methodology N-62, TIBC). Serum iron binding capacity was determined by an automated modification of the Ramsay method (Technicon AutoAnalyzer Methodology N-62).

Transferrin saturation was determined as percentage of serum iron of TIBC.

Uric acid

Serum uric acid/urate was determined by a colorimetric method (Technicon AutoAnalyzer Methodology N-13b).

Miniature X-ray

The miniature chest X-rays were 100 x 100 mm screen pictures. After ingestion of barium paste a frontal and side picture was taken on each examinee. The imaging distance was 140 cm. To enhance interpretation there was a centimeter scale in front of the screen. The equipment was Elema-Schönander DAT-154; the X-ray tube was Siemens PH 125/80; the miniature camera was Old Delft Odelca 100 XVIII; the developing machine Kodak X-Omat M5. The exposure values were 120 kV, 150 mA, tube distance 115 cm, focus 1.2 x 1.2 mm, and filter 0.7 mm Al. The film was Agfa-Gevaert Scopix T2. In regard of heart findings two radiologists independently of each other interpreted the pictures using 25 codes for X-ray findings. Weight was given to changes in heart size and form. The method and qualities of the interpretation have been described elsewhere (Aromaa 1978 c). One radiologist evaluated lung findings and, later, a rheumatologist interpreted presence and severity of thoracic spondylosis and hyperostosis (Julkunen et al 1981, Julkunen et al 1975). According to previous comparisons the differences between and internal variations within the two radiologists evaluating cardiac findings were rather large. However, both agreement in comparison with regular size thorax X-rays and the doctor's reliability were rather good.

Resting ECG

The coronary heart disease study was carried out in twelve communities (Mouhijärvi, Vammala, Kauttua, Koskenpää, Jämsänkoski, Jämsä, Rautaruukki, Saloinen, Merijärvi, Joensuu, Kiihtelysvaara, Tohmajärvi). In persons aged 30–59 a resting ECG was recorded, and a chest pain interview was carried out. Taking into account all four regions the total number of examinees was 10,962 (Reunanen et al. 1983, Ristola et al 1981). A 12-lead resting ECG was recorded within half an hour of arrival at the examination site, but always before ingestion of the glucose load. The ECG was recorded using an Elema Schönander Mingograf 4-channel ECG device. Paper speed was 50 mm/s. The functioning of the galvanometers was checked daily using an ECG-simulation device (ECG-Simulator EKS-70, Windsor Locks, Connecticut, USA). (N.B. The data reported earlier in the Finnish language report comprised the first nine communities with altogether 4,375 men and 3,739 women (Pyörälä et al 1974).

ECG was interpreted using the revised Minnesota-code (Rose and Blackburn 1968). In regard of ST- and T-changes an exception from the revised code was made in that in regard of codes 4.3–4 and 5.3–4 the finding was also recorded when it was registered only in lead aVF. Extra beats were coded according to the Nordic recommendation (The "Minnesota Code" for ECG classification, 1967). The ECG-coding was carried out by coders trained and supervised by two cardiologists. The coders worked in groups of two or three. Each coder performed the initial classification independently, and the results were compared. If they differed the final code was decided jointly by the group. Cardiologists checked and coded all ECGs in which any coder had recorded Q- or QS-changes. Every tenth ECG was recoded to assess reliability.

Chest pain interview

To identify chest pain symptoms a standard interview was administered (Rose and Blackburn 1968, Reunanen 1977). During the whole survey the interview was performed by one and the same trained nurse. The responses to the standard questions were suggestive of angina pectoris if the interviewee reported:

- pain or bother in the chest when walking uphill or hurrying on level ground
- that pain had forced to stop or reduce space
- that pain had disappeared within 10 minutes after the strain had finished
- that the feeling was localized in the sternal area or at the same time both in the left chest and in the left arm.

A severe chest pain attack was suggestive of possible myocardial infarction.

The interview also inquired about dyspnea and symptoms of intermittent claudication.

Dietary history interview

The dietary survey was carried out in 27 communities. The usual food intake during the past year was recorded for 10,054 subjects (Turpeinen and Roine 1967, Seppänen et al. 1973, Koskinen 1975, Järvinen 1996). The structure of a questionnaire was followed and in addition there were food samples and food models to help to assess the portion sizes. Nine interviewers had training in household or nutrition science.

Based on the food consumption data the intake of food-stuffs and nutrients was calculated per day. At first, a data-set derived from the Finnish foodstuff table was used (Turpeinen and Roine 1967, Seppänen et al. 1973, Koskinen 1975). In late 1980s the information on nutrients was up-dated mainly using the Social Insurance Institution's new nutrient contents table (Rastas et al. 1989).

Classifications

Occupations were classified according to the Nordic classifications of Occupations (1963).

Medicines were classified according to *Remedia Fennica* (Heinonen 1966–1972).

A classification of social stratification was used (Rauhala 1966).

Reported diseases were classified according to the official classification of diseases and causes of death (Disease classification 1969).

Quality assurance

To ensure good quality the following means were used: comprehensive guidelines and training, monitoring performance and results, and servicing and calibrating the equipment.

Ethical aspects and data protection

In the 1960s there was no legally prescribed ethical evaluation concerning research work, although the general guidelines concerning medicine were also applicable for research. In research, also no informed consent procedures were used. The subjects invited to the Mobile Clinic examinations were thoroughly informed, their participation was voluntary and the use of the information for medical research was explained to them. Participation was interpreted as informed consent for research use of the data. Record linkage to national health registers has been approved by the register authorities (Social Insurance Institution, National Institute for Health and Welfare, Statistics Finland). The data were stored and used so that they were confidential and available only to research personnel.

Aspects related to research use

Except for the youngest and oldest a very high proportion of the subjects participated. Random samples of the adult population were examined in different parts of the country. Also, different types of communities (rural, towns, industrial) were well represented. Although the subjects of the multiphasic screening examination do not represent the whole country's population several comparisons (Aromaa 1981, Knekt 1988) show that the distribution of the examinees by age, occupation and social stratum is similar to that of the whole population.

Some analytical results, especially plasma glucose, may have been based on too short a fast. Of the examinees only 60% were examined prior to 12 o'clock, when the duration of fast was usually up to 12 hours. The length of fast was less than 9 hours in 54%.

Also, the glucose load administered had an effect because blood pressure was measured 10–20 minutes after ingestion of glucose and blood samples were drawn one hour later.

This reduced diastolic blood pressure by about 2 mmHg, which may have led to an underestimation of diastolic hypertension by about 20% (Aromaa 1981).

The glucose load increased plasma volume and this has probably slightly reduced many plasma and serum concentrations.

Other studies

In addition, the multiphase health examinations and the dietary surveys the Mobile Clinic carried out

- a genetic study
- a psychiatric study
- a mercury study
- a breast cancer study.

Baseline results of most of those studies have been published.

The sample stores

A 10 ml serum sample and a plasma sample were deep frozen at -20 °C on about 80% of the participants.

Record linkage to national registers

The personal identification number was used to link every year health related data to the following national registers: deaths and causes of death, hospital discharges, specially reimbursed and other medicines, cancer registry and work disability.

Early research publications

During the first years the most extensive publications concerned foods and nutrition (Seppänen et al 1973, Koskinen 1975, Hasunen 1978), mental health and mental disorders (Lehtinen 1975, Väisänen 1975), breast cancer screening (Lahti 1977), hypertension (Aromaa 1981) and coronary heart disease (Pyörälä et al 1974, Reunanen 1977, Reunanen et al 1983). One entity dealt with iron deficiency anemia (Takkunen 1976).

The field survey results, the follow-up data and the determinations on frozen samples have been utilized in many cause- and effect studies of cardiovascular diseases and cancer. In addition, risk factors for osteoporosis, rheumatoid arthritis and sciatica have been carried out.

Based on the material, prospective cohort studies, retrospective and nested case-control studies have been carried out comprising topics such as the effect of antioxidants on cancer risk (Knekt 1988), or studies related to genetics and health monitoring. In cause- and effect studies the material can be used for further studies.

The Mobile Clinic
Follow-up Survey
1973–1976

The Mobile Clinic Follow-up Survey

A follow-up survey was carried out in 1973–1976 in 12 communities. Its aims were to examine the incidence of important public health problems, their determinants and changes in these determinants. The survey and its methods have been described in the THL web-pages (www.thl.fi/finnish-mobile-clinic). One aim was to evaluate the impact of screening and early detection. An operational aim was detecting persons needing examinations or treatment. The survey was carried out in communities where also the coronary heart disease study had been carried out in the multiphasic examination 1966–1973 (Heinonen 1966, Aromaa 1981). All those invited to the multiphasic examination were also invited to the follow-up.

The lists of subjects were drawn up based on the SII population register (The book of our country) with support from the local social insurance office. Data on non-participants helped to complete the lists on the examination site, and non-participants were re-invited.

Material

Altogether 24,833 persons were invited to the follow-up survey, and 9,885 men and 9,633 women participated. Tables 8 and 9 show the numbers invited and participants in the whole material and in participants to the multiphasic screening examination. Of screening examination participants aged 30–59 11,370 were invited and 10,495 (92%) participated.

In the coronary heart disease follow-up survey in 12 communities 5,928 men and 5,442 women were invited. Of them 5,419 men and 5,076 women participated, and thus the participation rate (of those previously examined) to the follow-up survey was over 90%.

The communities and the total number of examinees were:

Satakunta-Pirkanmaa	5,885
Central Finland	4,604
Pohjanmaa	3,559
North Karelia	5,470

Tables 8 and 9 show the numbers by age group.

Table 8. Persons invited to the follow-up survey and participation by age group. Age at the follow-up survey.

Age (y.)	Men			Women		
	Invited	Participated	%	Invited	Participated	%
15–19	103	68	66.0	95	71	74.7
20–29	2,948	2,165	73.4	2,717	1,996	73.5
30–39	2,423	2,022	83.4	2,150	1,838	85.4
40–49	2,463	2,178	88.4	1,986	1,808	91.0
50–59	2,010	1,683	83.7	1,978	1,780	90.0
60–69	1,678	1,276	76.0	1,708	1,416	82.9
70–99	1,027	493	48.0	1,547	724	46.8
30–59	6,896	5,833	84.6	6,114	5,426	88.7
15–99	12,652	9,885	78.1	12,181	9,633	79.0

Table 9. Participants to the Mobile Clinic screening examination 1966–1972 invited to the follow-up survey and their participation rate. Age at the follow-up survey.

Age (y.)	Men			Women		
	Invited	Participated	%	Invited	Participated	%
15–19	86	64	74.4	79	62	78.5
20–29	2,093	1,725	82.4	2,097	1,687	80.4
30–39	1,949	1,766	90.6	1,804	1,649	91.4
40–49	2,204	2,059	93.4	1,831	1,736	94.8
50–59	1,775	1,594	89.8	1,807	1,691	93.6
60–69	1,446	1,186	82.0	1,493	1,333	89.3
70–99	732	436	59.6	1,027	643	62.6
30–59	5,928	5,419	91.4	5,442	5,076	93.3
15–99	10,285	8,830	85.9	10,138	8,801	86.8

Invitation to the baseline survey

Lists of examinees were created in the office. Daily 60 persons were invited by a letter comprising also directions and the baseline questionnaire.

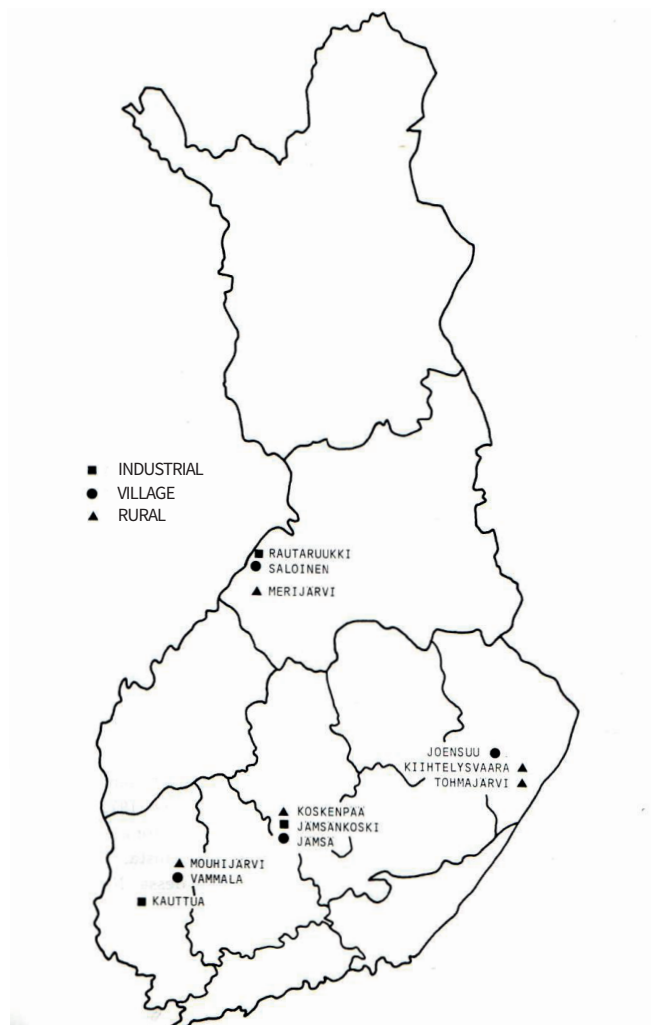


Figure 5. The geographical location of the study communities.

Survey topics

The Mobile Clinic follow-up survey was a follow-up of the Multiphasic screening examination after an average of 5 years. The main interests were coronary heart disease and other cardiovascular diseases, especially their incidence and its determinants. The survey topics and methods in many respects resembled those of the coronary heart disease study.

Diseases

- coronary heart disease and some other heart diseases
- hypertension
- some other cardiovascular diseases
- diabetes mellitus
- hyperlipidemia
- diseases of the kidneys and the urinary tract
- diseases of the thyroid gland
- lung tuberculosis and other lung diseases
- anemia and polycythemia

Individual determinants of health and diseases

- a. Physiological factors
 - blood pressure level
 - serum lipid concentration
 - plasma glucose concentration
 - serum thyroxin concentration
 - serum creatinine concentration
 - hematocrit and hematology
 - obesity and thickness of subcutaneous fat
 - aberrations of heart size and shape
 - lung X-ray findings
 - ECG findings
- b. Behavior
 - diet and nutrition
 - smoking
 - alcohol consumption
 - coffee consumption
 - physical activity
 - sauna bathing
- c. Health services
 - treatment situation
 - use of medicines
 - utilization of health services
- d. Background factors and environment
 - age
 - genetics (diseases of parents and siblings)
 - place of birth and place of residence
 - previous diseases
 - occupation and characteristics of work
 - social group
 - education.

For the follow-up survey a comprehensive questionnaire was prepared and it was to be filled in at home. The questionnaire also enquired about diseases diagnosed after the previous health examination carried out five years earlier. In addition to serum cholesterol also serum triglycerides were determined.

There was a lot of interest on the survey as also demonstrated by the picture below (Figure 6).



Kirjoitapa Myhinpään vaarille lähetelappu keskussairaalaan. Sydänhän tikittää kuin ompelukone.

Figure 6. From the follow-up survey. A drawing in the Finnish Medical Journal in the 1960s. Unknown artist.

The health examination as a whole

Baseline examination

At the examination site the baseline questionnaire was checked, a urine sample was obtained, an ECG was recorded, blood pressure and heart rate were measured, a chest pain questionnaire was administered, an interview on diet and nutrition was performed, a miniature X-ray was taken and finally a fasting and one-hour glucose loading blood sample were obtained. Persons reporting any of the diseases of special interest (coronary heart disease, cerebrovascular disease, diabetes, hypertension) were asked to reply to an additional questionnaire on the disease in question. The chest pain questionnaire was presented, and an ECG recorded in persons aged 30–59 at the time of the previous survey.

Measures in order of implementation were:

1. Administering the baseline questionnaire and interviews
2. Measuring blood pressure and heart rate, recording length of fast
3. Obtaining the urine sample
4. Recording the resting ECG
5. Drawing fasting blood samples
6. Measuring height and weight and administering the glucose drink
7. Administering the coronary heart disease symptom interview
8. Taking the chest X-ray picture
9. Measuring skinfold thickness
10. Drawing the one-hour glucose load blood sample

The baseline questionnaire (Appendix 3. [AU01 Baseline Questionnaire of the Mobile Clinic Follow-up Health Examination Survey](#)) was checked and corrected at the start of the examination.

Additional interviews were presented to four subgroups i.e. those who in the previous Mobile Clinic examination had been referred to a doctor or hospital because of hypertension, diabetes mellitus, urinary tract infection or hyperlipidemia or who, in the baseline questionnaire, reported such an ailment. The coronary heart disease additional questionnaire was carried out on all reporting strain related chest pain or severe chest pain suggesting myocardial infarction.

Urine and blood samples

Urine determinations. Every examinee was asked to provide a urine sample, women a clean midstream urine sample. Protein, blood and glucose were determined by test strips. In women, bacterial growth was determined by a Uricult® slide.

Fasting blood samples were drawn prior to ingestion of the glucose drink:

- EDTA tube for hematological determinations
- a heparinized tube for plasma glucose
- two large tubes for serum.

The 1-hour glucose load sample was drawn one hour after ingestion of the glucose load. The sample was analyzed for P-glucose and P-creatinine.

The samples were immediately processed and deep frozen, the heparinized tubes were centrifuged within half an hour, and the serum tubes within an hour. The frozen serum and plasma samples were sent twice a week as cold transport to the laboratory and the X-rays to the Mobile Clinic office for being processed.

The baseline examination lasted about 1.5 hours per examinee.

Re-examination

The second phase of the field survey was a re-examination. Persons with abnormal findings and those with important missing data were invited. In the follow-up survey examinations directed according to the findings were carried out. These were e.g. the heart, cardiovascular and chest-X-ray examination. The field doctors examined patients according to the screening findings. The doctor referred patients for examinations and treatment according to need.

The indications for repetition of the measurements were hypertension, lacking or failed ECG: s, lacking or failed X-ray, cardiovascular symptoms, findings in the resting ECG or miniature X-ray, hyperlipidemia, high or low hematocrit, high glucose, high creatinine, urine findings.

Examination and measurement methods

The baseline questionnaire (Appendix 3. [Link to mobile clinic AU01](#)) inquired in addition to name and other identification information about marital status, family size, education, work disability, and one's own and the family head's occupation and work. Next, there were questions about the family head's and the subject's own education.

The next part (B) dealt with health and diseases. The first topic was perceived health, and the next one chronic diseases and handicaps and consequent need for doctor's care. Next, there was a list of diseases (15 diseases: e.g. myocardial infarction, hypertension, latent diabetes mellitus, high serum lipids). For each disease there were questions on:

- When did a doctor diagnose it for the first time?
- Did the subject ever use medication for it?
- Was the subject currently being treated by a doctor for the disease?
- Did the subject use medicines for it?
- How long a time ago was the latest doctor visit?

After the disease list there were questions about cancer, accidental injuries and some other diseases. Finally, several questions dealt with events after the previous Mobile Clinic screening examination.

Part C of the questionnaire considered use of prescribed medicines. It inquired about medicines used during the past 3 months, 7 days, and two days. Their names were recorded and coded. Next, there were questions on other medicines.

Part D dealt with health examinations and use of health services

Part E dealt with smoking

Part F concerned use of alcohol, and based on the number of drinks, intake of absolute alcohol was calculated

Part G dealt with physical strain and physical activity (work, leisure, commuting)

Part H inquired about diseases, deaths and causes of deaths of parents and siblings

Part I dealt with sauna bathing habits (frequency, duration in and number of visits to the hot bath, bathing temperature, and use of alcohol in connection of bathing)

The last part (K) of the questionnaire concerned women and asked about pregnancies, periods and use of contraceptive pills.

Classifications

Occupations were classified according to the Nordic Classification of Occupations (1963).

Medicines were classified according to Remedia Fennica (Heinonen O.P. Remedia Fennica 1973–1976, Helsinki 1973–1976).

Chest pain questionnaire

The interview questionnaire was the same as in the baseline examination. It was based on the form developed by Geoffrey Rose (Rose and Blackburn 1968). The interview was presented to all aged 30–59 in the previous examination. It identified persons suffering from dyspnea symptoms, strain related chest pain symptoms suggestive of coronary heart disease, chest pain symptoms suggestive of possible myocardial infarction or symptoms of intermittent claudication in the lower extremities. The additional coronary interview was carried out on all reporting strain related chest pain or chest pain suggesting myocardial infarction.

The interviews were carried out by 4 nurses and the examination lasted 3–10 minutes.

Additional interviews

The questionnaires (coronary heart disease, hypertension, urinary tract infection, diabetes mellitus, lipids, diet) are on the web-pages (www.thl.fi/finnish-mobile-clinic).

Measurements and determinations in consecutive order

Time of study and length of fast

In each person the baseline examination started between 8 a.m. and 1 o'clock p.m. and lasted about one hour and a half. 35% of the examinees reported that they had fasted for at least 9 hours and 70% at least 5 hours.

Urine samples

Every examinee was asked to provide a urine sample, women a clean mid-stream sample and men a usual casual sample.

Blood samples

The fasting samples were obtained prior to ingestion of the glucose drink:

- An EDTA sample for hematological determinations.
- A heparinized tube for plasma glucose. It was also used for P-creatinine determination.
- Two large tubes for serum. They were used for S-cholesterol and S-triglycerides determination.

The glucose tolerance sample was drawn one hour after ingestion of the glucose load. The blood sample was drawn as closely as possible one hour after the glucose load.

Into the heparinized tube a 15 ml blood sample was drawn from the elbow vein. The heparinized tubes were centrifuged within half an hour after drawing the sample. The samples were deep frozen (overnight) and sent to the Central laboratory at least twice a week. The samples were drawn by five laboratory nurses.

The blood samples were processed and deep frozen immediately, the heparinized tubes were centrifuged within half an hour and the serum tubes within one hour. The deep-frozen serum and plasma samples were sent twice a week to the laboratory and X-ray films to the Mobile Clinic office.

Measurements and laboratory determinations

Blood pressure and heart rate

Prior to blood pressure measurement the subject was asked not to eat, drink or smoke. Blood pressure was measured before drawing the blood samples and ingesting the glucose load. Four male technicians carried out the measurements.

Blood pressure was measured by Erkameter Original manometers. The size of the rubber bag was 12.5 x 40 cm. Every morning the functioning of measurement apparatus was tested by raising the pressure to 250 mmHg and reducing it slowly. Systolic blood pressure was recorded as the height of the mercury column when the Korotkoff sounds became audible, and diastolic on disappearance of the sounds. The recommended measurement technique was used (WHO 1962, Rose and Blackburn 1968, Arterial hypertension 1978, Aromaa 1978a).

On the seated subject casual blood pressure was measured on the right arm. The arm rested on the table so that the cuff was at heart level, and pressure was raised 30 mmHg above assessed systolic blood pressure (based on the heart rate), the observer listened by stethoscope to the Korotkoff sounds and recorded as systolic blood pressure the point when sounds appeared and as diastolic when they disappeared (Vth phase).

Height, weight and glucose load

Height was measured without shoes using a stand.

Weight was measured by a heavy-duty spring scale. At the beginning of the survey in each community its functioning was checked by weights. The subject was weighed without shoes in light indoor clothing. In the summer 1 kg and in the winter 2 kg was subtracted from the reading.

The body mass index was calculated as the ratio of weight to height squared.

At this point a twenty percent glucose load was administered (according to the subject's size 250–337 ml, 338–412 ml, 413–450 ml; to estimate the portion size a table based on height and weight was used).

The observers were 10 nurses and 5 technicians.

Measurements of skinfold thickness

Calibrated instruments were used with a jaw surface area 6 x 15 mm and a standard pressure between 2–40 mm, about 10 g/mm² two instruments (Harpenden Skinfold Caliper, Edwards et al. 1955, Tanner 1959) were used on alternate days.

The thickness of the triceps and subscapular skinfolds was measured and recorded at 0.2 mm accuracy. Five technicians alternated as observers.

Determinations on urine samples

A clean midstream urine sample was obtained on women and men aged 50 and over. Other men provided a usual casual sample. Albumin, glucose, blood and keto substances were determined qualitatively by test strips (Labstix). If U-prot was +, a quantitative test was carried out.

In women Uricult[®] slides were used to cultivate bacteria. If bacterial growth showed more than 10⁴ colonies the slides were sent to the National Public Health Laboratory for typing and determining antibiotic resistance. The diagnosis of bacteriuria was based on a growth of 10⁵ or over in two samples (Kass 1956, Heinonen et al 1968).

Resting ECG

A 12-lead ECG was recorded with the subject lying on his back. ECG was recorded on all subjects aged 30–59 in the previous study.

The equipment was Elema-Schönander, Mingograf 34, and the ECG simulator was EKS-70, Windsor Locks, Connecticut, USA and it was used daily to check the functioning of the galvanometers. The observers were five male technicians who, in addition, alternated as observers of blood pressure and skinfold measurement. The amplification of the ECG instrument was checked daily. The ECG was carried out according to the

revised Minnesota code (Rose and Blackburn 1968). In regard of ST- and T-changes there was a deviation from this code in that for codes 4.3–4 and 5.3–4 the finding was coded also when it was observed only in connection aVF. Extra beats were coded according to the recommendations of the Nordic committee (Scandinavian Committee on ECG Classification 1968).

ECGs were coded by trained observers supervised by two cardiologists. The observers worked in groups of two or three. Every observer first worked independently, their results were compared and if they differed the final code was agreed upon by the group. The cardiologists checked and coded all ECGs in which any observer had recorded Q or QS-changes. One out of ten ECGs was reread two assess reliability.

Chest pain questionnaire

The standard structured questionnaire was used to identify chest pain symptoms (Rose and Blackburn 1968). One and the same trained nurse carried out all the interviews. The replies were interpreted to suggest angina pectoris if the subject reported:

- pain or trouble in the chest when walking up-hill or hurrying on level ground
- that pain had forced one to stop or to reduce speed
- that pain disappeared within 10 minutes of stopping or slowing down
- that the feeling was in the sternal area or simultaneously at the left chest and left arm.

The interview also inquired about symptoms of dyspnea and intermittent claudication.

Chest-X-ray

The miniature X-rays were screen pictures sized 100 x 100 mm. There were no clothes on the upper trunk. The technician put a 10-cm long gauge to hang on the subject's neck and fed him/her a desert spoonful of Microtrast contrast medium. After barium paste ingestion a frontal and lateral picture was taken. The imaging distance was 140 cm. To enhance evaluation of the pictures a horizontal-vertical centimeter scale had been placed in front of the screen. For heart findings two radiologists independently of each other interpreted the findings using 25 X-ray finding codes. Most weight was given to changes of heart size and shape. The method and its evaluation have been presented elsewhere (Aromaa et al 1978).

Lung findings were evaluated by one radiologist. Spondylosis and hyperostosis of the thoracic spine was assessed and classified by a rheumatologist familiar with the topic (Julkunen et al 1975, 1981).

The equipment: Elema-Schönander DAT-154; X-ray tube Siemens PH 125/80; camera Old Delft Odelca 1000 XVIII; developing machine Kodak X-Omat M5.

Dietary history interview

The dietary history survey was carried out in all communities of the follow-up survey. The interview recorded the usual food intake of 4,343 subjects during the past year (Seppänen et al. 1976, Järvinen 1996). Of these persons 1,844 had been interviewed also during the Mobile Clinic Health Examination Survey. Rather small modifications had been made to the questionnaire and questions had been added on intake of coffee, tea, alcoholic drinks, soft drinks and sweets. To enhance the assessment of the quantity of food stuffs there were food specimens and food models. Both interviewers had a degree in nutrition or home economics.

The intake of food stuffs and nutrients was calculated by day. The recipes of dishes were drawn from Finnish cook books and studies on intake of foods. Initially the dataset used in calculating the intake of nutrients was based on the then actual food-stuff table (Turpeinen and Roine 1967). In the end of the 1980s the data on nutrient contents of food stuffs was updated mainly following the nutrient contents table created in the Social Insurance Institution (Rastas et al. 1989).

Determinations on blood samples

Fasting blood sample

A 15-ml sample was drawn from the elbow vein into a heparinized tube. The tubes were centrifuged within half an hour of drawing the sample. The samples were deep frozen (overnight) and sent at least twice a week to the Central laboratory. The samples were drawn by five laboratory nurses.

Hematocrit (PCV) and the hematological examination

The samples drawn into an EDTA-tube were examined by the CLAY-ADAMS® microhematocrit method. The centrifugation lasted 5 minutes with a speed of 12,500 rounds per minute (Takkunen 1976).

The hematological (follow-up) examination was carried out on persons whose hematocrit was under 35 or over 55. The shape of the red cells, number and type of white cells as well as observations on quantity of reticulocytes and thrombocytes were recorded. Any explanations for the findings were also recorded in free form.

The one-hour glucose tolerance blood sample

The blood sample was drawn as exactly as possible one hour after ingestion of the glucose drink. A 15-ml sample was drawn from the elbow vein to a heparinized tube. The tubes were centrifuged within half an hour of drawing the sample. The samples were deep frozen (overnight) and sent to the Central laboratory at least twice a week. The samples were drawn by five laboratory nurses.

In the Central laboratory from the tolerance test blood samples plasma glucose and creatinine were determined, and other determinations were carried out on fasting samples.

Cholesterol

Until 9.1.1967 serum cholesterol (mg/100 ml) was determined by the method of Huang (Huang et al. 1961) (Technicon AutoAnalyzer Methodology N-24a, 1965) and 10.1.1967–31.12.1968 its modification (Boy 1963). As of 1.1.1969 methods described in the manual were used (Technicon AutoAnalyzer Methodology N-54 and N-77). The coefficient of variation /CV) measuring reliability was good i.e. 0.02–0.04.

In comparison with control sera (Kliinisten laboratoriotutkimusten laaduntarkkailu Oy) the Mobile Clinic central laboratory's results were in 1967–1968 about 10% lower than the mean of other laboratories in the control circle. In 1969 they were closely like those of other laboratories. The control sera were also used to compare results to those of the U.S. CDC and the Mobile Clinic Central laboratory's results were 5% higher.

Triglycerides

In addition to cholesterol triglycerides were determined in the Follow-up survey (Björkstén 1972).

Glucose

Plasma glucose was determined by a modification of Hoffman's ferricyanide method (Hoffman 1937) (Technicon AutoAnalyzer Methodology N-2b, 1965), which on the level 160/100 ml gave about 5% higher results than the enzymatic method. Reliability was good with a CV of 0.01–0.03. In comparison to other laboratories of the control circle the Mobile Clinic Central laboratory's results were 3–10% higher. On the same samples the U.S. CDC using the enzymatic method produced 5% higher results than the Mobile Clinic laboratory.

Creatinine

The creatinine concentration was determined on a plasma sample using a modification of the Jaffe method (Technicon AutoAnalyzer Methodology N-11b, 1965). The Mobile Clinic Central laboratory had slightly higher results than other laboratories of the control circle. During the first years this difference was up to +10% but since 1970 only a few percentage units. Reliability was good with a coefficient of variation CV 0.02–0.05.

Quality assurance and quality control

Quality assurance comprised written instructions and training, monitoring the field activities, monitoring quality and taking care of servicing and calibration of the equipment.

In addition to measurements of standards and follow-up of population means and observer specific means the measurements were repeated on a random sample of the examinees. Furthermore, experimental designs were used to compare field observers and reference observers.

The equipment was repeatedly calibrated, part of it every day. The ECG instrument was checked using a simulator, the weighing scale was calibrated by weights, the blood pressure observers listened to Rose's training tape, and all recordings were followed up.

The personnel were trained to follow instructions closely and their activities were monitored on field visits. All observations were used to make corrections, if possible.

The measurements and interviews were repeated on a 10% sample of the examinees. The results were used to assess total overall reliability.

Population means and their standard deviations by observer were continuously followed-up. The data were used for training of the personnel.

In the Central laboratory usual valid quality control methods were used. These were calibration of the equipment, repeat measurements and analyses of internal and external quality control samples. Such reference data were obtained both from the Finnish quality control system (Laboratorioiden laaduntarkkailu Oy) and the U.S. CDC.

The monitoring of results and observer specific comparisons provided valuable results to be used in the training of the field personnel. However, usually, the differences between observers were small. When using all data (observer specific means, experimental designs, measurements of standards and observations in the field visits) there were often data that could be interpreted and used to guide training.

Classifications

The occupations were classified according to the Nordic Classification of Occupations (1963).

Based on occupations a social classification was used (Rauhala 1966).

Medicines were classified according to Remedia Fennica (1973–1976).

Reported diseases were classified according to the classification of diseases and causes of deaths (Disease classification, 1969).

Ethical aspects and data protection

In the 1960s there was no legally prescribed ethical evaluation concerning research work, although the general guidelines concerning medicine were also applicable for research. In research, also no informed consent procedures were used. The subjects invited to the Mobile Clinic examinations were thoroughly informed and the use of the information for medical research was explained to them. Participation was interpreted as informed consent for research use of the data. Record linkage to national health registers has been approved by the register authorities (Social Insurance Institution, National Institute for Health and Welfare, and Statistics Finland). The data were stored and used so that they were confidential and available only to research personnel.

Stored samples

For later research for each examinee four serum tubes of 4 ml each and two plasma tubes of 4 ml were frozen to -20 °C and permanently stored.

Linking the data to national registers

The personal identification number was used to link to the survey data of all examinees the following information: deaths and causes of death, hospital discharges, specially reimbursed and other prescription medicines, cancer and work disability pensions.

Aspects of research use

Except for the youngest and oldest age groups participation was high. In different parts of the country population samples of communities were examined and different types of communities were well represented.

Some laboratory determinations, especially plasma glucose, may be affected by too short a fast. First, of the examinees only 60% were examined prior to 12 o'clock when the length of fast usually was over 12 hours. 54% had fasted less than 9 hours.

The material comprised over 20,000 persons and was much larger than is usual in population surveys. It is particularly suitable for studying disease incidence and risk factors and following up changes of behavior and risk factors.

Of the whole material plasma and serum samples have been stored enabling new determinations for further studies.

The data have been used in cross-sectional studies, in prospective and retrospective cohort studies, in nested case-control studies, in meta-analyses, and in health monitoring. In future research there are many opportunities to utilize the data and to carry out new determinations on the samples.

The Mini-Finland Survey
1978–1980

The Mini-Finland Survey

The purpose of the Mini-Finland survey was to provide in Finland and Europe the first ever representative and comprehensive picture of health, functioning, need for care and its satisfaction (Aromaa et al. 1985, Lehtinen et al. 1985, Sievers et al. 1985, Aromaa et al. 1989a, Aromaa et al. 1989b, Vehkalahti et al. 1991). The survey has also been described in the THL web-pages (www.thl.fi/finnish-mobile-clinic). The main study topics were cardiovascular, respiratory, and musculoskeletal diseases, mental disorders and functional limitations. The survey was built on the SII Mobile Clinic Health examination survey and the SII national health interview surveys (so called sickness insurance surveys).

The general aim was to produce data and develop methods, which were needed to promote the population's health and functioning, to prevent diseases and functional limitations, to develop prevention, care and rehabilitation and to assess and plan health security. To attain this general goal, the survey aims were:

- to study the population's health and need for care and its satisfaction
- to develop measurement and monitoring methods for health, need for care and its satisfaction; e.g. to compare the findings of the health interview and health examination on health and need for care
- to develop a standardized comprehensive health examination
- to study the associations between health problems and their determinants
- to study the impact of the most important diseases as causes of functional limitations and that of functional limitations as causes of social handicaps
- to produce new information on the causes of diseases and functional limitations and their prevention
- to produce reference data for health care services and research.

Thus, the study topics were:

- health and functioning and their determinants
- need for care and its satisfaction and their determinants.

The field examination as a whole

The study was directed at a representative sample of the population aged 30 and over. The two-stage sample comprised 40 regions and a random sample of individuals from each area (Figure 7). After pilot studies the examinations carried out by the Mobile Clinic began in early 1978 and they were completed in 1980. The in-depth studies in the SII Rehabilitation Research Centre were completed in 1981.

The field survey had several phases. Its main phases were the health interview, a two-phase health examination and an in-depth study (Figure 9). The health interview and health examination were independent of each other.

Of the 8,000 person sample 96% participated in the interview and 90% in the baseline health examination.

Sampling and sample

The sampling frame comprised the Finnish population aged 30 and over in 1978. The sample size was 8,000 people. The method was two-stage stratified sampling. The primary sampling units were clusters of one or several communities. There were 320 clusters, they were combined to 40 strata each with 40,000–60,000 inhabitants.

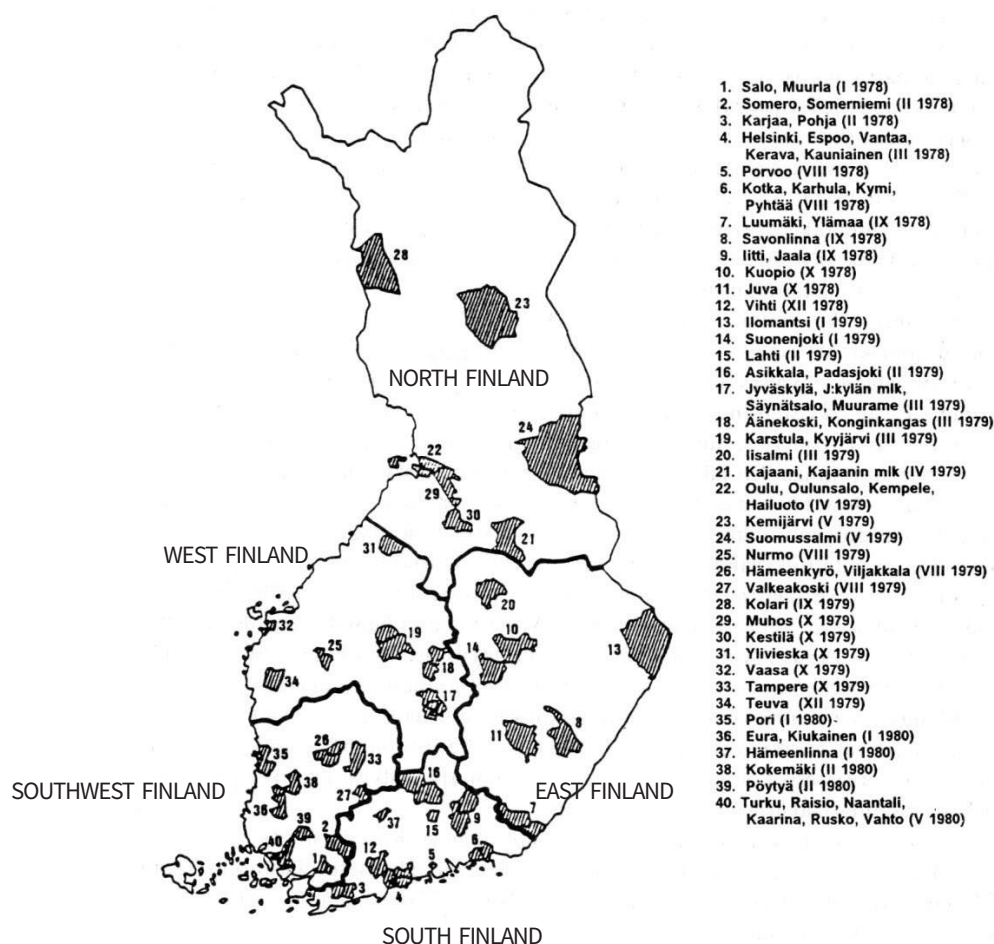


Figure 7. The study regions of the Mini-Finland survey.

The stratification criteria were degree of urbanization, and proportion of industrial and farming population. There were 8 strata of one cluster, and 32 strata of two-stage clusters comprising several clusters. By PPS (probability proportional to size) sampling one cluster of each stratum was drawn to represent the whole stratum (Figure 7). The second stage sampling units (persons) were selected by systematic sampling from the SII population register. The sample was selected in each area 3–5 months before the survey. Prior to the study all addresses were checked in the SII local offices and those who had died or moved permanently were replaced by new people living in the same area. The study began in winter (Figure 8).



Figure 8. The Mini-Finland survey begins.

Study population

8,000 people were invited, 3,637 men and 4,363 women, and 7,703 (3,493 men and 4,205 women i.e. 96 % of the sample) participated in the initial health interview.

All alive subjects were invited to the health examination, and 7,217 persons, 3,322 men and 3,895 women i.e. 90% of the sample participated (Tables 10 and 11).

Table 10. Persons invited and participating to different survey phases.

	Men Number	%	Women Number	%	All Number	%
Sample	3,637	100.0	4,363	100.0	8,000	100.0
Sample, alive	3,625	99.7	4,348	99.7	7,973	99.7
Health interview	3,498	96.2	4,205	96.4	7,703	96.3
Examination, screening phase	3,322	91.3	3,895	89.3	7,217	90.2
Clinical phase, all	2,626	72.2	3,193	73.2	5,819	72.7
Doctor's examination	2,204	60.6	2,636	60.4	4,840	60.5

Of the subjects attending the screening phase (baseline examination) more than 6,000 (86%) had a symptom, finding or disease leading to invitation to the clinical study phase, and of them 5,800 (73% of the sample) participated. Of the 5,300 persons invited to the clinical doctor's examination over 91% participated and thus 4,840 subjects were examined by a doctor. After complementing the data, findings comparable to those of doctors' examinations were available on all 5,292 persons invited to the doctor's examination

Non-participants to the field survey were studied by obtaining data from institutions and the non-participant questionnaire. The interview, health examination or data retrieval from institutions was carried out on 96% of the sample. Of the whole sample of 8,000 interview data were available on 96.4%, the baseline health examination data on 90.2%, and at least some health information on 98.4%.

