THE NORTH KARELIA PROJECT:

FROM NORTH KARELIA TO NATIONAL ACTION

Pekka Puska, Erkki Vartiainen, Tiina Laatikainen, Pekka Jousilahti, Meri Paavola (editors)

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PREFACE

A great number of articles and other reports have been published about the North Karelia Project and about the associated national developments in Finland. Because of the great international interest a comprehensive summary report on the 20 year experiences was published in 1995 in form of the book Puska P, Tuomilehto J, Nissinen A, Vartiainen E: The North Karelia Project: 20 year results and experiences (Helsinki University Press 1995).

During the following years many further results and experiences have been obtained. The emphasis has shifted to national applications, programmes and policies. Also the links with many international developments, not least with WHO have increased. Due to the great international interest about these experiences – by visitors and other persons and organizations in the area – the 1995 book ran out of print.

Because of the developments since 1995 we decided to prepare a new book that describes the latest experiences and results, but also at the same time repeats the historical information on the background, principles, methods, early activities and experiences of the Project, as this is of great interest to countries that are starting similar activities. For this reason this book has some chapters from the original book. The new chapters are about the later experiences, with the main emphasis being on national developments and results.

Since the scope of the work is large, the decision on what material to include has been difficult and somewhat arbitrary. Also, the information given here is of a relatively general and summary nature. For any more detailed descriptions and results we ask the reader to consult the specific papers that we have published.

We hope that the book will be useful to the great number of people and organizations working in the area of prevention of chronic noncommunicable diseases and health promotion in different parts of the world. At the same time we want to acknowledge how much we have learnt from our extensive international collaboration. We want to thank all our friends and collaborators – the book and our work clearly reflects much of that.

Finally we want to thank the authors of the various chapters and the great work of the numerous agencies, organizations and individual persons that have made the presented results possible.

Helsinki, December 2008
Pekka Puska, Erkki Vartiainen, Tiina Laatikainen, Pekka Jousilahti, Meri Paavola (editors)

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Chapters 1, 2, 3, 4, 5, 12, 15, 17 and 18 are from the book published in 1995 "The North Karelia Project – 20 year Results and Experiences" with only minor changes.

FOREWORD

The global burden of noncommunicable diseases continues to grow; tackling it constitutes one of the major challenges for development in the twenty-first century. These health problems, principally cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases, currently cause around 60% of all deaths globally, with mortality projected to increase by 17% over the next 10 years. Low- and middle-income countries bear about 80% of the mortality burden of these diseases, and a substantial proportion of deaths are premature. Clearly, noncommunicable diseases have serious socioeconomic implications. They are closely related to poverty and contribute to it. If current trends continue, noncommunicable diseases will not only impede development, they will also derail efforts to reduce poverty.

We now know a great deal about preventing and controlling cardiovascular diseases and other noncommunicable conditions. Indeed, available evidence and experience clearly demonstrate that countries can significantly halt and even reverse the advance of these health problems if appropriate action is taken. Much of the international experience in preventing cardiovascular diseases is based on the pioneering work of the North Karelia Project and its nation-wide extension. The project is a successful model of integrated prevention of noncommunicable diseases that share the same risk factors. As well, the lessons learned from North Karelia have been used extensively these past two decades in developing policies and in implementing community-based interventions in many countries. Furthermore, the rich experience gained in reducing risk factors and in changing behaviours continues to be employed in capacity building activities in various regions and countries.

Sharing the experience of the North Karelia Project will contribute to international efforts to increase awareness of the preventability of these health problems. It will also highlight the need for urgent action to implement the Global Strategy for the prevention and control of noncommunicable diseases and its plan, recently endorsed by the World Health Assembly. I am confident that documenting this experience and updating this book will provide an important reference for all involved and interested in addressing the increasing magnitude of the global burden of noncommunicable diseases.

Dr Ala Alwan
Assistant Director General
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I

BACKGROUND
AND
GENERAL PRINCIPLES

1. PREHISTORY OF THE NORTH KARELIA PROJECT

Martti J. Karvonen

In Finland, "heart stroke" (apoplexia cordis) was already a commonly recorded cause of death back in the 19th century. It occurred in both sexes and was not exclusive to the elderly. Angina pectoris was the dreaded premonitor of heart stroke.