Table 11. Sample and participation by age group.

	Sample	Health interview Number	%	Health examination Number	%
Men					
30–44	1,447	1,397	95.9	1,343	92.8
45–54	840	819	97.5	781	93.0
55–64	659	629	95.5	603	91.5
65–74	490	470	95.9	436	89.0
75+	201	193	96.0	159	79.1
Total	3,637	3,498	96.2	3,322	91.3
Women					
30–44	1,452	1,422	97.9	1,373	94.6
45–54	883	858	97.2	826	93.8
55–64	821	782	95.3	745	90.7
65–74	760	719	94.6	642	84.5
75+	447	424	94.9	307	68.7
Total	4,363	4,205	96.4	3,895	89.3

Non-participation was extremely small, but in the oldest age groups (70 or 75 +) it was 20–30% and higher in women than in men. Since functional limitations have an impact on participation, the occurrence of functional limitations may have been underestimated in the elderly.

We compared the survey participants to the population of the whole country. The age and sex distributions were comparable. Also, the distribution of participants by various background factors was similar to that of the population. The sample and its properties have been described in detail elsewhere (Lehtonen and Kuusela 1986).

Implementation of the field survey

The field survey was initiated by a home interview and all subjects were invited to the health examination implemented by the Mobile Clinic. Figure 9 depicts the flow chart of the health examination.

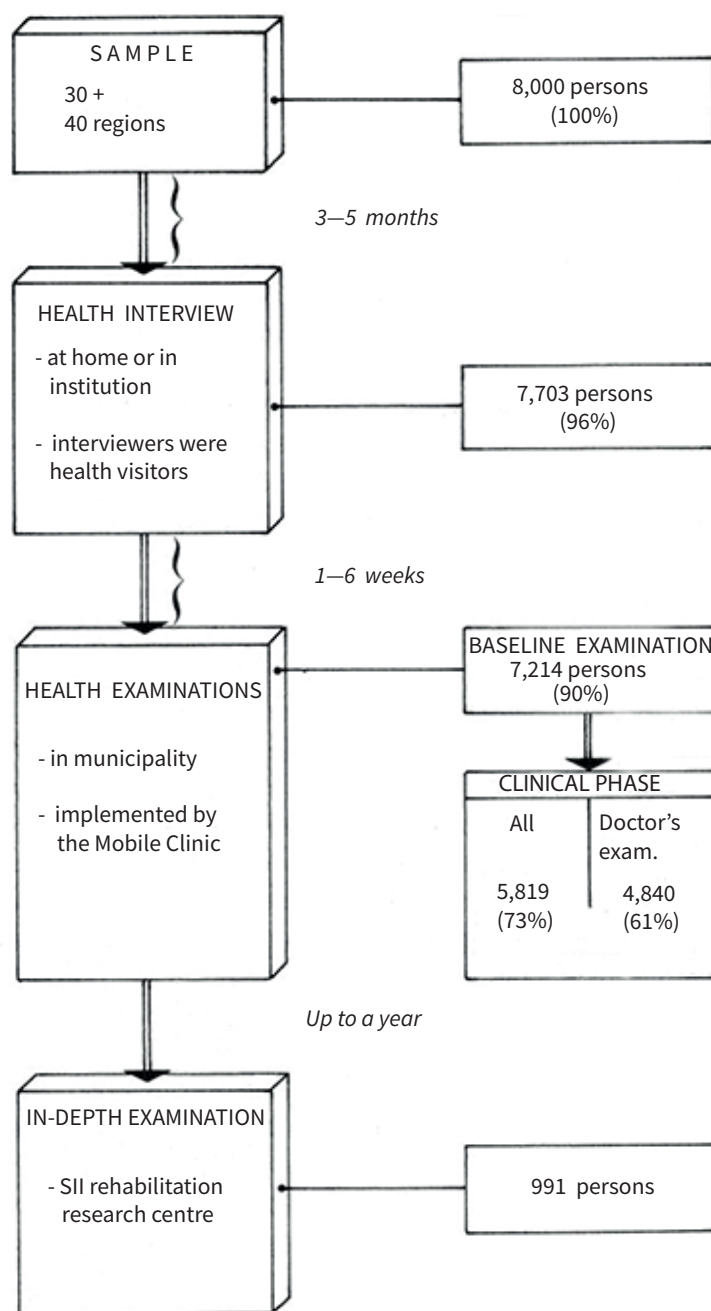


Figure 9. Phases of the field survey.

The health interview at home or in an institution

The first phase of the survey was a health interview carried out at home or, if needed, in an institution. Interviewers were trained municipal public health nurses, altogether 626 persons. The interview form had 120 questions (Appendix 4. [MS124 Health Interview of the Mini-Finland Health Survey](#)). Its main part comprised the following topics: personal data, health, disability, mental health, use of health care services, use of medicines, dentist visits and oral health, health examinations, smoking and food intake.

Information obtained by interviews and questionnaires

The information gathered by interviews and questionnaires is presented below. The interview and baseline questionnaires are found under www.thl.fi/finnish-mobile-clinic. The interview comprised questions on smoking habits and health care use, as well as part of the questions concerning food intake and those on health and functioning.

The interview recorded the duration and level of basic education and vocational training, and a five-grade classification of education was formed (Koulutusluokittelu, Käsikirjoja 1, 1971/Classification of Education, Handbooks 1, 1971). Based on occupation and type of work, the occupations were classified according to the Nordic Classification of Occupations (1963). Comprehensive information was collected on family and living conditions. Of living habits data on food intake and smoking (and use of alcohol) were recorded. Use of alcohol was assessed by number of drinks and type of drink, and the intake of absolute alcohol was calculated. Physical activity was charted by asking about strenuousness of work on a seven-grade scale, and leisure time physical activity.

The baseline questionnaire also inquired about social participation by asking about eight entities of leisure time activities. These results have also been used to describe social capital.

Both the health interview and the baseline questionnaire asked about chronic illnesses, and in the latter, there was a list of diseases ever diagnosed by a doctor. Use of health care services was recorded for the past 12 months and 2 weeks.

The use of medicines was inquired both in the health interview and in the baseline questionnaire. Medicines were classified according to Pharmaca Fennica, and an ATC-classification was carried out.

Several questions dealt with work ability and functioning as well as with handicaps caused by diseases, and one of them considered work ability and number of limitations of usual activities.

In addition, there were many directed interviews such as the cardiovascular interview, the digitalis interview, the interview of cardiovascular and respiratory symptoms, and the interview on dyspnea and cough symptoms.

The baseline health examination

The SII Mobile Clinic carried out the baseline health examination 1–6 weeks after the health interview. The subjects were invited by letter two weeks prior to the proposed examination date. They received also a form considering mental health and the baseline questionnaire. The baseline questionnaire (www.thl.fi/finnish-mobile-clinic) comprised 107 questions dealing with health status, diseases, work, working conditions, hobbies, physical activity, performing usual activities, and use of alcohol.

Every day the examinations started between 8 a.m. and 1.30 p.m. and for each person the examination lasted 2.5–3.5 hours.

The order of the first measures and measurements was fixed. First, the questionnaires were checked, height and weight were measured, symptom interviews were carried out, a urine sample was obtained, blood pressure and heart rate were measured, ECG was registered, and respiratory functioning was recorded by spirometer. Next, other examinations were carried out in varying order. These were complementing

interviews, the joint function tests, the oral health examination, the chest-X-ray and the drawing of the blood samples. Finally, psychometric group examinations were carried out and the reaction time was tested. The clinical examination of mental health disorders was the Present State Examination (PSE) interview which was carried out during the baseline examination on as many subjects as possible of the subjects identified by screening as possibly suffering from mental disorder. Other screening positive individuals were invited to the clinical phase of the examination. After the clinical phase the protocol also comprised a JAS (Jenkins Activity Survey) mail survey.

The baseline questionnaire gathered data on previous diseases and their treatment, hospital treatment episodes, use of medicines, limitations of work ability and functioning, work tasks and the of work, working conditions, physical activity and alcohol use. In addition, women were asked about pregnancies, use of contraceptive pills and menopause.

To determine the degree of obesity and overweight, body height, weight and the thickness of triceps and subscapular skinfolds were measured. As a measure of obesity, the body mass index ($\text{weight}/\text{height}^2$, kg/m^2) was calculated.

The time to blood pressure measurement from arrival at the examination was usually at least 40 minutes. The usual auscultatory method was used to measure blood pressure (Hypertension and coronary heart disease 1959, WHO 1962, Pickering 1968, Geddes 1970). The instruments were new mercury manometers (Erkameter original) with sufficiently broad and long rubber bags. The size of the rubber bags was 12.5 cm x 45 cm.

To measure heart-size chest-X-rays (posteroanterior and lateral views) were taken by four technicians. The lateral view was taken with the subject's left chest toward the film after ingestion of barium paste (Microtrast).

Resting ECG was recorded with the subject lying down. The instrument was a device of Olli-tuote (Kone Oy), Olli 308. The signals were also interpreted by a computer using the DATA-ECG system (Ahokas et al. 1977) using the Pipberger probabilistic program (Cornfield et al. 1973, Pipberger et al. 1975). In addition, the ECGs were classified according to the Minnesota classification (Rose and Blackburn 1968).

Respiratory functioning was measured by spirometry. The instrument was a Vitalograph. The examination aimed at three successful blows, and it measured maximal respiratory capacity (VC), forced maximal respiratory capacity (FVC) and forced expiratory capacity in one second (FEV1). The peak flow of expiration (PEF) was measured using Wright's device (Airmed Ltd).

Hand grip strength was measured on all participants, and other measurements of muscle strength were carried out on subsamples of the subjects (Mälkiä 1983). The 10-item joint function test was carried out on all, and an abnormal finding was one of the screening conditions (Heliövaara et al 1993a).

The clinical dental examination was carried out in a specially equipped van in conditions resembling those of a dentist's surgery. The baseline examination was carried out by a specialist dental nurse and the follow-up examination by one of the 8 dentists. The methods of the oral health examination have been described elsewhere (Vehkalahti et al 1991) and in brief in this book. The most common and most important oral diseases are dental caries and periodontal diseases. The aim was to assess by both an interview and the dental examination the occurrence of diseases, need for care and its satisfaction.

The samples for biochemical determinations were obtained in standard conditions. Except for diabetics all subjects were asked to fast after 10 clock p.m. on the previous night and to refrain from urinating at least six hours before arriving at the examination site. The length of fast prior to drawing the samples was at least 11 hours. Blood was drawn for serum, heparin plasma and EDTA-samples.

The frozen samples were sent as cold transport to the laboratory of the Rehabilitation Research Centre in Turku. They were stored there at $-20\text{ }^{\circ}\text{C}$ until analyses.

In the field laboratory hematocrit (packed cell volume) was determined. Of the samples of all participants serum total cholesterol, HDL-cholesterol, triglycerides, gamma-glutamyl transferase, plasma fasting glucose and creatinine were determined (Aromaa et al. 1989). To create reference values other determinations were also carried out. On all subjects the rheumatoid factors were determined by using the Waaler-Rose and Latex tests. Further determinations were carried out in subsamples of the examinees: these were serum uric acid, plasma sodium and potassium, one in four lipoproteins by ultracentrifuge analysis, and digitalis determinations on digitalis users. In a sample, also clotting factors and fatty acids of the lipoprotein fractions were analyzed.

Further analyses were carried out in part of the subjects. These are presented in separate publications (Aromaa et al 1989a, Aromaa et al 1989b) and on the THL web-pages <https://www.thl.fi/en/web/thlfi-en/research-and-expertwork>.

The usual determinations with test strips were carried out on urine samples to detect protein and glucose. Part of the survey was collecting an overnight urine sample for examining sodium and potassium excretion.

The clinical phase of the health examination and the clinical doctor's examination

The clinical (re-examination) phase was carried out 3.5 months after the screening (baseline). Subjects were invited who based on baseline results or data from the SII register were suspected to suffer from any of the diseases selected for the study. Also, persons with missing results were invited. To assess the reliability a random sample of all subjects was also invited for repeated examinations.

The main aim of the clinical examination was to create clinical estimates of diseases and need for care. A purpose was also to verify the results obtained in the screening examination. A dentist evaluated all oral mucosal findings and carried out a clinical examination on a subsample of all examinees. The PSE interview was the clinical examination of mental health disorders, and it was carried out by a specialized psychiatric nurse.

The invitations to the clinical examination were mailed about two weeks before the date of the examination. The examination started between 8 o'clock a.m. and 1.30 p.m. and it lasted 1.5 to 3 hours.

The clinical examination started with interviews and questionnaires after which a urine sample was provided, heart rate and blood pressure were measured (also in the lower extremities), ECG was registered, spirometry was performed, joint function tests and tests of muscle strength were carried out, blood samples were drawn, X-ray examinations and psychometric measurements were carried out, and finally there was the doctor's clinical examination and the PSE interview.

According to the findings of the screening examination, the doctor's examination was directed at cardiovascular and respiratory diseases, musculoskeletal diseases or both. Diagnostic assessments concerning all other diseases were made on subjects participating in the doctor's examination, and so were person level assessments of work ability and functioning, diseases causing handicaps and need for care.

The clinical examinations were carried out by seven doctors. On standard forms the doctor recorded the medical history, the results of the physical examination and the diagnostic assessments according to preset criteria. The diagnoses were classified as definite or possible and as new or previously known. Finally, the doctor assessed by diagnosis the need for care and adequacy of care received. In this assessment the reference was good treatment practice.

When assessing cardiovascular and musculoskeletal diseases the doctor first formed an opinion on which diseases the subject had or had had. Next, he verified and recorded the central cardiovascular and musculoskeletal findings and carried out the diagnostic assessments on the basis of preset criteria. He also assessed the functional class (NYHA, New York Heart Association classification), estimated the subject's work ability and functional ability, diseases limiting these, and need for care and control and their satisfaction.

The clinical method for mental health disorders was the short version of the PSE (Present State Examination). The interviewer classified the symptoms (presence, certainty, severity and duration) into one of five classes. The results were classified using the CATEGO-program, which produced diagnoses in accordance with the International Classification of Diseases.

Complementing and combining the clinical assessments

Subjects were invited to the doctor's examination and the PSE-interview based on the findings in the screening examination. If the only finding was hypertension, diabetes, hyperlipidemia, bacteriuria, anemia or raised creatinine the measurements/determinations were repeated, and the diagnostic assessments were carried out solely on the basis of the determinations and measurements.

The clinical disease specific assessments were complemented in those not participating in the doctor's examination (about 10% of those invited) and those whose assessments to begin with were to be made solely by measurement results and interview and questionnaire reports. The doctors carried out these assessments using the same criteria as in subjects who participated to the clinical examination.

First, person level estimates of need for care and the treatment situation were carried out on physical diseases, and next the forms of all subjects were checked, whose new assessments did not agree with the earlier ones made in the field examination.

In the final assessment on cardiovascular diseases and respiratory diseases the doctor decided whether any of 15 cardiovascular and 5 respiratory diseases (diagnosis possible or definite) were present. Also, the doctor assessed by disease need for care (no, yes), the treatment situation (no, insufficient, proposed not carried out, sufficient) and the need for new actions (general practitioner, specialist, control of finding). The diagnoses of cardiovascular diseases were myocardial infarction, angina pectoris, congenital heart disease, syphilitic heart disease, rheumatic heart disease, hypertension, congestive heart failure, hypertensive heart disease, cor pulmonale, rhythm disturbance, arterial disease of the lower extremities, cerebrovascular disease, and other. The respiratory diseases were bronchial asthma, chronic bronchitis, lung tuberculosis, and other.

The final assessment of musculoskeletal diseases comprised the following diseases: polyarthritis (rheumatoid arthritis, psoriatic arthritis, Mb. Reiter, other reactive), monoarthritis, spondylarthrosis, osteoarthritis of hip, knee and hand joints, amputated limb, neck syndrome (cervical syndrome, muscular, cervical spondylarthrosis), low back syndrome (herniated lumbar disc, sciatica, spondylolisthesis, lumbar spondylarthrosis, muscular spondylolisthesis, other defined, shoulder disease, foot deformity (hallux valgus, hammer toe, flat foot), other defined, non-defined.

Of mental disorders the diagnoses set were dementia, schizophrenia, affective psychosis, other psychosis, personality disorder, alcoholism, narcomania, anxiety neurosis, phobic neurosis, obsessive/compulsive neurosis, depression, other neurosis, personality disorder and oligophrenia.

Finally, the clinical assessments of somatic diseases and those on mental disorders were combined. The clinical examination phase with assessments and combining the assessments has been described later. If the subject had a chronic physical disease or a mental health disorder he/she was classified chronically ill. A subject needing care because of a physical disease or a mental disorder was classified as needing treatment in the long term. The current care was assessed as insufficient or lacking if and disease specific need was insufficiently met or not met at all. As a net result there are diagnostic assessments and need for assessments of all subjects.

Oral health

The implementation of the dental and oral survey has been described in detail elsewhere (Vehkalahti et al 1991). The most common and most important oral public health problems are dental caries and diseases of the connective tissue (gingivae). The purpose was to assess by an interview and a clinical examination the occurrence of oral diseases, need for care and satisfaction of need.

The health interview inquired about dentist visits, dental condition, cleaning the mouth and teeth as well as equipment used for cleaning.

Dental caries was recorded by tooth surface. Caries was defined as a lesion with a clearly soft base and which showed grooved enamel walls or softened walls (WHO 1997b).

Fillings were recorded by dental surface, but crowns by tooth.

The state of the connective tissues was recorded by quarter of the mouth. For each quarter the most severe finding was recorded to represent the quarter. Gingivitis was recorded when one of the three criteria was met (reddening, swelling and bleeding) (Løe and Sillness 1963). Tissue destruction was recorded when there were at least 4 mm deep gingival pockets.

In the baseline examination oral health was examined by a specialist dental nurse and in the follow-up phase one in six were examined by a dentist together with the specialist nurse.

Quality assurance and quality control

A lot of attention was paid to maintaining good quality. Quality assurance comprised checks on the contents, quality control based on monitoring the variability of the results, monitoring sample distributions, repeat measurements and quality control experiments. In addition, repeat measurements, parallel measurements, reference and standard measurements were performed. In addition to the actions in the field many other means were used to ensure good quality.

The survey conditions were standardized. The effect of daily and seasonal variation was evenly spread over the study material. Also, the order in which communities were studied was designed so that seasonal variations would not reduce the comparability of regional comparisons.

The methods were standardized, the observers were trained, written instructions were used, the work was observed, and the quality of the material was monitored. The remaining differences were evened out by dividing the examinees randomly between observers and by using alternately different measurement devices. To assess the size of the variation and reliability a 20% sample of the subjects was re-examined.

The results were monitored especially by following the sample distributions. Monitoring revealed that the Turku sample which had been examined first differed in many respects from later communities. Therefore, a new sample was selected from the Turku area and it was studied last.

In addition, special quality control experiments were carried out. The most important of these was the examination of an additional sample of 600 persons examined before the beginning of the field survey, in the middle and after the end of it. These repeated examinations were used to assess the changes in the measurements over the two and a half years of the field survey.

To reduce the amount of clinical work the doctor's examination was carried out only on those who according to the screening might have had any of the target diseases. To assess the validity of the screening a clinical follow-up examination was carried out on 740 subjects independently of the screening findings. These results were used to assess the sensitivity of screening for cardiovascular, respiratory and musculoskeletal diseases i.e. how well the screening findings identified persons suffering from certain diseases. These results allow conclusions about the outcome in case all subjects would have participated in the clinical doctor's examination.

The results of the musculoskeletal screening have been published (Heliövaara et al. 1993b). The sensitivity of the cardiovascular and respiratory screening has been shown in Table 12 and that of the musculoskeletal screening in Table 13.

Table 12. The sensitivity of the screening for cardiovascular and respiratory diseases (possible and definite diagnoses).

	Sensitivity	Number of cases
Any cardiovascular disease	95.3	143/150
Myocardial infarction	97.1	33/34
Angina pectoris	97.6	82/84
Heart failure	100.0	70/70
Hypertensive heart disease	95.8	23/24
Cerebrovascular disease	88.9	8/9
Any respiratory disease	94.0	125/133
Asthma	100.0	12/12
Chronic bronchitis	97.8	88/90
Emphysema	92.9	26/28

Table 13. The sensitivity of the screening for musculoskeletal diseases (possible and definite diagnoses).

	Sensitivity	Number of cases
Any musculoskeletal disease	82.3	289/351
Musculoskeletal disease limiting functioning	90.7	165/182
Polyarthritis	100.0	12/12
Coxarthrosis	100.0	39/39
Joint arthrosis	89.0	113/127
Neck-shoulder syndrome	90.6	87/96
Low back syndrome	82.9	116/140
Shoulder joint syndrome	92.6	50/54

Over 95% of those suffering from cardiovascular or respiratory diseases, 97% of those suffering from myocardial infarction or angina pectoris, and all those with heart failure were identified. Of those suffering from respiratory diseases almost 95%, and all of those with chronic bronchitis were identified.

Of subjects suffering from musculoskeletal diseases more than 80% were identified and of those with functional limitations due to musculoskeletal diseases more than 90%. Of individual diagnoses more than 90% were identified of the subjects suffering from polyarthritis, osteoarthritis of hip and knee joints and neck-shoulder-syndrome. Slightly fewer were detected (80%) of those with low back syndrome. If the disease required treatment it was detected more often.

The results show that the screening procedure was very sensitive: almost all persons suffering from any of the diseases in question were detected. From this respect the Mini-Finland survey findings on disease occurrence are accurate.

Non-participation

Non-participation was small. A special questionnaire was sent to non-participants. Of those invited 96% participated in the home health interview and 90% in the baseline health examination. At least some information was obtained on 98% of the sample. Furthermore, some data were gathered for specific purposes on sub-samples.

Sample store and follow-up by registers

For further research on all subjects four 4 ml serum tubes and one 4 ml plasma tube were frozen to -20° C and permanently stored.

Since drawing the population sample the data have been regularly linked to national registers on mortality, use of health services and medicines, and disease incidence. Follow-up data are available on mortality, causes of death, hospital discharges, specially reimbursed medicines and cancer incidence.

Baseline reports and research uses

The baseline results of the Mini-Finland survey have been published in four books i.e. the comprehensive report (Aromaa et al. 1989b), the main report on musculoskeletal diseases (Heliövaara et al. 1993a), the main report on mental health (Lehtinen et al. 1991) and the main report on oral health (Vehkalahti et al. 1991).

Many topic specific articles and dissertations have also been published. They have been listed on the web-pages (www.thl.fi/finnish-mobile-clinic) and there is also a description in the last chapter of this book (The data, their follow-up and use).

Description of the methods

Data obtained by interviews and questionnaires

Social factors

Education. In the health interview the duration and level of basic education and vocational education were asked about. The responses were used to create a commonly used classification: Educational classification, 1971:

1. Primary level, 2. Basic level, 3. Lower intermediate level, 4. Upper intermediate level, 5. Higher level

Data on occupation and type of work was gathered both by the health interview and the baseline questionnaire. Titles of occupations were coded according to the Nordic Classification of Occupations (1963). If disagreement occurred between the interview and the questionnaire, all the information was checked to determine the correct code for research purposes.

Other factors. The interview gathered background data and information on living conditions. The most important of these were family size and structure, marital status, the status of the subject in the family, family income, the type of pension, if any, and the size of the farm (total and cultivated).

Living habits and behavior

Diet. Part of the data was obtained in the health interview, and part by a separate dietary questionnaire carried out during the baseline examination. The questionnaire inquired about the daily intake of some basic foodstuffs such as bread, milk and fluid milk products, coffee and sugar. The dietary questionnaire selected for this survey was the one-page questionnaire (what did you eat yesterday?) used in the Swedish campaign *Kost och motion* (Arvidsson et al. 1973, Seppänen and Karinpää 1986). The questionnaire comprised questions on the use of staple foods from the groups milk products, grain products, meat and fish products, potato and roots, vegetables, fruits and berries, and beverages (including coffee and tea) and sweets in connection of different meals of the day. The staff helped with filling in the questionnaire and asked about the amount of fat used on bread by showing model sandwiches with an artificial spread of 2.5, 5 or 10 grams. The responses were used to calculate points used to calculate a health index of the diet.

Smoking. A short question series was used to inquire about smoking. The questions dealt with current and previous smoking and quitting (Appendix 4. [MS124 Health Interview of the Mini-Finland Health Survey](#)). The smoking data as such are valid and reliable. The information is further refined by the serum cotinine concentration (Korpilähde et al. 2004, Vasankari et al. 2011).

Use of alcohol. The question series on alcohol use was included in the baseline questionnaire (Appendix 5. [MS011 Baseline Questionnaire of the Mini-Finland Health Survey](#)). The purpose of the questions was to assess the mean consumption of different types of beverages (consumption per week during the past month). Total alcohol consumption (per week) was estimated as the sum of beer, wine and spirits and weighting the consumption of each type of beverage by its average alcohol content. It is well known that questionnaires and interviews underestimate use of alcohol to such an extent that in comparison to sales statistics they reveal only one third or half of the true consumption. However, it is likely that the order of the subjects by consumption is correct.

Behavior pattern (JAS). The JAS-questionnaire was mailed after the follow-up survey to subjects aged under 65 years. The questions were the same as those in the Jenkins Activity Survey Form B (Jenkins et al. 1967, Jenkins et al. 1971). For every subject the score suggesting type A behavior was calculated. The coefficients needed were obtained from the designers of the form (JAS Manual, Jenkins D unpublished information).

Physical strenuousness of work was inquired about by a seven-step scale beginning at light sedentary work and finishing at very heavy manual work. At each stage there were examples of typical work. Furthermore, strain was assessed concerning the latest previous work and the work of longest duration during lifetime.

Physical activity. Leisure physical activity was asked by three degrees:

Class 1. Little physical activity

Class 2. Physical activity relating to other hobbies and occasional physical activity

Class 3. Regular physical activity

For regular activity the types of activity separately for summer and winter, the kinds of sports, the frequency and duration of the activity as well as breathlessness and sweating were recorded.

Social participation

The baseline questionnaire inquired about eight hobby entities and frequency of carrying out these hobbies. The replies have also been used to describe social capital and its predictive value (Hyypä et al. 2006).

Health status and use of health services

In the health interview there were questions about chronic diseases, and the diseases were classified according to the international classification of diseases (Tautiluokitus 1969/International classification of diseases and causes of death, 1969).

The baseline questionnaire inquired about diseases ever diagnosed by a doctor. There were 28 diseases. Four of them were respiratory diseases (lung tuberculosis, emphysema, chronic bronchitis, asthma and other) and eight cardiovascular diseases (myocardial infarction, angina pectoris, congestive heart failure, enlarged heart, other heart disease, hypertension, cerebrovascular disease, arterial disease of the lower extremities, varicose veins of the lower extremities). For each disease there were further questions on hospital treatment, current treatment by a doctor, and previous and current use of medicines.

The subjects were also asked to record on the form all previous hospital treatments, surgical operations and their causes. Field physicians classified the diseases according to the 8th revision of the International Classification of Diseases (Tautiluokitus 1969/International Classification of Diseases and Causes of Deaths 1969).

Use of health services. In the health interview self-perceived need for services, the number of doctor visits during the past 2 weeks and twelve months and their causes were asked. Corresponding information was recorded on visits to public health nurses. Finally, the interviewer also assessed whether the subject had received sufficient treatment and rehabilitation. Although the 12 months data underestimate true use, overall the replies are rather valid.

One of the special aims of the Mini-Finland survey was to compare the results on morbidity and need for care obtained by the health interview with those of the health examination (Heliövaara et al. 1993b). Therefore, the interview and the examination were carried out independently of each other.

Use of medicines

Use of medicines was recorded in the health interview and in the baseline questionnaire. In the baseline questionnaire there were questions on prescription and other medicines used during the past 3 months. In addition, there were questions on whether use was continuous or almost continuous and whether the subject had used this medicine during the past 7 and 2 days. In the health interview the subjects were also asked to present prescriptions to the interviewer and to take them along to the health examination.

The medicines were classified according to indication and composition using the alphabetical list (Pharmaca Fennica 1977–1981), and later also an ATC-classification was carried out.

Work ability, functioning and disease induced handicaps

Handicaps due to diseases and disabilities were inquired in the health interview, which also comprised a question series on limitation of usual activities and disabilities (Klaukka 1981).

Work ability was charted in the baseline questionnaire. Diseases causing complete or partial work disability were recorded. Subjects in gainful employment were asked about managing work duties, previous changes of jobs due to illness, sickness absence days and permanent reduction of working hours, and the diseases causing these limitations were to be named.

In the baseline questionnaire there were also questions on managing non-employment tasks and leisure activities. Again, diseases causing abandoning or reducing some tasks were to be named.

The subject was requested to declare for each activity how he/she managed it: without difficulties, with slight difficulties, with major difficulties or not at all. The initial question concerned mobility at large, then climbing stairs, walking a lengthy distance, running/jogging, and cleaning. Furthermore, there were questions on writing, concentrating, and taking care of demanding tasks. The last questions dealt with travelling by train or bus, and managing some other complex activities.

Additional interviews on cardiovascular and respiratory diseases and their care

Additional interviews were carried out on some diseases and medications mentioned in the baseline questionnaire. These additional questionnaires concerning detection of diseases and treatment were the cardiovascular disease interview and the digitalis interview. The interview on asthma was carried out during the follow-up examination.

Cardiovascular disease interview

The interview was used to complete baseline questionnaire information on doctor diagnosed diseases and their treatment. The interview was presented to all reporting in the baseline questionnaire that a doctor had diagnosed one of the following diseases:

- myocardial infarction or angina pectoris
- congestive heart failure or enlarged heart
- other heart disease (except a mild functional disorder)

- cerebrovascular accident
- arterial disease of the lower limbs
- hypertension.

Persons who within the past 3 months had used nitroglycerin or digitalis were also interviewed. The interview ended with questions on limitations according to the NYHA-classification.

Digitalis interview

Digitalis preparations were extensively used. If the subject reported that he/she had used any digitalis preparation an interview on digitalis medication and its side-effects was carried out. The data were used to determine e.g. the daily dose, the dose taken at a time, and how constant it was. The data were used together with the measurements of digitalis concentrations (Impivaara 1986).

Symptoms of cardiovascular and respiratory diseases

Interviews on symptoms were carried out immediately after checking the baseline questionnaire and when the additional interviews had been completed. Training of the interviewers followed the instructions of the developers of the symptom questionnaire (Rose 1962, Rose and Blackburn 1968). On the questionnaire there were first questions on dyspnea, next those on chest pain and intermittent claudication, and finally cough and phlegm symptoms suggesting respiratory disease.

The questions on chest pain symptoms had been translated from the original English language questions (Rose 1962). Based on reported chest pain symptoms the subjects were classified into the following hierarchical classes:

- B 01–04 Typical angina pectoris according to location and quality
- B 05–18 Strain related chest pain of atypical location and quality
- B 19 Chest pain feelings which are not present in slight strain, but the relationship to more severe strain cannot be assessed
- B 20 Chest pain not related to strain
- B 21 No chest pain symptoms.

These symptom data were combined with information on severe chest pain attack to create a so called condensed chest pain classification placing the subjects into six hierarchical classes according to how typical and how severe the symptoms were:

- S 01 Severe chest pain attack and typical angina pectoris
- S 02 Severe chest pain attack but no typical angina pectoris
- S 03 No severe chest pain attack but typical angina pectoris
- S 04 Strain related to other chest pain symptoms
- S 05 Chest pain symptoms not related to strain
- S 06 No chest pain symptoms.

The classification was the same as in previous Mobile clinic studies (Reunanen 1977).

Intermittent claudication. The generally recommended method was used to identify intermittent claudication (Rose and Blackburn 1968). It has been used also in the previous Mobile Clinic studies (Reunanen et al. 1982, Reunanen et al. 1983). The symptoms were classified as follows:

- D 01 Severe typical claudication
- D 02 Mild typical claudication
- D 03 Strain related atypical pain in the calves
- D 04 Pain in the calves not classified by relation to strain
- D 05 No claudication.

The claudication symptoms have been shown to adequately measure the occurrence of symptomatic deteriorated arterial flow in the population.

Symptoms of dyspnea. The question series recommended by the British Medical Research Council was used. It has previously been used in Finland by Huhti (1965). The severity classification was:

- A 01 Dyspnea at rest
- A 02 Severe strain related dyspnea
- A 03 Intermediate strain related dyspnea
- A 04 Mild strain related dyspnea
- A 05 No dyspnea.

Based on symptoms the subjects were also invited to the follow-up examination comprising a clinical examination, spirometry and chest X-ray.

Cough and phlegm symptoms

The interview dealt with dyspnea and phlegm symptoms, and to capture those the questions recommended by the MRC were used (Rose and Blackburn 1968). These questions have been recommended by expert groups (MRC Committee 1965, Fletcher et al. 1976). The following cough symptom classes were created:

- E 01 No chronic cough
- E 02 Chronic morning cough
- E 03 Chronic day or night cough
- E 04 Chronic all-day cough and the cough symptom classes
- E 05 No chronic phlegm
- E 06 Chronic morning phlegm
- E 07 Chronic day or night phlegm
- E 08 Chronic all-day phlegm.

Physical measurements

Height, weight, skinfold thickness and obesity

To determine obesity and overweight the subjects' height and weight as well as the thickness of the triceps- and subscapular skinfolds were measured. The indicators of obesity were the body mass index (weight/height squared (kg/m²) and the sum of skinfolds (mm).

Height was measured at 1 cm precision with the subject standing erect without shoes with his/her back against the measurement stand. A weight scale was used for weighing (SECA, Volke & Helke, Hamburg), and it was calibrated using standard weights in each community. The subjects were in light cloths and in stocking feet. The observer assessed the weight of the clothing and subtracted it from the reading: in the summer 1 kg and in the winter 2 kg.

The triceps-skinfold was measured from a vertical fold in the back of the right arm and the subscapular skinfold from the horizontal fold (Tanner 1959). Two calibrated instruments (British Indicators Ltd, John Bull, 'Harpenden Skinfold Caliper') were used on alternate days. The surface area of the jaws was 6 x 15 mm and the compression constant, about 10 g/mm², over the space of about 2–40 mm.

Measurement of blood pressure and heart rate

Blood pressure was measured at least 40 minutes after arrival at the examination site. During the examination the subjects were not allowed to eat, drink or smoke. Blood pressure was measured in a peaceful room of regular room temperature (+18 – +23 °C). There were four observers.

The usual auscultatory method was used (WHO 1962, Geddes 1970), which has been recommended also for epidemiological studies (Rose and Blackburn 1968). The instruments were new mercury manometers (Erkameter Original) equipped with sufficiently long and broad rubber bags. The size of the rubber bags was 12.5 cm x 45 cm.

Usually blood pressure was measured from the right arm after 5 minutes rest (Rose and Blackburn 1968, Arterial hypertension, Report of a WHO expert committee, 1978). From the wrist the observer palpated the pulse for 30 seconds. After the subject was seated the cuff was wound around the arm, there was a rest of 5 minutes, the brachial artery was palpated, and pressure was pumped 30 mmHg above the estimated pressure corresponding with the disappearance of pulse. Pressure was reduced at 2 mmHg every 2–3 seconds. Blood pressure was recorded. Immediately after appearance of the sounds systolic pressure was recorded and immediately after disappearance of the sounds, diastolic.

In the baseline examination two measurements were performed. Casual blood pressure and heart rate were measured twice at 1.5-minute intervals. Subjects with raised blood pressure in the first measurement were invited to the follow-up examination.

The training of the observers was continued during the whole survey by the observers listening to the blood pressure training tape (Rose 1965). During the field survey there were also feedback sessions and combined to these, measurements using a double stethoscope.

Heart and lung X-ray

To measure heart volume normal-size chest X-rays were taken (PA and lateral pictures). There were four observers. The lateral picture was taken with the subject's left side towards the film after he/she had ingested barium paste (Microdrast). The subject was standing erect. The pictures were taken in the clinic van with an automated instrument.

Two radiologists independently interpreted the findings according to an agreed code. Both radiologists measured the length of the heart (L), its breadth (B) and depth (D) at an accuracy of one mm (Lusted and Keats 1972). Whilst coding the films the radiologists also made recommendations on immediate referral for treatment or a follow-up examination.

For quality assurance a standard material of 200 pictures was compiled. It was interpreted three times mixed with pictures proper. In addition, the occurrence of findings was monitored by radiologist.

ECG examination

The ECG was recorded on the resting subject lying down. In 1972 a DATA-ECG project was initiated, and its automated computerized interpretation was first put into clinical use. There were sparse experiences of using computerized interpretation in population studies (Jokinen et al. 1977). In the Mini-Finland survey both traditional Minnesota-coding and this computerized interpretation system was used.

ECG recording

The ECG was recorded after about 1.5 hours from arrival at the examination site. The ECG was recorded in a clinic truck prior to spirometry, muscle strength measurement and drawing the blood sample.

The instrument was Olli 308 made by Olli-tuote Oy (KONE Oy). It transforms the ECG signal to digital form and stores it on magnetic tape (tape cassette DC 300 A). Simultaneously the ECG is recorded on tape.

The usual 12 leads as well as Frank's orthogonal (XYZ) leads were recorded. There was an automatic calibration pulse prior to and after each recording. Prior to initiating the recording, the data on the subject's medication, body build, and blood pressure were recorded.

The recording speed was 50 mm/s. First, the standard connections were recorded in groups of three in manual control and next the recording proper was initiated in automated mode. During the recording the curve produced on paper was monitored by eye as a means of quality assurance.

The tape cassettes were sent the Computing Centre of Kuopio university. There they were analyzed, and the result of the analysis was sent usually within a week to the Mobile Clinic office.

Computerized ECG interpretation

The DATA-ECG interpretation (Ahokas et al. 1977) is based on Pipberger's probabilistic program using the ECG- signal based on the orthogonal (XYZ) connections (Pipberger et al. 1975, Cornfield et al. 1973). The program calculates the probabilities of the following diagnostic classes:

- normal atrial functioning
- over burdening of the left atrium
- overburdening of the right atrium
- normal interpretation of the ventricles
- infarction of the frontal or medial wall
- infarction of the lower or medial wall
- infarction of the lateral wall
- hypertrophy of the left ventricle or left weighted hypertrophy of both ventricles
- hypertrophy of the right ventricle or right weighted hypertrophy of both ventricles
- left bundle branch block
- left bundle branch block or myocardial infarction
- right bundle branch block
- right bundle branch block and myocardial infarction.

If the computer program interpretation of the ECG was normal the results were used as such. Abnormal findings were referred to cardiologists experienced in ECG interpretation. There were altogether six such reference observers.

The alternative results of the DATA-ECG interpretation were:

- ECG not within the normal range, follow-up is necessary
- ECG not within normal range, follow-up not necessary
- No clear-cut pathological finding
- No clear-cut finding
- ECG within the normal range
- Technically poor ECG, to be registered again
- Discarded.

The follow-up survey was needed if any of the following was true:

- atrial fibrillation
- malign ventricular ectopic extra beats
- atrial ventricular block of degrees two or three
- complete left or right bundle branch block
- major left ventricular hypertrophy.

A doctor of the research team checked all interpretations and ECGs recorded on paper. He decided about the need for further action as follows:

1. To be invited to the follow-up examination because of the DATA-ECG finding
2. To be examined in the follow-up examination because of a lacking DATA-ECG finding or a discarded one
3. To be invited to the follow-up examination because of errors in the standard leads, no actions
4. To be referred immediately for treatment, if the finding suggested recent myocardial damage or ischemia or second or third-degree bundle branch block, if there were signs of malfunctioning of the sinus node, or if the subject had malignant ventricular extra beats or ectopic tachycardia.

The Minnesota-classification

Four experienced persons in pairs classified all Mini-Finland ECGs. The revised Minnesota code was used (Rose and Blackburn 1968). The coders visually identified aberrations and used a rule as an aid. If their classifications differed the observers compared them. Those ECGs were reclassified. If contradictions remained, the supervising cardiologist decided the result.

Due to the large number of the Minnesota-codes and their varying importance a hierarchical four-class classification of codes suggestive of coronary heart disease was formed:

- M 01 Minnesota code 1.12 or simultaneously both 1.2 and 5.1–2
- M 02 Any of the Minnesota codes 1.2–3, 4.1–3, 5.1–2, 6.1–2, 7.1–2, 7.4 or 8.3
- M 03 Minnesota code 5.3
- M 04 Any other Minnesota code or no classifiable changes.

The same classification has been used in previous Mobile Clinic surveys (Reunanen et al. 1983).

The Minnesota-code has an established position and it is accepted as the most suitable one (Blackburn et al. 1960, Blackburn 1969).

Quality

The reliability of the Minnesota classification is extremely good. The same is true of validity, although differences between the verifying interpreters add to variation.

Spirometry

Spirometry is used to diagnose diseases and to monitor treatment. In population studies spirometry has been used to screen for limitations of respiratory functioning and for charting respiratory functioning at large. Since respiratory functioning depends in part on the mechanical properties of the chest and on muscle function, spirometry has also been used to describe them (Cotes 1975).

Maximal respiratory function or forced vital capacity (FVC) is used as a measure of restriction, i.e. the volume of air which can be exhaled by forced expiration in one second following maximal inhalation. Restriction of air flow can also be measured by the ratio of the capacity in one second and forced maximal respiratory capacity (FEV1/FVC), which is usually expressed as a percentage (FEV %). In definite obstruction the ratio is smaller than usual.

Peak expiratory flow (PEF) can also be used as a measure of ventilatory capacity. Peak flow is maximal air flow lasting at least 10 milliseconds during forced expiration after maximal inhalation (Cotes 1975).

In the Mini-Finland survey the topics measured were:

- Maximal respiratory capacity (VC)
- Forced maximal respiratory capacity (FVC)
- Forced expiratory capacity in one second (FEV1)
- Peak expiratory flow (PEF).

Prior to the survey several spirometry instruments were tested. The Vitalograph (Vitalograph Ltd) was selected. It was equipped with a digital display and Wright's peak flow meter (Airmed Ltd). The Vitalograph instrument yields results similar to those of the reference instrument, which was the Bernstein and Stead-Wells spirometer (Wever et al. 1976).

The observers were laboratory nurses of the Mobile Clinic. The subject was standing. First, the correct exhalation technique was taught, and for training he/she blew once or twice. During the measurement proper the goal was to achieve 3 successful blows. If the results differed more than 10% from each other the subject was asked to blow one more time. The results reported here are those of the best single expiration, which has also been recommended by Fletcher et al. (1976).

The Vitalograph recorded the spirometry values as ATPS values. During the measurement room temperature and ambient air pressure were recorded. The Vitalograph ATPS values were corrected to BTPS values (body temperature, saturated with water vapor) with a coefficient obtained from the formula:

$BTPS\text{-coefficient} = 273 + 37 / 273 + T \times PB - PW / PB - 47.08$, where T = approximate temperature of the Vitalograph (room temperature).

PB = Out door air pressure (mmHg) and PW = partial water vapor pressure corresponding to room temperature.

All whose BTPS coefficient corrected forced maximal ventilatory capacity (FVC) or capacity in one second (FEV1) or the uncorrected peak flow (PEF) result were less than 80% of the corresponding age, sex and height specific reference value were invited to the follow-up examination of spirometry and the clinical examination. The reference values were those of Berglund et al. (1963). The reference values for peak flow were the British ones of the instrument manufacturer (Airmed Leaflet A/135 4.p.).

Quality

The functioning of the instruments was checked every day before beginning the measurements. All instruments were calibrated daily and always after 1,000 blows. The measurement level and reliability were monitored during the whole survey. The effect of observers was assessed by monitoring population means, the measurements were repeated on every fifth subject. The constancy of the measurement level was also assessed by repeating the measurement every year in a separate population sample. It was also assessed by monitoring the field personnel.

Quality assurance revealed that early in the study (some communities in South-West Finland) the results were false (+8%) which was due to faulty functioning of the instrument. The examination in those communities was repeated. After that the level and reliability of the results were faultless.

Biochemical determinations

The blood samples were drawn in standard conditions, so that, except for diabetics using insulin, the subjects were asked to fast after 10 p.m. (at least 11 hours) the previous night and not to urinate for at least 6 hours prior to coming to the examination. During the examination smoking, eating and drinking as well as physical exertion were to be avoided.

On the sitting subject the sample was drawn from the brachial vein using a minimal stasis. The skin was cleaned with a 70% ethanol-water mixture. The blood was drawn by a disposable needle directly into tubes for serum, heparin plasma and EDTA samples. Samples were drawn between 9 o'clock a.m. and 2 o'clock p.m.

After the blood had clotted (1–2 hours) serum was separated by a disposable pipette into small plastic tubes and the samples were deep frozen. The heparin plasma was separated after centrifugation about half an hour after the sample was drawn. The plasma was deep frozen (-20 °C).

The EDTA tube was held in the mixer until hematocrit had been determined.

The frozen samples were sent as cold transport to the Central laboratory in Turku, where they were kept frozen at -20 °C until analyses.

Determinations on all subjects

On all samples the following determinations were carried out: serum total cholesterol, HDL-cholesterol, triglycerides and gammaglutamyltransferase, plasma fasting glucose and creatinine and, from whole blood, hematocrit. In addition, many other determinations were carried out to provide reference values. The latter are documented in a separate publication (Aromaa et al. 1989a) and they are listed in Table 14. The cholesterol determinations were carried out by a modification of the Liebermann-Burchard method without serum blank subtraction (Carr and Dekter 1956). In the HDL-cholesterol determination LDL and VLDL were precipitated by Mg-dextranesulphate (Kostner 1976, Finley et al. 1978) and from the supernatant HDL was determined as in the total cholesterol method.

The method for triglyceride determination was completely enzymatic (Boehringer, Mannheim R) (Wahlefeld 1974). The proportion of free glycerol was not subtracted.

To determine plasma glucose a commercial glucose oxidase method was used (Boehringer, Mannheim R) (Werner et al. 1970).

A kinetic modification of the picric acid method was used to determine plasma creatinine (Bartels et al. 1972, Helger et al 1974).

Gammaglutamyltransferase was determined kinetically by measuring in a glycylbuffer at pH 8.2 the amount of p-nitroaniline set free from gamma-glutamyl-p-nitroanilide. (Szasz 1969, Rosalki and Tarlow 1974).

Hematocrit was determined from the EDTA blood sample. The microcapillaries were centrifuged for 5 minutes at a speed of 12,500 rpm (Adams Autocrit Centrifuge ser. No AD 1601).

Thyroxine (T4) was determined radio immunologically using a commercial kit of Lääke Oy.

The rheumatoid factor (Latex and Waaler-Rose) determination was carried out in the laboratory of the National Public Health Institute (Aho et al 1988, Aho et al 1989, Heliövaara et al. 1995).

Determinations on part of the subjects

Serum uric acid was determined in a random sample of 20% of subjects examined in the screening phase. It was also determined in all users of diuretics and control subjects, and other determinations were carried out in this group (Table 14).

Serum uric acid was determined by the uricase-/catalase method (Kageyama 1971, Thefeld et al. 1973). The reagents were commercial kits (Boehringer, Mannheim, R). Plasma potassium and sodium were determined by flame photometry (Corning Flame Photometer 430). The instrument automatically dilutes the sample to 1:200. The internal standard was lithium.

In one of four subjects lipoproteins were determined by ultracentrifuge in the scientific laboratory of the third clinic of internal medicine. Fractionation by ultracentrifuge (Havel et al. 1955) was carried out by Beckmann-Spinco L 50. From each fraction (VLDL, LDL, HDL) and the serum sample prior to centrifugation cholesterol was determined by an enzymatic method (Röschlau et al. 1974) and triglycerides with Technicon AutoAnalyzer by a modification of the Kessler and Lederer (1966) method. In addition, when possible apoprotein A 1 and A 2 determinations were carried out. This determination was done by the immunodiffusion method.

In users of digitalis serum digoxin concentration was determined. These analyses were carried out in the department of biomedicine of Turku university (Smith et al. 1969).

Table 14. Other determinations, measurements and studies on subsamples (the numbers relate to the 8,000-subject sample)¹.

	Sample
Validation of screening	One out of five since Äänekoski
Lipoproteins	One out of four
Urine trace elements and minerals	One out of four aged 30–59
Hand X-ray	One out of five and those screening positive for musculoskeletal diseases
Diuretics	All using diuretics and controls
Claudication	Subjects with symptoms and controls
Digitalis	Digitalis users and controls
IgA, IgG, and IgM rheumatoid factors	Dg rheumatoid arthritis, raised Waaler-Rose and controls
Clotting factors	Three communities
Fatty acids	Four communities
Saliva study	Three towns

¹)The biochemical methods in the Table: Urate: uricase/catalase (Kageyama 1971, Thefeld et al. 1973); Plasma potassium and sodium: flame photometry (Corning Flame Photometer 430); apoprotein A1 and A2: immunodiffusion method (Cheung and Albers 1977); T3, TSH, T3U: radio-immunological method using standard kits (T3-Lääke Oy, TSH – Corning, T3U – Amersham); TIBC, iron and UIBC; Digitalis (digoxin and digitoxin): radio-immunological method (Smith et al. 1969, Impivaara 1986).

Later e.g. the following determinations have been performed on stored serum samples:

- Vitamin D; the concentration of serum 25-hydroxy-D-vitamin was determined radio-immunologically (RIA, DiaSorin, Stillwater, Minnesota) (Mattila et al. 2007, Knekt et al. 2010).
- Sensitive CRP.
- Cotinine and thiocyanate; the serum cotinine concentration was determined radio-immunologically (Nicotine Metabolite radioimmunoassay: Diagnostic Products Corporation, Los Angeles, USA) and the serum thiocyanate concentration color metrically (Korpilähde et al. 2004, Vasankari et al. 2011).
- Serum insulin was determined by a modification of Herbert's immunological method (Microparticle enzyme immunoassay, insulin kit; Abbott Laboratories, Dainabot, Tokyo, Japan).
- The celiac endomycin and transglutamin antibodies were analyzed in the research group of Markku Mäki in Tampere (Lohi et al. 2007).

Laboratory quality assurance

In internal quality control of the laboratory commercial control sera and an own serum pool stored in gaseous phase of liquid nitrogen were used. Also, determinations on repeat samples of the subjects were repeated. In each analysis series there were 2–4 control sera of different concentrations. To assess reliability, the determinations were carried out again on a 10% sample of the subjects on the same or the following day.

In external quality control sera from the local control circle (Kliinisen kemian laadunvalvonta Oy) were used. The laboratory also participated in the quality control program of the WHO Lipid Reference Laboratory (Prague). The Prague laboratory, in turn, participated to the quality control program of USPHS center (Atlanta) (Grafnetter 1977).

Clinical examination

The aim of the clinical phase of the examination was to verify the presence and treatment situation of cardiovascular and respiratory diseases, musculoskeletal diseases and mental disorders. These examination methods have been described in detail in separate methodological publications (Aromaa et al. 1985, Lehtinen et al. 1985, Sievers et al. 1985, Aromaa et al. 1989a).

Clinical examinations were carried out by seven specially trained doctors. They were trained by cardiologists and internists, and rheumatologists. First, the examinations and measurements of the program of the clinical phase were carried out, and the examining doctor had access to all questionnaires and interviews (except the home interview) and measurements, as well as previous statements by doctors, summaries of records, X-ray pictures and assessments and blood pressure cards. The doctor's examination lasted some 15–30 minutes.

Usually the examination started with interviews and the first of these was a treatment change interview. All cardiovascular and respiratory examinations were carried out before the joint functioning and muscle strength examinations. The round of examinations ended with the doctor's examination.

In the assessment the doctor formed an opinion as follows:

- Assessment of disease history
- Physical examination
- Functional class
- Diagnostic assessments and estimate of need for care and surveillance by diagnosis.

When assessing the disease history, the doctor formed an opinion on which cardiovascular and respiratory diseases the subject had or had had. The assessment considered the following diseases:

1. Myocardial infarction
2. Angina pectoris
3. Congenital heart disease
4. Acquired valve disease
5. Rheumatic fever
6. Hypertension
7. Heart failure
8. Rhythm disturbance
9. Arterial disease in the lower limbs
10. Cerebrovascular accident
11. Other cardiovascular disease
12. Bronchial asthma
13. Chronic bronchitis
14. Pulmonary emphysema
15. Pulmonary tuberculosis
16. Other chronic respiratory disease

The disease history was classified as follows:

0. No disease history
1. Possible disease history
2. Definite disease history.

Whilst assessing the disease history the doctor also recorded whether the subject was being treated by a doctor for that disease.

Physical examination

The examination was structured and comprised e.g. listening to heart sounds and the lungs as well as observing different joint functions. The functional class was recorded according to NYHA.

Screening of cardiovascular and respiratory diseases to the follow-up examination

The aim was to obtain a comprehensive picture of the occurrence and consequences of cardiovascular and respiratory diseases. The screening for the follow-up examination was a comprehensive entity comprising conditions based on disease history, symptoms, and physical and biochemical findings. The conditions were the following:

Symptom interview

- Typical angina pectoris or severe chest pain attack
- Typical severe or mild claudication
- Dyspnea at rest or severe strain related dyspnea
- Chronic morning phlegm, day phlegm or all-day phlegm.

Baseline questionnaire

- Doctor diagnosed myocardial infarction, coronary heart disease, heart failure, enlarged heart, other organic heart disease, cerebrovascular accident, asthma or digitalis use during the past three months.
- Doctor diagnosed lung disease and intermediately severe strain related dyspnea.

First blood pressure measurement

- (Systolic ≥ 180 mmHg or diastolic ≥ 100 mmHg) and age ≥ 45 years or
- (Systolic ≥ 160 mmHg or diastolic ≥ 96 mmHg) and age < 45 years.

Chest X-ray findings

- Enlarged heart, cor pulmonale, enlarged left atrium, calcified valve, lung changes in heart disease or recommendation by radiologist: follow-up recommended or essential.

ECG

- Atrial fibrillation or flutter or other ectopic rhythm
- Malignant extra beats
- II-III-degree AV-block or signs of malfunctioning of the sinus node
- Complete left or right bundle branch block
- Considerable left ventricular hypertrophy
- Right ventricular hypertrophy
- Clear cut signs of old infarction
- Finding suggesting recent myocardial damage or strong ischemia.

Spirometry

Either:

- Forced maximal vital capacity (FVC),
- Forced expiratory volume in one second (FEV1) or
- Peak expiratory flow (PEF) below 80% of the reference value.

Cardiovascular and respiratory disease examination

Depending on the screening findings the following examinations (Aromaa et al. 1985) were carried out:

- Clinical doctor's examination
- Measurement of lower and upper limb blood pressure by the Doppler technique
- Spirometry
- Repeat symptom interview
- Digitalis interview and serum digitalis determination
- Asthma interview
- Repeat measurements of blood pressure
- Repeat registration of ECG.

Subjects with missing results were also invited to the follow-up examination.

Process of the clinical examination

The clinical phase of the examination was carried out about 3.5 months after the screening examination, and the subjects were invited by personal letter. According to the screening findings a personal program was designed for each subject. To assess reliability and biological variation of the measurements a 20% sample was invited to the clinical examination. Many of these subjects had also another reason for the invitation. The follow-up program depended on whether the findings were suggestive of cardiovascular and respiratory diseases alone or whether they suggested other disease groups as well (Sievers et al. 1985, Lehtinen et al. 1985). The examinations were carried out between 8 o'clock a.m. and 5 o'clock p.m. and to examine one person took about 1.5–3 hours, but it could last up to 5 hours.

The examination began by interviews such as the changes of treatment interview and disease and symptom specific interviews. After the interviews the subjects provided a urine sample, and then blood pressure was measured and ECG was recorded. All measurements mentioned were carried out before the joint function tests and the muscle strength measurements.

Next, the chest X-ray was taken, and blood samples were drawn.

Asthma interview

The interview concerned asthma symptoms and detection of asthma, and it was carried out in the follow-up examination on all who had reported that a doctor had diagnosed asthma.

Blood pressure measurement in the upper and lower extremities

Measurement of distal blood pressure is a simple method for examining the arterial circulation in the lower extremities (Liebermann 1977, Härkönen 1979). The Doppler ultrasound technique well identifies the pulse in the brachial and ankle arteries (a. brachialis and a. tibialis posterior) and allows exact measurement of the systolic pressure at which flow commences. If there is an obstruction in arterial tree of the lower extremities the blood pressure ratio (arm/ankle) decreases below one and the decrease is the larger the more severe the obstruction is (Johnston and Kakkar 1976). A blood pressure ratio below 0.90 is with high probability an indication of insufficiency of arterial blood flow in the lower extremities (Lieberman 1977).

The same observers who measured blood pressure proper carried out these measurements by using a regular mercury manometer and the Medsonics BF 4A Doppler instrument. The pressure measurements were carried out on the lying down subject. First, pressure was measured from both ankles (a. tibialis posterior) and then from the arm (a. brachialis). The cuff was fastened proximally to the malleoli. Pressure was recorded at 2 mmHg accuracy.

After the Mini-Finland survey De Backer and co-workers (1979) have published their experience on using the method in population studies. When studying men aged 40–55 and using the threshold 0.90 for the blood pressure ratio, they showed that the prevalence of symptomatic claudication was fourfold in subjects below that threshold.

The clinical study of cardiovascular and respiratory diseases

There were altogether seven specially trained doctors. Cardiologists and internists were responsible for training, and rheumatologists for training for the musculoskeletal examination. First, the examinations of the clinical phase were carried out. The doctors had access to all questionnaire data, interviews (except the home interview) and examinations, as well as previous doctor statements, summaries of hospital records, X-rays and statements, and blood pressure cards. This part of the doctor's examination usually took 15 minutes.

The task of the doctor was to

- Assess the disease history
- Recognize and record the central physical findings related to the cardiovascular, respiratory and musculoskeletal system
- Combine all available information to set the diagnostic assessments, and to assess by disease the need for care and control as well as adequacy of the care received
- Assess the subject's functional class according to NYHA.

In addition, the doctor assessed the subject's work ability and functioning, diseases limiting them as well as need for care and adequacy of care received.

In the assessment the doctor took dealt with:

- the disease history
- the physical examination
- the functional class and
- the diagnoses and need for treatment and control by diagnosis.

The disease history was classified as follows:

0. no disease history
1. possible disease history
2. definite disease history.

In assessing the disease history, the doctor considered whether the subject was being treated or monitored by a doctor for the disease in question.

The physical examination

The examination was carried out in a standard fashion and the doctor listened to the lungs and the heart sounds and observed various functions. The functional class was recorded according to NYHA. In the thorough examination of the musculoskeletal system also functional limitations were recorded.

The diagnostic assessment

Toward the end of the clinical examination the doctor carried out a diagnostic assessment, and each diagnosis was classified as definite or possible. The doctor also assessed whether the diagnosis was new or had been previously made. The doctor also assessed by disease whether the subject's treatment was adequate or not.

The diagnostic criteria and classification has been defined in the methodology report (Aromaa et al. 1985) and they were:

1. Myocardial infarction
2. Angina pectoris
3. Congenital heart disease
4. Syphilitic valvular disease
5. Rheumatic valvular disease
6. Other valvular disease
7. Hypertension
8. Heart failure
9. Hypertensive heart disease
10. Cor pulmonale
11. Rhythm disturbance
12. Arterial diseases of the lower limbs
13. Cerebrovascular disease
14. Other cardiovascular disease.

The diagnostic classes for respiratory diseases were:

1. Asthma
2. Chronic bronchitis
3. Pulmonary emphysema
4. Pulmonary tuberculosis
5. Other chronic respiratory disease.

All doctors carrying out clinical examinations had been working with the Mini-Finland survey and the development of clinical methods since the beginning. The actions were repeated and clarified in meetings of the doctors. The validity of the field doctors' conclusions was assessed in the in-depth study by re-examining 396 subjects who had been evaluated in the follow-up examination. Validity and reliability was also assessed with a standard material. This material comprised subjects participating in the follow-up examination proper. The material was enriched with the results of 57 persons participating in the follow-up examination proper. Such assessment rounds were carried out both in the autumn of 1979, and immediately after the end of the field examinations in spring 1980.

The disease history was classified as follows:

0. No disease history
1. Possible disease history
2. Definite disease history.

When assessing the history, the doctor assessed whether the subject was being treated or monitored by a doctor for the disease in question or not.

Musculoskeletal diseases

The special aims of the examination for musculoskeletal diseases was to

1. describe the occurrence of the most important musculoskeletal diseases, their severity and consequences as well as need for care and adequacy of the care received
2. study risk factors for the diseases
3. develop methods for study and health monitoring
4. assess the relationship of different musculoskeletal syndromes to other morbidity band
5. assess the relationship between musculoskeletal diseases and limitations of work ability and functioning.

The primary study topics of musculoskeletal diseases were:

1. Low back pain
2. Neck pain
3. Osteoarthritis of the hip and knee and hand joints
4. Diseases of the shoulder joints
5. Inflammatory rheumatic diseases
6. Deformities of the foot
7. Functional limitations
8. Spondylosis and hyperostosis.

Of the study topics low back pain, neck pain, shoulder joint diseases, osteoarthritis of the hip, knee and hand as well as foot deformities and thoracic spondylosis are prevalent (Julkunen et al. 1981, Kärkkäinen 1985, Heliövaara et al. 1993a, Mäkelä et al. 1993, Haara et al. 2003, Haara et al. 2006).

Methods for studying musculoskeletal diseases

The development of the musculoskeletal interview was based on the Dutch EPOZ-study, its questionnaire and directions (Valkenburg 1975, Valkenburg 1976, Valkenburg 1977).

By study object the time frame was as follows:

- a) Low back pain: within a month – for 5 years – during life time (incidence, repeatability, duration)
- b) Sciatica: during 5 years – during one month – during life time (incidence, repeatability, duration)
- c) Neck-, shoulder pain: during last month – 5 years (duration)
- d) Joint inflammation: during life time
- e) Tendovaginitis: during life time
- f) Hip joints: during past month
- g) Knee joints: during past month
- h) Foot: at examination
- i) Pain, ache, tenderness in different joints: during past month – 5 years
- j) Stiffness when waking up: at examination – during past month – for 5 years.

In addition to interviews there were examinations such as

- joint function test and measurement of muscular functioning
- chest X-ray (spondylosis and hyperostosis)
- serological determinations.

The location was identified with the aid of a manikin (Figure 10).

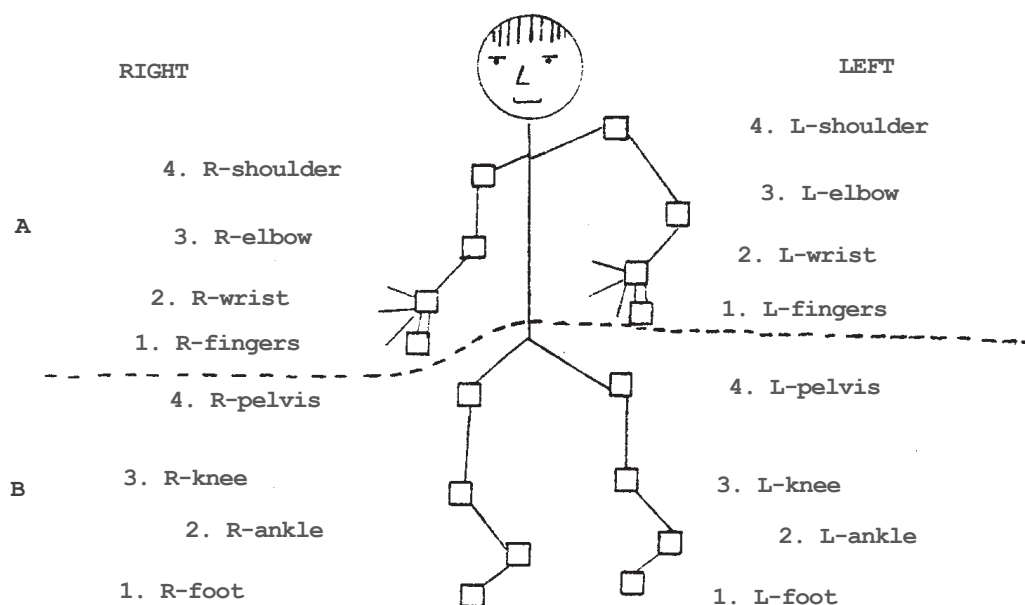


Figure 10. Diagram of a human.

Screening for the clinical musculoskeletal examination

Persons receiving a work disability pension because of a musculoskeletal disease, reporting a back injury, back pain, sciatica, neck-shoulder pain, ache or mobility limitation in the joints of the extremities, joint inflammation, a posture abnormality in the feet limiting walking, congenital hip deformity, walking difficulty due to the hip, walking difficulty due to the knee, back or joint operation, work absence due to back or joint disease or functioning limitations in the joint function test or weakness in the extremities or squatting.

Contents of the clinical musculoskeletal examination

Usually the examination began with interviews, and the first of them was the treatment change interview. All cardiovascular and respiratory examinations were carried out prior to the joint function tests and muscle strength tests. The round of examinations ended with the doctor's clinical examination.

The treatment and handicap interview for screening-positive persons was directed as follows: foot, knee, neck, shoulder, lower back comprising sciatica, wrist and hand. Comparable questions were also put concerning other joints, muscles, and tendons. First, the questions dealt with pain within the past month by study topic. Also, the interview asked whether the subject had seen a doctor and when last. Next, it inquired about proposed treatment and treatment received. Also, additional information on surgical operations of the back and joints was recorded.

The doctor's examination of musculoskeletal diseases

The purpose of the doctor's examination was to

1. assess the previous disease history
2. record abnormal findings
3. set the diagnoses

4. assess the certainty of the diagnoses
5. assess the need and adequacy of treatment and measures
6. assess mobility, physical performance, work ability and other functioning
7. record person level assessments of handicapping diseases, and need for care and monitoring.

The doctors' examinations were carried out by Mobile Clinic doctors trained for the musculoskeletal examination in The Hospital for Rheumatic diseases directed by a rheumatologist and in the SII Research Centre under the direction of orthopedists and physiatrists. The training comprised demonstrations, examining patients with ample findings and parallel examinations. The instructions were finalized based on the training experiences.

The examinations were performed by seven doctors. First, the measurements of the clinical examination were carried out and the doctors had access to all questionnaire, interview and measurement data as well as previous doctors' statements, summaries of hospital records, X-ray films and interpretations. This part of the doctor's examination usually took 15 minutes. The examination was started with interviews. All cardiovascular disease and respiratory disease examinations were carried out before the joint function tests and the muscle strength tests.

Disease history

The assessment was based on the screening examination and the treatment and handicap interview. All other documents on previous diseases (X-ray films, medicines, doctors' statements) were available. Assessments concerning the following diseases were made:

1. Polyarthritis
2. Monoarthritis
3. Spondylarthritis
4. Osteoarthritis of the hip, knee and hand joints osteoarthritis
5. Gout
6. Lack of a limb or its part
7. Neck syndrome
8. Low back syndrome
9. Shoulder syndrome
10. Foot deformity
11. Other defined musculoskeletal disease
12. Other disease of relevance to musculoskeletal diseases.

Presence and treatment of each syndrome was recorded as follows: no disease history, possible disease history, definite disease history, symptoms within the past month, surveillance by a doctor.

Physical examination

In addition to the methods of the Dutch EPOZ-project (Valkenburg 1975, Valkenburg 1976, Valkenburg 1977), the reference values of the American Orthopedic Society (Solonen and Nummi 1971) and established clinical methods were utilized.

The musculoskeletal organs were divided into the following areas: hand, upper extremity, spine, lower extremity and foot. The mobility limitations were divided into four classes. Palpation tenderness and mobility tenderness of the joints was classified into two classes. Mobility limitation was usually assessed from active movement, and the severity of the limitation was recorded as the maximum limitation in that group of joints. Proceeding joint by joint the findings recorded were: swelling, mobility limitation, mobility

tenderness and palpation tenderness as well as the core special findings and deformities. Special findings were e.g. contracture of Dupuytren, Heberden's nodes, tenosynovitis of fingers and tendons, forearm nodes, swelling of the Achilles tendon, hammertoes, hallux valgus and flattened foot valve.

Diagnostic assessment

The doctor combined information from the disease history and the physical examination, and his conclusions concerned the presence of a diagnosis, its certainty and treatment situation (Sievers et al 1985, Heliövaara et al 1993a). Finally, the doctor assessed the subject's mobility, functioning of the upper extremities, work ability (physical strenuousness of work) and other functioning. The doctor's examination took 15–30 minutes.

The diagnostic criteria of musculoskeletal diseases have been described in the methodology report (Sievers et al. 1985) and the summary report (Heliövaara et al 1993a). The same criteria were applied in the Health 2000 survey.

Hand X-ray examination

A hand-X-ray was taken in the follow-up examination on all screening positive for the musculoskeletal screen. Furthermore, a 20% repeat population was examined, and, in the PA-projection, a picture of both hands was taken. The instrument was Monodor and the scanning values were 85 kV, 45 mAs, FFD 70 cm, focus size 1.4 x 1.4 mm and exposure 3 seconds.

The interpretation of the films in regard of osteoarthritis was based on the classification by Kellgren and Lawrence. In regard of rheumatoid arthritis, the classification of Larsen (Atlas of Standard Radiographs 1965, Larsen et al. 1975) was used.

Study methods for mental health disorders

The methods for the mental health survey have been described in a separate publication (Lehtinen et al. 1985). The baseline results can be found in the book Lehtinen et al. (1991).

The aim of the survey on mental disorders was to assess the population's state of mental health, associations between mental and physical illnesses, developing survey methods, and identifying possible causal factors.

The main topics were

1. Mental disorders
2. Need for psychiatric treatment and attention
3. Limitation of work ability and functioning
4. Mental performance
5. Mental symptoms
6. Factors promoting or reducing mental health.

The study topics were defined as follows:

The topics were all those mental disorders that were named in the International Classification of Diseases. Thus, information was gathered on, amongst others, the following conditions: senile and presenile dementia, schizophrenia, affective psychosis, other psychosis, anxiety neurosis, phobic neurosis, obsessive neurosis, neurotic depression, other neurosis, personality disorder, alcoholism, other intoxicant or drug problem, other psychiatric diagnosis, oligophrenia.

A need for psychiatric treatment or attention was recorded if the subject had a mental disorder which could be influenced by health care means.

Limitation of work ability or functioning was diagnosed when it was due to mental limitation of functioning.

Mental performance was defined to mean the subject's ability to use his/her mental capacity. Mental symptoms were the subject's abnormal perception, abnormal way to react, or abnormal behavior, which can be signs of pathological mental processes (Leighton 1979).

Symptoms were assessed in three ways:

1. Perceived symptoms (GHQ-36, Goldberg 1972)
2. Assessment scales (somatization (SCL-90, Derogatis et al. 1974), hypochondria, Whiteley index, Pilowsky 1967)
3. Clinical assessment.

Factors promoting and weakening mental health

Factors promoting mental health are the subject's resources (individual, human relations, social). The following means were used to study factors promoting and weakening mental health:

- Registers and archives
- Key personalities in the community
- Questionnaires
- Psychological tests and examinations
- Structured and standardized interviews.

The main aim of the baseline examination was to identify by screening persons possibly suffering from a mental health disorder. The disorders were made more explicit by the psychiatric interview (PSE, Wing et al. 1974), in part during the baseline and in part during the follow-up examination.

Interviews and questionnaires

The interview was developed based on earlier Finnish interviews (1964, 1968 and 1976) on social and health security (Purola et al. 1967, Purola et al. 1971, Nyman and Raitasalo 1978). A brief mental health part was added.

In the baseline questionnaire the following core aspects important to mental health were inquired:

- doctor diagnosed mental disorders
- hospital care
- medicines
- capacity to manage mental tasks
- capacity to manage everyday activities
- working conditions
- leisure activities and hobbies
- use of alcohol.

The baseline questionnaire covered all disease groups in question in the survey. However, previous studies have shown that part of the subjects does not reply to questions concerning mental health (Commission on Chronic Illness 1957, Purola et al. 1971, Lehtinen 1975).

Perceived mental health symptoms and disorders (symptom questionnaire)

The questionnaire had three goals:

- to act as a screening tool for mental symptoms
- to describe the occurrence of a tendency for somatization and hypochondria
- to investigate perceived mental health disorders and associated need for care and disability.

Many methods were needed:

- The screening instrument General Health Questionnaire (Goldberg 1972)
- The method to measure somatic pressure symptoms was the SCL scale (Derogatis et al. 1973, Derogatis et al. 1974)
- Hypochondria was measured by the WI-scale (Pilowsky 1967)
- Direct questions were used to assess mental disorders, need for care as well as limitations of work ability and functioning.

Mental symptoms (GHQ 36)

GHQ comprises questions in the following areas:

- general health
- sleeping disorders
- factors related to work ability and functioning
- preparedness for human relations
- mild pressure symptoms, disorders of self-esteem
- clinical stress symptoms (depression, anxiety).

The reply alternatives dealt with recent change and the alternatives were

1. Improved
2. Remained the same
3. Become worse than usual
4. Become much worse than usual

General Health Questionnaire

The 36-item version of GHQ was selected for the Mini-Finland survey. The replies were scored so that the reply alternatives 1 and 2 were given 0 points and alternatives 3 and 4 one point. The utility of the GHQ-method could be evaluated based on previous studies (Goldberg 1972, Finlay-Jones and Murphy 1979, Nott and Cutts 1982). The GHQ-questionnaire has been evaluated more extensively than any other questionnaire measuring mental disturbance. However, the qualitative description of the disorder is limited by the lack of validated sub-scales. The parts of the GHQ are mainly concentrated on depressive symptoms and disturbance of mental functioning.

Somatic pressure symptoms

The 13 items by Derogatis and coworkers were selected for this study. They mainly measured feelings due to imbalance of the vegetative system. They are such as different pains, lack of strength and dizziness, hot and cold waves. These items had been selected from a large number of questions representing the area, and the scale is as good as other short assessment methods.

Hypochondriasis

The hypochondria is a disorder which is characterized by worried observation of one's own bodily functions and unrealistic interpretation of quite common physical symptoms and feelings as abnormal. The person may strongly believe that he/she is severely ill or feels fear of a severe illness.

Since there was no satisfactory measure of hypochondria at the time when the Mini-Finland survey was being planned, the Whiteley-index by Pilowsky (1967) was adopted. It comprises three types of parts: accentuated observation of one's bodily functions, fear and anxiety due to diseases and their threat, being convinced of suffering from a severe disease although the opposite is assured. The sum score of the Whiteley index is 56, and in the person level summary subjects scoring 14 and above were assessed as needing medical attention.

Questionnaire on mental disorders

Although this topic was touched upon in the health interview and the baseline questionnaire, more detailed information was needed especially on perceived mental disorders, perceived need for psychiatric treatment, mental disability and use of mental health services. Therefore, questions on these topics were added at the end of the symptom questionnaire.

About the use of services, the questions concerned visits to mental health offices, to private practices of psychiatrists, visits to private practices of other doctors and psychologists. In addition, there were questions about perceived mental health disorders or their presence, their duration, their impact on work ability and other functioning, and perceived need for psychiatric care and its quality.

Friendship and family relationship questionnaire

A questionnaire was drafted for assessing the subjects' close personal relationships (Lehtinen et al. 1985).

Assessing mental and psychomotor capacity

Mental capacity

In a group test there were 3–10 persons at a time and it comprised tests on reasoning, memorizing, learning and concentration. The group test lasted 30 minutes and tests were carried out on memory, learning capacity, concentration as well as reasoning, and flexibility of thinking.

An effort was made to ensure validity by training the observers, standardizing the instructions and forms, using recorded instructions and panels of examples and using small enough groups.

Test of concentration (NJEVD)

The test comprised of capital letters placed in 32 rows on an A4 size sheet. The subject was asked to delete five specified letters when checking the sheet row by row. This concentration task has been developed by the Swedish Work, Health and Safety organization and it is relatively easy and suitable as a basic task in demanding study designs (Lahtela et al. 1979).

Test of memory and learning capacity

The test was carried out as a word memorizing group test. The stimulus comprised 10 words: lieska, vamma, koti, nähdä, pallo, joskus, reuna, tulo, kaartaa ja hepo (flame, injury, home, see, ball, sometimes, edge, income, bend, horse). The instructions and the words were tape recorded and presented from the tape recorder to the subjects. The subjects listened three times to the word series, and after each time they were expected to write down the memorized words.

The test of reasoning and flexibility of thinking (Cattell-G/II)

Intelligence is the core component of mental performance. Cattell (1960) has presented the generally accepted theory of the nature of intelligence. It proposes that there is a flexible and crystallizing component. The methods best assessing the flexible component are reasoning tasks. In this survey the reasoning tests were complemented both in regard of memorizing and concentrating. Thus, the individual's mental capacity was examined both by activity related to concentrating ability and flexible memory and reasoning.

Reasoning was tested by the Cattell (1960) G-factor test (2nd version parts 'series' and 'classifications'). The previous had 12 and the latter 14 tasks. In the first component the tasks related to realizing the change between the figures, in the second recognizing joint features by observing similarities and dissimilarities. Roughly speaking the tests measure the analytical and synthetic components of reasoning.

The test was carried out as a group test and its instructions were presented by a tape recorder. The subjects received precise instructions about the principles of the tasks. They recorded on a paper form the alternatives they thought to be correct. Three minutes were available for the first and four for the second task.

Cattell's G-test is accepted as valid, reliable and independent from the culture.

Tests of reaction speed

Reaction speed is the time between the stimulus and the response. The implementation of the measurement was based on forced frequency so that the stimuli were issued at random and independently of the subject's actions. Also, disturbance by noise was added to the test.

In the front panel of the instrument there were three 10 W bulbs (diameter 20 mm). The distance between the bulbs was 123 mm and their height from the desk was 155 mm. The bulbs were approximately 20 cm below the subject's eye level and the angle was about 20 degrees, when the viewing distance was about 70 cm. A timing device built in to the instrument triggered the appearance of the stimuli according to a computer program. Reaction times and the number of correct and false reactions were recorded into the registers of the instrument. During the test the subject was wearing headphones which transmitted from the tape recorder once a minute altogether three noise periods. The noise was so called white interrupted noise and its mean volume was 80 dB(A). During the first minute there was no noise.

Later, severe problems in functioning and the records produced were detected. Therefore, it was not possible to use the measurement results as such (Lahtela et al. 1985, Lahtela et al. 1986).

The clinical examination of mental disorders

Subjects screened for possible disorder were invited to the mental health clinical examination. The clinical method was the PSE interview. Part of these interviews were carried out already during the screening examination.

The screening conditions were the following:

- Disability pension (permanent or temporary) due to a mental disorder (diagnoses 290.0–309.9) according to the SII disability pension register.
- According to the SII register entitled to fully reimbursed medicines due to a mental disorder. The diseases in question were schizophrenia, affective mental disorder, < mental disorder related to menopause, illusion-mindedness, dementia of old age, presenile dementia, other mental disorders
- The subject in the baseline questionnaire reported that a doctor had diagnosed either a milder mental disorder (mild depression, neurosis, weak nerves) or a severe mental disease (severe depression, psychosis).
- At least 5 points in the GHQ.
- An affirmative reply to at least one of the questions concerning use of mental health services, if the visit(s) were due to a nervous or a mental disorder.
- An affirmative reply to the questions in the symptom questionnaire dealing with the presence or continuousness of a nervous or mental disorder.

The screen picked up about one third of the subjects. It was estimated that all cases were identified and that there were few false negative cases. However, this method cannot pick up subjects with a personality disorder or those with a drug problem. Furthermore, oligophrenia was not noted.

Present State Examination (PSE)

The purpose of the PSE-method is to standardize how psychiatric symptoms are examined and classified. The PSE has been developed in London in the social psychiatric unit of the MRC institute for Psychiatry (Wing et al. 1967, Wing et al. 1977a). When the Mini-Finland survey commenced there was the 9th version of PSE and its handbooks (Wing et al. 1974). According to the handbook the purpose is to help in structuring the clinical interview.

The so called short version intended to be used in population surveys, was adopted for the Mini-Finland survey (Wing et al. 1974, Wing et al. 1977b). The short version lacks most of the items concerning psychotic disturbances.

Initially PSE was intended to be used by psychiatrists, but it has been proven to be suitable also for use by persons with other training (Cooper et al. 1977, Wing et al. 1977a).

To ensure that the method was applied correctly in the Mini-Finland survey one psychologist of the mental health working group in autumn 1977 visited Professor J. Cooper's institute in Nottingham and received a PSE training lasting one week. He in turn trained four other members of the working group.

Interview and assessment

The method is a list of symptoms which can be crossed, and each symptom or group of symptoms and their assessment has been defined in the instructions (Wing et al. 1974). Each key question and its follow-up questions represent one symptom, but the interview can proceed flexibly. The intention is that the symptom is assessed as present or absent. Each symptom was classified by using five classes dealing with the presence of the symptoms during the past month:

0. The researcher is sure that there has not been any important degree of the symptom
1. The symptom is at least moderate, or if severe, not more than half of the month in question
2. The symptom has been severe for more than half of the month in question
8. The researcher is not sure, it is not possible to exclude the possibility of the symptom
9. Not classified.

The short PSE interview comprised 48 symptoms which were divided into 13 groups as follows:

- worrying
- tension
- autonomic anxiety
- thinking and concentration
- depressiveness
- one self and others
- appetite, sleep, slowing down, libido
- irritability
- raised mood and hurrying thought
- obsessions
- derealization and depersonalization
- other disturbances of realization and observation
- observation and its determinants.

Finally, the interviewer set his/her own diagnostic assessment and classified the strength of the subject's disorder in relation to work ability and functioning.

The results were classified using the Catego-programme developed by the authors of the PSE (Wing et al 1974). The program takes into consideration 140 symptoms of the PSE. In the next phase the symptoms were grouped into up to 35 syndromes. Next, 48 so called descriptive categories are created. A subject may have 1–6 of these. The ninth phase produces for each subject one class corresponding to a clinical diagnosis. The long version of the PSE has 50 of them and the short one 21.

Since also the severity of the diagnosis must be taken into consideration in population studies, the additional program Index of Definition (ID) was applied (Wing et al. 1977b, Wing 1980, Wing et al. 1978) was applied. ID considers the total PSE score, the type of symptoms and their severity as well as their combinations. The result comprises eight levels of certainty, and the levels 6–8 imply an increasing certainty that the symptoms can be classified into one or the other of the usual categories of psychosis or neurosis.