Coronary heart disease as a diagnostic entity became firmly established in medical clinics during the 1930s. In 1947 a young demographer, Väinö Kannisto, published his doctoral thesis on mortality in Finland, pointing out that mortality in eastern regions of the country had been higher than in the west since the 19th century, and that heart disease deaths there were particularly common (Kannisto, 1947). In fact, rates for eastern Finland headed the international league table of heart disease mortality. I was one of those who read the short review of Kannisto's thesis in the Finnish medical journal "Duodecim". My curiosity was aroused.

Back in 1945, as a junior demonstrator in the Institute of Physiology at Helsinki University, I had accepted the somewhat perilous challenge of organising physiological studies in connection with the National Championships for Lumberjacks, which involved the men in felling and cutting trees over four days - all with hand saw and axe. Work physiology and occupational health became the focus of my career from 1950 on. In those days forestry was the dominant occupation in the eastern regions of Finland where cardiovascular mortality was highest. This was despite the fact that physical activity and sports were already reputed to enhance health and prolong life. That something was seriously amiss in current scientific understanding was becoming increasingly obvious to the young physiologist, by now at the Institute of Occupational Health.

On my first journey to the United States in the spring of 1954 I visited the Laboratory of Physiological Hygiene of the University of Minnesota in Minneapolis. I had a short discussion with its director, Ancel Keys, who had just returned from visiting Italy. In 1952 he had published his hypothesis on the chain of causation: dietary fat - high blood plasma cholesterol - atherosclerosis, and its clinical manifestations in the cardiovascular system (Keys, 1952). This encounter provided the decisive stimulus to our joining forces in 1956 for the first East-West study of coronary risk factors.

Two areas of Finland with contrasting mortality were selected: one in the east and the other in the southwest. Clinically healthy men and women were examined, and habitual family diets subjected to intensive study. The results appeared to support the cholesterol hypothesis: dietary intakes of saturated fats, as well as serum cholesterol values, were high by international standards, and both were higher in the east than in the southwest (Keys *et al*, 1958; Roine *et al*, 1958).

The experiences gained in these cross-sectional surveys were sufficiently encouraging to add a time dimension. Thus began the longitudinal study of two contrasting populations of men aged 40-59 years at entry - one in the east and the other in the southwest, as before. Both the five and 10-year follow-ups confirmed the marked east-west disparity in coronary risk. This East-West project began in 1959 as a component of the unique "Seven Countries Study", where the same cohorts of men have continued to be examined at regular intervals, allowing their coronary heart disease incidence and mortality to be monitored for 25 years and beyond.

In Finland the 30-year follow-up examination of these cohort survivors took place in 1989, and their hospitalizations and mortality are still being recorded, at least up to 40 years. In the course of the East-West study several potential contributors to the risk were examined in addition to diet and serum cholesterol, viz. blood pressure, smoking habit, salt intake, trace elements in water, habitual physical activity, thyroid antibodies, childhood environment, war experiences, and recent life changes (Kromhout *et al*, 1994).

It is one thing to identify the cause(s) of a disease - quite another to prevent it. Planning for a medium-scale experiment in dietary prevention started in 1957, and a 12-year cross-over experiment involving dietary fats was launched in two Finnish mental hospitals in 1960. These efforts quickly prompted the development of expertise for modifying typical Finnish diets with acceptable substitutes for milk and butter.

By replacing dairy fats in milk by soybean oil, and butter by a soft margarine with a high content of polyunsaturated fatty acids, the trial resulted in a radical change in the P/S ratio (polyethenoid/saturated fatty acids) of the hospital diets: from 0.25 to 1.48 on average over the entire duration of the open-cohort experiment. Serum cholesterol levels responded with a sizable average decrease in men from 267 to 226 mg/dl (6.90 to 5.84 mmol/l), and in women from 275 to 249 mg/dl (7.11 to 6.20 mmol/1) over the study period. Moreover, the incidence of coronary heart disease tended to diminish in both men and women (Miettinen *et al*, 1983; Turpeinen *et al*, 1979; Turpeinen *et al*, 1960).

As research on risks and prevention gathered pace, the issues began to be 'taken to heart' by a wider public. The Finnish Heart Association, founded in 1955, was the first to emulate its American counterpart, established way back in 1924. Right from

the outset the Finnish Heart Association attracted support from health authorities and various social and political leaders, enabling it to smooth the path for research and the application of study findings. It also rapidly developed a field organization, whose regional branch members in North Karelia were always eager for fresh information from the East-West study. The investigators reported the findings from eastern Finland at the annual Heart Association meetings, which were also attended by regional leaders.