Earlier studies suggest that, in England, the agreement of PSE findings and clinical diagnoses is good. However, this does not necessarily hold in other countries, since there are differences in the diagnostic and treatment practices. Our working group believes that the PSE-diagnostics has stricter criteria than the criteria of previous Finnish population surveys.

The person level summary of mental disorders

The person level summary was created using many different data sources in the following hierarchical order:

1. A psychiatric institution diagnosis
2. From the disability pension register a psychiatric main diagnosis
3. From the disability pension register other than main psychiatric diagnosis
4. From specially reimbursed medicines register any of the following diseases (and medicine code in parentheses): ICD-8-code [12 (295.0–295.9), 13 (296.0–296.9), 14 (297.1), 15 (297.0), 16 (290.0), 17 (290.1), 18 (291.294, 298–299), 19 (310–315)]
5. Other hospital diagnosis
6. Field doctor's assessment
7. Diagnosis by the Catego-ID-program (1,2 schizophrenia; 3,4 paranoid psychosis; 5,6 other psychosis; 9,10 depressive psychosis; 11 retarded depression; 12,13 neurotic depression; 14,15 anxiety depression; 16,17 obsessive neurosis; 18,19 other neurosis; 21 phobic neurosis; 20 no disorder)
8. The PSE interviewer's diagnostic assessment (0 = no disorder; 1 = neurotic disorder; 2 = borderline disorder; 3 = psychotic disorder). In addition, a person who was assessed by the interviewer to need treatment, was classified as a psychiatric case.

Data from different sources were combined and contradictions were removed. In addition, a definite diagnosis always was given preference over probable and psychosis over neurosis. Next, the certainty and duration of the disturbance was assessed as well as need for treatment, treatment situation and mental work ability and functioning. The methods have been described in the methodology report on mental health (Lehtinen et al 1985).

Summary assessments

Finally, the results of the mental health examinations were combined with other results. In the person level summary of diseases causing limitations all mental disorders were recorded, if there was at least mildly reduced mental work ability and functioning. Next, a summary of previous long-term or permanent need for care and the treatment situation.

Clinical summary assessments

Finally, the observations and assessments were recorded on disease group specific forms prepared separately for cardiovascular and respiratory diseases, musculoskeletal diseases, mental disorders and other diseases.

In the summary assessment the doctor recorded whether 15 cardiovascular diseases and 5 respiratory diseases were present (diagnosis possible or certain) and the need for care due to each disease (no, yes), treatment situation (no, inadequate, suggested but not realized) and need for treatment (general practitioner, specialist, surveillance of the finding). The cardiovascular diagnoses were myocardial infarction, angina pectoris, congenital heart disease, syphilitic valve disease, rheumatic valve disease, hypertension, heart failure, cor pulmonale, rhythm disturbance, arterial disease of the lower extremities, cerebrovascular disease and other. The respiratory diseases were asthma, chronic bronchitis, emphysema lung tuberculosis, and other.

The summary assessment of musculoskeletal disease dealt with almost 20 disorders: polyarthritis (rheumatoid arthritis, psoriatic arthritis, Morbus Reiter, other), monoarthritis (and its location), spondylarthritis, osteoarthritis of hip, knee and hand joints, gout, amputation of a limb or its part, neck syndrome (cervical syndrome, muscular, arthrosis), back syndrome (prolapsed disc, muscular, spondylarthritis, sciatica, spondylolisthesis, spondylarthrosis), shoulder disease, foot deformity (hallux valgus, hammer toe, flattened foot), other defined, undefined musculoskeletal pain. For each of these the presence of the diagnosis as well as need for care and treatment situation were assessed. Of mental disorders the diagnoses dementia, schizophrenia, obsessive psychosis, other psychosis, anxiety neurosis, phobic neurosis, obsessive neurosis, neurotic depression, other neurosis, personality disorder, alcoholism, drug dependence and oligophrenia were assessed.

Finally, a summary was created comprising other diseases, work ability and functioning. The listed diagnoses were diabetes, hyperlipidemia, anemia, bacteriuria and renal failure. Next, mobility and functioning of the upper extremities and maximum physical capacity (strenuous physical work, intermittently heavy work, light physical work, sedentary work, none of these) were assessed. The assessment of work ability in the current or the last previous job comprise the classes completely fit for work, work ability slightly decreased, work ability considerably decreased, and unfit for work. The assessment of other functioning was classified as follows: completely functioning – no limitations, slightly decreased functional capacity, considerably decreased functional capacity, almost or completely disabled.

At the end, the doctor assessed disabling diagnoses and recorded the most important ones.

Oral health

The examination of mouth and teeth is described elsewhere (Vehkalahti et al. 1991) and earlier in this book. The most common and most important oral diseases are dental caries and diseases of the gingivae. The aim was to investigate by both an interview and a clinical examination the occurrence of these diseases, need for care and its satisfaction.

In the interview there were questions on dentist visits, condition of the teeth and cleaning the mouth and teeth, as well as equipment used for cleaning. In the baseline examination the mouth was examined by a specialist dental nurse (N=7,190), and in the follow-up phase one out of six was examined by a dentist and a specially trained dental auxiliary together.

In the screening examination the state of the oral mucosae was assessed, and each tooth was examined and caries teeth and filled tooth surfaces were recorded. The state of the gingivae and plaque retentions were also recorded.

Clinical methods

The same clinical measurements were carried out both in the screening and the clinical phases of the examination. The clinical findings were first dictated, and then transcribed whilst the patient was still present.

Detailed written instructions and definitions were prepared for each clinical measurement and determination of need for care.

Oral mucosal changes were assessed using an atlas: its pictures and classification (Pindborg 1973). Of mucosal changes related to use of dental prostheses the following were recorded: stomatitis, fibroma and papilloma. Of other mucosal lesions changes of the tongue, hyperkeratosis and ulcerations were recorded.

A tooth was recorded as being present in the mouth if any part of it was visible or could be felt with an instrument. The identification of a tooth was based on its location and form, about which instructions were given. If a milk tooth was present in the mouth and there was not a corresponding permanent tooth, observations were made on the milk tooth instead of the permanent one. Prostheses replacing lost teeth were recorded as fixed and removable prostheses.

Fillings were recorded by tooth surface, but crowns by tooth.

Caries was recorded by tooth surface. A lesion was recorded as caries if its base was clearly soft and which had grooved enamel walls or softened walls (WHO 1997b). In fissures, approximal surfaces and fossae the probe had to fasten clearly into the lesion or the lesion should otherwise be clearly verifiable. Caries was diagnosed as primary, secondary or root caries. The tooth was recorded as a remnant root if more than half of all vertical surfaces were destroyed. Dissolved fillings and fractured teeth without secondary caries were recorded as need for treatment and not as caries.

Need for treatment was assessed by tooth and taking into consideration occlusion. First, need for fillings was recorded when there was caries, or the filling was incomplete or dissolved or when the filling had

loosened, or the tooth was broken, and secondly if there was a tooth requiring root treatment. There was need for root treatment when close to the tooth there was a fistula or there was soreness on tapping without other reason or earlier clearly located ache and pain. An abrasion was assessed to require root treatment if the pulp could be dimly seen or there was shooting pain in the tooth caused by hot or cold. Wisdom teeth were not assessed to need root treatment. All remnant roots needed extraction, and so did all badly damaged teeth and teeth that could be moved over 3 mm horizontally measured from the incisal tip. Also, symptomatic or partly erupted wisdom teeth and all teeth under removable prostheses needed to be extracted.

The state of the periodontium was recorded by quarter of the mouth. The most severe finding was recorded as the state of each quarter. Gingivitis was recorded when two of its three criteria were observed (reddening, swelling, and bleeding) (Løe and Sillness 1963). Tissue destruction was recorded if there were at least 4 mm deep periodontal pockets. The amount of tissue destruction was classified into two classes: 4–6 mm deep pockets and pockets deeper than 6 mm. Plaque retentions were recorded as two types, in the first there was supragingival calculus and in the other either subgingival calculus or excess fillings.

Some additional measurements were carried out in the follow-up examination. The state of the gingivae in the index teeth (16, 21, 24, 36, 41, 44) was diagnosed according to Ramfjord's (1959) PDI-index. The horizontal and vertical movement was measured from four index teeth (14, 25, 32, 41). The number of contra biting teeth, and the premolars and molars were recorded separately for both sides.

To assess reliability 20% of subjects participating to the baseline examination were invited to the follow-up examination. The within and between observer reliability (kappa coefficients) was rather good and varied between 0.66 for stomatitis to a kappa of 0.89 for retentions and 0.97 for fillings.

Health interview

There were 16 questions on oral health. They inquired about dentist visits, condition of the teeth and equipment for cleaning the teeth, methods adopted for cleaning the mouth and teeth, smoking and dietary habits.

The questions concerned one's own perception of the condition of the teeth, pain and ache, lost teeth, removable dentures, perceived need for fillings, need for extraction of teeth, need for dentures, and ability to bite hard food. In regard of dentist visits there were questions on the distance from one's home to the nearest dentist, visits for check-ups, visits on one's own initiative, measures taken, and the costs of dentist's and dental technician's services. Also, there were questions about cleaning the mouth and teeth, and equipment used and frequency of tooth brushing.

In regard of oral health there was interesting information on smoking, sweet drinks and snacks.

The in-depth study in the Social Insurance Institution's (SII) Research Centre

After the field survey part of subjects aged 30–64 years were invited to an in-depth study organized within a year in the SII Research Centre (KKT) in Turku. The study lasted for two days. The main aim was to assess the validity of the clinical assessments made in the field examination. Also, there were some special aims.

Answers were sought to the following questions:

- the validity of the clinical diagnoses and assessments of work ability and functioning as well as treatment and rehabilitation
- the health, work ability, functioning, need for treatment and rehabilitation in subjects suffering from different diseases
- the differences in symptoms and their causes between the regions of low and high morbidity
- the importance of cardiovascular and respiratory diseases as causes of disability and functional limitations
- the diagnostics of knee and hip osteoarthritis, low back pain and sciatica
- the validity of mental health screening and diagnostics
- the ability of some clinical-physiological study methods to differentiate between healthy and ill.

To find out about these topics several groups selected by the baseline screening were examined:

- cardiovascular and respiratory symptoms and findings
- osteoarthritis of the knee and hip joints
- low back syndrome
- mental health screen
- subjects with limited work ability and functioning
- controls.

The subjects were invited about two weeks before the intended date to the two-day examination. In the SII Research Centre e.g. the following examinations and measurements were carried out: resting ECG, spirometry (the field examination was repeated, and the central items were measured by a gas bell spirometer), a physician's examination, questionnaire and interviews were repeated, a clinical stress test (by ergometer) was carried out (Aromaa et al. 1985). Furthermore, mental work ability and functioning were assessed, a life event and life situation questionnaire was presented, and psychological group tests were carried out. Finally, all results were summarized, and a doctor and psychologist together carried out an overall assessment of disabling diseases, work ability and functioning as well as need for treatment and rehabilitation.

The in-depth study of musculoskeletal diseases

Due to suspected musculoskeletal diseases (baseline data and doctor's examination) subjects were invited to the in-depth examination. 100 subjects were invited because of knee or hip osteoarthritis and 234 because of low back syndrome. In addition, there were 190 control subjects.

In the in-depth examination the treatment and handicap questionnaire following an anatomical structure was repeated. In the examination a physiatrist carried out the musculoskeletal interview. The X-ray films taken were those of the lumbar spine in also bending positions (Korpi 1982, Sievers et al. 1985).

For subjects receiving a diagnosis of hip or knee arthrosis X-rays were also taken of the hips and knees. The equipment was a Picker apparatus.

Neurophysiological examinations

The purpose was to define more exactly the data on root compression syndromes. The examiner was a specialist in neurophysiology who carried out the examination using the Disa 134 A 30 equipment. Usually only the extremity showing radicular symptoms was examined. The diagnosis was based on observing denervation activity in muscles with a recent or subacute injury. In addition to root irritation, findings suggesting polyneuropathy were recorded.

Electrical irritation examination

The study was performed on subjects who came to the examination because of the findings in the back-disease screening and their controls. The Neuroton-616-electrical irritation equipment was used. The test was carried out on both the lower extremities on four superficial muscles receiving denervation from different levels. The aim was to measure the irritation threshold of each target muscle (m. vastus lateralis, m. gastrocnemius, m. tibialis anterior, m. extensor digitorum) by using direct current pulses of 100 ms and 1 ms duration.

The physiatrist's examination

A physiatrist carried out an examination which corresponded to the examination of the field physician at the clinical stage but was more detailed. The basis of this examination were textbooks and methods used in previous studies. The physiatrist's examination lasted up to one and a half hours.

The in-depth study of mental health

Part of the working age subjects was invited on the average after a year to attend the two-day in-depth study. The aims of the mental health in-depth study were:

1. to assess the validity of the screening
2. to assess the success of psychiatric diagnostics
3. to compare in east and west Finns psychiatric symptoms and morbidity
4. to study the association of mental factors and low back pain
5. to investigate the association of pain symptoms and personality
6. to investigate factors related to mental demands and prerequisites of work ability.

To achieve these aims screening positive and control subjects were invited to the in-depth study. The mental health in-depth study has been described in detail in the methodology report (Lehtinen et al. 1985). The psychiatric examination comprised an interview about history, assessment of personality and the clinical assessment of mental disorders. The interview lasted about one hour. In the study of patients with low back pain and their control subjects, special attention was paid to the significance of back pain to the subject, and it took two hours. The results of the study on low back pain have been reported separately (Joukamaa 1986).

The psychological examination

The task was to assess the validity of the methods, mental demands of work ability and factors related to prerequisites as well as the association of pain symptoms and personality. To arrive at the first of these aims the same method was applied, which the psychiatrists of the working group had used when assessing mental disorders. The assessment of the demands of work ability and prerequisites was carried out by a method developed in the Research Centre. It comprised a questionnaire on working conditions, an interview on work strain, assessment of mental prerequisites of work, examination of skills to read and write, assessment of work satisfaction and target self-image as well as clinical assessments of work ability. The methods have been described in the methodology report (Lehtinen et al. 1985) and elsewhere (Lahtela et al. 1979, Takala 1984).

Ethical aspects and data protection

In the 1960s there was no legally prescribed ethical evaluation concerning research work, although the general guidelines concerning medicine were also applicable for research. In research, also no informed consent procedures were used. The subjects invited to the Mini-Finland survey were informed also on the use of the data for medical research. Participation was interpreted as informed consent for research use of the data. Record linkage to national health registers has been approved by the register authorities (Social Insurance Institution, National Institute for Health and Welfare, and Statistics Finland). The data were stored and used so that they were confidential and available only to research personnel.

Sample store

For later research four 4 ml serum tubes and two 4 ml plasma tubes were frozen to -20 °C and deposited in a permanent storage space.

Linking the data to national registers

Using the personal identification number, the data of all subjects were linked yearly to national registers on deaths, causes of death, hospital discharges, specially reimbursed and other prescription medicines, cancers and work disability pensions.

Health 2000

2000–2001



TERVEYS
HÄLSA
HEALTH
2000

Health 2000

Planning of the Health 2000 survey began in 1998. The purpose of the study was to obtain up-to-date information on the most important chronic diseases, their causes and treatment situation as well as work ability and functioning. This new study was also to assess the development of health by comparisons to the Mini-Finland survey carried out 20 years earlier. The general description, baseline results and methods have been previously published in English (Aromaa and Koskinen 2004, Heistaro 2008). The population, methods and baseline results can also be found in the www-pages (www.thl.fi/health2000). The project was carried out in close collaboration between the Central Pensions Institute (ETK), Social Insurance Institution, National Public Health Institute, Municipal Pensions Institute, Research and Development Centre for Social Affairs and Health (Stakes), Finnish Dental Society Apollonia, Finnish Dentists' Association, Work-Environment-Fund, Institute of Occupational Health, UKK Institute for Health Promotion, State Work Protection Fund and many university departments. The study was led by the National Public Health Institute. Statistics Finland carried out the home interviews and the National Public Health Institute the health examinations. After two pilot studies the personnel was recruited in June 2000 to five field units working in different parts of the country. The interviews commenced in the end of August and the health examinations in September 2000 (Figure 11). The field survey ended in the summer of 2001, when the survey of young adults was completed.



Figure 11. Health 2000 begins in Helsinki.

Health 2000 was the first national health examination survey receiving funds from several financiers. Its budget of more than 30 million Finnish marks (5 million euro) had to be gathered from several sources. Half of it was obtained from collaborators and half from the National Public Health Institute.

The project was in many ways based on the Mini-Finland survey carried out in 1978–80. As the SII Mobile Clinic was not functional any more, the field survey had to be redesigned. In Health 2000 the number of sampling units was increased from the previous 40 to 80, which improved accuracy. The home health interview was carried out by interviewers of Statistics Finland. The health examinations were carried out in local premises and the logistics company (KTK) cars transported equipment between locations.

Aims

The aim was to obtain an accurate picture of

- the occurrence and distribution by region and population group of the most important public health problems
- the prevalence and distribution of limitations of work ability and functioning
- the treatment received and its adequacy
- the factors affecting the above
- the development over time by comparing the results to those of the 1978–80 Mini-Finland survey.

The survey concerned especially cardiovascular and respiratory diseases, musculoskeletal diseases, mental disorders, and other diseases.

The survey as a whole

The main parts of the survey were

- survey of subjects aged 30 and over
- follow-up survey of participants to the Mini-Finland survey
- survey of young adults aged 18–29.

The survey of subjects aged 30 years and over and the Mini-Finland follow-up comprised an interview at home (or institution) and thereafter the subjects were invited to a health examination. The survey of young adults was a home health interview. Many means were used to gather data on non-participants and one of those was a health examination carried out during a home visit.

The regions were the five so called million districts i.e. the special responsibility regions of the university hospitals.

Sampling

The two-stage sample was designed by Statistics Finland. The sampling frame was the adult population (18 years and over) of mainland Finland. The base population was stratified according to university hospital regions by using relative quota related to population size. Each stratum was divided into two so that the 15 largest municipalities or municipality districts (health center districts) were all selected into the survey. The remaining sample i.e. 65 health center districts were sampled in each stratum by systematic PPS-sampling. In the whole country there were 80 health center districts (altogether 160 municipalities, Figure 12). The individual-level sample was selected by systematic sampling. The sample in large cities was drawn in relation to population size, and in other health center districts sample size was calculated so that it corresponded to the demands of relative quota. The smallest sample size in those aged 30 and over in these 65 health center districts was 50 and the largest 100 persons. Subjects aged 80 and over were oversampled and their share in the sample was twice as big as their share in the population. The Social Insurance Institution selected the sample which comprised 8,028 subjects aged 30 and over, and 1,894 young adults aged 18–29 years of age. When analyzing the results, the structure of the sample needs to be known, and methods able to consider the design such as SAS, SUDAAN, SPSS and StatA should be used. For the Mini-Finland follow-up seven municipalities were deliberately selected, and from these all living subjects examined in the Mini-Finland survey were invited to Health 2000 (Number = 1,260, age 50 years and over).

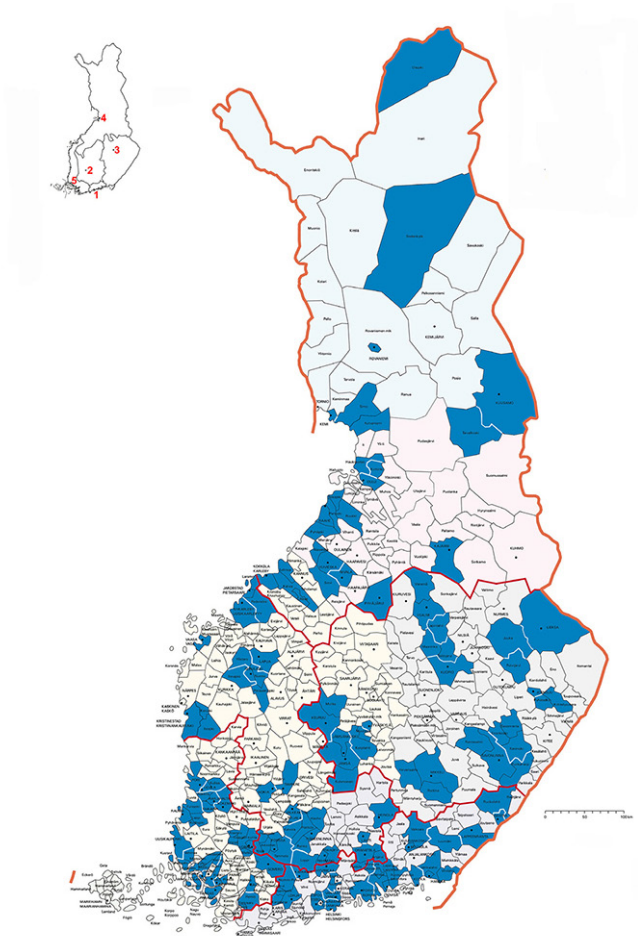


Figure 12. Survey regions.

Implementation of the survey

Prior to the survey proper two pilot studies were carried out and a three-week training period was organized for the health examination personnel in August 2000. The survey comprised quality assurance actions with observations, video-filming and repeat and parallel measurements. In sub-samples field observers of the unit and observers working in different field units were compared. A special training day was organized for the interviewers of Statistics Finland.

Prior to the beginning of the field survey and during it both national and local media were informed. However, to ensure good participation the Statistics Finland interviewers played a key role. In addition to carrying out the health interview they searched for addresses of people who had moved, they also recommended for the subjects that they should participate in the health examination and made an appointment for it. A home health examination was carried out on non-participants. If that was not possible an effort was made to carry out a telephone interview, and as a last resort a questionnaire survey.

The field surveys were carried out between September 2000 and July 2001.

Training of health examination personnel

The training for the health examination personnel was organized on 21.8.–8.9.2000 in Helsinki. During the last training week, the work was rehearsed so that the staff made observations on each other. During the next week the personnel of each field unit moved to their own region, and examined voluntary persons. The first subjects of the sample proper arrived at the health examination on 18.9.2000.

Data protection, ethical statements and radiation safety

A lot of attention was paid to data protection in all phases of the study and outsiders did not have access to the data. In the data files personal identifications were replaced by study numbers. Personal identification numbers are available only to few named personnel of the research center.

Health 2000 received positive statements from the ethical committees of the National Public Health Institute and the Uusimaa hospital region. The radiation safety board accepted the panoramic imaging of the mouth and jaws (OPTG) and the radiation safety center (STUK) gave a safety permission for the study.

After getting acquainted to the information letter the subject was asked to sign a letter of consent. Identical consent letters were signed both prior to the home health interview and the health examination. The information letters and consent forms can be found in the web-pages (www.thl.fi/health2000); the information letters forms T2051, 2052, and the consent forms 2050; The English language forms are also under the Finnish www.thl.fi/terveys2000).

The survey of persons aged 30 or over

The first phase of the field survey was a home health interview carried out by 158 interviewers of Statistics Finland. A few weeks later there was the health examination. The health examination was carried out by five field units of the National Public Health Institute comprising nurses, dentists and doctors, 16–17 persons in each group. For the examination, premises were acquired in each municipality. The logistics company Kaukokiito moved the equipment (about 25 m³ per field team) from one municipality to another. The results were stored on laptop computers which were connected to each other by a wireless radio network. The results were encrypted and regularly sent to Statistics Finland or the National Public Health Institute. The forms and samples were moved to the National Public Health Institute and the SII laboratory by the logistics company or the National Public Health Institute's vans or by air. ISDN connections had been installed in the examination premises, and they were used for sending results to the National Public Health Institute, up-dating the programs and e-mail.

During the home interview the interviewers made an appointment for the subject's health examination. Should the interviewer not have a suitable time available for the examination, he/she phoned the National Public Health Institute's appointment secretary, and she gave a suitable time for the health examination.

The invitation to the health examination was mailed about two weeks before the examination date.

Both at the home interview and at the examination the subjects were asked to provide an informed consent.

Study population

In the sample of persons aged 30 years and over there were 8,028 subjects, and 6,986 of them (87%) were interviewed at home or in an institution. Of the sample 6,354 (79% of the sample) participated in the health examination proper and 416 in the home health examination. Thus, a health examination was carried out on altogether 6,770 persons (84%) (Table 15).

Table 15. The sample and participation in different phases of data gathering.

	Number	%
Sample	8,028	
- those who died		
Final sample	7,977	100.0
Home interview	7,087	88.8
Health examination proper	6,354	79.6
Home health examination	417	5.2
Baseline questionnaire (1)	6,736	84.4
Dietary questionnaire	5,996	75.2
Any data gathering phase	7,415	92.9
Non-participation	564	7.1

After removing from the sample persons who had died prior to the survey there were 7,977 persons in the final sample. Of them 88.8% participated on the home interview, 79.7% in the health examination proper and 5.5% in the home health examination. Considering also participation in the telephone interview and replying to the questionnaire to non-participants, data were obtained on 93.0% of the sample.

Home visit interview

The interviewer checked that the address was correct and then contacted the subject by letter and suggested a time for the interview. The interviews were computer assisted. During the interview an information letter and consent form were handed to the subject. Part of the replies were classified during the interview by applying computer-based classification schemes. The classifications were supported by comprehensive lists of e.g. municipalities, occupations, diseases, medicines and surgical operations. The interviewer also agreed the appointment for the health examination. He/she also left back a questionnaire (questionnaire 1) and asked the subject to fill it in and bring it along to the health examination. The interview lasted about 90 minutes and to fill in the questionnaire took about 30 minutes.

The interview gathered the most important background data, data on health status and diseases, use of medicines, utilization of health services, living habits, living environment, functioning, work and work ability as well as need for help and rehabilitation. The contents are shown in set-up 1 and the questionnaire (Home interview, Form T2001) is on the web-page (www.thl.fi/health2000).

Set-up 1. Contents of the home interview

- Background data (marital status, household, education, main activity, occupation, working hours and salary, unemployment, data on the spouse, income)
- Health status and diseases, utilization of health services
- Data on parents and siblings
- Health services and medicines
- Oral health and use of dental services
- Living habits
- Living environment
- Functioning and its limitations
- Work and work ability
- Use and need of rehabilitation

Interview information

In the interview there was the established question about perceived health (de Bruin et al. 1996) which had five reply alternatives from good to bad. The question on chronic diseases was similar to that in previous Finnish surveys (Purola et al. 1967, Aromaa et al. 1989b). Thus, the question dealt with both diseases and handicaps and injuries limiting work ability and functioning. Next, there was a list of common chronic diseases diagnosed by a doctor.

About childhood living conditions there were e.g. questions on the father's and mother's occupational status and education at the time when the subject had started going to school i.e. when he/she was about 7 years old.

Next there were questions about doctor visits during the past 12 months. A separate question dealt with contacts by phone or e-mail. Visits to and contacts with public health nurses and mental health services were asked in the same way. The questions about physiotherapy considered visits during the past 12 months. There were also questions on visits to a chiropractor, masseur or homeopath.

The question on medicines concerned use of prescription medicines and other medicines during the last 12 months, and their names and use during the past seven days. Next, there were questions on non-prescription medicines including vitamins, natural medicines and homeopathic preparations.

The medicines were classified according to Pharmaca Fennica (*Pharmaca Fennica. Lääkevalmisteet 1999, 1998, Pharmaca Fennica. Lääkevalmisteet 2000.1999, Pharmaca Fennica. Lääkevalmisteet 2001.2000*), and they were also classified into ATC-classes.

The interview also inquired about the condition of the teeth, dental prostheses, self-care of the mouth and equipment used as well as use of dental services. The presence and absence of dental prostheses was used to classify the subjects into dentate and edentulous.

The questions on dietary habits comprised meals, type of fat spread on bread, type of fat used in cooking, quantity of bread, vegetables and root vegetables. Dietary habits were more closely charted by the dietary questionnaire. Smoking was asked by the question series recommended by the WHO, which has also been used in previous Finnish population studies (Vartiainen et al. 1998, Helakorpi et al. 2000).

Functioning and need for assistance and help was charted by questions on usual functions and their limitations (ADL and IADL), and the majority of these was derived from questions of Katz et al. (Katz et al. 1963, Lawton and Brody 1969, Katz et al. 1970) and the recommendation of the OECD working group (McWhinnie 1981).

The home interview also comprised psychological tests of cognitive functioning. The Mini-Mental State examination (Folstein et al. 1975) was presented in an abbreviated form.

The questions on work and work ability were a combination of questions used in the Mini-Finland survey (Aromaa et al. 1989b) and of those used in several studies of the Institute of Occupational Health (Tuomi et al. 1992, Piirainen et al. 2000). The subjects were asked to assess their current work ability, to describe how their work ability was limited and to state when they had become disabled for work. Next, they were asked to compare their present work ability to their best one on a scale of 1–10. Then, there were questions on perceived physical and mental work ability, disabling diseases and injuries, sickness absences and working although sick. Pension attitudes were reviewed with a few questions. Finally, there were questions about rehabilitation and health promotion at work. The last questions dealt with need for rehabilitation and its quality as well as need for aids.

Baseline questionnaire

The baseline questionnaire can be found on the web-pages (Questionnaire 1) (www.thl.fi/health2000) the English language form is also under www.thl.fi/terveys2000). The questionnaire to be filled in at home contained the following type of information (Set-up 2).

Set-up 2. Contents of the baseline questionnaire

Functioning and quality of life
 Livelihood and sickness expenditure
 Usual symptoms
 Weight and height
 Spending time and hobbies
 Computer and computer steered tools
 Gathering information on health and diseases
 Physical activity (interests, leisure activity, home chores, walking and sitting, commuting)
 Use of alcohol and treatment of alcohol related problems
 Eating sweets and drinking sweet beverages
 Health promotion
 Living environment and social environment
 Mental experiences
 Mood and feelings
 Perception of work and strain
 Working conditions

Information gathered by the baseline questionnaire

The questionnaire began with questions on functioning derived from the EuroQol-series (EuroQol-group 1990). The following questions dealt with disease induced disabilities and handicaps at work, in home chores and hobbies caused by diseases. There were also questions on livelihood and health care costs.

The next question series concerned symptoms, which were the same as those in the SCL-questionnaire (Derogatis et al. 1973).

The questions about height and weight also comprised questions on putting on weight, losing weight and reducing weight during the past 12 months, about current weight, weight at ages 20, 30, 40 and 50, and height at age 20.

An extensive group of questions dealt with time consumption and leisure time activities, especially the frequency of various hobbies. In the section on physical activity there were questions on leisure physical activity, which were derived from the Gothenburg scale (Wilhelmsen et al. 1972). Next, questions followed drawn from the then latest version of IPAQ (Craig et al. 2003) and they dealt with leisure time physical activity and physical activity in home chores.

Use of alcohol was inquired both with the scale used in the Mini-Finland-survey and by more detailed questions based on questions used in previous surveys (Simpura et al. 2003). The results were used to compute total alcohol intake.

The next questions inquired about participation in various groups and courses. The questions on the living environment concerned the perceived security of the near-by environment.

Mental experiences and symptoms were explored by the 12 item GHQ-questionnaire (Goldberg 1972, Pevalin 2000). Under the headline 'mood and feelings' the Beck depression questionnaire was presented (Beck et al. 1961) as modified by Raitasalo (Raitasalo 1977).

The questions on perception of work and work strain considered physical strain of work. Next, there was a series of questions on (mental) work strain (Maslach Burnout Inventory (Maslach et al. 1996, Kalimo 1997, Maslach and Jackson 1981). Then followed a series on job demands and working environment (Pirainen et al. 2000).

The subjects experienced major difficulties in replying to the physical activity questions of IPAQ and to assess the largest doses of alcohol consumed at a time.

Health examination

The health examination took 3 hours and 15 minutes per subject. It comprised the following phases:

1. Registration (15 minutes)
 2. Measurements: height, body circumferences, ECG, blood pressure (15 minutes)
 3. Measurements: spirometry, bio impedance, heel bone density (15 minutes)
 4. Laboratory, drawing and processing blood samples (15 minutes)
 5. Oral examination: clinical, orthopantomography (15 minutes)
- Snack, filling in questionnaire 2 (15 minutes)
- 6 a and b. Functional capacity tests: physical and cognitive capacity, vision and hearing (30 minutes)
 - 7 a and b. Clinical examination (30 minutes)
 - 8 a and b. Mental health interview (30 minutes)
 9. Final interview (15 minutes)

a and b indicate two parallel measurement stations.

Measurement station 1. Registration and symptom interviews

First, personal details were recorded, the questionnaire filled in at home was checked, information was provided about the phases of the health examination, and handed to the subject an information letter and an informed consent to be signed.

The symptom interview (www.thl.fi/terveys2000; form T2003; www.thl.fi/health2000) was carried out in this station. The symptom questionnaire dealt with e.g. cardiovascular and respiratory symptoms, atopic and allergic symptoms as well as musculoskeletal symptoms (see set-up 3).

Questionnaire 2 (www.thl.fi/terveys2000; form T2004; www.thl.fi/health2000) dealt with infections and vaccinations and it was filled in during the examination.

Set-up 3. Contents of the symptom interview

Respiratory symptoms (cough and chronic bronchitis, dyspnea)
 Strain related chest pain
 Possible myocardial infarction
 Dysfunction of the arterial circulation of the lower extremities
 Atopy and allergy symptoms
 Hand-eczema
 Musculoskeletal symptoms (neck–shoulder, joints of the extremities)
 Pain–back, neck, shoulder, hip, knees
 General handicap

Measurement station 2. Blood pressure, ECG and anthropometric measurements

Blood pressure and heart rate were measured, and resting ECG was recorded both on paper and on a diskette (Figure 13). Also, anthropometric basic measurements were carried out: height, body circumferences and the sagittal measurement of the trunk.

Blood pressure and heart rate. The letter of invitation asked the subject to refrain from smoking for at least one hour prior to the examination and not to eat for at least four hours. The subjects waited 5–10 minutes before entering the room of station 2. Blood pressure was usually measured from the right arm. The equipment was a Merкуро 300 mercury manometer (Speidel & Keller, Jungningen, Germany). The size of the standard cuff was 12 cm (breadth) times 35 cm (length).

Blood pressure was measured after the subject had been seated in the room for at least five minutes. The recommendations (Rose et al. 1982, The working group of the Finnish Hypertension Society 2002) were followed concerning how to place the cuff around the arm, how to position the arm at heart level and how to listen to the Korotkoff sounds at the crook of the arm.

Height was measured at an accuracy of 0.5 cm using a rigid metal measure (Person Check, Medizintechnik, KaWe, Kirchner & Wilhelm, Germany).

The body circumferences were measured at the height of the waist and the hips following the recommendations for anthropometric measurements in population studies (WHO 2000, Seidell et al. 2001). A usual flexible tailor's measure was used.

The sagittal measure of the abdomen is used to assess the amount of fat tissue in the midbody (Kahn et al. 1996). To measure abdominal height a metal measure made by the technical unit of the National Public Health Institute was used. Body height was measured as the distance between two parallel wings of the measure.

Resting ECG (12 leads) was measured on the lying down subject. Recommendations were followed (Heikkilä 1982, Rose et al. 1982). The equipment was MAC-5000 manufactured by Marquette Hellige (Freiburg, Germany and Milwaukee, WI, USA). This equipment recorded the electronic signal into the machine's memory and printed a usual paper printout.

The ECG was printed twice and one the printouts was handed to the subject to give to his/her own doctor after the field doctor had interpreted possible abnormal findings.

The electronic signals were transferred from the machine's memory to diskettes, which were sent for further analysis to the SII Research Centre in Turku. Findings observed in visual screening were coded according to the Minnesota-code (Prineas et al. 1982, Rose et al. 1982). In further processing of the electronic signal various specially developed computer programs were used.

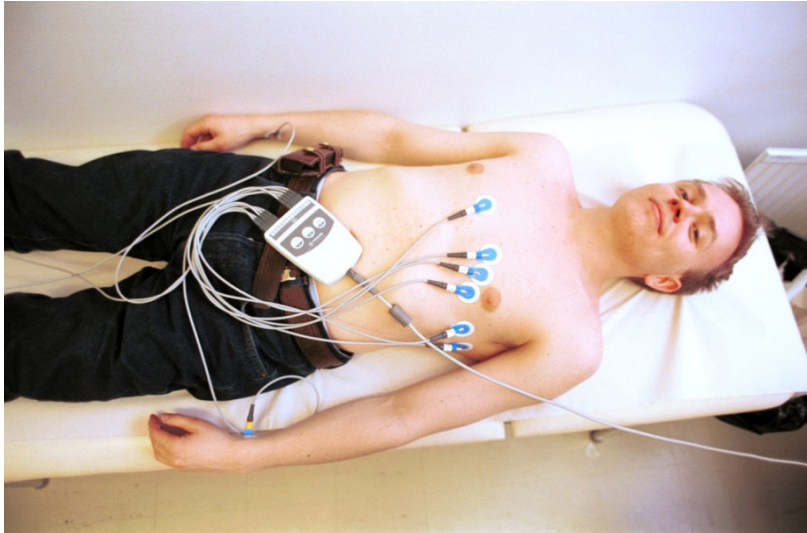


Figure 13. ECG recording.

Measurement station 3. Spirometry, bio impedance and heel bone density

In the third measurement station spirometry was carried out, bio impedance and heel bone density were measured. The subject was also weighed. The measurement of bio impedance provided information on fat content and other composition of the body.

Spirometry is used in the diagnostics and surveillance of treatment outcomes as well as assessment of disability (Cotes 1975). The apparatus in Health 2000 was a bellows spirometer Vitalograph 2150. This equipment was like that used 20 years earlier in the Mini-Finland survey.

Spirometry measures the ventilatory capacity of the lungs, the nature of the dysfunction of the lungs (bronchial obstruction, restriction or decrease in the volume of the lungs), and severity. The recovery of obstruction was measured by the bronchodilation test.

Core measurements were:

- Forced maximum respiratory capacity (FVC, forced vital capacity)
- Forced expiratory capacity in one second (FEV1, forced expiratory volume in one second)
- The proportion of the capacity in one second to vital capacity (FEV1/VC).

Bio impedance. The then new eight terminal equipment was selected for Health 2000 (InBody 3.0, Biospace, Söul, South Korea) (Bedogni et al 2002, Pietrobelli et al. 2004). First, it weighed the subject, and then measured the resistance by body segments using alternate current frequencies of 5, 50, 250 and 500 kHz and then calculated estimates of the composition of the five segments (Thomas et al. 2003, Salmi et al. 2004).

Heel ultrasound measurement. WHO has defined osteoporosis as a decrease of bone density by 2.5 standard deviations of the mean of young adults (WHO 1994). In the ultrasound measurement speed of sound (SOS) is determined and its attenuation (broadband ultrasound attenuation, BUA) when the sound impulse passes the heel, and on that basis the heel density is assessed. The method is under investigation (Gonnelli et al. 1995, Hans et al. 1996, Marshall et al. 1996, Cepollaro et al. 1997).

Measurement station 4. Samples and laboratory determinations

The subjects had been asked not to eat and drink before coming to the examination. In the laboratory station a record was made of how the directions had been followed. Next, blood samples were drawn, and part of them were intended to be used for serum and plasma to be used for biochemical determinations and part for DNA extraction. The samples were centrifuged at the examination site and placed in a freezer at -20 °C until the samples were transferred to the National Public Health Institute to a freezer at -70 °C. The determinations and their quality are described next.

Blood sample

Ten tubes of blood were drawn (a 10-ml plastic Terumo Venoject II vacuum tube, a gel tube for serum). An attempt was made to obtain from as many subjects as possible, the first serum tube to be used for lipid determinations and the EDTA tube to be frozen for DNA extraction.

Saliva sample

A saliva sample was taken of 1,500 subjects in the Helsinki region. The subject chew on a paraffin capsule for two minutes and spat at least 3 ml into the medicine measuring cup. A scraping sample from the tongue was taken by scraping the surface of the tongue with a wooden stick and submerging the stick into a tube containing an alkaline solution.

Casual urine sample

All subjects were asked to provide a casual urine sample. The urine samples were divided into several tubes with stick-on labels.

Stool sample

In the last station, a package for the stool sample was handed to every sixth subject. The sample was to be taken at home and to be sent by mail to the National Public Health Institute.

Processing the blood samples

The first EDTA tube for DNA extraction was transferred unopened to -20 °C, and from the second 1 ml, whole blood was taken prior to freezing. The serum and plasma tubes were centrifuged for 10 minutes with a force of 1,600–1,800g. Both serum and plasma were pipetted into small tubes of 1.5 ml in the order shown by the division scheme. On the form also date, the observer's identification number and time were recorded. There was also space for recording aberrations. The subject's folder contained the laboratory sample form and the stick-on labels. Each label had the same repeated serial number and the individual tube number as a bar code. In addition, the label contained the survey code and the code of the sample type. In the laboratory the number of the stick-on label series was fastened to the sample form and in the registration to the subject's survey program form. The survey number and the number of the label series were linked by recording the form information on the same day. The bar code identification glued on the lid and side and the bar codes of the tubes in the container were read one by one into the computer program.

The survey form and the data were transferred together with other material from the field laboratory to the National Public Health Institute. There the existence, identification, type, location, quantity and comment data were transferred to the sample administration system. The location in the container rack and the location of the rack were later read directly into the sample data base. A specified sample tube can be located at the accuracy of freezer/rack/container/ site in the container.

Storing samples and sending them

The serum, plasma, whole blood and urine samples were immediately transferred to -20 °C in a field freezer, which usually took some 45 to 60 minutes from drawing the sample. Under the lid of the freezer there was a sorting level which comprised 12–13 empty tube containers with stick-on labels. These were filled according to the predetermined container map by placing 1–5 tubes of the subject into the container.

Quality assurance in the field laboratory

The design of how the samples were to be drawn and processed was tested during two pilot studies. The field observers were trained and in the field units there were one to two audits during the survey. Written directions had been given about the tasks of the field laboratory and there was also a guideline for work in the laboratory. In addition, there was the National Public Health Institute's communicable disease guideline, instructions of the instruments and contact addresses of their maintenance and a listing of spare parts. In problem situations the field laboratory personnel contacted the corresponding person in the National Public Health Institute. The electronic field mail and the error and problem situations were gathered in a memorandum and archived. The person drawing the samples, the sample processing person and the nurse in measurement station 1 rotated in the tasks every week.

Cholesterol, HDL-cholesterol, LDL-cholesterol, triglycerides and glucose were analyzed in the laboratory of the SII Research Centre (Olympus AU 400, Germany) and glutamyl transferase and urate in the unit for Analytical Biochemistry of the National Public Health Institute (Optima 909, ThermoElectron, Vantaa, Finland). LDL-cholesterol was also calculated. All determinations were carried out on frozen samples at least half a year after drawing the sample.

As part of quality assurance lipid determinations (about 1,000 samples) were carried out in parallel in the laboratories of the National Public Health Institute (NPHI) and the SII laboratory. The findings are presented in Table 16.

Table 16. Comparison of means in the laboratories of SII and the National Public Health Institute (NPHI).

Determination	SII mean	NPHI mean	Difference %	Standard deviation
Cholesterol	5.97 mmol/l	5.81 mmol/l	2.6%	3.1
HDL-cholesterol	1.33 mmol/l	1.45 mmol/l	-8.1%	7.4
Triglycerides	1.62 mmol/l	1.46 mmol/l	9.5%	5.5

Table 17 shows further data on methods and quality. This information has been extracted from the methodology report. The validity of the analysis series has been ensured by including into each series controls, which have been used to calculate the coefficient of variation (CV %) between the series. The laboratories also participated in the external quality control rounds of Labquality. The percentage difference has been calculated as a mean of Labquality's short term quality control sera, which were received once a month. They were analyzed just as other samples. The lipid determinations have also been part of the quality control of CDC.

In the first phase the methods were

- Cholesterol (Cholesterol, CHOD PAP, Olympus System Reagent)
- HDL-cholesterol (HDL-CPlus, Roche Diagnostics, Germany)
- LDL-cholesterol (LDL-CPlusRoche Diagnostics Germany)
- Triglycerides (Triglycerides, GPO PAP, Olympus System Reagent, Germany).
- Glucose (Glucose, Hexokinase, Olympus System Reagent, Germany)
- Glutamyl transferase (Gamma-GT [IFCC/ECCLS], Konelab, ThermoElectron, Finland)
- Urate (Uric Acid, URICASE PAP, Konelab, ThermoElectron, Finland).

Table 17. Analytical methods.

Determination	Method	CV % between series	Difference (Diff. %)
Cholesterol	Cholesterol, CHOD PAP Olympus System Reagent	CV = 2.1%, mean 5.4 mmol/l CV = 2.2%, mean 7.1 mmol/l	Labquality short and long-term 11/00–8/01 Diff. 2.0%, SD 3.0
HDL-cholesterol	HDL-C Plus Roche Diagnostics Germany	CV = 4.8%, mean 1.30 mmol/l CV = 5.3%, mean 1.37	As above but 1/01-6/01 Diff. -4.6%, SD 3.0
LDL-cholesterol	LDL-C Plus Roche Diagnostics Germany	CV = 4.5%, mean 2.66 mmol/l CV = 5.7%, mean 2,96 mmol/l	As above but 2/01-5/01 Diff. 0.4%, SD 3.5
Triglycerides	Triglycerides, GPO PAP Olympus System Reagent Germany	CV = 2.1%, mean 1.39 mmol/l CV = 2.3%, mean 1.47 mmol/l	As above but 11/00-8/01 Diff. 5.8%, SD 4.0
Glucose	Glucose, Hexokinase Olympus System Reagent Germany	CV = 2.1%, mean 9.3 mmol/l CV = 2.3%, mean 5.2 mmol/l	Labquality, short term 11/00-8/01 Diff. 0.7%, SD 3.6
Glutamyltransferase	Gamma-GT (IFCC/ECCLS) Konelab, ThermoElectron Finland	CV = 2.2%, mean 172 U/l CV = 2.8%, mean 81 U/l	Labquality short-term 10/00-12/01 Diff. -1.5%, SD 3.6
Urate	Uric Acid URICASE PAP Konelab, ThermoElectron Finland	CV = 2.1%, mean 413 microgram/l CV = 2.3%, mean 604 mikrogr/l	Labquality short-term Diff. 0.0%, SD 2.2

The quality (reliability and validity) was good both in comparison to internal variation and to external reference samples (Labquality and CDC).

Measurement station 5. Examination of the mouth

The examination of the mouth has been described in the methodology report (www.thl.fi/health2000), in the reports on baseline results of oral health (Suominen-Taipale et al. 2004, Suominen-Taipale et al. 2008) and summarized here. The clinical oral and X-ray examination were carried out as part of the health examination, and part of the data was obtained in the home interview and by questionnaires.

Data gathered by interviews and questionnaires

The subject was asked about own teeth and/or removable dentures. The subject was also asked to assess symptoms and how well he/she managed to eat. The following questions dealt with cleaning the mouth and equipment used, and about dental care visits, contents of the care and costs. Most of the questions were the same as in previous Finnish dental health surveys (Vehkalahti et al. 1991, Arinen et al. 1998). Part of the new questions were based on the survey of Great Britain (Kelly et al. 2000). The reply choices in the questions on teeth and dental prostheses dealt with dentures and own teeth. These data were used to classify the subject as dentate or edentulous.

The subject was asked to assess the condition of the teeth and oral health and to report whether he/she during the past 12 months had suffered from tooth ache or other troubles associated with teeth or dentures. Chewing ability was evaluated by asking whether the subject was able to eat dry bread or biscuits without drinking (Fox et al. 1987) and whether he/she could chew hard or tough food. The questions on cleaning the mouth considered how often, at which time of the day, with which equipment and substance the subject cleaned and cared for his/her teeth. About dental care services there were questions on whether the subject used to visit a dentist for a check-up and how often, as well as whether he/she had an own dentist

and where. There were also questions on dentist visits. The questionnaires comprised questions on sweet snacks, and how the subject perceived that the health of the mouth and teeth, and disabilities and functional disturbances impacted on quality of life. Altogether eight types of sweet drinks and foods were listed.

Clinical examination of the mouth

The clinical and radiographic examinations of the mouth (Figure 14, Figure 15) were carried out by a team of dentist and dental auxiliary and it took 15 minutes (Vehkalahti et al. 2004, Suominen-Taipale et al. 2008). The dentist carried out the clinical examination, and the nurse recorded the dictated observations on a computer and took the radiograph. A portable dental treatment unit (Dentronic Mini-Dent[®] Planmeca Oy) was used. It comprised an air compressor, a saliva suction device and a high-powered suction engine. In addition, there was a portable patient chair, fiber optic light (Novar[®]), fiber optic head lamp (Tekmala Oy) and a letter scale.

First, maximum mouth opening was measured, and the subject's jaw joints and the masticatory muscles were palpitated. Next, the dental prostheses were recorded and their condition, functioning and cleanliness were examined. After that the patient chair was lowered to the reclining position. Then possible mucosal findings were photographed intraorally, dental plaque was measured, and lacking teeth were recorded, and the teeth, gingival pockets and gingival bleeding were examined. The teeth were examined starting from the last tooth in the upper right quadrant and ending with the last tooth in the lower left quadrant. After the clinical examination a radiographic picture was taken (Figure 15).

To ensure that the examination was comparable to the Mini-Finland survey the methods (Vehkalahti et al. 1991) were selected so that results like the Mini-Finland ones could be derived. Most of the new measurements is based on the dental population surveys of Great Britain (Todd and Lader 1991, Kelly et al. 2000) and the United States (Drury et al. 1996), and part on other surveys and textbooks.

Masticatory muscles and temporomandibular joints

The measurement was developed based on guidelines by Dworkin and LeResche (1992), but were confined to the most common aspects of masticatory function. Presence of a clicking and a crepitation sound when opening the mouth was recorded as well as whether these findings were observed on the left or right-hand side. The subject was asked whether he/she felt pain during palpitation. The temporalis and the masseter muscles were palpitated separately on both sides.

Dentures

Removable dental prostheses and their type were separately recorded for the upper and lower jaw. If there was no plaque or dental calculus the prosthesis was recorded as clean. Mucosal ulcers and gingival hyperplasia relating to dentures were recorded separately for the upper and lower jaw. The presence of stomatitis was examined only relating to upper jaw prostheses.

Oral mucosa

The procedure of the examinations and the definitions of the findings were based on the guidelines by WHO and a previous large population survey (Kramer et al. 1980, Zain et al. 1995). Every field dentist had a folder describing in writing mucosal findings and containing color photographs of typical findings (collection of A-L. Söderholm).

Of mucosal findings the following were recorded: angular cheilitis, pseudomembranous fungal infection, rhomboid glossitis, fistula, white and red mucosal lesions, nonspecific ulceration, swelling or tumor and gingival hyperplasia. A record was also made whether the finding was on the floor of the mouth and/or in the ventral surface of the tongue or elsewhere. The size of the lesion was recorded as its diameter: either under 1 cm or 1 cm or over. A still video picture was taken by an intraoral camera (Intracam[®], Planmeca Oy).



Figure 14. Clinical examination of the mouth.



Figure 15. Radiographic examination.

Occlusion and deviations in occlusion

Entries were made on the number of opposing teeth, crossbite, scissors bite and the intracuspals relationship (Angle's classification). Opposing teeth were determined in the same way as in the Mini-Finland survey (Vehkalahti et al. 1991). All other determinations were based on general orthodontic practice and earlier population studies (Todd and Lader 1991, Drury et al. 1996, WHO 1997b).

Open bite was measured from the central incisor in the upper right quadrant (d.11) and in its absence from the corresponding tooth in the upper left quadrant (d.21). Measurements were taken from the teeth in occlusion using a WHO periodontal probe with a ball end (Plandent Oyj, no. 19577). Overjet was measured as the distance between the incisal tip of the upper incisor and the anterior surface of the lower incisor and

recorded in one of four categories: less than 0 mm, 0–6 mm, 7–9 mm and more than 9 mm. Overbite was determined according to the position of the tip of the lower incisor in relation to the upper incisor when biting the teeth together. There were four classification options: normal and three malocclusion categories.

Dental plaque

Dental plaque was measured from one surface of three different teeth using a scale developed by Sillness and Løe (1964): the buccal surface of the last tooth in the upper right quadrant, the lingual surface of the last tooth in the lower left quadrant and labial surface of the canine tooth.

Spaces in dental arches

Spaces in dental arches were measured using the same method as in the population survey in Great Britain (Kelly et al. 2000). Spaces were measured from the entire dentition except for wisdom teeth. Spaces were determined according to the missing tooth by group of teeth separately in the upper and lower jaw. A single tooth replaced with a bridge was always entered as a missing tooth. A tooth remnant or a diastema were not classified as spaces. A space was recorded in the molar region when both the first and second molars were missing. A space in the frontal region was recorded when one or more teeth were missing and there were one or more clearly observable spaces (6 mm) or a bridged tooth.

Condition of the teeth

The teeth were dried with an air spray and a saliva ejector (Hygoformic[®]) and cotton rolls were used to make sure that they remained dry. The examination was performed using a mouth mirror, fiber optic light and a WHO periodontal probe with a ball end (Plandent Oyj, no. 19577). Tooth identification and the determination of the condition of the tooth were based on the Mini-Finland survey (Vehkalahti et al. 1991) and on WHO (1997) guidelines. All surfaces of all teeth were examined. The observations on each tooth were classified as follows: 'sound' (intact), 'filling but no caries', 'requires attention but no caries' (e.g. a fractured filling or tooth), 'caries' (coronal and root caries separately) or 'decayed to the root' (a distinction was made between tooth remnants with and without caries). In addition to ordinary fillings, entries as fillings were made for prosthetic crowns, bridges and facades. Teeth were recorded as needing repair when they did not show any caries but were fractured, or a filling in the tooth was fractured or had come loose or had dissolved or was otherwise clearly incomplete, or if the tooth had a temporary filling.

Periodontal health

Periodontal health was determined by measuring the depth of periodontal pockets and the presence of gingival bleeding on probing. The depth of the periodontal pockets was measured from all teeth (except wisdom teeth and tooth remnants). The measurements were made using a WHO periodontal probe with a ball end (Plandent Oyj, no. 19577) and markings at 3.5 and 5.5 mm. The gingival pocket depth of each tooth was measured on 4 points. The deepest finding for each tooth was recorded into three classes: 'no pocket', 'a pocket of 4–6 mm', 'a pocket 6 mm or deeper'. Bleeding was recorded immediately after the measurement of pocket depth.

Use of removable dentures

The dentist asked all subjects wearing removable dentures how old these were and whether they had been repaired during the past five years.

Radiographic examination

The field teams were equipped with digital panoramic imaging equipment (Planmeca Oy 2002 CC Proline[®]), laptop computers with software (Dimaxis[®], Plandent Oyj) and printers (HP Deskjet 930C[®]). At each examination site a Planmeca expert installed and calibrated the equipment, and a representative of the Radiation and Nuclear Safety Authority checked the settings at each examination site. For imaging, jewelry and eventual dentures were to be removed. The nurse made sure the subject was properly positioned with the aid of positioning lights. The dentist immediately assessed the quality of the picture, and if necessary a new radiograph was taken. There were 77 such images which had to be retaken.

Four specialist dentists (radiology) assessed the quality of the images and interpreted the findings. The image was presented on a normal sized screen. If needed, the image was enlarged. The diagnoses followed typical clinical practice (Langland and Langlais 1997). Of the images the following observations were recorded: diagnostic quality, condition of the dentition, root treatments, defects in root filling, periapical changes, vertical bone pockets, furcal lesions, pericoronitis, horizontal bone loss, jaw joints, sinus mucous membranes, jawbone atrophy, structure of mandibular bone, others.

Quality of clinical measurements

Repeated measurements were carried out on 111 subjects and parallel measurements on 269 subjects. The quality assurance measurements were made on so called quality days of type 3. All five field dentists and a reference observer examined the same 42 subjects. All four specialist dentists independently interpreted 50 images twice. During the interpretations proper about one out of 30 images was reinterpreted. There were altogether 327 images interpreted twice. A more detailed account of quality assurance in the oral examination is provided elsewhere (Suominen-Taipale et al. 2004).

Agreement of the measurements was described by the percentages of unanimous diagnoses, kappa values of measurements and the McNemar skewness test (Fleiss 1981). The parallel measurements on 42 subjects showed that the agreement of cross and scissor bites (kappa 0.78), Angle's classification (kappa 0.72), spaces in the dental arch (0.86) and the condition of the teeth (0.86) was good but e.g. mucous membrane findings (0.34) and the measurement of periodontal pockets (0.32) slightly poorer

Measurement station 6. Functional capacity

Performance and functional capacity were also assessed by objective measurements. Vision and hearing was tested and so was cognitive functioning, balance, perceptual motor speed and hand grip strength. The endurance of back extensor muscles was tested in subjects aged 30–54. Subjects over 54 took a chair stand test and a walking test, and the functioning of their lower and upper limb joints was assessed.

Visual acuity. Binocular visual acuity was measured using well illuminated (>350 lux) distant and near vision charts (Oriola Precision Vision Letter Chart Acuity Tests). Visual acuity was measured with spectacles or contact lenses if normally worn by the subject. The adequacy of illumination was checked using EC-1 digital lux meters (Hagner, Sweden).

For the examination of near vision, the subject held the chart at the distance at which they thought they saw best. For the examination of distant vision, the subjects stood four meters from the chart. As in the near vision test the recorded result was the lowest row on which the subject could read at least 4 correct letters.

For scotopic vision testing (vision in dim light) the lighting on the surface of the distant vision chart was reduced to 9–11 lux.

Hearing test. Air conduction threshold was measured using a screening audiometer (Micromate 304, Madsen Electronics) in both ears at three frequencies (500, 1,000 and 2,000 Hz) in a silent room. The lowest stimulation level was 5 db. The volume was lowered at increments of 10 db.

Tests of cognitive functioning. Cognitive functioning was examined by selected tasks from the CERAD neuropsychological test battery, originally developed for assessing early phases of dementia and memory disturbances (Morris et al. 1989, Hänninen et al. 1999, Pulliainen et al. 1999). The cognitive function tests assessed were first speech production coding and second, the test of verbal fluency in which the subjects were to list as many animals as possible for one minute. The number of correct choices was recorded. In the memory test, the subjects were shown 10 words one after another. Then they were asked to list the words and 90 seconds was given to recall the words. In addition, the short version of the Mini-Mental State Examination was carried out on subjects aged 55 and over (Folstein et al. 1975).

Perceptual motor speed. The system used (Good Response, Metitur Oy, Jyväskylä) (Era et al. 1986) consisted of a user panel, power source, and a computer program (Good Response). The panel had a waiting switch, four sets of lights and switches for turning off those lights. The subject was expected to react as quickly as possible to the lights appearing in the panel.

Measurement of hand grip strength. The equipment (Good strength, IGS01, Metitur Oy, Jyväskylä) was placed on a table at a distance where when the subject's elbow was resting against the table, the grip handle fitted into the hand with the wrist in a neutral position. The test was performed with the writing hand. The method was developed from that used by Viitasalo et al. (1985).

Measurement of balance. The main components of the measurement system (Good Balance, IGB01, Metitur Oy, Jyväskylä) were a triangular force platform and an electronics unit. Following the protocol of Guralnik et al. (1994), four different measurements of balance were conducted:

1. Feet side by side, eyes open; duration of measurement 30 seconds.
2. Feet side by side, eyes closed; standing eyes closed, duration of measurement 30 seconds.
3. Semi-tandem, eyes open; standing in a semi-tandem position with feet placed one after the other so that the proximal phalanx of the big toe of the trailing foot touched the inside of the heel of the leading foot, weight evenly on both feet; measurement duration 20 seconds.
4. Tandem, eyes open; standing in a tandem position, with the feet placed one after another along the same line so that the big toe of the trailing foot touched the heel of the leading foot, feet in a straight-line, weight evenly on both feet. Hands rested freely and when necessary they could be used to maintain balance. Measurement duration 20 seconds. The tandem test was only performed if the subject managed to stand at least 10 seconds in the semi-tandem position.

At home and during equipment malfunctions, balance was measured using a simple field test (Guralnik et al. 1994).

Endurance of back extensor muscles. The endurance of back extensor muscles (Biering-Sørensen 1984, Suni 2000) was measured in subjects aged 30–54 years. The subject lied down on a padded stepping board so that the lower body was on the stepping board and the upper body rested down on the floor, some 20 cm lower. The subject was then instructed to cross hands behind the neck and to lift the upper body into horizontal position. The subject was to remain in this position for as long as possible, but no more than four minutes. The examiner sat astride the subject's feet, on the lower part of the calves.

Tests administered to subjects aged 55 or over

Subjects aged 55 or over took a ten-item joint function test, a chair stand test and a walking test over 6.1 meters.

Joint function. The test to determine functional limitations of the joints (Sievers et al. 1985) comprised 10 separate movements, the first four of which were designed to test lower limb function and the remaining six tested upper limb functions:

- walking on level surface
- walking on toes
- climbing two stairs
- crouching/squatting
- raising upper arms
- extending elbow joints
- flexing elbow joints
- backs of hands against each other (volar flexion of the wrists)
- clenching fingers
- clenching thumbs (opponens movement).

Chair stand test. In the chair stand test (Guralnik et al. 1994) a standard chair was used with no arm rests and a seat height of 43 cm from the floor. The back of the chair was placed against the wall. The subject was asked to sit down on the chair with the hands across the chest and feet slightly apart. From this position the subject was asked to stand up and sit down five times as quickly as possible.

Walking speed. Walking speed was measured over 6.1 meters (Fiatorena et al. 1994). The subjects were asked to walk the distance as quickly as possible. The observer used a stopwatch to time the test and the number of steps was also recorded.

Measurement station 7. Doctor's clinical examination

The doctor defined more closely the disease history and carried out a structured clinical examination, which also comprised many tests of joint functioning and extent of their movements. Furthermore, the doctor assessed and explained previous findings and gave advice on possible future care.

The topics of the clinical examination were the main chronic diseases, the consequent need for care and the subject's functional capacity. The doctor performed a structured general practitioner-level examination. The main topics were cardiovascular diseases and musculoskeletal diseases. Also, an effort was made to diagnose other most important somatic and mental disorders.

In the training of field doctors, emphasis was put on carrying out a structured physical examination and uniformity of the diagnostic criteria. The main principles when assessing functional capacity were also the same. Furthermore, an effort was made to ensure that the diagnostic assessments were comparable to those of the Mini-Finland survey.

The field doctor explained to the subject the results and findings obtained in the previous measurement stations such as resting ECG, spirometry, bio impedance and heel bone density measurement. If needed, the doctor directed the subject to further examinations or treatment for any diagnosed disease.

Diseases known to the subject

To begin with the doctor asked about the most important symptoms limiting daily activities and verified the diseases previously diagnosed by a doctor.

The clinical examination

The clinical examination proceeded according to the principles of good clinical practice. In subjects with findings suggesting cardiovascular and respiratory diseases the examination began with auscultation of the heart and lungs and went on to the peripheral arteries. In addition to current rhythm disturbances an effort was made to detect previous rapid atrial arrhythmias.

The musculoskeletal examination resembled that carried out in the Mini-Finland survey (Heliövaara et al. 1993). It was initiated with a nerve-pinch test in the lower limbs and continued through examining the knee and hip joints to the lumbar spine. An electric tooth brush was used in the lumbar spine test. The vibrating head with a specially made rubber cap was gently applied to the processus spinosus of the vertebrae to see whether there were any signs of pain in the nerve root. This simple test has relatively recently been adopted and it is quite reliable in detecting nerve root symptoms in the lumbar spine region (Yrjämä and Vanharanta 1994, Yrjämä et al. 1997).

The clinical examination then proceeded via an assessment of shoulder and neck movements to elbow and wrist joints. Wrist examinations focused especially on tests to determine constriction of the carpal tunnel (e.g. Tinell and Tetro). Special attention was paid to the active and passive range of movement of the joints. Angle measurements were used to make assessments. The examination is illustrated in Figures 16 and 17.

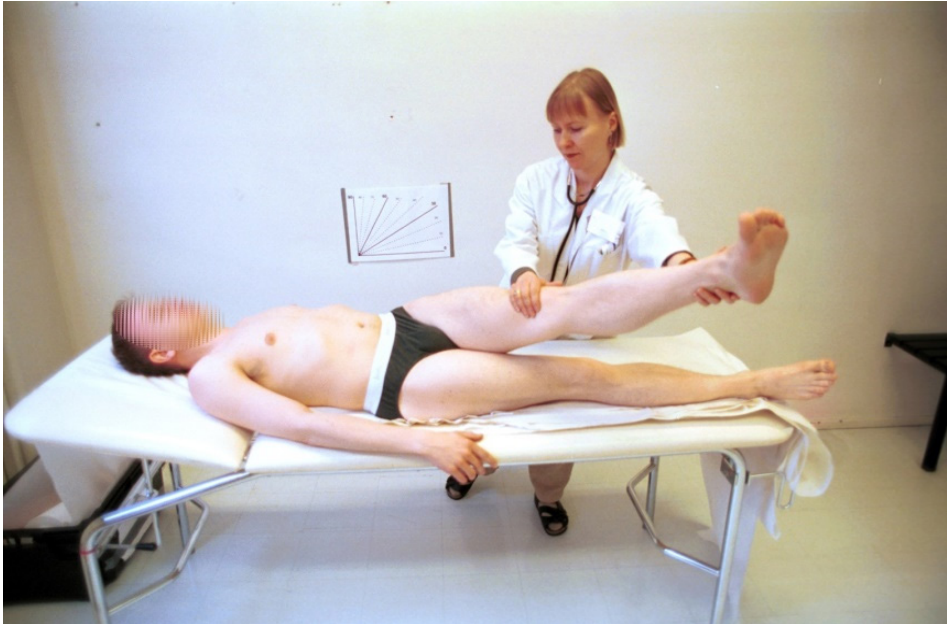


Figure 16. Movement of the hip.



Figure 17. Movement of the spine.

Diagnostic assessments

A diagnostic assessment was subsequently made of all diseases and disorders detected. The main topics were the certainty of the diagnosis (definite/possible), the year of diagnosis, need for treatment (no need/receiving treatment/inadequate treatment/no treatment despite of need) and adequacy of treatment. The diagnostic criteria of the main diseases are presented in the methodology report (www.thl.fi/health2000).

Of cardiovascular diseases the following were recorded: angina pectoris, myocardial infarction, heart failure, hypertension, arrhythmia, valvular disease, obstruction in the arteries of the lower extremities and cerebrovascular disease. Of subjects suffering from coronary heart disease also invasive operations (bypass surgery, angioplasty) were recorded. For arrhythmias, valve disorders and cerebrovascular disease an effort was made to determine the specific type of the condition. Finally, the doctor recorded the assessment whether there were clear-cut changes in the ECG.

The respiratory diseases separately listed were asthma, chronic obstructive pulmonary disease and allergic rhino-conjunctivitis.

In regard of musculoskeletal diseases, the diagnoses listed were inflammatory arthritis, knee and hip arthrosis, chronic neck syndrome, chronic lower back syndrome, chronic shoulder impingement syndrome, chronic epicondylitis, chronic carpal tunnel syndrome as well as sequelae of amputations and injuries to knee and ankle ligaments. In regard of arthritic conditions, neck syndromes, lower back syndromes and shoulder syndromes the specific type of disease was also recorded.

A record was made of other physical diseases such as diabetes, hyperlipidemia, hypothyroidism, Parkinson's disease, cataract, glaucoma, chronic eczema and hand eczema. For diabetes and chronic eczema, the specific type of disease was also noted. Structured items for mental disorders comprised psychotic disorders, depression and dementia.

Functional capacity and need for rehabilitation

On all subjects with mobility limitations and heart diseases the examining doctor assessed also the functional class according to NYHA (see *Criteria Committee of the New York Heart Association. Diseases of the Heart and Blood Vessels; Nomenclature and Criteria for the Diagnosis*. 1964). Work ability and functional capacity were assessed in working age subjects. An effort was made to assess the main reason of any limitation. In addition to permanent functional limitations also temporary ones were recorded.

In addition, the doctor also was expected to assess the subject's potential work ability in four hypothetical occupations: teacher, builder, school caretaker and systems analyst.

At the end the doctor assessed whether the subject needed rehabilitation.

Quality assurance

The quality of the doctor's clinical examination was assessed by repeated examinations during which the other doctor of the field team examined the same subject, and by a separate quality control test. In the test a doctor from a different field team examined the subjects. However, the number of examinees was small and thus conclusions can be drawn only on very common abnormalities.

The reliability (kappa coefficients) of the diagnoses varied between 0.31 and 1.00. Reliability was best for the diagnoses asthma, arthritis and myocardial infarction. Reliability was particularly poor for the diagnosis COPD.

The kappa coefficients between doctors from different field teams varied between 0.34 and 0.89. Agreement was best for the diagnoses arthrosis, asthma and diabetes, and worst for COPD.

Comparability with the Mini-Finland survey

The clinical examinations were conducted along the same general lines in both the Mini-Finland survey carried out in 1978 (Aromaa et al. 1985, Sievers et al. 1985, Aromaa et al. 1989b) and in the Health 2000 survey. The diagnoses and assessments of functional capacity are largely comparable. However, there are differences between doctors (Koran 1975a, Koran 1975b).

In the Mini-Finland survey only subjects having in the baseline examination a finding suggestive of any of the examined diseases were invited to the doctor's examination, whereas in Health 2000 the doctor examined every subject. In the Mini-Finland survey the doctor examined two out of three subjects. A study on the validity of the screening process in the Mini-Finland survey (Heliövaara et al. 1993a) showed that also in the Mini-Finland survey all or a great majority suffering from the main examined diseases were, in fact, examined by a doctor. Thus, the comparability of the results is good.

Another difference between the studies was that in the Mini-Finland survey the examining doctor had access to more extensive and detailed information about the subject's diseases and treatments than in the Health 2000 survey. This could have led to underestimating the occurrence of some diseases. However, we believe that such effects, if any, were small.

The slight differences between the two studies in the details of the clinical examination probably had no effect on the diagnostic assessments.

Measurement station 8. Study of mental health disorders

The interview on mental health disorders and symptoms mainly concerned four central groups of disorders: mood disorders, substance addiction, psychoses and anxiety disorders. In addition, data were gathered with other questionnaires and interviews.

The interviewing method was CIDI (Composite International Diagnostic Interview, version 2.1). It is a structured interview developed by the World Health Organization (WHO) for epidemiological research (WHO 1990). The version selected for Health 2000 was the German M-CIDI (Wittchen et al. 1998a, Wittchen et al. 1998b). A group of National Public Health Institute researchers was trained by Professor Hans-Ulrich Wittchen who had been involved in developing the M-CIDI program and DSM-diagnostics.

Based on symptoms during the last year the CIDI-interview assessed the occurrence of depressive states, chronic depression, generalized anxiety, social phobia, panic disorder, alcohol use disorder and psychotic disorder during that year. For alcohol and substance dependence there were also questions on those symptoms earlier during life time.

Measurement station 9. Final interview

During the final interview the nurse checked that the subject had visited all measurement stations and that the questionnaires had been filled in, and handed the dietary questionnaire and questionnaire 3 (www.thl.fi/terveys2000; form T2005). Both were to be filled in at home and to be mailed to the National Public Health Institute. The observer also gave advice, if needed.

The subjects received many results. These were e.g. blood pressure values, the ECG tracing, spirometry results, bio impedance results, the radiographic image of the mouth, results of the vision and hearing tests, and the field observers' assessments of findings and measures needed.

Questionnaire 3 inquired about sleep and sleeping, quality of life, perception of everyday life and sense of life control (Antonovsky's Sense of Coherence scale; Antonovsky 1993). In addition, seasonal depression was investigated (Seasonal Pattern Assessment Questionnaire (Rosenthal et al. 1984)). There was also a second question series on quality of life, the 15D (Sintonen 1981, Sintonen 2001). Alexithymia (perception of feelings) was investigated by the established TAS-20 question series (Bagby et al. 1994a, Bagby et al. 1994b).

Dietary questionnaire. The frequency-type dietary questionnaire has been established in large epidemiological surveys studying the association of diet and disease risk (Willett 1998, Pietinen 1999). The food frequency questionnaire (FFQ) provides information on the subject's diet during the past year. In the FFQ the subject was asked to describe his/her usual diet during the past year. The questionnaire comprised 125 foods generally consumed in Finland. The subject estimated the frequency of intake of the listed groceries and dishes.

Home blood pressure measurement

To assess the variation of blood pressure, part of the subjects interviewed at home received a measurement device for measuring blood pressure at home. The importing company provided about 1,000 instruments. They were rotated to altogether about 2,000 persons. Recommendations were followed in the measurement (Reims et al. 2001, O'Brien et al. 2003). The target group was subjects aged 45–74 years. The equipment used in the home measurements were OMRON M4 -instruments. (Omron Matsusaka co., Japan, OMRON Healthcare Europe B.V., Hoofddorp, the Netherlands).

At the end of the interview the interviewer asked whether the subject was ready to carry out home blood pressure measurements. The blood pressure was measured on the non-dominant arm, in right-handed persons in the left arm. Usually a cuff was used with measures of 14 x 48 cm (rubber bag 13 x 23 cm). If the arm circumference exceeded 35 cm a long cuff (14 x 48 cm, rubber bag 15 x 29 cm) was used. The interviewer instructed how to correctly fasten the cuff.

Home health examination

The condensed health examination was carried out at home on subjects who did not participate in the health examination proper. There is more information on the contents of the home examination in Table 18. A two-day training session was organized for the home visit nurses between 9.–10.10.2000. On 29.11.2000 a further training session was organized. An attempt was made to carry out the home health examinations whilst the field team was still in the area where the subject lived. The home health examination nurse daily made 1–4 visits. Thus, also quite disabled persons could be examined.

The home health examination as a whole

The examination comprised a large proportion of the health examination proper and it could take from 2 to 3 hours. The content of the examination is shown in Table 18.

Table 18. The home health examination as a whole.

Duration minutes	Measure
10	Informing the subject (oral, written, consent form) and setting up the IT-equipment
10	Baseline data
10	Blood pressure measurement
7	Laboratory: drawing the blood sample (30 ml) and processing
3	Oral examination: edentulousness, dentures, number of teeth
20	Snack, questionnaire 2, short questionnaire 1 if needed
40–60	Interview (short home interview, questionnaires 1 and 2
10	The home modification of the symptom questionnaire
10	Measurements: height, weight, circumferences, PEF
40	Tests of functional capacity: vision (without dim light), hearing, cognitive functioning, reaction and movement speed, hand grip strength, balance (Guralnik), joint function test for subjects aged 55 years and over, chair stand test and walking speed
10	Final information: feedback form, handing questionnaire 3, dietary questionnaire

Total duration 150 minutes (including collection of the equipment)

The examination and its instructions were altered for the home conditions as follows:

- If the subject is unable to provide the information, it should be gathered from a relative, other close one or a nurse etc.
- If the subject cannot fill in questionnaires 1 and 2, the home visiting nurse gathers as much as possible by interview.
- The core differences between the instructions of the home visit directions and those of the health examination directions were the following: 1) blood pressure measurement with Omron M4 equipment, 2) weighing by the portable scale (EKS 3), 3) measurement of height against a wall with a steel tape, and 4) PEF instead of spirometry.
- Blood samples were drawn and processed as described in the separate laboratory guidelines for home examinations.
- The oral health examinations were carried by a method described on the home examination guidelines.
- In the test of functional capacity, for the stair climb and chair stand tests, the stairs and chairs available at home were used.
- If the walking speed test on 6.1 meters could not be carried out, a shorter distance was allowed and recorded. The balance test was carried out as a field test (Guralnik et al. 1994).

The equipment of the home examination is described in the methodology report (Heistaro 2005; www.thl.fi/health2000).

Telephone interview and follow-up questionnaire

Subjects who could not be contacted otherwise were telephoned and a brief phone interview was carried out. Persons who could not be contacted at all received by mail a follow-up questionnaire.

The survey of young adults

The detailed description of the survey and its questionnaires can be found in the THL web-pages (www.thl.fi/health2000) and a summary is in the following.

Data on young adults have been gathered in a few previous national studies. The SII has carried out interview surveys of health security since 1964 (Arinen et al. 1998) and the National Public Health Institute has implemented mail surveys on health and health behavior of adults since the 1970s (Helakorpi et al. 2003). Already in the 1960s the SII Mobile Clinic examined adults aged 15 and over in different parts of the country. Relatively young adults have been examined in the National Public Health Institute's FinRisk studies (Vartiainen et al. 2003). There are data on health also in the living conditions studies of Statistics Finland (Huuhka et al. 1996). At a three-year interval the Institute of Occupational Health has gathered data on determinants of health in adults aged 25 and over. In Europe there is little information on the health of children and young adults (Aromaa et al. 2003a, Currie et al. 2004).

The survey of young adults comprised an extensive interview and a questionnaire. In April–July 2001 Statistics Finland implemented the home interview of adults aged 18–29 years. The survey of non-participants was completed by December 2001. The survey of young adults resembled in many ways the survey of 30-year olds. Further information is available in the report (Nuorten aikuisten terveys/Health of young adults, Koskinen et al. 2005a).

Sampling and data collection

The sample of young adults comprised 1,894 persons (Table 19) and participation was good; 79% in the interview. The field survey comprised a home interview implemented by Statistics Finland, a questionnaire handed to the interviewee and a dietary questionnaire mailed to subjects who had returned the questionnaire.

Subjects who did not participate to the interview received by mail a condensed questionnaire, comprising the most important questions of the interview and the baseline questionnaire. An effort was made to ensure high participation. It was supported by information and a lottery organized for participants with prizes provided by companies supporting the study. Subjects who returned the baseline questionnaire and those who replied to the final questionnaire received two cinema tickets.

Table 19. The sample of 18–29-year olds, participation in different phases of data gathering and non-response.

	Number	%
Sample	1,894	100.0
Participants to		
Interview	1,503	79.4
Baseline questionnaire	1,282	67.7
Dietary questionnaire	789	41.7
Final questionnaire	205	10.8
At least one of the above	1,710	90.3
Non-response		
Declined	114	6.2
Abroad	12	0.6
Not contacted	56	2.9
Other reason	3	0.2

Of the 1,894 persons in the sample of young adults 1,503 (79%) was interviewed, 1,282 (68%) returned the baseline questionnaire, and 205 (11%) the final questionnaire. Thus, data were obtained on 90% of the sample. Participation was clearly better than in any other health survey of young adults in Europe (Aromaa et al. 2003a, Aromaa et al. 2003b).

The baseline questionnaire resembled that of the questionnaire of the 30-year-old. It inquired about participation in health promotion, looking for information on health and diseases, quality of life, mental perceptions, perception of work and study, symptoms, physical activity, eating sweets, use of alcohol, spending time and hobbies, using computers, childhood living conditions and working conditions. The questions of the adult questionnaire 3 concerning sleep and infections of the genital area were added. In the baseline questionnaire there were also questions on weight control, suicide attempts, drug use and sex life. Persons who had not returned the baseline questionnaire within four weeks were mailed a new questionnaire and stated that those returning the questionnaire would receive two cinema tickets.

The interview of young adults gathered information on health and diseases and use of medicines, utilization of health services, living habits, current and childhood living environment, functional capacity, work and work ability, rehabilitation and studying, difficulties at school and use of snuff.

Diet was measured by a similar frequency type dietary questionnaire as that used in the survey of the 30-year-old and older. Data were obtained on 789 young adults.

Follow-up of the Mini-Finland survey

As part of the Health 2000 survey also a follow-up survey of subjects participating 20 years earlier in the Mini-Finland survey was conducted (www.thl.fi/terveys2000). 1,278 persons from 7 towns participating in 1978–80 were selected. Over 80% participated in the health examination of Health 2000.

Table 20. The sample of subjects invited to the Health 2000 survey, participation and non-response.

	Number	%
Sample	1,278	
- died before the health examination	8	
Final sample	1,270	100.0
Participants to		
Interview	986	77.6
Baseline questionnaire	994	78.3
Health examination	923	72.7
Home health examination	95	7.5
Phone interview	86	6.8
Final questionnaire	25	2.0
One of the above	1,130	89.0
Non-response		
Not invited	18	1.4
Refused	80	6.3
Abroad	0	-
Not contacted	42	3.3

Participation to Health 2000

A detailed account is in the www-pages (www.thl.fi/health2000).

Various efforts were made to encourage participation. These methods were applied both before data gathering and during it by information and motivation. One method was securing the appointment to the health examination during the home health interview. Also, an agreement was made with the employers' organizations that they recommended to their member organizations that employees could participate to the study during working hours. If the subject was unable to attend, the study organization offered to carry out the survey at home or in the institution. If necessary, a taxi fare to the examination site was paid.

These measures and the interesting contents resulted in that the participation rate was very high.

Of the subjects aged 30 and over 89% participated in the home health interview, 89% in the health examination proper and 5% in the home health interview (see Table 20).

Of young adults 89% participated in the interview and, considering the final interview, the most important information was available on 90% of the subjects.

In-depth studies

After the field survey proper there were in-depth studies, which are described in the methodology report (www.thl.fi/health2000). A summary is below.

Cardiovascular diseases and diabetes

The ultrasound examination of the carotid arteries and the glucose tolerance test were deemed necessary and later tests of blood clotting were added. The ultrasound examinations were carried out in three university Central hospitals (Helsinki, Kuopio and Oulu), in the Joensuu Central hospital, the UKK-institute

(Tampere) and in the SII research institute (Turku). Of the subjects invited 1,526 persons participated. In the examination blood pressure was measured, fasting blood samples were drawn, and a glucose tolerance test was performed. Determinations on the samples were plasma glucose and insulin as well as the clotting factors Lewis-antigen, plasma fibrinogen and D-dimer.

After the subject had been sitting in the examination space for 10 minutes blood pressure was measured three times at an interval of 1–2 minutes. Measurement was carried out using the same automated OMRON M4 devices, which were used in the home measurements. Next, fasting blood samples were drawn.

The glucose tolerance test was carried out after drawing the fasting samples and international recommendations were followed (Alberti and Zimmet 1998, WHO Consultation, 1999).

Glucose and insulin concentrations were determined from EDTA plasma samples in the scientific laboratory of Kuopio University Central Hospital. A whole blood tube with ACD solution as anticoagulant, and a citrate plasma tube were sent to the Finnish Red Cross clotting factor laboratory for determination of Lewis-antigen, plasma fibrinogen and D-dimer. The clotting factor tubes were immediately frozen after centrifugation and pipetting and stored at -70 °C in a freezer.

The ultrasound examination of the carotid artery followed generally accepted principles (Howard et al. 1993, Liao et al. 1999, Selzer et al. 2001). For research purposes the right carotid artery was imaged. Prior to the study the observers were trained in the Kuopio University Central Hospital.