In response to the summary and conclusions from the 10-year follow-up in 1970, the Regional Governor of North Karelia, Esa Timonen, invited all North Karelian members of the Finnish parliament and several representatives of official and voluntary organizations to form a pressure group. A petition for state aid to reduce the cardiovascular problem in North Karelia was signed on January 12th 1971. The governor headed the delegation which took the petition to Helsinki, where it was presented to the Finnish Government, the National Board of Health, the Medical Research Council of the Finnish Academy, and the Finnish Heart Association. Publicity was generated and action promised.

The Finnish Heart Association was the first to act, by convening a special working group for the task. This group conceived a basic plan for the North Karelia Project, and the association appointed two full time physicians to work out the details. The working group concluded that leadership of such a project was not a task appropriate for senior medical professionals likely to be preoccupied with other work, but was rather a make-or-break challenge for a younger candidate. In 1972 Dr Pekka Puska was appointed as Principal Investigator. Dr Puska thoroughly immersed himself in the North Karelia Project from the outset, has persisted with it throughout, and deserves much of the credit for its resounding success.

Two institutions also deserve a mention. The Finnish "home" of the East-West Study was the Helsinki Institute of Occupational Health, founded in 1951, a facility which offered novel approaches and a broad spectrum of research and services. The institute soon established close contacts with the World Health Organization (WHO). Cardiovascular diseases entered the programmes of WHO in the early sixties, first via the Regional Office for Europe in Copenhagen, and later at WHO Headquarters in Geneva. There was mutual interest in preventive cardiology, and close professional and personal ties developed between the WHO staff members responsible: initially Mikhail Akhmetely, then Zbynek Pisa in Copenhagen and Zdenek Fejfar in Geneva.

For WHO, the concept of the North Karelia Project was a logical step towards the realization of shared ideas, and a welcome opportunity for the practical testing of prevention in the community. To assist finalization of the detailed plan at the

planning seminar held in Joensuu on September 7-9th 1971, WHO contributed four international experts: Z. Fejfar, WHO, Geneva; J.N. Morris, London; Z. Pisa, WHO, Copenhagen; H. Blackburn, Minneapolis.

The old East-West Study continued its observational research in Ilomantsi as before, while the new North Karelia Project was to become a broad-spectrum community intervention covering the entire North Karelia Province. For the Ilomantsi cohort of men the contrasting southwest was the comparison area, while the North Karelia Project selected the neighbouring province of Kuopio as its primary initial reference area.

In summary, the North Karelia Project was a logical, yet courageous stride forward based on the results and inferences of the East-West Study (Karvonen *et al*, 1970; Keys & Aravanis, 1980).

REFERENCES

Kannisto V. (1947) Kuolemansyyt väestöllisinä tekijöinä Suomessa. Väitösk, Kansantaloudellinen yhdistys, Helsinki.

Karvonen MJ, Orma E, Punsar S, Kallio V, Arstila M, Luomanmaki K, Takkunen J (1970) Coronary heart disease in seven countries. VI. Five-year experience in Finland. *Circulation* **41**: I52-62

Keys A (1952) The cholesterol problem. *Voeding* **13**: 539-555

Keys A, Aravanis C (1980) *Seven countries : a multivariate analysis of death and coronary heart disease.* Cambridge: Harvard Univ. Press

Keys A, Karvonen MJ, Fidanza F (1958) Serum-cholesterol studies in Finland. *Lancet* **2**: 175-8

Kromhout D, Menotti A, Blackburn H (1994) *The seven countries study a scientific adventure in cardiovascular disease epidemiology.* Bilthoven: Studio RIVM

Miettinen M, Turpeinen O, Karvonen MJ, Pekkarinen M, Paavilainen E, Elosuo R (1983) Dietary prevention of coronary heart disease in women: the Finnish mental hospital study. *Int J Epidemiol* **12**: 17-25

Roine P, Pekkarinen M, Karvonen MJ, Kihlberg J (1958) Diet and cardiovascular disease in Finland. *Lancet* **2**: 173-5

Turpeinen O, Karvonen MJ, Pekkarinen M, Miettinen M, Elosuo R, Paavilainen E (1979) Dietary prevention of coronary heart disease: the Finnish Mental Hospital Study. *Int J Epidemiol* **8**: 99-118

Turpeinen O, Roine P, Pekkarinen M, Karvonen MJ, Rautanen Y, Runeberg J, Alivirta P (1960) Effect on serum-cholesterol level of replacement of dietary milk fat by soybean oil. *Lancet* **1**: 196-8

2. MAIN OUTLINE OF THE NORTH KARELIA PROJECT

Pekka Puska

INITIATION AND PLANNING

The background of the North Karelia Project is described by Professor Karvonen in the previous chapter. In the late 1960s the emerging Western epidemic of cardiovascular diseases, and their exceptional prevalence in Finland, began to alert widespread public concern. This was fuelled by media reports and research findings drawing particular attention to Finland's eastern region. In addition, the studies of Karvonen, Keys and others had begun to focus on the possible role of certain "risk factors".

After the petition of January 1971, described earlier, the Finnish Heart Association set up a planning group including several Finnish experts, and contacts were established with WHO. At the large planning seminar in September 1971, the main principles of the North Karelia Project were formulated and further steps recommended.

The initial organization of the North Karelia Project was composed of a board of directors (chaired by the Governor, Esa Timonen), a steering committee (chaired by the County Medical Officer, Väinö Soininen), a principal investigator (Pekka Puska), and a co-ordinating centre (initially at the University of Turku, but shortly relocated to the University of Kuopio). The project organization members further elaborated and refined the plans.

It was quite obvious even during this planning phase that any major control of cardiovascular diseases in North Karelia would be largely dependent on the potentials for primary prevention. Findings from the Seven Countries Study, the Framingham Study and others had already suggested the important causal role of certain risk factors. While several trials were being planned to "prove the causality", it was also being pointed out that the risk factors were very closely linked with community life styles. This was certainly the case in North Karelia, where the pervasiveness of the main risk factors was clearly related to the generally unhealthy diet and smoking habits etc.

These considerations, combined with the historical background, guided the formulation of a community-based intervention strategy. The central task became to shift the risk factor profile of the entire North Karelian population through a

community-based intervention: "A mass epidemic calls for mass action and the changing of lifestyles can only succeed through community action".

In the process of outlining these intervention principles, the team was aware of the importance of carefully evaluating the results and experiences. It was felt that only the most thorough scientific evaluation would allow the project to contribute to our knowledge of how to modify risk factors in a population and whether this can really lead to reduced disease rates. The "evaluation study design", described later, was the outcome of these deliberations.

Thus was launched the world's first major community-based preventive study in the field of CVD.

It was stressed that sound evaluation of the findings and experiences in North Karelia would allow this approach to benefit the whole country, and perhaps others, too. So the North Karelia Project was seen both as a "pilot" and a "demonstration" project for Finland as a whole.

The original North Karelia Project was planned for a five year period. In January 1972 a large baseline survey was launched in North Karelia and its matched reference area (the neighbouring province of Kuopio); large representative population samples were involved, as well as carefully standardized methods.

The baseline survey was completed in April 1972, by which time the more detailed plans for the intervention were ready. The various features and elements of the planning (e.g. community diagnosis) are described later. On World Health Day, April 7th, the intervention was announced, and several monitoring systems (disease registers) were activated soon afterwards.

The planning of the project, its initial progress during the first five years, as well as numerous relevant background features, are described in the WHO monograph "The North Karelia Project in 1972-77" (Puska *et al*, 1981).

NORTH KARELIA

Finland is a republic in northern Europe whose population of about 5 million is relatively homogenous by international standards. Finland has evolved into a modern welfare state since emerging from the devastating experiences of World War II. North Karelia is one of the country's provinces (counties), running along part of the eastern border with Russia (the Soviet Union until 1992). It is approximately 20.000 km in size and characterized by large tracts of forest, hilly terrain and numerous lakes.

North Karelia's population has remained stable at around 180.000 for the past 30 years. People live in the countryside, in smaller towns, or in Joensuu the provincial capital. The main sources of livelihood used to be agriculture and forestry, but their importance has declined sharply since the 1960s and it is now industry and the service sector which predominate.

All provinces in Finland are divided into local authority districts. These municipalities provide and operate schools and health and other welfare services according to central statutory requirements, mainly using revenues from municipal and state taxes.