The qualitative interview of coronary heart disease patients

In Helsinki and Tampere persons were selected who had reported that they suffered from coronary heart disease or had experienced a myocardial infarction.

Long-term ECG registration

In Helsinki 200 participants to the in-depth examination also participated in long-term ECG registration with a Holter device.

Endothelial functioning and noninvasive study of hemodynamics

In Tampere and Turku all subjects participating in the cardiovascular and diabetes study also participated in a study of endothelial functioning and noninvasive study of hemodynamics. About 400 persons participated. The study of hemodynamics was carried out by impedance cardiograph.

The ultrasound examination of the arterial tree

In Oulu the large arterial vessels of the right-hand side were examined by ultrasound.

Structural study of lipoproteins

Subjects participating in the cardiovascular and diabetes study in Helsinki, and who had poor glucose tolerance or diabetes were invited to a study carried out in the Helsinki University Hospital. It dealt with the dynamics and structure of lipoproteins and the fat concentration of liver.

NAVIGATOR study

The project examined the angiotensin blocking agent in subjects with decreased glucose tolerance.

Musculoskeletal diseases

Validation of arthrosis diagnoses and heel bone ultrasound findings

To evaluate the properties of the ultrasound examination 130 subjects in the Kuopio region were re-examined about one year after the field survey proper. DXA imaging of the heel bone, hip joints and vertebral joints was carried out.

Mental health disorders

Prevalence of psychoses in Finland (PIF)

Subjects suspected, based on register data, Health 2000 data or medicine use of suffering from mania or psychosis were invited. The criteria were:

- hospital treatment with a diagnosis of psychosis
- disability pension or specially reimbursed medicine (SII, Central Pensions Institute) with a diagnosis psychoses or severe depression
- self-reported psychosis
- psychosis according to the Health 2000 field doctor
- lithium medication, carbamazepine, lamotrigin, topiramate or valproate for other than physical disease
- mania or psychosis in the screening by CIDI.

Altogether 897 subjects (of whom 174 were controls) came to the examination. The study began with a neuropsychological examination comprising several valid tests (Wechsler 1981, Reitan 1985, Wechsler 1987, Delis et al. 1987). The subjects were interviewed by a specialist psychiatric nurse. The treatment began with a neuropsychological examination comprising the following tests:

- California Verbal Learning Test (CVLT), immediate recall (duration 10 minutes) (Delis et al. 1987)
- WMS, visual series (duration 5 minutes) (Wechsler 1987)
- Trails A and B (duration 8 minutes) (Reitan 1985)
- WMS, number series (duration 5 minutes) (Wechsler 1987)
- CVLT, delayed recall (duration 5 minutes) (Delis et al. 1987)
- WAIS, word storage (duration 5 minutes) (Wechsler 1981).

After the neuropsychological examination a diagnostic interview was carried out by the SCID-interview method (Structured Clinical Interview for DSM; First et al. 2001).

Disability due to a possible psychiatric disease was assessed by the scales of the DSM-system. A tendency to self-destruction was assessed by a few questions added to the SCID interview.

In the diagnostic assessment the diagnoses according to DSM-IV-TR were set and a record was made of how well the diagnostic criteria of disorders were fulfilled.

Prevalence of mental health disorders in young adults (NAPS)

The incidence of schizophrenia (Suvisaari et al. 1999) and mood disorders (Aalto-Setälä 2002) is at its highest in late youth and early adulthood.

A questionnaire was sent to all belonging to the sample of young adults. In the second phase about half of them were invited to a mental health interview. A neuropsychological examination and a structured mental health interview were carried out, and then the subjects were handed a questionnaire.

Questionnaire

The questionnaire mailed to all subjects reiterated questions from the interview and questionnaire of the baseline examination. These were questions on family, education, occupation, main activity, unemployment, health related quality of life, work ability, chronic diseases and life styles. The questionnaire also comprised many measurement scales, which were used to select the subjects for a detailed interview.

Set-up 4. Measurement scales of NAPS

1. K-10; K 10 is a screening method of current psychological symptoms of the U.S. National Health Interview Survey (Kessler et al. 2003).
 2. GHQ-12 (General Health Questionnaire); GHQ was a questionnaire originally comprising 60 questions charting current psychological symptoms. The short 12 item GHQ- 12 is now the most common one (Goldberg et al 1997).
 3. SCOFF; The SCOFF questionnaire comprises five questions (59-63; yes/no) to identify eating-disorders.
 4. Basic questions of CIDI part G. In NAPS the CIDI part G (questions 100–122) was used for screening of psychosis. Twenty questions on delusions and hallucinations were put (WHO 1997a).
 5. MDQ (Mood Disorder Questionnaire); Questions 95–97 are a screening method for bipolar disorder.
 6. Intoxication screens. The Cage questionnaire comprises a screening test for alcoholism (Ewing 1984).
 7. Screening for self-destructive behavior; persons with a suicide attempt ever.
 8. Screening for use of mental health services and perceived need for care.
-

The questionnaire comprised many questions used in screening the subjects to follow-up examinations: K-10 (Kessler et al. 2003), GHQ-12 (Goldberg et al. 1997). SCOFF, CIDI part G (WHO 1997a), MDQ (Hirschfeld et al. 2000, Hirschfeld et al. 2003), CAGE, Ewing 1984) as well as the screens on self-destructive behavior and use of mental health services.

The NAPS-interview

The subjects were chosen to the interview either based on replies in the questionnaire or by data in authority registers if they had:

- a disability pension (or rehabilitation allowance) due to a mental disorder according to the register of the Central Pensions Institute
- according to the SII register fully reimbursed medication for psychiatric disease, or if they used any psychiatric medicine (Pharmaca Fennica part F or specified mood stabilizing medicines in group G) according to the SII prescription medicines register
- or if they received or had received SII supported rehabilitation, mainly psychotherapy, because of a mental health disorder.

The interview was always carried out by the same psychiatric specialist nurse or a psychologist. The interview started with a neuropsychological examination comprising the following tests:

- California Verbal Learning Test (CVLT), immediate recall (Delis et al. 1987)
- WMS, visual series (Wechsler 1987)
- Trails A and B (Reitan 1985)
- WMS number series (Wechsler 1987)
- CVLT, delayed recall (duration 5 minutes) (Delis et al. 1987)
- WAIS, vocabulary (Wechsler 1981)
- WAIS-III, letter and number series (Wechsler 1997).

After the neuropsychological examination a diagnostic interview was performed using the SCID-interview (First et al. 2001).

Disability was assessed by the scales Global Assessment of Functioning (GAF) and Social and Occupational Functioning (SOFAS), which belong to the DSM system.

NAPS follow-up questionnaire

After the interview the subject received a questionnaire to be filled in at the examination site or at home. The follow-up questionnaire comprised many scales concerning e.g. quality of life, life events, hopelessness, social support and burnout (Pilowsky 1967, Beck et al. 1974, Maslach and Jackson 1981, Horne ja Ostberg 1976, Parker et al. 1979, Blumenthal et al. 1987, Hays et al. 1993, Kendler 1997, Kwapil et al. 1997, Kwapil 1998, Kendler et al. 2003, Lillberg et al. 2003).

Other data

Data from several sources were linked to the material. These dealt with hospital treatment for mental disorders, SII data on use of psychiatric medication and special reimbursement for psychosis medication, and the Central Pensions Institute data on work disability pensions due to mental health disorder. During the interview the subject was asked to give permission to the researchers to gather data from patient records. The final diagnosis was made by researchers of the National Public Health Institute based on the SCID-interview and patient records.

Complementary examinations of oral health

In order to monitor the development of oral health and of dental health care an in-depth study was carried out on a subsample of subjects participating in Health 2000 (www.thl.fi/terveys2000), methodology report (www.thl.fi/health2000). The aim was to evaluate the legislative changes coming into effect on 1.12.2002. To achieve this goal questionnaires were mailed to the subjects every 5 years. With changes in the Public Health Act and the Sickness Insurance Act the dental care of the whole population was partly covered by public funds.

The subjects for the clinical study were selected at random from those 2,000 people who had participated in the Health 2000 survey. The clinical follow-up phase comprised 1,200 persons in 44 health center districts.

The examination comprised a radiographic examination, a clinical examination and complementary questionnaires. After the examination the subjects filled in two questionnaires. One of them dealt with use of dental care services and the other comprised two quality of life measures (OHIP-14 and 15-D).

The first phase of the monitoring study of the dental care reform comprised one sub-population of the adults examined in Health 2000. In the second phase 2,000 persons were selected from these. They received a questionnaire on use of dental care and perceived oral health. This second phase comprised the dentate subjects.

Other complementary studies

Occurrence of celiac disease in Finland

A serum sample of all participants to the health examination was sent to the Research Center for Children's diseases of the Tampere University Hospital. Tissue transglutaminase antibodies suggesting celiac disease and endomysium antibodies were analyzed in the celiac disease research group. There were 6,403 serum samples. Considering known diseases, the prevalence estimate for celiac disease was 1.3 %.

The population's physical activity, condition and health – the complementing study by the UKK-institute

The UKK-institute implemented a follow-up study measuring physical performance in a many-sided way using the UKK-health condition tests (www.thl.fi/terveys2000; www.thl.fi/health2000). The properties and usefulness of the measurements has previously been examined in relatively small population samples (Suni et al. 1996, Rinne et al. 2001, Suni et al. 1998a, Suni et al. 1999, Suni 2000, Malmberg et al. 2002a, Malmberg et al. 2002b). The tests have been described in the methodology report. The target population was subjects living in the Tampere university hospital region aged 30 and over participating in the Health 2000 examination (N=1,266) and in the Mini-Finland follow-up survey (N=188) and living in the Tampere university hospital region (15 health center districts). The health performance tests were carried out in the winter 2000/2001. Altogether 1,321 subjects participated in the UKK project.

Testing health performance

The physical health performance tests were always performed with indoor or outdoor shoes on and in a specified order.

The implementation has been described in detail in the UKK-institute's publication Testaajan opas (guide for the test-observer), the UKK health performance test for middle-aged persons (Suni 2003). These tests concerned motor condition (Suni et al. 1996, Rinne et al. 2001), the condition and flexibility of the musculoskeletal system (Alaranta et al. 1994, Suni et al. 1996, Suni 2000) and condition, muscle strength and durability of the musculoskeletal system (Suni et al. 1996, Suni 2000). Also walking tests were carried out (Oja et al. 1991, Malmberg et al. 2002a, Malmberg et al. 2002b).

Validation of bio impedance measurement

In Kuopio a validation study of the bio impedance measurement was carried out by comparison with DXA measurements.

Vision of Finns

The study population comprised 677 persons reporting problems in seeing or the eyes or whose distant vision was poorer than that demanded for a driving license. All earlier ophthalmological examination results were retrieved. Of these persons 75% could be contacted and their results were available.

IT-system

The Statistics Finland IT-system supported the home interviews and it also helped in retrieving and providing to the interviewers contact information and distributing the electronic questionnaires. It also helped to receive and link the data. The health interview was computer assisted and based on the Blaise-program. The interviewers daily sent the interview data to Statistics Finland, and there the data of different interviewers were linked. From Statistics Finland the interview data were sent daily to the National Public Health Institute (KTL). Via ISDN-connections KTL took care of sending the needed data to the five field teams.

The network of each field team was built on two wireless Orinoco-stations (IEEE 801.11b) and a Cisco 800 (LAN ISDN) router. The data traffic between the field team and the central office was taken care of by the Sonera DNRA service (DataNet Remote Access).

The database consisted of form-specific SAS-files. Mainly SAS was also used for later data processing.

In addition to physical data protection means the data protection and privacy of the electronic data was ensured by equipping the field team computers with a partition concealed by the PGP program.

Quality assurance and quality control

Quality assurance and quality control is described in detail in the methodology report (www.thl.fi/health2000). When data are gathered the results show systematic and random variation, which is due to variation within the subjects over time and technical variation in the measurement itself. Technical variation of the measurement is due to the equipment or observer.

Core aims were to gather valid measurement results and a stable level of the measurements as well as good comparability of the measurements of different observers. Good quality was ensured by standardizing the measurements, by various quality assurance means, by continuous monitoring of quality during data collection and by special study designs during the so-called quality days.

In quality assurance the following designs were used:

- repeated measurements (the same observer measured the same subject twice)
- parallel measurements (two or several observers measured the same subject)
- reference measurements (the results of the observer were compared to those of a reference observer)
- measurement of standards (a standard target or subject was measured).

As part of the field survey quality was continuously monitored.

For monitoring of quality written instructions were prepared and training was organized. At the beginning of the survey the observers' performance was video-filmed. The persons in charge of each measurement repeatedly monitored performance. The measurement conditions were standardized, the equipment was calibrated, and its functioning was checked. Monitoring results ensured that quality remained stable. Reliability of the observers and the equipment was assessed and so was the agreement between the results of different observers and instruments. Repeated and parallel measurements were carried out on both personnel and examinees. At the start of the day the observer carried out on himself/herself the following measurements: spirometry, heel ultrasound, and bio impedance. Parallel measurements by two observers and repeated measurements by one observer were carried out in each measurement station by one or two first subjects.

To assess total variation 40 subjects per field team were invited 6–8 months after their field survey to attend repeated measurements. The measurements repeated were questionnaire 1, short home health interview, short symptom interview, blood pressure measurement, hip circumference, and several functioning tests (vision, hearing, reaction speed, hand grip strength, balance (Guralnik), cognitive functioning, and blood samples). In addition, on subjects aged 55 and over joint functioning, chair stand and walking speed were tested. The total variation of the Mini-Mental State Examination was assessed in 105 subjects and that of the dietary questionnaire in 180 subjects.

Three types of quality days were organized to gather information on quality. Type 1 and 2 days were organized in the field teams and the type 3 day common to all field teams was organized at the end of the field survey.

The program of each field team comprised six type 1 quality days. During them parallel and reference measurements were carried out, and 300 persons were examined. Reference measurements between home

visit nurses and observers proper were carried out on about 180 subjects. These comprised hip circumference, and some functioning measurements (vision, hearing, hand grip strength and Guralnik's balance). In addition, on 78 subjects aged 55 and over joint functioning, chair stand and walking speed tests were carried out. In the clinical examination of the mouth parallel and reference measurements were carried out on 269 subjects.

The program of each field team comprised four type 2 quality days, and about 200 subjects were examined. Repeated measurements were carried out so that in addition to the observer proper there was an observer from another field team. The subject visited each measurement station twice. Parallel measurements were carried out as follows: blood pressure, spirometry, heel bone ultrasound, functional capacity (vision, hearing, reaction speed, hand grip strength, balance, joint function, chair stand, walking speed) and the clinical examination.

Quality day 3 was organized in Helsinki and Vantaa. Persons not belonging to the sample proper were invited. The agreement between observers was assessed as well as their agreement with reference observers. Reference and repeated measurements were carried out on 138 subjects aged 25–83 years by repeating the measurement in each subject three times. The measurements were symptom interview, blood pressure, hip circumference, trunk sagittal measurement, and functional capacity (hearing, joint functioning, chair stand and cognitive capacity). Thus, a material of 138 subjects was formed. The agreement of M-CIDI was assessed on parallel measurements in 49 subjects. In quality assessment of the clinical examination of the mouth there were 42 examinees.

Additional quality assurance

In the laboratory there was a usual laboratory quality control system monitoring the level and repeatability of determinations. The validity of the dietary questionnaire was assessed by a three-day dietary diary filled in by 294 examinees. The reliability of radiographic imaging of the mouth was assessed in a material of 327 images and that of the ECG Minnesota-coding by repeated coding of 200 ECGs. Some clinical examinations were repeated in the in-depth study.

Documentation and quality assurance by photos and videos

In each field team one of the nurses carrying out functional capacity test was appointed responsible for video-filming. The researcher responsible for functional capacity measurements once a month viewed the videos.

The video films were mainly used in monitoring the quality of musculoskeletal examinations. In October 2000 the three-person musculoskeletal study group of the Institute of Occupational Health viewed the first video. Not unexpected, the greatest differences between doctors were observed in tests most unfamiliar to them.

Video-filming was a good method for monitoring quality. It resulted in noting deviations which could also be corrected.

Checking the data and processing it

Checks

The questionnaires were checked before they were recorded. Formal validity checks were applied to all data, and in addition checks of logic between replies and corrections were performed. The verification and correction tasks directed by experienced personnel, and a large part was carried out by post-graduate health sciences students.

The checking and recording of the data has been described in detail in the methodology report (www.thl.fi/health2000). Using the Blaise-program a large part of the data was collected into electronic form. First, the variables needed for the baseline report were checked. Next, verification was extended to cover all variables. Much time was needed to specify the logical conditions.

Every week the field teams sent material to the central office. The Blaise-files were received in electronic form and the paper forms were fetched or sent. When the number of type of the form and the study number were fed to the computer it displayed the name of the subject. It was compared to the personal identification on the forms.

The verification programs, files, conditions and correction rules were recorded. After the first corrections a new permanent file of the data was recorded. During verification participation data were created for each examinee.

For each measurement station or form a description was created as an Excel-file. Versions were made of the forms which contained the variable names.

The document of verification comprised the acceptable values by variable, logical conditions, and variables to be printed in case the dependence was false. If the corrections were right, a new version of the file dated on that day, was created.

The permissible upper and lower values were checked, and corresponding corrections were made. To define corrections called for by the remarks, codes were defined which could call for changes in the variables. The changes were recorded in the file.

In the logical checks the logic between the main question and the follow-up question was checked and corrected.

Finally, so called frequency checks between several variables were performed. The outcome were tables of all different variable combinations. Possibly false combinations were listed and corrected.

Weights and statistical processing of the data

The two-stage sampling scheme must be considered when analyzing the data. Usually, SUDAAN-procedures (Research Triangle Institute 2001) have been used in the analyses. The standardization by confounding factors was performed using the logistic or the linear model. In direct standardization the weights were derived from the 1980 population. The original weights considering the design will be provided together with the data. Later, new versions of statistical programs have become available and they are able to analyze complex data correctly. The programs are StatA and SPSS. A more detailed description of the weights and statistical analysis is below:

The purpose of the weights is to return the data set to correspond to the distribution of the original target population. Creating the weights begins by calculation of the original probabilities for the sample individuals. The probability depends on the population's regional distribution and the target individuals' age:

1st stage sampling-region clusters

- 15 big health center districts were sampled with probability 1
- 65 health center districts were sampled with varying probabilities

2nd degree sampling – stratification of the clusters

- by age, considering the denser sampling at age 80 and above

The revision of the design weights has two corrective effects: 1) the effect of non-response is corrected and 2) the final material is generalized so that the material corresponds to the target population. The calibration of the design weights was done using the CALMAR-macro (Sautory 1993).

Sample variance, standard errors and model based standardization

In the 15 largest cities the sampling design was one-stage stratified sampling. Each of these cities is a stratum of its own, and every respondent is handled as a cluster. In the two-stage sample proper each stratum has a hospital district identification of its own; the first-degree stratum is the health center district and the second the individuals. The clusters have a consecutive numbering, so that analysis becomes simple. There were 65 clusters sampled by PPS-sampling. Design-based estimation is described in modern text books of sampling theory, in the books by Skinner, Holt and Smith (1989), Lehtonen and Pahkinen (1996) and Lohr (1999). It is also described in the manual of the generally used program (SUDAAN User's Manual 2001).

It is worthwhile to use in the analyses programs which can take into account the sampling design, or to use methods which can consider the hierarchical nature of the data set (Lehtonen and Pahkinen 1996, Graubard and Korn 1999).

To illustrate the effect of different determinants predictive margin modelling standardization can be used. It eliminates the effect of confounding factors on the study variables (Lee 1981). For each observation unit a predicted value is calculated by linear or logistic regression. The mean of individual predictive values describes the population mean or prevalence.

In 2002 the most comprehensive properties for taking design into account were in the program package SUDAAN. Another suitable program was StatA. Other programs are Lisrel, the survey package of R and the SURVEY procedures of SAS. Nowadays (after 2010) also SPSS can analyze data based on multistage sampling.

Follow-up by national registers and sample storage

Data retrieval from national registers and their use have been described in more detail in the methodology report (www.thl.fi/terveys2000; www.thl.fi/health2000).

The register data were used to complement the picture on the subjects' health. Data collection began before the field survey and continues. By comparing the register data of participants and non-participants it is also possible to assess selection due to non-participation. Monitoring by registers also enables the study of prognostic impact. The most important data linked to the study material concern causes of death, hospital discharges, special reimbursements for medicines, prescription medicine purchases, cancer, and work disability.

When using the register data, data protection and privacy are taken care of. Obviously, use closely followed legislative rules, and the directions of holders of the registers and directions and the Good Research Practice guidelines of the National Public Health Institute. The subjects were informed about the use of the register data, and the informed consent signed by them also covered this use.

In the sample store there were serum and plasma samples and whole blood samples from all examinees. Many determinations had already been carried out on them, and further ones will be performed on them also in future.

Health 2011

2011–2012



Health 2011

The aim of Health 2011 representing the Finnish adult population was to provide new valid data on the population's health, functional capacity and well-being as well as changes therein during the preceding decade. A project organization comprising financiers and those carrying out the survey was formed. The planning and implementation were coordinated by the National Institute for Health and Welfare (THL) in collaboration with the Ministry of Social Affairs and Health and the Social Insurance Institution (SII) as well as other parties active in the field of population health such as the Central Pensions Institute (CPI) and the Institute of Occupational Health (IOH). Other participants in planning and implementation were experts from other research institutes and universities and societies, and the collaboration was based on the successful way of working in Health 2000. The major funding agencies were THL, SII, IOH, the Ministry of Social Affairs and Health, the Finnish Academy of Sciences, The Work, Environment Fund, the Finnish Dental Society Apollonia and the Finnish Dental Association, the UKK Institute, Finance Finland, GlaxoSmithKline, Normomedical Oy and the hospital district of Pirkanmaa.

The Health 2011 survey is in many ways based on the Health 2000 survey implemented in 2000–2001. All living subjects invited to Health 2000 were also invited to Health 2011 unless they had forbidden it (N=8,135). In 2011 they were at least 29 years old. In addition, a new random sample of 18–28-year-old (N=1,994 of whom 415 were invited to the health examination). The sample represents Finnish adults. Furthermore, persons invited in 2001 to Health 2000 due to the Mini-Finland follow-up were invited for a third time (N=922).

The study was implemented largely in the same way as Health 2000. It comprised a comprehensive interview, questionnaires and a large-scale health examination. Much weight was again given to collecting data which are not available from other sources. A general description, baseline results and methods have been presented in two main reports (Koskinen et al. 2012, Lundqvist and Mäki-Opas 2016) and in the web-pages (www.thl.fi/health2011).

Aims

The aims of Health 2011 were to provide comprehensive and timely data on the health, functional capacity and welfare as well as their changes in the population and its subgroups during the first decade of the 2000s. Data were collected on the same persons in the years 2000 and 2011, and due to the follow-up design the determinants predicting changes in health, functional capacity and welfare. Such data are indeed needed to assess and to anticipate factors correlated with the changes in health and functional capacity. By influencing these factors, the population's wellbeing and work ability can be improved, work careers can be extended, the independence of the elderly and prerequisites for good quality of life can be enhanced and the healthy life expectancy can be extended.

The material is also used for studying health and welfare differences between population groups. By studying the use of services and social security, their need and adequacy a basis can be created for the development of social security at large. Since there are comparable data for the years 1978–1980, 2000–2001, and 2011–2012, valid predictions can be made on the development of the population's health, functional capacity and welfare as well as need for treatment and assistance. Furthermore, actions to promote health, functioning and welfare can be directed as correctly as possible.

The survey and its general implementation

The parts of the survey were

- health examination of adults aged 18 and over
- health examination of subjects participating in 1978–1980 to the Mini-Finland survey and its follow-up health examination in 2001
- mail survey of young adults (18–28-year-old).

The sample

The Health 2011 sample is based on the sample drawn in year 2000 for the Health 2000 survey (Aromaa and Koskinen 2002). Since the youngest subjects in this sample were aged 29 years, in 2011 a new sample was drawn of young adults aged 18–28. As a result, the sample was representative of Finnish adults aged 18 and over. In addition, those subjects who had been invited to the Mini-Finland resurvey in 2001 and were still alive were asked to participate also in 2011 (Heistaro and Koskinen 2005).

The Health 2000 sample was based on a two-stage stratified cluster sample (Laiho et al. 2005). Mainland Finland was divided into 20 strata, and 15 of these comprised the largest cities and the other 5 strata divided mainland Finland into regions according to the borders of the University Central Hospital districts. From these 15 largest cities the individual samples were chosen by systematic sampling and from the other 65 health center districts the individuals were sampled by systematic PPS sampling. Subjects aged 80 and over were sampled with a double probability. The survey regions are shown in Figure 18.

The original sample represented the adult population of mainland Finland in year 2000. Since Health 2000 was not an intervention study the mortality of the individuals in the sample corresponds to the mortality of the population. Thus, the living subjects in 2011 represent the population in 2011. Also, due to the same reasoning the emigrants represent emigration in the population. The sample does not represent persons who had immigrated to Finland after year 2000, but this immigration, however, is concentrated to young adults and does not have a major influence on the results of this study. A separate study has been carried out on the immigrant population (Castaneda et al 2012).

Due to the ageing of the original population sample it was complemented by a new sample of adults aged 18–28 years. For sampling young adults, the original sampling regions were used. In the study Collaborative Research on Ageing in Europe (Courage) comparable data were gathered to enable comparisons to the Spanish and Polish populations. For the Courage study 3,967 subjects were sampled at random from the Health 2011 sample. In a similar way 4,916 persons were sampled for the study on physical activity and fitness, which was carried out in collaboration with the UKK-institute.

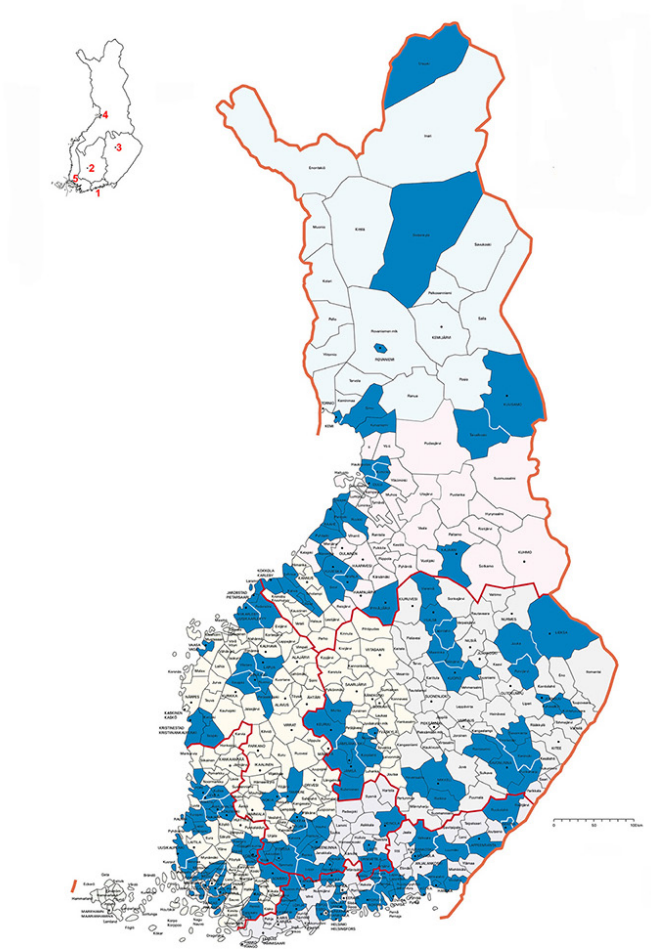


Figure 18. Study regions.

Implementation of the survey

Planning of the survey began in 2009. During that year a draft of the contents was created comprising the interviews, health examinations and questionnaires. Planning was carried out in collaboration with experts from the National Institute for Health and Welfare, the Institute of Occupational Health, the University of Helsinki, and many other institutes. As the funding of the study was secured by the end of 2010, detailed planning of the field survey was begun. During the spring and summer of 2011, the contents of the interviews, the health examination, the questionnaires and the computer assisted data gathering methods were finalized. Also, the necessary equipment was acquired. Furthermore, the local contact persons were approached to obtain study premises. The survey was preceded by a pilot study in May 2011. The pilot tested the study process, and time consumption. In addition, the computer assisted data gathering methods were tested. The experiences from the pilot study led to finalizing the study contents proper, the instructions and the time tables.

For Health 2011 and the Courage study implemented in connection with Health 2011 one hundred field staff were recruited during spring and summer 2011. A two-week training period was organized for the field staff in Helsinki 25.7.–5.8.2011. Training was differentiated so that each field observer received both general training about population surveys and specific training about working in two measurement stations. During the first training week the Courage field nurses had a separate one-week course.

The field survey proper was implemented between 8.8. and 21.12.2011 in 60 study regions by five field teams in different parts of the country. The field team centers were the cities of Helsinki, Turku, Tampere, Kuopio and Oulu. Each field team comprised 15–18 nurses, and 2–3 of them acted as home visit nurses. The field study comprised a health examination with various measurements and examinations, interviews and questionnaires.

An abbreviated health examination was carried out at home on persons unable to come to the field health examination proper. If the subject was unable or not willing to participate in any health examination, a telephone interview was proposed.

For persons in the Courage sample a separate interview was carried out at home prior to the field health examination. On persons in the physical activity and fitness sub-sample the physical condition tests were carried out at the end of the health examination, and they received a tri-axial accelerometer for a week. In the Helsinki and Oulu field teams the health examination also comprised an examination of oral health.

The field personnel used passenger cars to move from one study municipality to the other. Equipment was transported by vans. The beginning of the field examinations was broadly announced in national and local media. Information was continued throughout the field phase. Equipment was supplied as needed from Helsinki (THL) to storage spaces located in the central cities and the field examination premises. The samples gathered were transported to the THL disease risk unit as registered mail packages in dry ice.

Internet-connections were provided via USB-modems for all health examination sites. They were used to send data to the THL central database and to up-date data gathering programs as well as for communication with the field teams. Furthermore, daily a spare copy of the files was made on a memory stick. The memory stick was replaced regularly and mailed as registered mail to THL. The aim was that data quality could be followed closely during the field phase and that checks and corrections for the baseline report could begin already during autumn 2011.

In spring 2012 a questionnaire survey was carried out on the additional sample of young adults (aged less than 29 years) both as a mail survey and as an internet survey.

All who had not returned a questionnaire received two reminders. After the field survey proper data gathering was continued in spring 2012 implemented by six field nurses. Two of them worked in the Helsinki region and one in Turku, one in Tampere, one in Oulu and one in Kuopio. Complementary data gathering was implemented between 2.1. and 30.6.2012 and it was offered to all non-participants. The options in the complementary data collection were 1) an abbreviated health examination in the central city, 2) home health examination, 3) telephone interview. The content of the abbreviated health examination was the same as that of the home health examination. In addition, it comprised a few additional measurements. If the subject had not participated in any part of the survey, a mail questionnaire like the telephone interview was sent. Two reminders were also mailed to non-responders.

Material

The Health 2000 sample comprised 9,922 adults aged 18 years and over. During the 11-year follow-up 1,573 persons died, 103 moved abroad and 111 had forbidden all contacts. All other persons in the Health 2000 sample, i.e. 8,135 persons were invited to the Health 2011 health examination survey. In 2011 they were aged 29 or over. The Health 2000 sample was complemented by a new sample of 415 persons aged 18–28 years. In addition, a questionnaire was mailed to 1,579 young adults.

In comparisons between the Health 2011 and Health 2000 results it is advisable to divide the material into two parts: persons aged 30 years and over and persons aged 18–29. In the Health 2011 sample there were 7,964 persons aged 30 and over. Of them 5,806 participated (72.9 %) at least in one data gathering phase. 4,218 persons participated in the field health examination, 453 in the home health examination, 441 in the telephone interview and 763 in the final questionnaire. The most common reason for non-participation was refusal.

Table 21. The sample of persons aged 30 and over, participation in different phases of the study and non-response.

	Number	%
Sample	8,022	100.0
Participants to		
Health examination	4,277	53.0
Home health examination	452	5.7
Health examinations (total)	4,729	58.6
Telephone interview	404	5.5
Final questionnaire	770	9.6
At least one of the above	5,903	72.9
Non-response		
Refused	1,331	
Not contacted	788	

The participation rate of women to any part of the survey (77%) was higher than that of men (70%). In women the participation rate was highest at ages 41–80 years. In men the highest participation rate was 80% in age group 61–80. There were no major differences between the university central hospital districts.

Of the 18–29-year-old 406 persons were invited to the health examination of Health 2011 (9 persons were not invited because they were staying abroad). In addition, a questionnaire was mailed to 1,575 young adults. Of those young adults invited to the health examination, 121 (30%) participated in the health examination and 93 (23%) participated in the telephone interview or replied to the mail questionnaire. Of subjects receiving the questionnaire only 623 (40%) filled it in.

Of the participants to the Mini-Finland survey in 1978–80 those still alive were invited to participate to the Health 2000 survey, and 1,130 participated. Of the 920 subjects invited after a further 11 years follow-up 748 (81%) participated in Health 2011, and 723 of them participated in all three surveys.

The same principles and methods used in checking the data and the same statistical methods as described under Health 2000 were used.

Methods of the field survey

The purpose of Health 2011 was to produce a comprehensive and sufficiently thorough picture of the health of the adult population by paying attention to phenomena, which cannot be examined by other than health survey methods. The core areas were functional capacity and work ability, mental health, health of the musculoskeletal system, oral health, need for services and social security benefits and their satisfaction, as well as the objective and perceived aspects of well-being. The starting point for planning the survey contents were the Mini-Finland survey implemented in 1978–80 (Aromaa et al 1989b) and the Health 2000 survey implemented in 2000–2001 (Aromaa and Koskinen 2002). The 2011 results were also to be compared with those of these previous studies.

Working groups put together from experts of different study areas assessed on which phenomena and at which detail new data should be gathered. These assessments were based on the availability of needed data from other sources and took also into account the need for comparability, new data needs and possible improvements in methods. These expert groups had originally been gathered for planning and making good use of the Health 2000 data and they were complemented over the years. Based on these expert proposals the leadership of the study compiled the final content of the survey. Many important issues and methods could not be included in the field program and the available time frame.

To involve a broad expert network in planning the survey content was a good solution, which can be recommended for other studies as well. The best experts could be involved, and in addition to planning

they also participated in training the field staff and monitoring field work. It is particularly valuable that these experts, their students and other members of their research group are also involved in making good use of the material gathered.

The content and phases of the field survey are shown in set-up 5. A letter of invitation to the health examination was mailed to the subjects about two weeks prior to the examination date. In the letter there was 1) a letter of information, 2) a covering letter, which comprised time and location of the health examination and instructions for arrival including a map, 3) a questionnaire to be filled in at home (questionnaire 1), 4) a general brochure about the survey and 5) two copies of the consent forms. For subjects in the physical activity and fitness sub-sample, instructions for preparing for the measurements were included.

Set-up 5. Contents of the field survey

Home interview of the Courage subsample

Registration

- Information and consent
- Checking questionnaire 1, Questionnaires 2, 3, diet, Vision

Measurements 1

- Height, Bioimpedance, Resting ECG, Balance 70+

Measurements 2

- Blood pressure and heart rate, Abdominal circumference, Chair stand

Measurements 3

- Drawing samples, Spirometry

Measurements 4

- Verbal fluency, Learning, Hand grip strength, Delayed recall, Mental health interview, Walking speed

Final station

- Receiving questionnaires, Joint function 55+
- Questionnaire 4: Interview: Background, Living environment, Health, Functioning, Health services, Health behavior, Work and work ability, Quality of life

Physical activity subsample

- Accelerometer, One leg stand, Jump and reach, Modified push-up, Six-minute walk, Questionnaire

Home visits

Examinees per day

- Regular day 25
- Arrival/departure day 12

55+: only for subjects aged 55 and over; 70+: only for subjects aged 70 and over.

A home visit was paid to subjects belonging to the Courage-subsample about 1–2 weeks prior to the health examination. During the home visit an interview was carried out inquiring about background data, health, illnesses, quality of life, utilization of services and welfare as well as their determinants. Several measurements were also carried out during this home visit: blood pressure and handgrip strength, a cognitive test (repeating numbers in the same and reversed order) and a crude test of near and distant vision. Furthermore, the living circumstances of the subject were observed. All subjects belonging to the Courage subsample were also invited to the health examination proper.

Health examination

In the health examination all subjects were asked to participate in measurements in six stations (Set-up 5). In the field teams in Helsinki and Oulu also a clinical oral examination was carried out on all participants to the health examination. In subjects in the physical activity and fitness sub-sample measurements of physical fitness were carried out at the end of the health examination. Usually subjects were invited to the health examination at 15-minute intervals. Furthermore, some slots had been reserved for possible changes and cancellations. Overall the health examination took 3.5 to 6 hours per person. A laptop in each measurement station was used to record measurement results and other data.

The health examination proper began with registration, ensuring the subjects identity and recording possible changes in personal details. The course of the examination was explained and oral and written information about the study was provided. Also, the subject's right to refuse to participate was explained. After getting acquainted to the study and the intended use of the data the subject signed the consent forms. Labels were used, which identified (three sheets of adhesive labels/examinee) the subject. The first label of the sheet was fastened in this measurement station on the day specific visit list at the place for that subject. A label was then fastened on each form handed to or received from the subject. The questionnaire (questionnaire 1) filled in at home was received and checked.

Questionnaire 1 inquired about e.g

- functional capacity
- social environment
- security of the nearby environment
- mental perceptions
- weight
- height
- living habits
- hobbies
- sex life
- health promotion
- quality of life
- working conditions
- loneliness
- livelihood
- childhood living conditions.

At registration near and distant vision were examined. Finally, the subject was handed a personal study program, the subject's copy of the consent document and three questionnaires (questionnaire 2, questionnaire 3 and the food frequency questionnaire). The subject was asked to fill in as many of them as possible during the health examination. Questionnaire 2 inquired about respiratory symptoms and cardiovascular symptoms, atopic and allergic symptoms, musculoskeletal symptoms, mood and sense of coherence. Questionnaire 3 comprised questions on sleep and sleeping, general symptoms, quality of life, oral health, human relations, perception of feelings and financing of services. The dietary questionnaire aimed at assessing intake of nutrients and energy by putting questions about consumption of foodstuffs typical to the Finnish diet. Set-up 5 summarizes the contents of the interview and the questionnaires.

In the second measurement station (Measurements 1) height was measured with a scale (Seca 123) fastened to the wall, and body composition was measured (Seca 514) after weight had been measured. The body composition (or bio impedance) findings provided data e.g. on fat percentage and muscular mass. A 12-lead resting ECG was also registered. Abnormal ECG findings were clarified in discussion with the nurses and THL expert doctors, who also advised on necessary actions. Subjects aged 70 years and over also participated in a balance test.

In the third measurement station (Measurements 2) blood pressure was measured twice on the sitting subject's right arm with a mercury manometer. Between the two measurements pulse was measured from the

right wrist for 60 seconds (a stopwatch was used). Next, abdominal circumference was measured. Finally, a chair stand test was carried out. After the test the subject was guided either to the oral health station (Helsinki and Oulu) or the Measurements 3 station.

In the oral health station, a dentist and a dental auxiliary carried out a structured clinical examination of the mouth. In addition, in Helsinki a radiograph (orthopantomograph) was taken. If necessary, the subjects were given a referral letter and advised to consult their own dentist. After this the subject was guided to the next measurement station.

In the laboratory station (Measurements 3) a blood sample was drawn and spirometry measuring respiratory functioning was carried out. The subjects had been asked to refrain from eating and drinking four hours prior to the health examination. Prior to drawing the blood samples in the laboratory station, the nurse recorded how well the instructions had been followed. Blood samples were drawn for determinations on serum, plasma and whole blood. The samples were centrifuged in the examination site and placed into a freezer at -20 °C until they were sent packaged with dry ice to THL where they were placed into a freezer at -70 °C. Next, the subjects were guided to a snack and they were also asked to fill in questionnaires received at registration.

In the interview station an extensive interview was carried out. It inquired about background data and comprised questions on health status, diseases, accessibility and use of health services, oral health, living habits, functional capacity, working conditions and work ability as well as rehabilitation. After the interview the subject was guided to the final station.

The measurement results were handed to the subject on a separate feedback form (vision, height, weight, body mass index, fat percentage, abdominal circumference, ECG findings, blood pressure, chair stand, walking speed and hand grip strength tests as well as the results of spirometry) and the results were also explained. The subjects received the ECG and spirometry records and the results printed out by the bio-impedance instruments.

In the final station the observer first checked that the subject had visited all intended measurement stations. In addition, the questionnaires filled in during the health examination were received. These were questionnaire 2, questionnaire 3 and the dietary questionnaire. If needed the subject was helped in filling them in. The subject received a further questionnaire 4 (questions to be repeated) with a return envelope. For subjects belonging to the physical activity and fitness subsample a physical activity questionnaire was given, which they were asked to fill in at home. Subjects aged 55 years and over were administered a joint function test examining squatting, raising the arms and rotation of the arms. Subjects belonging to the home blood pressure sub-sample (1,872 persons) were handed an automated blood pressure device (Omron M6) to be used at home for one week. The observer also replied to possible questions on the findings and the content of the study. This was the final station for subjects not belonging to the physical activity and fitness sub-sample. Those who did were guided to the physical activity station.