Since 1972 the bulk of primary health care in North Karelia (as in Finland as a whole) has been dispensed at the fairly comprehensive municipal health centres spread around the province. These employ general practitioners, public health nurses, dentists etc. and have small wards attached. Most specialized medical care is provided at the central hospital in Joensuu.

Judged by numerous criteria, North Karelia has had the lowest socioeconomic status of any Finnish province for the 25 years of the Project. However, as in the rest of the country, there was substantial expansion in the economy and welfare services during the period. These developments have been reasonably homogenous across Finland, largely thanks to relatively centralized policies.

OBJECTIVES OF THE PROJECT

The objectives of the North Karelia Project were derived from the background described. The general aim was to perform a community-based health intervention for the benefit of the citizens of North Karelia, and to generate new knowledge and experiences for utilization throughout Finland and elsewhere.

A hierarchy of objectives was developed, as described in greater detail later. Towards the end of the first ten years (1972-82), these objectives were expanded to satisfy local needs and complement international developments (particularly within WHO).

MAIN OBJECTIVES
1) Initially (1972-82): to reduce CVD mortality in the local population
2) Later (1982 onwards): to reduce major chronic (non-communicable disease) mortality and promote health in the local population.

INTERMEDIATE OBJECTIVES

To reduce the levels in the local population of the main risk factors and to promote secondary prevention.

Main target risk factors: smoking, elevated serum (LDL) cholesterol and elevated blood pressure. Major emphases on general lifestyle changes (especially smoking and dietary habits).

NATIONAL OBJECTIVE

1) Initially (1972-77): as a pilot project for the whole of Finland
2) Later (1977 onwards): as a national demonstration project and model programme

In the CVD category, most of the emphasis was placed on coronary heart disease (CHD), but cerebrovascular stroke was also an important specific target. When other chronic diseases were later included, cancers (especially those possibly influenced by smoking and diet) were a particular concern.

Most of the emphasis was on the working age population - especially the men. This was because of the remarkable excess of CVD mortality among middle-aged men. It was also thought that relatively rapid results in the community could be achieved in this population sector and that these people have the greatest influence in community change. Since then, more systematic emphasis has been devoted to children and youth, and also to older folk.

The intervention methods and actual programme were developed from these objectives and background features by the application of various theoretical frameworks and practical considerations, as explained later.

PROJECT EVOLUTION

The following summarizes some of the main developments during the North Karelia Project:

1971:	- petition - initial planning and project organization
1972:	- baseline survey in North Karelia and reference area (Kuopio) - finalizing of intervention and monitoring plans - launch of the intervention
1972-77:	- comprehensive community-based CVD prevention in North Karelia (initial media campaigns, involvement of various community organizations and health services, mobilizing lay leaders and the public etc.)
1977:	- 5-year population survey in North Karelia and Kuopio

1977-82:	- continuation of the project in North Karelia: integration of activities within the community structures, introduction of novel elements (especially youth interventions) - start of national activities and involvements (TV programmes, health policy etc.)
1982:	- 10-year population survey in North Karelia and Kuopio and a similar survey in southwest Finland (with WHO/MONICA)
1982-87:	- continuation of the demonstration area activities in North Karelia and of national activities in the framework of WHO/ CINDI and INTERHEALTH programmes (integrated prevention of major chronic diseases and promotion of health)
1987:	- 15-year population surveys in North Karelia, Kuopio and southwest Finland
1987-92:	- continued activity in North Karelia and nationally, but with major emphasis on reinforcing CHD prevention through cholesterol lowering dietary changes (intensified collaboration with food manufacturers)
1992:	- 20-year population surveys in North Karelia, Kuopio, southwest Finland and metropolitan Helsinki (thus follow-up of the North Karelia Project progressively evolved into a national risk factor monitoring system)
1992-97:	- continued activity in North Karelia and nationwide to ensure and demonstrate further successes.
1997:	- After 25 years the project was declared finished, but the work in North Karelia continues, as described later.

Over this period the project organization was modified to reflect actual developments. The work of the board of directors and steering committee was completed, and the project further integrated with appropriate organizations, resulting in more operational flexibility for the core project team.

Coinciding with the reorganization of the National Public Health Institute (KTL) in 1980, the co-ordinating centre of the North Karelia Project moved in 1980 from the University of Kuopio to KTL headquarters in Helsinki (at the Department of Epidemiology and Health Promotion). This ensured much greater stability in terms of basic resources, as well as providing an appropriate site for long term monitoring and evaluation, and (under the Ministry of Social Affairs and Health) a useful location from which to disseminate experiences throughout the country.