For subjects in the physical activity and fitness sub-sample measurements of physical performance were carried out: one leg stand, jump and reach (vertical jump), modified push-up or dynamic trunk flexion test, and a six-minute walk test. In addition, an accelerometer to be used for seven days was handed to the subject. In parallel with using it a physical activity diary was to be filled in.

Set-up 6. Interviews and questionnaires

All forms are in electronic format in the THL web-pages (www.thl.fi/health2011).

Interview

A. Background data

Mother tongue
Household
Education
Main activity, occupation
Present/previous occupation (main job)
Working hours and form of remuneration
Unemployment
Data on the spouse

B. Health status and diseases

Perceived health and chronic illnesses
Treatment of diseases
Hospital care
Surgical operations
Questions for men
Infertility

C. Questions for women

Menstruation
Pregnancies and childbirths
Infertility and its treatment
Contraception
Hormone replacement therapy

D. Health services

Accessibility and access to services
Ambulatory visits due to diseases and symptoms
Physiotherapy
Other treatments
Medicines

E. Oral health

Health status of the mouth
Self-care of the mouth
Use of services
Client of dental care

F. Behavior

Diet and nutrition
Smoking

G. Living environment

Housing
Disadvantages of housing
Services in the neighborhood

H. Functional capacity

Usual activities
Mobility
Sensory functions
Need of assistance and adequacy of assistance
Assistive devices
Cognitive capacity

I. Work and work ability

Working conditions
Work ability
Know-how
Pension attitudes
Job history

J. Rehabilitation

Use of services
Need for rehabilitation

K. Interviewer's assessments

Questionnaire 1

Functioning (e.g. EuroQol)	Eating and drinking sweet foods and drinks
Social support (e.g. 4 questions by Sarason)	Health promotion
Security of the neighborhood	Quality of life (WHOQoL-8)
Mental perceptions (GHQ 12)	Job perception and strain (MBI-GS)
Height and weight	Working conditions
Physical activity	Vitality
Use of alcohol (e.g. Audit-C)	Loneliness
Treatment of alcohol problems	Livelihood

Questionnaire 2

Dyspnea	Falls
Chest pain	Mood and feelings (BDI-13)
Allergic symptoms	Sense of coherence (Antonovsky SOC)
Musculoskeletal symptoms	

Questionnaire 3

Sleep and sleeping	Human relations (Cynical mistrust)
Seasonal variations	Perception of feelings (TAS-20)
Symptoms (SCL-25)	Financing of care and health services
Health related quality of life (15 D, OHIP)	

Questionnaire 4 (short repeat questionnaire)

Health status	Quality of life
Health behavior	

Dietary questionnaire

Meal frequency	Potatoes, rice and pasta
Diets adhered to	Meat dishes
Milk products	Fish dishes
Cereals	Chicken, turkey and eggs
Fat spreads	Fruits and berries
Vegetables	Desserts
Sweets and snacks	Nutrient products
Drinks	

Physical activity questionnaire (for physical activity sub-sample)**Migraine questionnaire (for subjects reporting severe headache in the interview)**

Home health examination

A home health examination was carried out on subjects unable to come to the health examination proper. The home health examination comprised blood pressure measurement, measurements of height, weight and abdominal circumference, a short oral health examination in the Helsinki and Oulu regions, drawing blood samples, a brief interview, tests of near and distant vision, chair stand and handgrip strength tests, walking speed test, tests of cognitive capacity, a balance test for subjects aged 70 years and over and joint functioning tests for subjects aged 55 and over. In addition, the mental health interview was carried out.

Set-up 7. Schedule of the home health examination

Information and consent
 Blood pressure
 Other measurements
 Oral health examination
 Laboratory
 Snacks and questionnaires 1 and 2
 Checking the questionnaires
 Interview
 Measurements of functioning
 Mental health interview
 Final information

Telephone interview

An attempt was made to carry out a telephone interview on all non-participants to the health examination proper or the home health examination. The telephone interview was a condensed version of the long interview carried out during the health examination proper and of questionnaire 1. Its average duration was 15–20 minutes. It comprised questions on the person's background, health status, illnesses, health services use, oral health, living habits, functioning and work ability.

Complementary data gathering

Complementary data gathering was organized after the field survey proper in the beginning of year 2012 and subjects who had not participated previously were asked to do so now. The methods comprised the home health examination and the telephone interview. Also, the possibility was offered to participate in a modified health examination comprising the home health examination to which the measurement of bio impedance and spirometry had been added. Subjects in the physical activity sub-sample were asked to participate in the tests of physical performance and received the accelerometer and diary to be used at home for a week. Subjects in home blood pressure measurement sub-sample received a blood pressure measurement device for home measurements. All questionnaires of the study proper (questionnaires 1–4, dietary questionnaire) were used in the condensed health examination.

Recruiting and training the health examination field personnel

Altogether 100 field workers were recruited during spring and summer 2011 for Health 2011 and the Courage-study. In year 2000 about 1000 persons, i.e. 10 times more than were needed, applied for field worker positions in Health 2000. This was mostly the result of one announcement in a national newspaper. The situation had completely changed by 2011. Field workers had to be looked for by numerous advertisements in newspapers, by contacting schools of social and health care and other means so that qualified persons could be recruited for all tasks. This change was mainly due to the vastly improved employment situation of nursing personnel.

A two-week training for field workers was organized in Helsinki between 25.7. and 5.8.2011. Training was stratified so that each field worker received both general training about population surveys and detailed training of the tasks in two measurement stations. The Courage nurses received a one-week separate training during the first training week. The training of home visit nurses comprised measurement stations included in the home health examination.

During the last training days field workers of each field team carried out measurements on each other. After training the field teams moved to the study regions. During the first survey days key persons of the project and the training were present in each field team and provided support. During those days also, the number of examinees invited was smaller than later.

The persons responsible for each measurement station visited the field teams to monitor the work, and the chief nurses visited Helsinki. The visits to the field teams were extremely useful and ensured that measurements were carried out as intended. It was also possible to support the field workers and to solve problems when necessary. It was evident that also the field workers appreciated these visits. In general, field workers were rather satisfied with their tasks and working conditions. However, from time to time problems and contradictions arose due to hurry, the travelling nature of the job and dissatisfaction with division of work.

Mail questionnaire for young adults

A questionnaire was mailed to the additional sample of young adults aged 18–28 (N= 1,575). Its content is depicted in set-up 6. The questionnaire is in electronic format in the THL web-pages (www.thl.fi/terveys2011; form T2140).

Set-up 8. Contents of the mail questionnaire for young adults

Family	Work ability
Childhood living circumstances	Vision and hearing
Education	Learning and memory
Quality of life	Weight and height
Health	Smoking and drugs
Visits in ambulatory care due to diseases and symptoms	Contraception
Mental experiences	Physical fitness and physical activity
Sleep and sleeping	Main activity and occupation
Medicines	Unemployment
Symptoms	Questions for women

Statistical methods

In the original Health 2000 cross-sectional statistical analyses the stratification and clustering of the sampling design was accounted for by design-based methods (Lehtonen and Pahkinen 1996). In Health 2011 an additional challenge was the repeated measures design, in which the same subjects were examined twice. The measurement results of the same persons were usually strongly associated, although 11 years had passed, and it is essential to consider these associations when assessing changes. The solution was that every subject's measurements were handled as clusters, since the internal correlations within health center regions were much weaker than those within individuals.

Non-participation varied considerably between population groups. In the original Health 2000 the effects of non-response (and oversampling of those aged 80 and over) were corrected by weights based on post-stratification. These weights were calibrated by age, sex, region and mother tongue (Laiho et al. 2005). In the Health 2011 survey the weights for the new sample of young adults were calibrated by the inverse probability (IPW) method (Molenberghs and Kenward 2007) by using age, sex and region. For those re-examined the original weights considering non-response were used. These weights were up-dated by using data from the Health 2000 survey and the IPW method. In addition to age and sex important predictors of participation in Health 2011 were education, leisure activities, alcohol use, leisure time physical activity, intake of fresh vegetables, household size and body mass index. The weights were calculated by the R program package (R Core Team 2008). The factors mentioned predict many illnesses and functional limitations or are directly associated with participation. The assumption in the weighting method is that in the initial situation the non-respondents are like the respondents in regard of the background data.

The data should be analyzed by using the weights provided and statistical methods which consider the design.

Data protection and ethical statements

A positive ethical statement was received from the coordinating ethical committee of the Helsinki and Uusimaa Central hospital districts.

An information letter was handed to the subject relating to the health examination, and the field observers replied to the subject's questions, if any. After receiving the information letter, the subject was asked to sign the consent form.

In all phases of the survey special attention was paid to data protection, and the data and materials were handled and archived with appropriate care, so that outsiders did not have access to them. In the survey files personal identification information was replaced by survey numbers. Thus, even the researchers did not have access to personal identification information. However, personal identification data are needed for follow-up and linkage to other data. For those purposes they are available for a few selected research workers.

Participation rate

In Health 2000 many means were used to achieve a high participation rate and the efforts were very successful: At least some data were obtained from 93% of the sample, and 85% participated in either the health examination proper or the home health examination (Koskinen et al. 2005b). Similar means were used in the Health 2011 survey (national and local communication, stressing the benefits to the subject, contacting non-participants e.g. by phone, various kinds of complementing data gathering etc.), but the result was considerably poorer: 73% of the sample participated in at least one survey phase and 59% participated in the health examination either in the field facilities or at home.

The participation rate to population studies has decreased both in Finland and elsewhere. This development probably has several reasons. More and more contacts to citizens are made because of research studies, marketing studies and commercial purposes. This has probably caused as a counter-reaction a general negative attitude toward different contacts made by unknown quarters. It is also likely that to gain information about one's own health is not as tempting as before, as ample health services and various kinds of measurements are available.

The decrease in the participation from 93% to 73% during 11 years is in part due to some differences in the implementation between Health 2000 and Health 2011. The central of these is probably that in 2011 financial restrictions prohibited making the first contact by Statistic Finland's extensive interview organization. In that organization interviewers are dispersed over the country corresponding to the regional distribution of the population. An interviewer living near the subject could contact the subject with more ease and could also convincingly argue for the benefits of participation. Another major difference was that there was no doctor's examination in Health 2011. It is possible that to be able to discuss one's health with a doctor also motivated many subjects to participate in Health 2000. The decreasing participation rate is a serious problem for monitoring the population's well-being and research based on it. When the prerequisites of knowledge-based policy and development work weaken, the negative effects also affect the population's well-being. It is obligatory make much greater efforts to investigate and develop methods for enhancing the participation rate.

In Health 2011 the bias due to non-response can be considerably reduced by using weights, which could be formed by using register data on the whole sample and data from the Health 2000 survey. The utility of weights can be illustrated by results concerning the proportion of persons receiving a disability pension. In the whole Health 2011 sample 9.5% were receiving a disability pension. Among the participants there were fewer persons receiving a disability pension i.e. 8.8%. When this percentage was calculated using the weights, the result was very close to the observed level in the total sample i.e. 9.4%.

Quality assurance and quality control

Many means of quality assurance were used to attain good quality. The survey's experts selected methods, measurements and instruments, which were known to be valid and which were backed up by international or national recommendations. Most of the measurements of Health 2011 were included already in Health 2000. For the health examinations suitable premises were selected so that the survey environment would not bias the results. Field workers to the teams were selected so that they were expected to exactly follow the instructions, and they were thoroughly trained to their job. The persons responsible for field work were selected sufficiently early before the beginning of data gathering. Thus, they could get acquainted with the data gathering methods and the work plan of the field team, and were well able to lead the field team. In addition, a pilot study was performed to ensure the functioning of the data gathering and recording methods.

During data gathering the work of the field teams was monitored and new advice and instructions were given during numerous auditing visits. The gathering data were monitored during the whole survey. If there were major differences between the results of the field workers an effort was made to find out their cause and, if needed, corrections were made for field workers to adhere to the instructions. In addition, field workers were motivated to quality data gathering in all survey phases, and much emphasis was put on providing optimum working and accommodation conditions to promote good working conditions and quality work.

Some key questions of the interview and questionnaire 1 were included in the questionnaire 4 handed to the subject at the final station. The purpose was to assess reliability. Furthermore, repeated measurements were carried out during the health examination on a limited group of subjects. Reliability was good regarding most variables (kappa at least 0.7). The exception was the joint function test and the reliability (kappa) of most of them was less than 0.7. More detailed results have been presented in the methodology report (Lundqvist and Mäki-Opas 2016).

Data gathered from registers and follow-up by registers

The data from registers complemented the picture on the subjects' health. Data retrieval began before the survey and continues. By comparing the register data of participants and non-participants the biases due to non-participation can be estimated. By monitoring register data, it is also possible to assess how various modifiable factors predict health and disease risk. The most important data linked to the study material comprise mortality and causes of death, hospital discharges, specially reimbursed medications, some other sickness related benefits, purchases of prescription medicines, cancer, work disability and employment status.

The register data were used following appropriate data protection and legislation, and the directives of the register holders, and THL, and the instructions of THL on good research practice. The subjects were informed about the use of register data and the signed consent form also covered the use of register data.

Files and their use by researchers

Files can be provided to researchers once their research plan has been accepted. The process is: The researcher sends a research plan to THL where it will be evaluated by experts of the study area. When the plan has been accepted the researcher can order the file via the THL web-pages. The procedure has been described more closely in the methodology report (Lundqvist and Mäki-Opas 2016).

The data, their follow-up and use

The data, their follow-up and use

Materials

The materials of these five surveys cover the health situation since the 1960s until year 2011. They contain data on health and functional capacity, utilization of services, risk factors, working and living conditions, mortality and incidence of diseases, and the use of medicines and other treatments. The files also comprise three large materials examined repeatedly (Mobile Clinic Health Examination survey–Mobile Clinic follow-up; Mini-Finland–Health 2000; Health 2000–Health 2011).

Sample store

The blood samples of all subjects are stored frozen (the Mobile Clinic Health Examination survey, MC follow-up and Mini-Finland -20 °C and since Health 2000 -70 °C) in THL laboratory freezers. The first three survey materials comprise serum and plasma samples whereas the Health 2000 and 2011 also comprise whole blood samples. Altogether there are blood samples from about 80,000 persons, and from some of them they have been repeatedly drawn. For different study designs the samples can be located by the study number. For new determinations e.g., nested case-control designs can be formed in which the cases and controls have been matched for some central confounders such as age and sex.

Follow-up by national registers

Mortality, work disability, hospital treatments, use of medicines and incidence of cancer is being annually followed in all survey materials. The whole extensive material is well suited for studying the incidence and determinants by selecting incidence cases or by monitoring incidence of health problems in a cohort setting.

Research use and publications

From all surveys there are both the field survey data and frozen serum and plasma samples and the data gathered from national registers. As of Health 2000 the sample store also contains whole blood samples. The extensive material is well suited for studies of the incidence of health problems and their determinants in cohort and case-control studies.

The measurement results from different surveys are comparable, but in some cases special features must be considered such as the variation of non-response (especially Health 2011), the sampling design and the systematic errors of measurements and laboratory determinations. Examples of these in the Mobile Clinic Health Examination survey are the possible bias due the blood pressure measurement device and the procedure of measuring blood pressure after ingestion of the glucose load (diastolic about + 2 mmHg). In samples drawn after the ingestion of the glucose load the results of many determinations are slightly lower than usual because plasma volume had expanded.

The results obtained by questionnaires, interviews and biochemical determinations are valid. However, all of them house variation, which is difficult to assess and to prevent. It is important to try to take such factors into account when interpreting the results. The materials are also suitable for time series analyses studying the changes and future development of diseases, functional limitations, need for care and services.

When the materials are used for new studies it is advisable to get acquainted with previous publications close to one's own topic.

Published studies

For each survey some topics of publications have been mentioned below. A comprehensive list of the publications based on the Mobile Clinic Health Examination survey, its follow-up and the Mini-Finland survey is on the Finnish Mobile Clinic web-page (<https://thl.fi/en/web/thlfi-en/research-and-expertwork/population-studies/finnish-mobile-clinic/publications>). Correspondingly, the Health 2000- and Health 2011- publications have been listed on another web-page (<https://thl.fi/en/web/thl-biobank/for-researchers/sample-collections/health-2000-and-2011-surveys>). Part of the studies deal with the occurrence and distribution of different diseases and functional limitations and the major part deals with determinants and protective factors. As of the Health 2000 survey, a major proportion concerns genes and the whole genome.

First, the publications based on the Mobile Clinic Health Examination survey and the follow-up survey were cross-sectional studies. Later they became longitudinal studies of the impact of risk and protective factors on mortality, cancer, coronary heart disease and cerebrovascular disease. In all there are many hundred publications. Examples of the topics of these studies are:

Hypertension, coronary heart disease, cerebrovascular disease, intermittent claudication, diabetes, dementia, iron deficiency, hyperostosis, obesity and leanness and food consumption and nutrient intake. Many of them comprised a follow-up partition. Topics of the follow-up studies were e.g. *risk factors and protective factors of cancer* such as antioxidants, HPV-virus and cancers of the cervix and cancer of the esophagus, diet and nutrition, antibiotics and iron stores and breast cancer, flavonoids, vitamin D, depressiveness, helicobacter pylori antibodies and stomach cancer, fats, smoking and colon cancer, PSA and screening for prostate cancer, sex hormones and prostate cancer. Risk factors and protective factors of *coronary heart disease* such as intake of vegetables and fruits, intake of fiber, vitamin C, flavonoids, fats, hyperhomocysteinemia, and ECG changes (QT interval), infections (such as enterovirus and mycoplasma), use of analgesics, metabolic factors and depression. Some risk factors and protective factors of cerebrovascular disease and risk factors of diabetes, such as intake of vegetables and fruits, dietary fat and fiber, coffee, vitamin D, sweetened drinks, antioxidants, obesity and fatty liver. Risk and protective factors of *rheumatoid arthritis*, such as antioxidants and coffee, *osteoporotic* fractures and vitamin D and *joint arthritis*. The risk and protective factors of *Parkinson's disease* (coffee, physical activity, smoking, metabolic factors, vitamin D and environmental toxins) and vitamin D as a determinant of *dementia*.

Publications during the early years from the Mini-Finland survey dealt with baseline findings and the occurrence of various common diseases and functional limitations. Based on the material e.g. the following topics have been elaborated:

Musculoskeletal diseases. Common musculoskeletal syndromes, functioning limitations of the shoulder joint, rheuma factors, chronic neck pain, a low metacarpal index and hip fracture, obesity and walking difficulty, bone strength and hip fracture, arthritis and osteoporosis in hand X-rays; *Mental health.* Mental health disorders, dementia. *Oral diseases.* Edentulousness, root caries, oral health and coronary heart disease; *Cardiovascular diseases.* Change of the prevalence of cardiovascular diseases over time, ECG and sudden death, viral infections and myocardial infarction, cardiovascular diseases and functional limitations, digitalis use. *Diabetes.* Change in the prevalence of diabetes. *Functional limitations.* Change in the prevalence of functional limitations.

The Health 2000 and Health 2011 early publications dealt with baseline findings and later many different topics including genetics were treated. Examples are:

Topics of baseline publications were oral diseases, musculoskeletal diseases, nutrition, health behavior, health service use, reproductive health, dimensions of work ability, work ability and health.

Other publications dealt with e.g. the following topics: *Social status*: socioeconomic standing, social capital; *Mental health*: mental disorders and burnout; *Cardiovascular diseases*: cerebrovascular accident and carotid arteriosclerosis, genetic variations and risk of sudden death, genome and ECG, risk of sudden death and home blood pressure. *Musculoskeletal diseases*: arthrosis and risk factors for falls. Determinants of bone strength and predictors of hip fracture, hip arthrosis and risk factors for falls. *Oral health*: Sense of coherence, smoking and caries, unemployment and oral health and vitamin D and gingival pockets and bleeding; *Functional capacity*: performance of subjects suffering from COPD, predictors of disability pensions. *Genes and genome*: genetics of the metabolic syndrome, genetic risk of intracranial aneurysm, migraine loci, burnout, medicine-gene-interactions, subgroups of migraine, loci for obesity, reference material for genotypes, loci for migraine and new genetic signals of respiratory functioning.

Providing data to researchers

The process of creating data sets for research purposes and providing these to researchers have been described in the methodology reports and in Finnish in the THL web-pages (www.thl.fi/autoklinikka and www.thl.fi/terveys2000 or in English in the pages www.thl.fi/finnish-mobile-clinic and www.thl.fi/health2000). The researcher needing specified study materials sends a research plan to the responsible working group on an electronic form.

www.thl.fi/finnish-mobile-clinic > Information for researchers > Submit a study proposal

www.thl.fi/health2000 > Information for researchers > Submit a study proposal

The electronic forms present with an initial screen showing their structure.

After the research plan has been accepted the researcher can order the needed material as a data file. When data are provided a written agreement will always be made. The material will be provided without personal identification data. Data can be ordered via the web-pages of the Mobile Clinic, Mini-Finland and Health 2000 and Health 2011. These pages also include the data gathering forms and corresponding variables can be found. When the data order arrives an agreement of collaboration will be made and signed by the researcher and THL.

Literature

Literature

- Aho K, Heliövaara M, Sievers K, Maatela J, Isomäki H. Clinical arthritis associated with positive radiological and serological findings in Finnish adults. *Rheumatol.Int.*, 1989; 9, 7–11.
- Aho K, Tuomi T, Heliövaara M, Palosuo T. Rheumatoid factors and rheumatoid arthritis. *Scand.J.Rheumatol.Suppl.*, 1988; 74, 41–44.
- Ahokas S, Jokinen Y, Tiihonen J, Vuorio A. *KEAS, Kuopio ECG Analysis System. System Description, Subsystem Descriptions, File Descriptions*. University of Kuopio. Kuopio, 1977.
- Alaranta H, Hurri H, Heliövaara M, Soukka A, Harju R. Flexibility of the spine: normative values of goniometric and tape measurements. *Scand.J.Rehabil.Med.*, 1994; 26, 147–154.
- Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet.Med.*, 1998; 15, 539–553.
- Antonovsky A. The structure and properties of the sense of coherence scale. *Soc.Sci.Med.*, 1993; 36, 725–733.
- Arinen S, Häkkinen U, Klaukka T, Klavus J, Lehtonen R, Aro S. *Suomalaisten terveys ja terveyspalvelujen käyttö. Terveystienhuollon väestötutkimuksen 1995/96 päätulokset ja muutokset vuodesta 1987. (Health and use of health services. The main results of the health care survey 1995/1996)*. SVT Terveys 5, Stakes ja Kansaneläkelaitos. Helsinki, 1998.
- Aromaa A. *Kohonnut verenpaine ja sen kansanterveydellinen merkitys Suomessa. (Epidemiology and public health impact of high blood pressure in Finland)*. Kansaneläkelaitoksen julkaisuja. AL:17. Helsinki, 1981.
- Aromaa A. Verenpaineen mittaaminen. Teoksessa: Eisalo A, Pyörälä K, Siltanen P, (toim.). *Verenpainekäsikirja. (Measurement of blood pressure)*. Suomen Sydäntautiliitto ry. s. 65–82. Pori, 1978a.
- Aromaa A. Verenpainetauti – kansanterveysongelma. Teoksessa: Eisalo A, Pyörälä K, Siltanen P, (toim.). *Verenpainekäsikirja. (Hypertension. A public health problem)*. Suomen Sydäntautiliitto ry. s. 23–64. Pori, 1978b.
- Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, Joukamaa M, Klaukka T, Lehtinen V, Melkas T, Mälkiä E, Nyman K, Paunio I, Reunanen A, Sievers K, Kalimo E, Kallio V. *Terveys, toimintakyky ja hoidontarve Suomessa. Mini-Suomi-terveys tutkimuksen perustulokset. (Health, functional limitations and need for care in Finland)*. Kansaneläkelaitoksen julkaisuja. AL:32. Helsinki ja Turku, 1989b.
- Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J. Tavoitteet, menetelmät ja aineistot. Osa 1. In: Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, (ed.). *Mini-Suomi-terveys tutkimuksen toteutus. (The execution of the Mini-Finland Health Survey. Part 1)*. Kansaneläkelaitoksen julkaisuja. ML:88. Helsinki ja Turku, 1989a.
- Aromaa A, Heliövaara M, Knekt P, Reunanen A, Rinne S. *Autoklinikka. (The Mobile Clinic)*. Kansanterveyslaitos ja Kansaneläkelaitos. Helsinki, 2006.
- Aromaa A, Knekt P, Jääskeläinen J, Standertskjöld-Nordenstam C. *Sydänsairauksien seulonnassa käytetyn pienoisoröntgenkuvien luentamenetelmän arviointi. (The evaluation of the interpretation of miniature x-rays used in screening for heart diseases)*. Kansaneläkelaitoksen julkaisuja. ML:13. Helsinki, 1978.
- Aromaa A, Koponen P, Tafforeau J, Vermeire C, HIS/HES Core Group. Evaluation of Health Interview Surveys and Health Examination Surveys in the European Union. *Eur.J.Public Health*, 2003b; 13, 67–72.
- Aromaa A, Koponen P, Tafforeau J, Vermeire C. *Status and future of health surveys in the European Union. Final report of Phase 2 of the project Health Surveys in the EU: HIS and HIS/HES Evaluations and Models*. Publications of the National Public Health Institute B15. Helsinki, 2003a.
- Aromaa A, Koskinen S (ed.) *Health and functional capacity in Finland. Baseline results of the Health 2000 Health Examination survey*. Kansanterveyslaitoksen julkaisuja (Publications of the National Public Health Institute). B12/2004. Helsinki, 2004.
- Aromaa A, Reunanen A, Impivaara O, Heliövaara M, Knekt P, Maatela J, Verenkiertoelinten sairauksien tutkijaryhmä. Verenkiertoelinten ja hengityselinten sairauksien tutkimusmenetelmät. Osa 2. Teoksessa: Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J (ed.). *Mini-Suomi-terveys tutkimuksen toteutus. (The execution of the Mini-Finland Health Survey. Part 2. Cardiovascular and respiratory survey methods)*. Kansaneläkelaitoksen julkaisuja. ML:49. Helsinki ja Turku, 1985.
- Arterial hypertension. Report of a WHO expert committee. *World Health.Organ.Tech.Rep.Ser.*, 1978; 628, 7–56.
- Arvidsson O, Johnsson E, Skerfving S, Stutz G. *Kost och motion I Sverige. Beteenden, attityder och kunskaper hos den vuxna befolkningen. (Diet and physical activity in Sweden)*. Socialstyrelsen redovisar 34. Stockholm: Allmänna Förlaget, 1973.
- Atlas of standard radiographs. The epidemiology of chronic rheumatism. Vol 2*. Blackwell. Oxford, 1963.

- Bagby RM, Parker JD, Taylor GJ. The twenty-item Toronto Alexithymia Scale-I. Item selection and cross-validation of the factor structure. *J.Psychosom.Res.*, 1994a; 38, 23–32.
- Bagby RM, Taylor GJ, Parker JD. The Twenty-item Toronto Alexithymia Scale-II. Convergent, discriminant, and concurrent validity. *J.Psychosom.Res.*, 1994b; 38, 33–40.
- Bartels H, Bohmer M, Heierli C. Serum creatinine determination without protein precipitation. *Clin.Chim.Acta*, 1972; 37, 193–197.
- Beck AT, Rial WY, Rickels K. Short form of depression inventory: cross-validation. *Psychol.Rep.*, 1974; 34, 1184–1186.
- Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch.Gen.Psychiatry*, 1961; 4, 561–571.
- Bedogni G, Malavolti M, Severi S, Poli M, Mussi C, Fantuzzi AL, Battistini N. Accuracy of an eight-point tactile-electrode impedance method in the assessment of total body water. *Eur.J.Clin.Nutr.*, 2002; 56, 1143–1148.
- Berglund E, Birath G, Bjure J, Grimby G, Kjellmer I, Sandqvist L, Söderholm B. Spirometric studies in normal subjects. I. Forced expirograms in subjects between 7 and 70 years of age. *Acta Med.Scand.*, 1963; 173, 185–192.
- Biering-Sørensen F. Physical measurements as risk indicators for low-back trouble over a one-year period. *Spine (Phila Pa.1976)*, 1984; 9, 106–119.
- Björkstén F. Determination of plasma and serum triglycerides with a fully automated method. *Clin.Chim.Acta*, 1972; 40, 143–152.
- Blackburn H, Keys A, Simonson E, Rautaharju P, Punsar S. The electrocardiogram in population studies. A classification system. *Circulation*, 1960; 21, 1160–1175.
- Blackburn H. Electrocardiographic classification for population comparisons. The Minnesota code. *J. Electrocardiol.*, 1969; 2, 5–9.
- Blumenthal JA, Burg MM, Barefoot J, Williams RB, Haney T, Zimet G. Social support, type A behavior, and coronary artery disease. *Psychosom.Med.*, 1987; 49, 331–340.
- Boy J. Automatic determination of blood cholesterol. *J. Clin. Pathol.*, 1963; 16, 178–180.
- Bruin Ad, Picavet HS, Nossikov A, (toim.). *Health Interview Surveys. Towards international standardization of methods and instruments*. WHO Regional Publications. European Series No. 58. Copenhagen, 1996.
- Carr JJ, Dreker IJ. Simplified rapid technic for the extraction and determination of serum cholesterol without saponification. *Clin.Chem.*, 1956; 2, 353–368.
- Castaneda AE, Rask S, Koponen P, Molsa M, Koskinen S, (ed.). *Maahanmuuttajien terveys ja hyvinvointi: tutkimus venäläis-, somalialais- ja kurditaustaisista Suomessa. (Health and well-being of immigrants)*. Terveysten ja hyvinvoinnin laitos. Raportti 61/2012. Helsinki, 2012.
- Cattell RB. *Handbook for the individual or group culture fair intelligence test, scale 2, forms A and B*. Institute for Personality and Ability Testing. Coronado Drive, IL, 1960.
- Cepollaro C, Gonnelli S, Pondrelli C, Martini S, Montagnani A, Rossi S, Gennari L, Gennari C. The combined use of ultrasound and densitometry in the prediction of vertebral fracture. *Br. J. Radiol.*, 1997; 70, 691–696.
- Cheung MC, Albers JJ. The measurement of apolipoprotein A-I and A-II levels in men and women by immunoassay. *J. Clin. Invest.*, 1977; 60, 43–50.
- Commission on chronic illness. Chronic illness in the United States. Vol. 4. Chronic illness in a large city – The Baltimore study*. Harvard University Press. Cambridge, MA, 1957.
- Cooper JE, Copeland JR, Brown GW, Harris T, Gourlay AJ. Further studies on interviewer training and inter-rater reliability of the Present State Examination (PSE). *Psychol.Med.*, 1977; 7, 517–523.
- Cornfield J, Dunn RA, Batchlor CD, Pipberger HV. Multigroup diagnosis of electrocardiograms. *Comput.Biomed.Res.*, 1973; 6, 97–120.
- Cotes IE. *Lung function. Assessment and application in medicine*. Blackwell Scientific. 3rd ed. London, 1975.
- Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, Yngve A, Sallis JF, Oja P. International physical activity questionnaire: 12-country reliability and validity. *Med.Sci.Sports Exerc.*, 2003; 35, 1381–1395.
- Criteria Committee of the New York Heart Association. Diseases of the Heart and Blood Vessels; Nomenclature and Criteria for the Diagnosis*. Little Brown. 6th ed. Boston, USA, 1964.
- Currie C, Roberts C, Morgan A, Smith R, Setterbulte W, Samdal O, Barnekow Rasmussen V. *Young people's health in context. Health Behaviour in School-aged Children (HBSC) study: international report from the 2001/2002 survey*. Health Policy for Children and Adolescents, No 4, WHO Europe. 2004.

- De Backer G, Kornitzer M, Sobolski J, Denolin H. Intermittent claudication—epidemiology and natural history. *Acta Cardiol.*, 1979; 34, 115–124.
- Delis DC, Kramer JH, Kaplan E, Ober BA. *California Verbal Learning Test. Manual. Research Edition.* The Psychological Corporation. Harcourt Brace & Company, San Antonio, 1987.
- Derogatis LR, Lipman RS, Covi L. SCL-90: an outpatient psychiatric rating scale—preliminary report. *Psychopharmacol. Bull.*, 1973; 9, 13–28.
- Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L. The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. *Behav.Sci.*, 1974; 19, 1–15.
- Drury TF, Winn DM, Snowden CB, Kingman A, Kleinman DV, Lewis B. An overview of the oral health component of the 1988–1991 National Health and Nutrition Examination Survey (NHANES III-Phase 1). *J.Dent.Res.*, 1996; 75 Spec No, 620–630.
- Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. *J. Craniomandib. Disord.*, 1992; 6, 301–355.
- Edwards DA, Hammond WH, Healy MJ, Tanner JM, Whitehouse RH. Design and accuracy of calipers for measuring subcutaneous tissue thickness. *Br. J. Nutr.*, 1955; 9, 133–143.
- Era P, Jokela J, Heikkinen E. Reaction and movement times in men of different ages: a population study. *Percept.Mot.Skills*, 1986; 63, 111–130.
- EuroQol Group. EuroQol—a new facility for the measurement of health-related quality of life. *Health Policy*, 1990; 16, 199–208.
- Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA*, 1984; 252, 1905–1907.
- Fatarone MA, O’Neill EF, Ryan ND, Clements KM, Solares GR, Nelson ME, Roberts SB, Kehayias JJ, Lipsitz LA, Evans WJ. Exercise training and nutritional supplementation for physical frailty in very elderly people. *N.Engl.J.Med.*, 1994; 330, 1769–1775.
- Finlay-Jones RA, Murphy E. Severity of psychiatric disorder and the 30-item general health questionnaire. *Br.J.Psychiatry*, 1979; 134, 609–616.
- Finley PR, Schifman RB, Williams RJ, Lichti DA. Cholesterol in high-density lipoprotein: use of Mg²⁺/dextran sulfate in its enzymic measurement. *Clin.Chem.*, 1978; 24, 931–933.
- First MB, Spitzer RL, Gibbon M, Williams JBW. *Structured Clinical Interview for DSM-IV-TR Axis I Disorders – Patient Edition (SCID I/P, 2/2001 Revision)*. Biometrics Research Department, New York State Psychiatric Institute. New York, NY, 2001.
- Fleiss JL. *Statistical methods for rates and proportions.* John Wiley & Sons. 2nd. New York, 1981.
- Fletcher C, Peto R, Tinker CM. *The natural history of chronic bronchitis and emphysema.* Oxford University Press. Oxford, 1976.
- Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J.Psychiatr.Res.*, 1975; 12, 189–198.
- Fox PC, Busch KA, Baum BJ. Subjective reports of xerostomia and objective measures of salivary gland performance. *J.Am.Dent.Assoc.*, 1987; 115, 581–584.
- Geddes LA. *The Direct and Indirect Measurement of Blood Pressure.* Year Book Medical Publishers. Chicago, 1970.
- Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O, Rutter C. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol.Med.*, 1997; 27, 191–197.
- Goldberg DP. *The detection of psychiatric illness by questionnaire. Maudsley Monograph 21.* Oxford University Press. London, 1972.
- Gonnelli S, Cepollaro C, Agnusdei D, Palmieri R, Rossi S, Gennari C. Diagnostic value of ultrasound analysis and bone densitometry as predictors of vertebral deformity in postmenopausal women. *Osteoporos.Int.*, 1995; 5, 413–418.
- Grafnetter D. World Health Organization (WHO) coordinated quality control in the lipid laboratory. *Giorn Arterioscler*, 1977; 2, 113–128.
- Graubard BI, Korn EL. Predictive margins with survey data. *Biometrics*, 1999; 55, 652–659.
- Guralnik JM, Simonsick EM, Ferrucci L, Glynn RJ, Berkman LF, Blazer DG, Scherr PA, Wallace RB. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. *J. Gerontol.*, 1994; 49, M85–94.
- Haara M, Heliövaara M, Impivaara O, Arokoski JP, Manninen P, Knekt P, Kärkkäinen A, Reunanen A, Aromaa A, Kroger H. Low metacarpal index predicts hip fracture: a prospective population study of 3,561 subjects with 15 years of follow-up. *Acta Orthop.*, 2006; 77, 9–14.

- Haara MM, Manninen P, Kröger H, Arokoski JP, Kärkkäinen A, Knekt P, Aromaa A, Heliövaara M. Osteoarthritis of finger joints in Finns aged 30 or over: prevalence, determinants, and association with mortality. *Ann.Rheum.Dis.*, 2003; 62, 151–158.
- Hans D, Dargent-Molina P, Schott AM, Sebert JL, Cormier C, Kotzki PO, Delmas PD, Pouilles JM, Breart G, Meunier PJ. Ultrasonographic heel measurements to predict hip fracture in elderly women: the EPIDOS prospective study. *Lancet*, 1996; 348, 511–514.
- Hasunen K. *Suomalainen varhaisaamiainen*. (The Finnish breakfast). Kansaneläkelaitoksen julkaisuja. ML:15, Helsinki, 1978.
- Havel RJ, Eder HA, Bragdon JH. The distribution and chemical composition of ultracentrifugally separated lipoproteins in human serum. *J. Clin. Invest.*, 1955; 34, 1345–1353.
- Hays RD, Sherbourne CD, Mazel RM. The RAND 36-Item Health Survey 1.0. *Health Econ.*, 1993; 2, 217–227.
- Heikkilä J, (toim.). *EKG, perusteet ja tulkinta. (ECG basics and interpretation)* Lääketehtas Orion. Espoo, 1982.
- Heinonen OP, Laitinen H, Takkunen H, Jahkola M, Virkola P, Mäkelä P. Bakteriurian diagnosointi aluslasimenetelmällä väestötutkimuksessa. (Diagnosis of bacteriuria in a population study). *Duodecim*, 1968; 85, 1269–1280.
- Heinonen OP. Autoklinikka. (Mobile Clinic). *Duodecim*, 1966; 83, 1161–1164.
- Heinonen OP. *Remedia Fennica 1966–1972*. Helsinki, 1966–1972.
- Heiskanen M, Aromaa K, Niemi H, Sirén R. *Tapaturmat, väkivalta, rikollisuuden pelko. Väestöhaastattelujen tuloksia 1980–1997. (Accidental injuries, violence and fear of criminality)*. Tilastokeskus. Oikeus 2000:1, Oikeuspoliittisen tutkimuslaitoksen julkaisuja 171. Helsinki, 2000.
- Heistaro S, (ed.). Methodology report Health 2000 Survey. Publications of the National Public Health Institute B26/2008. Helsinki, 2008.
- Heistaro S, Koskinen S. Resurvey of persons who participated in the Mini-Finland survey. In: Heistaro S. (ed.) Methodology report. Health 2000 Survey. Publications of the National Public Health Institute. B26/2008, Helsinki 2008.
- Helakorpi S, Patja K, Prättälä R, Aro AR, Uutela A. *Suomalaisen aikuisväestön terveystilanne ja terveys. (Health behavior and health of Finnish adults)*. Kansanterveyslaitos. Kansanterveyslaitoksen julkaisuja B 17/2003. Helsinki, 2003.
- Helakorpi S, Uutela A, Prättälä R, Puska P. *Suomalaisen aikuisväestön terveystilanne ja terveys, kevät 2000*. Helsinki. (Health behavior and health of Finnish adults). Kansanterveyslaitoksen julkaisuja B8/2000, 2000.
- Helger R, Rindfrey H, Hilgenfeldt J. Direct estimation of creatinine in serum and in urine without deproteinization using a modified Jaffe method. *Z. Klin. Chem. Klin. Biochem.*, 1974; 12, 344–349.
- Heliövaara M, Aho K, Knekt P, Aromaa A, Maatela J, Reunanen A. Rheumatoid factor, chronic arthritis and mortality. *Ann. Rheum.Dis.*, 1995; 54, 811–814.
- Heliövaara M, Aromaa A, Klaukka T, Knekt P, Joukamaa M, Impivaara O. Reliability and validity of interview data on chronic diseases. The Mini-Finland Health Survey. *J. Clin. Epidemiol.*, 1993b; 46, 181–191.
- Heliövaara M, Mäkelä M, Sievers K, Melkas T, Aromaa A, Knekt P, Impivaara O, Aho K, Isomäki H. *Tuki- ja liikuntaelinten sairaudet Suomessa. (Musculoskeletal diseases in Finland)*. Kansaneläkelaitoksen julkaisuja. AL:35. Helsinki, 1993a.
- Hirschfeld RM, Calabrese JR, Weissman MM, Reed M, Davies MA, Frye MA, Keck PE Jr, Lewis L, McElroy SL, McNulty JP, Wagner KD. Screening for bipolar disorder in the community. *J.Clin.Psychiatry*, 2003; 64, 53–59.
- Hirschfeld RM, Williams JB, Spitzer RL, Calabrese JR, Flynn L, Keck PE, Jr, Lewis L, McElroy SL, Post RM, Rappaport DJ, Russell JM, Sachs GS, Zajecka J. Development and validation of a screening instrument for bipolar spectrum disorder: the Mood Disorder Questionnaire. *Am.J.Psychiatry*, 2000; 157, 1873–1875.
- Hoffman WS. A rapid photo-electric method for the determination of glucose in blood and urine. *Journal of Biological Chemistry*, 1937; 120, 51–55.
- Horne JA, Östberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int. J. Chronobiol.*, 1976; 4, 97–110.
- Howard G, Sharrett AR, Heiss G, Evans GW, Chambless LE, Riley WA, Burke GL. Carotid artery intimal-medial thickness distribution in general populations as evaluated by B-mode ultrasound. ARIC Investigators. *Stroke*, 1993; 24, 1297–1304.
- Huang TC, Chen CP, Wefler V, Raftery A. A Stable Reagent for the Liebermann-Burchard Reaction. Application to Rapid Serum Cholesterol Determination. *Anal. Chem.*, 1961; 33, 1405–1407.
- Huhti E. Prevalence of respiratory symptoms, chronic bronchitis and pulmonary emphysema in a Finnish rural population. Field survey of age group 40–64 in the Harjavalta area. *Acta Tuberc.Pneumol.Scand.Suppl.*, 1965; Suppl 61:1–111.

- Huuhka M, Lahelma E, Manderbacka K, Mattila V, Karisto A, Rahkonen O. *Terveystilanne ja sosiaalinen muutos. Vuosien 1986 ja 1994 elinolotutkimukset*. Tilastokeskus. (Health and social change). SVT Elinolot 1996:2. Helsinki, 1996.
- Hypertension and coronary heart disease: Classification and criteria for epidemiological studies*. WHO. Tech Rep Ser No 168. Geneva, 1959.
- Hyypä MT, Mäki J, Impivaara O, Aromaa A. Leisure participation predicts survival: a population-based study in Finland. *Health.Promot.Int.*, 2006; 21, 5–12.
- Hänninen T, Pulliainen V, Salo J, Hokkanen L, Erkinjuntti T, Koivisto J, Viramo P, Soininen H, Suomen muistitutkimuksen asiantuntijaryhmä. Kognitiiviset testit muistihäiriöiden ja alkavan dementiaan varhaisdiagnostiikassa: CERAD-tehtäväsarja. (Cognitive tests in early diagnosis of memory disturbances and early dementia). *Suomen Lääkärilehti*, 1999; 54, 1967–1975.
- Härkönen R. *Katkokävelyn veretön funktiodiagnostiikka ja sen soveltaminen liikuntaharjoitusten seurannassa. (The functional diagnosis of intermittent claudication and its application in the monitoring of physical training)*. Kansaneläkelaitoksen julkaisuja. AL:11. Turku, 1979.
- Impivaara O. *Utilization of Cardiac Glycosides in Finland*. Publications of the Social Insurance Institution Series. ML:55. Turku, 1986.
- Jenkins CD, Rosenman RH, Friedman M. Development of an objective psychological test for the determination of the coronary-prone behavior pattern in employed men. *J.Chronic Dis.*, 1967; 20, 371–379.
- Jenkins CD, Zyzanski SJ, Rosenman RH. Progress toward validation of a computer-scored test for the type A coronary-prone behavior pattern. *Psychosom.Med.*, 1971; 33, 193–202.
- Johnston KW, Kakkar VV. Rate of rise of arterial pressure as an index of peripheral arterial disease. Teoksessa: Woodcock J, (toim.). *Clinical blood flow measurement*. Pitman Medical. Kent, 1976.
- Joint motion – method of measuring and recording*. American Academy of Orthopaedic Surgeons. Chicago, IL, 1965.
- Jokinen Y, Pyörälä K, Raunio H. ATK-menetelmien hyväksikäyttö EKG-diagnostiikassa. *Duodecim*, 1977; 93, 555–567.
- Joukamaa M. *Alaselän kipu ja psyykkiset tekijät. (Low back pain and mental factors)*. Kansaneläkelaitoksen julkaisuja. AL:28. Turku, 1986.
- Julkunen H, Aromaa A, Knekt P. Diffuse idiopathic skeletal hyperostosis (DISH) and spondylosis deformans as predictors of cardiovascular diseases and cancer. *Scand. J. Rheumatol.*, 1981; 10, 241–248.
- Julkunen H, Heinonen OP, Knekt P, Maatela J. The epidemiology of hyperostosis of the spine together with its symptoms and related mortality in a general population. *Scand. J. Rheumatol.*, 1975; 4, 23–27.
- Järvinen R. *Epidemiological follow-up study on dietary antioxidant vitamins: results from the Finnish Mobile Clinic Health Examination Survey*. Social Insurance Institution, studies in social security and health 11. Helsinki, 1996.
- Kageyama N. A direct colorimetric determination of uric acid in serum and urine with uricase-catalase system. *Clin.Chim. Acta*, 1971; 31, 421–426.
- Kahn HS, Austin H, Williamson DF, Arensberg D. Simple anthropometric indices associated with ischemic heart disease. *J.Clin.Epidemiol.*, 1996; 49, 1017–1024.
- Kalimo R. *Työuupumus Suomen työikäisellä väestöllä. (Burn-out in the working age population)*. Työterveyslaitos. Helsinki, 1997.
- Kass EH. Asymptomatic infections of the urinary tract. *Trans.Assoc.Am.Physicians*, 1956; 69, 56–64.
- Katz S, Downs TD, Cash HR, Grotz RC. Progress in development of the index of ADL. *Gerontologist*, 1970; 10, 20–30.
- Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of Illness in the Aged. the Index of Adl: a Standardized Measure of Biological and Psychosocial Function. *JAMA*, 1963; 185, 914–919.
- Kauppinen T, Hanhela R, Heikkilä P, Lehtinen S, Lindström K, Toikkanen J, Tossavainen A. *Työ ja terveys Suomessa 2003. (Work and health in Finland 2003)*. Työterveyslaitos. Helsinki, 2004.
- Kelly M, Steele J, Nuttall N, Bradnock G, Morris J, Nunn J, Pine C, Pitts N, Treasure E, White D. *Adult Dental Health Survey: Oral Health in the United Kingdom 1998*. Her Majesty's Stationery Office. London, 2000.
- Kendler KS, Hettima JM, Butera F, Gardner CO, Prescott CA. Life event dimensions of loss, humiliation, entrapment, and danger in the prediction of onsets of major depression and generalized anxiety. *Arch.Gen.Psychiatry*, 2003; 60, 789–796.
- Kendler KS. Social support: a genetic-epidemiologic analysis. *Am.J.Psychiatry*, 1997; 154, 1398–1404.
- Kerekes K, Tronstad L. Long-term results of endodontic treatment performed with a standardized technique. *J. Endod.*, 1979; 5, 83–90.

- Kessler G, Lederer H. Fluorimetric measurements of triglycerides. Teoksessa: Skeggs LTJ, (toim.). *Automation in analytical chemistry*. Medical Inc. s. 341–344. New York: 1966.
- Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, Howes MJ, Normand SL, Manderscheid RW, Walters EE, Zaslavsky AM. Screening for serious mental illness in the general population. *Arch.Gen.Psychiatry*, 2003; 60, 184–189.
- Klaukka T. Application of the O.E.C.D. disability questions in Finland. *Rev.Épidémiol.Santé Publique*, 1981; 29, 431–439.
- Knekt P, Kilkkinen A, Rissanen H, Marniemi J, Sääksjärvi K, Heliövaara M. Serum vitamin D and the risk of Parkinson disease. *Arch.Neurol.*, 2010; 67, 808–811.
- Knekt P. *Serum alpha-tocopherol and the risk of cancer*. Publications of the Social insurance Institution. ML: 83. Helsinki, 1988.
- Koran LM. The reliability of clinical methods, data and judgments (first of two parts). *N.Engl.J.Med.*, 1975a; 293, 642–646.
- Koran LM. The reliability of clinical methods, data and judgments (second of two parts). *N.Engl.J.Med.*, 1975b; 293, 695–701.
- Korpi J. *Alaselän sairaudet Lounais-Suomen aikuisväestössä. (Low back disorders in the adult population of South-west Finland)*. Kansaneläkelaitoksen julkaisuja. AL:19. Turku, 1982.
- Korpilähde T, Heliövaara M, Knekt P, Marniemi J, Aromaa A, Aho K. Smoking history and serum cotinine and thiocyanate concentrations as determinants of rheumatoid factor in non-rheumatoid subjects. *Rheumatology (Oxford)*, 2004; 43, 1424–1428.
- Koskinen EH. *Suomalaisen ruoankäyttö ja ravinnon saanti vuosina 1967–1969 autoklinikan ravintotutkimusten valossa. (Consumption of foods and intake of nutrients in 1967–1969 according to the dietary studies of the Mobile Clinic)*. Kansaneläkelaitoksen julkaisuja. ML:6. Helsinki, 1975.
- Koskinen S, Kestilä L, Martelin T, Aromaa A, (ed.). *Nuorten aikuisten terveys. Terveys 2000 -tutkimuksen perustuloksia 18–29-vuotiaiden terveydestä ja siihen liittyvistä tekijöistä. (Baseline results concerning young adults)*. Kansanterveyslaitoksen julkaisuja. B7/2005. Helsinki, 2005a.
- Koskinen S, Laiho J, Rinne S, Kuosmanen N, Alha P, Rissanen H. Participation, complementary data collection and other measures to increase the participation rate. In: Heistaro S, (ed.). Methodology report. Health 2000 Survey. Publications of the National Public Health Institute B26/2008, Helsinki 2008.
- Koskinen S, Lundqvist A, Ristiluoma N, (ed.). *Terveys, toimintakyky ja hyvinvointi Suomessa 2011. (Health, functioning and welfare in Finland 2011)*. Terveiden ja hyvinvoinnin laitos. Raportti 68/2012. Helsinki, 2012.
- Kostner GM. Letter: Enzymatic determination of cholesterol in high-density lipoprotein fractions prepared by polyanion precipitation. *Clin.Chem.*, 1976; 22, 695.
- Koulutusluokittelu. (Classification of education). Käsikirjoja 1*. Tilastokeskus. Helsinki, 1971.
- Kramer IR, Pindborg JJ, Bezroukov V, Infirri JS. Guide to epidemiology and diagnosis of oral mucosal diseases and conditions. World Health Organization. *Community Dent.Oral Epidemiol.*, 1980; 8, 1–26.
- Kwapil TR, Miller MB, Zinser MC, Chapman J, Chapman LJ. Magical ideation and social anhedonia as predictors of psychosis proneness: a partial replication. *J.Abnorm.Psychol.*, 1997; 106, 491–495.
- Kwapil TR. Social anhedonia as a predictor of the development of schizophrenia-spectrum disorders. *J.Abnorm.Psychol.*, 1998; 107, 558–565.
- Kärkkäinen A. *Käden nivelrikko Suomen yli 30-vuotiaassa väestössä. (Hand arthrosis in the Finnish population aged 30 and over)*. Kansaneläkelaitoksen julkaisuja. ML:52. Turku, 1985.
- Lahtela K, Lahti R, Vuori I. *Psyykinen rasituskoe rintakipuoireiden tutkimisessa: menetelmän kuvaus. (The psychological stress test in examining chest pain symptoms)*. Kansaneläkelaitoksen kuntoutustutkimuskeskus. Raportteja 16. Turku, 1979.
- Lahtela K, Niemi P, Kuusela V, Hypen K. Noise and visual choice-reaction time. A large-scale population survey. *Scand.J. Psychol.*, 1986; 27, 52–57.
- Lahtela K, Niemi P, Kuusela V. Adult visual choice-reaction time, age, sex and preparedness. A test of Welford's problem in a large population sample. *Scand.J.Psychol.*, 1985; 26, 357–362.
- Lahti R. *Kliinisen tutkimuksen, mammografian ja termografian soveltuvuus rintasyövän joukkotutkimukseen. (The applicability of a clinical examination, mammography and thermography for a mass examination of breast cancer)*. Kansaneläkelaitoksen julkaisuja. AL:9. Helsinki, 1977.
- Laiho J, Djerf K, Lehtonen R. Sampling design. In: Heistaro S, (ed.). Methodology report. Health 2000 Survey. Publications of the National Public Health Institute. B26/2008, Helsinki 2008.

- Langland OE, Langlais RP. *Principles of dental imaging*. Williams & Wilkins. Baltimore, 1997.
- Larsen A, Dale K, Eek M. *Standard radiographs of rheumatoid arthritis*. Department of Radiology, Oslo Sanitetsforening Rheumatism Hospital. Oslo, 1975.
- Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*, 1969; 9, 179–186.
- Lee J. Covariates adjustment of rates based on the multiple regression model. *Journal of chronic diseases*, 1981; 34, 414–426.
- Lehtinen V, Joukamaa M, Jyrkinen T, Lahtela K, Raitasalo R, Maatela J, Aromaa A. *Suomalaisten aikuisten mielenterveys ja mielenterveyden häiriöt. (Mental health and mental disorders of Finnish adults)*. Kansaneläkelaitoksen julkaisuja. AL:33. Turku ja Helsinki, 1991.
- Lehtinen V, Joukamaa M, Kuusela V, Lahtela K, Raitasalo R. Mielenterveyden häiriöiden tutkimusmenetelmät. (Study methods for mental health). Osa 4. In: Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, (eds.). *Mini-Suomi-terveys tutkimuksen toteutus*. Kansaneläkelaitoksen julkaisuja. Helsinki ja Turku, 1985.
- Lehtinen V. *Psykiatrisen hoidon ja kuntoutuksen tarve sekä mielisairauteen kohdistuvat asenteet. (Need for psychiatric care and rehabilitation, and attitudes toward mental disorders)*. Kansaneläkelaitoksen julkaisuja. AL:3. Helsinki, 1975.
- Lehtonen R, Kuusela V. Mini-Suomi-terveys tutkimuksen otanta-asetelman tilastollinen tehokkuus. (The efficiency of the sampling design of the Mini-Finland health survey). Osa 5. In: Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, (eds.). *Mini-Suomi-terveys tutkimuksen toteutus*. Kansaneläkelaitoksen julkaisuja. ML: 65. Helsinki ja Turku, 1986.
- Lehtonen R, Pahkinen E. *Practical Methods for Design and Analysis of Complex Surveys. Revised Edition*. John Wiley & Sons. Chichester, 1996.
- Leighton AH. Research directions in psychiatric epidemiology. *Psychol.Med.*, 1979; 9, 235–247.
- Liao D, Arnett DK, Tyroler HA, Riley WA, Chambless LE, Szklo M, Heiss G. Arterial stiffness and the development of hypertension. The ARIC study. *Hypertension*, 1999; 34, 201–206.
- Lieberman JS. Newer diagnostic methods in peripheral vascular disease. *Cardiovasc. Med.*, 1977; 2:729.
- Lillberg K, Verkasalo PK, Kaprio J, Teppo L, Helenius H, Koskenvuo M. Stressful life events and risk of breast cancer in 10,808 women: a cohort study. *Am. J. Epidemiol.*, 2003; 157, 415–423.
- Loe H, Silness J. Periodontal Disease in Pregnancy. I. Prevalence and Severity. *Acta Odontol.Scand.*, 1963; 21, 533–551.
- Lohi S, Mustalahti K, Kaukinen K, Laurila K, Collin P, Rissanen H, Lohi O, Bravi E, Gasparin M, Reunanen A, Mäki M. Increasing prevalence of coeliac disease over time. *Aliment. Pharmacol. Ther.* 2007; 26, 1217–1225.
- Lohr SL. *Sampling: Design and Analysis*. Duxbury Press. Pacific Grove, 1999.
- Lundqvist A, Mäki-Opas T, (eds.). *Health 2011 Survey – Methods*. National Institute for Health and Welfare. Tampere, Finland, 2016.
- Lusted LB, Keats TE. *Atlas of roentgenographic measurement*. Year Book Medical Publishers. 3rd ed. Chicago, IL, 1972.
- Mäkelä M, Heliövaara M, Sievers K, Knekt P, Maatela J, Aromaa A. Musculoskeletal disorders as determinants of disability in Finns aged 30 years or more. *J.Clin.Epidemiol.*, 1993; 46, 549–559.
- Malmberg JJ, Miilunpalo SI, Vuori IM, Pasanen ME, Oja P, Haapanen-Niemi NA. A health-related fitness and functional performance test battery for middle-aged and older adults: feasibility and health-related content validity. *Arch.Phys. Med.Rehabil.*, 2002a; 83, 666–677.
- Malmberg JJ, Miilunpalo SI, Vuori IM, Pasanen ME, Oja P, Haapanen-Niemi NA. Improved functional status in 16 years of follow up of middle aged and elderly men and women in north eastern Finland. *J.Epidemiol.Community Health*, 2002b; 56, 905–912.
- Marshall D, Johnell O, Wedel H. Meta-analysis of how well measures of bone mineral density predict occurrence of osteoporotic fractures. *BMJ*, 1996; 312, 1254–1259.
- Maslach C, Jackson SE, Leiter MP. *Maslach Burn Out Inventory Manual*. Consulting Psychologist Press. Palo Alto, CA, 1996.
- Maslach C, Jackson SE. The measurement of experienced burnout. *J Occup Behavior*, 1981; 2, 99–113.
- Mattila C, Knekt P, Männistö S, Rissanen H, Laaksonen MA, Montonen J, Reunanen A. Serum 25-hydroxyvitamin D concentration and subsequent risk of type 2 diabetes. *Diabetes Care*, 2007; 30, 2569–2570.
- McWhinnie JR. Disability assessment in population surveys: results of the O.E.C.D. Common Development Effort. *Rev. Epidemiol.Sante Publique*, 1981; 29, 413–419.

- Molenberghs G, Kenward MG. *Missing Data in Clinical Studies*. John Wiley & Sons. Chichester, UK, 2007.
- Morris JC, Heyman A, Mohs RC, Hughes JP, van Belle G, Fillenbaum G, Mellits ED, Clark C. The Consortium to Establish a Registry for Alzheimer's Disease (CERAD). Part I. Clinical and neuropsychological assessment of Alzheimer's disease. *Neurology*, 1989; 39, 1159–1165.
- MRC committee, Definition and classification of chronic bronchitis for clinical and epidemiological purposes. A report to the Medical Research Council by their Committee on the Aetiology of Chronic Bronchitis. *Lancet*, 1965; 1, 775–779.
- Mälkiä E. *Eräät lihasten suorituskykymittaukset fyysisen toimintakykyisyyden kuvaajana suomalaisessa aikuisväestössä. (Some measures of muscle functioning as mirroring physical functioning in Finnish adults)*. Kansaneläkelaitoksen julkaisuja. AL:23. Turku, 1983.
- Nevanlinna HR, Furuholm U, Nuutinen M. Standardization of Hemoglobin Determinations. *Duodecim*, 1964; 80, 206–211.
- Nott PN, Cutts S. Validation of the 30-item General Health Questionnaire in postpartum women. *Psychol.Med.*, 1982; 12, 409–413.
- Nyman K, Raitasalo R. *Työstä poissaolot ja niihin vaikuttavat tekijät Suomessa. (Work absences and their determinants in Finland)*. Kansaneläkelaitoksen julkaisuja. A:14. Helsinki, 1978.
- O'Brien E, Asmar R, Beilin L, Imai Y, Mallion JM, Mancina G, Mengden T, Myers M, Padfield P, Palatini P, Parati G, Pickering T, Redon J, Staessen J, Stergiou G, Verdecchia P, European Society of Hypertension Working Group on Blood Pressure Monitoring. European Society of Hypertension recommendations for conventional, ambulatory and home blood pressure measurement. *J. Hypertens.*, 2003; 21, 821–848.
- Oja P, Laukkanen R, Pasanen M, Tyry T, Vuori I. A 2-km walking test for assessing the cardiorespiratory fitness of healthy adults. *Int. J. Sports Med.*, 1991; 12, 356–362.
- Parker G, Tupling H, Brown LB. A Parental Bonding Instrument. *Br.J.Med.Psychol.*, 1979; 52, 1–10.
- Partinen M. *Uni- ja vireystilakyselylomake (korjattu, tammikuu 2003). (The sleep and mental alertness questionnaire)*. Haagan Neurologinen Tutkimuskeskus NEURO. Helsinki, 2003.
- Pevalin DJ. Multiple applications of the GHQ-12 in a general population sample: an investigation of long-term retest effects. *Soc.Psychiatry Psychiatr.Epidemiol.*, 2000; 35, 508–512.
- Pharmaca Fennica. Lääkevalmisteet 1999. (Medicinal products 1999)*. Lääketeollisuusyhdistys ry, Lääketuojat ry. Helsinki, 1998.
- Pharmaca Fennica. Lääkevalmisteet 2000. (Medicinal products 2000)*. Lääketeollisuusyhdistys ry, Lääketuojat ry. Helsinki, 1999.
- Pharmaca Fennica. Lääkevalmisteet 2001. (Medicinal products 2001)*. Lääketeollisuusyhdistys ry, Lääketuojat ry. Helsinki, 2000.
- Pickering G. *High Blood Pressure, 2nd Edition*. Churchill Limited. London, 1968.
- Pietinen P. Ravinnonkäytön tutkimusmenetelmät. (Dietary survey methods). In: Aro A, Mutanen M, Uusitupa M, (eds.) *Ravitsemustiede*. Karisto Oy. Hämeenlinna, 1999.
- Pietrobelli A, Rubiano F, St-Onge MP, Heymsfield SB. New bioimpedance analysis system: improved phenotyping with whole-body analysis. *Eur.J.Clin.Nutr.*, 2004; 58, 1479–1484.
- Piirainen T, Hirvonen M, Elo A, Huuhtanen P, Kandolin I, Kauppinen K, Ketola R, Lindström K, Salminen S, Reijula K, Riala R, Toivanen M, Viluksela M, Virtanen S. *Työ ja terveys – haastattelututkimus 2003. (The work and health interview survey)*. Taulukkoraportti. Työterveyslaitos. Helsinki, 2003.
- Piirainen H, Elo A, Hirvonen M, Kauppinen K, Ketola R, Laitinen H, Lindström K, Reijula K, Riala R, Viluksela M, Virtanen S, 2000. *Työ ja terveys – haastattelututkimus v. 2000. (The work and health 2000 survey)*. Taulukkoraportti. Helsinki: Työterveyslaitos.
- Pilowsky I. Dimensions of hypochondriasis. *Br.J.Psychiatry*, 1967; 113, 89–93.
- Pindborg J.J. *Atlas of diseases of the oral mucosa*. Munksgaard. 2nd ed. Copenhagen, 1973.
- Pipberger HV, McCaughan D, Littmann D, Pipberger HA, Cornfield J, Dunn RA, Batchlor CD, Berson AS. Clinical application of a second generation electrocardiographic computer program. *Am. J. Cardiol.*, 1975; 35, 597–608.
- Pohjoismainen ammattiluokittelu. (Nordic Classification of Occupations)*. Kulkulaitosten ja yleisten töiden ministeriö, Valtionneuvoston Kirjapaino. Helsinki, 1963.
- Prineas RJ, Crow RS, Blackburn H. *The Minnesota Code Manual of Electrocardiographic findings. Standards and procedures for measurement and classification*. John Wright PSB. Boston, 1982.
- Pulliaainen V, Hokkanen L, Salo J, Hänninen T. *CERAD, kognitiivinen tehtäväsarja, käsikirja. (CERAD, the series of cognitive tasks, manual)*. Kuopion Yliopisto. Kuopio, 1999.

- Purola T, Kalimo E, Sievers K, Nyman K. *Sairastavuus ja lääkintäpalvelusten käyttö Suomessa ennen sairausvakuutusta. (Morbidity and use of medical services in Finland prior to health insurance)*. Kansaneläkelaitoksen julkaisuja. A:1. Helsinki, 1967.
- Purola T, Nyman K, Kalimo E, Sievers K. *Sairausvakuutus, sairastavuus ja lääkintäpalvelusten käyttö. (Health insurance, morbidity and use of medical services)*. Kansaneläkelaitoksen julkaisuja. A:7. Helsinki, 1971.
- Pyörälä K, Punsar S, Reunanen A, Heinonen O, Puro K, Aromaa A. *Kansaneläkelaitoksen sepelvaltimotautitutkimus. Rintakipuoireiden ja EKG- löydösten esiintyvyyden alkututkimuksessa. (The Social Insurance Institution's coronary heart disease study)*. Kansaneläkelaitoksen julkaisuja. AL:1. Helsinki, 1974.
- R Core Team. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna, Austria, 2008.
- Raitasalo R. *Depressio ja sen yhteys psykoterapian tarpeeseen. (Depression and its association with need for psychotherapy)*. Kansaneläkelaitoksen julkaisuja. Helsinki, 1977.
- Rastas M, Seppänen R, Knuts L, Karvetti R, Varo P, (toim.). *Ruoka-aineiden ravintoainesisältö. Nutrient composition of foods*. Kansaneläkelaitos. 2. Helsinki, 1989.
- Rauhala U. *Suomalaisen yhteiskunnan sosiaalinen kerrostuneisuus. The social stratification of Finnish society*. WSOY. Porvoo, 1966.
- Reims H, Fossum E, Kjeldsen SE, Julius S. Home blood pressure monitoring. Current knowledge and directions for future research. *Blood Press.*, 2001; 10, 271–287.
- Reitan RM. *The Halstead-Reitan Neuropsychological Test Battery*. Neuropsychology Press. Tucson, AZ, 1985.
- Research Triangle Institute. *SUDAAN User's Manual, Release 8.0*. Research Triangle Institute. Research Triangle Park, NC, 2001.
- Reunanen A, Aromaa A, Pyörälä K, Punsar S, Maatela J, Knekt P. The Social Insurance Institution's coronary heart disease study. Baseline data and 5-year mortality experience. *Acta Med.Scand.Suppl.*, 1983; 673, 1–120.
- Reunanen A, Takkunen H, Aromaa A. Prevalence of intermittent claudication and its effect on mortality. *Acta Med.Scand.*, 1982; 211, 249–256.
- Reunanen A. *Sepelvaltimotaudin rintakipuoireiden yleisyys ja ennuste väestössä. (Prevalence and prognosis of chest pain symptoms)*. Kansaneläkelaitoksen julkaisuja. AL:8. Helsinki, 1977.
- Rinne MB, Pasanen ME, Miilunpalo SI, Oja P. Test-retest reproducibility and inter-rater reliability of a motor skill test battery for adults. *Int.J.Sports Med.*, 2001; 22, 192–200.
- Ristola P, Knekt P, Reunanen A. *EKG-yksityiskohtien mittausmenetelmän luotettavuus. (Validity of the measurement of ECG-details)*. Kansaneläkelaitoksen julkaisuja. ML:18. Helsinki, 1980.
- Rosalki SB, Tarlow D. Optimized determination of gamma-glutamyltransferase by reaction-rate analysis. *Clin.Chem.*, 1974; 20, 1121–1124.
- Rose GA, Blackburn H, Gillum RF, Prineas RJ. *Cardiovascular Survey Methods*. WHO. 2nd ed, (Monograph series No. 56). Geneva, 1982.
- Rose GA, Blackburn H. *Cardiovascular Survey Methods*. WHO. Geneva, 1968.
- Rose GA. Standardisation of Observers in Blood-Pressure Measurement. *Lancet*, 1965; 1, 673–674.
- Rose GA. The diagnosis of ischaemic heart pain and intermittent claudication in field surveys. *Bull.World Health Organ.*, 1962; 27, 645–658.
- Rosenthal NE, Bradt GH, Wehr TA. *Seasonal Pattern Assessment Questionnaire*. National Institute of Mental Health. Bethesda, MD, 1984.
- Röschlau P, Berndt E, Gruber W. Enzymatische Bestimmung des Gesamt-Cholesterins im Serum. *Z Klin Chem Klin Biochem*, 1974; 12, 403–407.
- Salmi J, Pekkarinen H, Kröger H, Heliövaara M. Segmental assessments of fat free mass by bioimpedance in relation to DXA (abstract). *Int J Obes Relat Metab Disord*, 2004; 28: S127.
- Sautory O. *La Macro CALMAR. Redressement d'un échantillon par calage sur marges. I.N.S.E.E. Série des documents de travail n:o F 9310*. I.N.S.E.E. Paris, 1993.
- Seidell JC, Kahn HS, Williamson DF, Lissner L, Valdez R. Report from a Centers for Disease Control and Prevention Workshop on use of adult anthropometry for public health and primary health care. *Am. J. Clin. Nutr.*, 2001; 73, 123–126.
- Selzer RH, Mack WJ, Lee PL, Kwong-Fu H, Hodis HN. Improved common carotid elasticity and intima-media thickness measurements from computer analysis of sequential ultrasound frames. *Atherosclerosis*, 2001; 154, 185–193.

- Seppänen R, Hasunen K, Pekkarinen M, Bäckström L. *Autoklinikan ravintotutkimuksen seuranta vuosina 1973–1975. Suunnitelma, toteutus ja menetelmät. (The follow-up of the mobile clinic dietary survey in 1973–1975)*. Kansaneläkelaitoksen julkaisuja. ML:10. Helsinki, 1976.
- Seppänen R, Karinpää A. *Suomalaisen ruokavalion laatu. Mini-Suomi-terveystutkimuksen ravintokyselyn tulokset. (Quality of the Finnish diet)*. Kansaneläkelaitoksen julkaisuja. ML:58. Helsinki, 1986.
- Seppänen R, Koskinen EH, Pekkarinen M, Roine P. *Ravintohaastattelu Suomessa suoritetun epidemiologisen tutkimuksen yhteydessä. (Dietary interview in connection with an epidemiological survey carried out in Finland)*. Kansaneläkelaitoksen julkaisuja. ML:2. Helsinki, 1973.
- Sievers K, Melkas T, Heliövaara M, tuki- ja liikuntaelinten sairauksien tutkijaryhmä. Tuki- ja liikuntaelinten sairauksien tutkimusmenetelmät. (Methods for studying musculoskeletal diseases). Osa 3. In: Aromaa A, Heliövaara M, Impivaara O, Knekt P, Maatela J, (eds.). *Mini Suomi terveystutkimuksen toteutus*. Kansaneläkelaitoksen julkaisuja. ML:50. Helsinki ja Turku, 1985.
- Simpura J. Development of a common instrument for alcohol consumption. Teoksessa: Nossikov A and Gudex C, (toim.). *Eurohis*. IOS Press, WHO Regional Office for Europe. s. 61–78. Copenhagen, 2003.
- Sintonen H. An approach to measuring and valuing health states. *Soc.Sci.Med.Med.Econ.*, 1981; 15, 55–65.
- Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Ann.Med.*, 2001; 33, 328–336.
- Skinner C, Holt T, Smith TMF, (toim.). *Analysis of Complex Surveys*. John Wiley & Sons. Chichester, 1989.
- Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent.Health*, 1994; 11, 3–11.
- Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent.Oral Epidemiol.*, 1997; 25, 284–290.
- Smith TW, Butler VP Jr, Haber E. Determination of therapeutic and toxic serum digoxin concentrations by radioimmunoassay. *N.Engl.J.Med.*, 1969; 281, 1212–1216.
- Solonen K, Nummi J. Nivelten liikkeiden mittaaminen. (Measuring joint movements). *Suomen Lääkärilehti*, 1971; 26, 1953–1974.
- Suni J. *Health-related fitness test battery for middle-aged adults with emphasis on musculoskeletal and motor tests*. University of Jyväskylä. Jyväskylä, 2000.
- Suni J. *Testaajan opas: UKK-terveyskuntotestit keski-ikäisille. (An observers's manual: The UKK health fitness test for middle-aged persons)*. UKK-instituutti. 2003.
- Suni JH, Miilunpalo SI, Asikainen TM, Laukkanen RT, Oja P, Pasanen ME, Bos K, Vuori IM. Safety and feasibility of a health-related fitness test battery for adults. *Phys.Ther.*, 1998a; 78, 134–148.
- Suni JH, Oja P, Laukkanen RT, Miilunpalo SI, Pasanen ME, Vuori IM, Vartiainen TM, Bos K. Health-related fitness test battery for adults: aspects of reliability. *Arch. Phys. Med. Rehabil.*, 1996; 77, 399–405.
- Suni JH, Oja P, Miilunpalo SI, Pasanen ME, Vuori IM, Bos K. Health-related fitness test battery for middle-aged adults: associations with physical activity patterns. *Int.J.Sports Med.*, 1999; 20, 183–191.
- Suni JH, Oja P, Miilunpalo SI, Pasanen ME, Vuori IM, Bos K. Health-related fitness test battery for adults: associations with perceived health, mobility, and back function and symptoms. *Arch.Phys.Med.Rehabil.*, 1998b; 79, 559–569.
- Suomen Verenpaineyhdistys ry:n asettama työryhmä. Kohonneen verenpaineen hoito. (Treatment of hypertension). *Duodecim*, 2002; 118, 110–126.
- Suominen-Taipale L, Nordblad A, Vehkalahti M, Aromaa A. Oral Health in the Finnish Adult Population: Health 2000 survey. Publications of the National Public Health Institute B 25/2008, Helsinki 2008.
- Suvisaari JM, Haukka JK, Tanskanen AJ, Lönnqvist JK. Decline in the incidence of schizophrenia in Finnish cohorts born from 1954 to 1965. *Arch.Gen.Psychiatry*, 1999; 56, 733–740.
- Szasz G. A kinetic photometric method for serum gamma-glutamyl transpeptidase. *Clin.Chem.*, 1969; 15, 124–136.
- Takala I. *Työkyyvyn rajoitukset ja kuntoutuksen tarve 30–64-vuotiailla lounais- ja itäsuomalaisilla. Work ability limitations and need for rehabilitation in south-west and east Finns aged 30–64 years*. Kansaneläkelaitoksen julkaisuja. AL:24. Turku, 1984.
- Takkunen H. Iron deficiency in the Finnish adult population. *Scand.J.Haematol.Suppl.*, 1976; 25, 1–91.
- Tanner JM. The measurement of body fat in man. *Proc.Nutr.Soc.*, 1959; 18, 148–155.
- Tautiluokitus, (Disease Classification)*. Lääkintöhallitus. Helsinki, 1969.

- The “Minnesota Code” for ECG classification. Adaptation to CR leads and modification of the code for ECGs recorded during and after exercise by the Scandinavian Committee on ECG Classification. *Acta Med.Scand.Suppl.*, 1967; 481, 1–26.
- Thefeld W, Hoffmeister H, Busche EW, Koller PU, Vollmar J. Normal values of serum uric acid levels in relation to age and sex as determined using a new enzymatic uric acid color test. *Dtsch.Med.Wochenschr.*, 1973; 98, 380–384.
- Thomas BJ, Cornish BH, Pattermore MJ, Jacobs M, Ward LC. A comparison of the whole-body and segmental methodologies of bioimpedance analysis. *Acta Diabetol.*, 2003; 40 Suppl 1, S236–7.
- Todd JE, Lader D. *Adult dental health 1988*. Her Majesty’s Stationery Office. London, 1991.
- Tuomi K, Ilmarinen J, Jahkola M, Katajarinne L, Tulkki A. *Työkykyindeksi. (Work ability index)*. Työterveyslaitos. Helsinki, 1992.
- Turpeinen O, Roine P. *Ruoka-ainetaulukko. (Food composition tables, in Finnish)*. Otava. 8th ed. Helsinki, 1967.
- Wahlefeld AW. Triglycerides. Determination after enzymatic hydrolysis. Teoksessa: Bergmeyer HU, (toim.). *Methods of enzymatic analysis. Vol 4*. Academic Press. 2nd ed. New York, 1974.
- Valkenburg HA. *Epidemiological preventive examination Zoetermeer*. Erasmus Universiteit Rotterdam. Fourth Progress Report. 1977.
- Valkenburg HA. *Epidemiological preventive examination Zoetermeer*. Erasmus Universiteit Rotterdam. Third Progress Report. 1976.
- Valkenburg HA. *Epidemiological preventive examination Zoetermeer*. Erasmus Universiteit Rotterdam. Second Progress Report 1975. 1975.
- Vartiainen E, Jousilahti P, Juolevi A, Sundvall J, Alftan G, Salminen I, Puska P. *FINRISKI 1997. Tutkimus kroonisten kansantautien riskitekijöistä, niihin liittyvistä elintavoista, oireista ja terveystieteiden käytöstä. (A study of the risk factors for chronic diseases, related life styles, symptoms and use of health services)*. Tutkimuksen toteutus ja perustaulukot. Kansanterveyslaitoksen julkaisuja. B1/1998. Helsinki, 1998.
- Vartiainen E, Laatikainen T, Tapanainen H, Salomaa V, Jousilahti P, Sundvall J, Salminen M, Männistö S, Valsta L. Suomalalaisten sydän- ja verisuonisairauksien riskitekijät FINRISKI- tutkimuksessa 1982–2002. Cardiovascular disease risk factors in the FINRISK survey 1982–2002). *Suomen Lääkärilehti*, 2003; 58, 4099–4106.
- Vasankari T, Jousilahti P, Knekt P, Marniemi J, Heistaro S, Leppo K, Heliövaara M. Serum cotinine predicts bronchial obstruction regardless of self-reported smoking history. *Scand.J.Public Health*, 2011; 39, 547–552.
- Wechsler D. *Wechsler Adult Intelligence Scale – Revised (WAIS-R), Manual*. The Psychological Corporation. Harcourt Brace Jovanovich. Cleveland, 1981.
- Wechsler D. *Wechsler Adult Intelligence Scale, Third Edition (WAIS-III)*. The Psychological Corporation, Harcourt, Brace & Company. San Antonio, 1997.
- Wechsler D. *Wechsler Memory Scale – Revised (WMS-R), Manual*. The Psychological Corporation. Harcourt Brace Jovanovich. San Antonio, 1987.
- Vehkalahti M, Paunio IK, Nyyssönen V, Aromaa A. *Suomalaisten aikuisten suunterveys ja siihen vaikuttavat tekijät. (Oral health in Finnish adults)*. Kansaneläkelaitoksen julkaisuja. AL:34. Helsinki ja Turku, 1991.
- Werner W, Rey HG, Wielinger H. Über die Eigenschaften eines neuen Chromogens für die Blutzuckerbestimmungen nach der GOD/POD-Methode. *Z. Anal. Chem.*, 1970; 252, 224–228.
- Wever AM, Britton MG, Hughes DD. Evaluation of two spirometers: a comparative study of the Stead-Wells and the Vitalograph spirometers. *Chest*, 1976; 70, 244–250.
- WHO Consultation. *Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus*. World Health Organization. Geneva, 1999.
- WHO. *Arterial hypertension and ischaemic heart disease. Preventive aspects*. WHO. Tech Rep Ser No 231. Geneva, 1962.
- WHO. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Report of a WHO Study Group. *World Health.Organ.Tech.Rep.Ser.*, 1994; 843, 1–129.
- WHO. *Composite International Diagnostic Interview (CIDI, Version 2.1)*. World Health Organization. Geneva, 1997a.
- WHO. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health.Organ.Tech.Rep.Ser.*, 2000; 894, i-xii, 1–253.
- WHO. *Oral health surveys. Basic methods*. WHO. 4th ed. 1997, 1997b.
- Viitasalo JT, Era P, Leskinen AL, Heikkinen E. Muscular strength profiles and anthropometry in random samples of men aged 31–35, 51–55 and 71–75 years. – *Ergonomics*, 1985; 28, 1563–1574.
- Wilhelmsen L, Tibblin G, Werkö L. A primary preventive study of Gothenburg, Sweden. *Prev.Med.*, 1972; 1, 153–160.

- Willett W. *Nutritional epidemiology*. Oxford University Press. Oxford, 1998.
- Wing JK, Birley JL, Cooper JE, Graham P, Isaacs AD. Reliability of a procedure for measuring and classifying "present psychiatric state". *Br.J.Psychiatry*, 1967; 113, 499–515.
- Wing JK, Cooper JE, Sartorius N. *The Measurement and Classification of Psychiatric Symptoms*. Cambridge University Press. London, 1974.
- Wing JK, Henderson AS, Winckle M. The rating of symptoms by a psychiatrist and a non-psychiatrist: a study of patients referred from general practice. *Psychol.Med.*, 1977a; 7, 713–715.
- Wing JK, Mann SA, Leff JP, Nixon JM. The concept of a 'case' in psychiatric population surveys. *Psychol.Med.*, 1978; 8, 203–217.
- Wing JK, Nixon JM, Mann SA, Leff JP. Reliability of the PSE (ninth edition) used in a population study. *Psychol.Med.*, 1977b; 7, 505–516.
- Wing JK. Methodological issues in psychiatric case-identification. *Psychol.Med.*, 1980; 10, 5–10.
- Wittchen HU, Lachner G, Wunderlich U, Pfister H. Test-retest reliability of the computerized DSM-IV version of the Munich-Composite International Diagnostic Interview (M-CIDI). *Soc.Psychiatry Psychiatr.Epidemiol.*, 1998a; 33, 568–578.
- Wittchen HU, Reed V, Kessler RC. The relationship of agoraphobia and panic in a community sample of adolescents and young adults. *Arch.Gen.Psychiatry*, 1998b; 55, 1017–1024.
- Väisänen E. *Mielenterveyden häiriöt Suomessa. (Mental disorders in Finland)*. Kansaneläkelaitoksen julkaisuja. AL: 2. Helsinki, 1975.
- Yrjämä M, Tervonen O, Kurunlahti M, Vanharanta H. Bony vibration stimulation test combined with magnetic resonance imaging. Can discography be replaced? *Spine (Phila Pa.1976)*, 1997; 22, 808–813.
- Yrjämä M, Vanharanta H. Bony vibration stimulation: a new, non-invasive method for examining intradiscal pain. *Eur. Spine J.*, 1994; 3, 233–235.
- Zain RBM, Ikeda N, Yaacob MBH. *Oral mucosal lesions survey of adults in Malaysia*. University of Malaysia, Inoffice Equipment SDN. BHD, Malaysia, 1995.