At the same time the project office in Joensuu was expanded. It remained affiliated with the provincial health department, but assumed a far more active role in various media-related activities, and in "social marketing", community partnerships, etc.

The core project administration is depicted in Figure 1.

Key individuals involved during the 25 years of the North Karelia Project are as follows:

- Principal Investigator	Pekka Puska	1972-97
- Project Director	Pekka Puska	1978-97
- Co-principal Investigators	Jaakko Tuomilehto Aulikki Nissinen Jukka T. Salonen Erkki Vartiainen	1972-97 1977-97 1977-82 1987-97
- Project Co-ordinator	Heikki J. Korhonen	1982-97
- Executive Manager of the Field Office	Vesa Korpelainen	1986-97
- Governor of North Karelia	Esa Timonen	1972-92
- Director General of the National Public Health Institute	Jussi Huttunen	1978-97
- Director of North Karelia Provincial Health Department	Ismo Helenius	1972-97
- County Medical Officer of North Karelia	Väinö Soininen Pertti Puhakka	1972-78 1978-97
- Chief, Department of Internal Medicine, North Central Hospital	Helge Honkapohja Harri Mustaniemi Juha Mustonen	1972-80 1980-92 1992-97
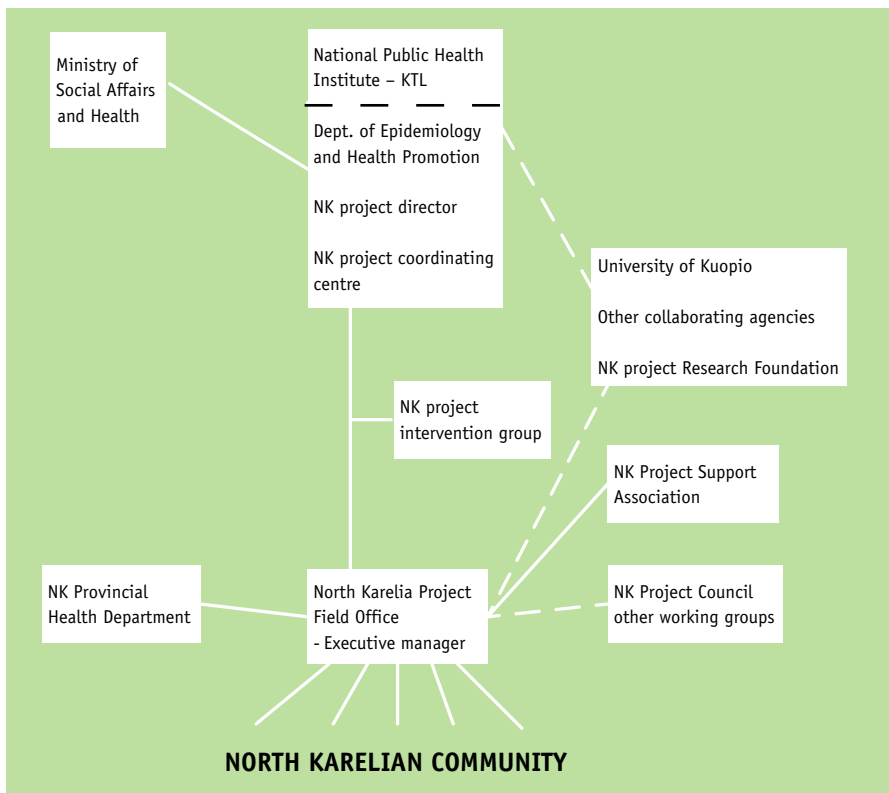
Figure 1. Simplified scheme of North Karelia Project Administration

REFERENCES

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo L, Kottke TE (1981) *Community control of cardiovascular diseases : evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland, 1972-1977*: Published on behalf of the National Public Health Laboratory of Finland by the World Health Organization, Regional Office for Europe

3. GENERAL PRINCIPLES AND INTERVENTION STRATEGIES

Pekka Puska

BACKGROUND

Cardiovascular and other non-communicable diseases (NCDs) form the major health burden in the industrialized countries and are a rapidly growing problem elsewhere. But at the same time they represent the area where the greatest health gains can be achieved. In most of the developed world three out of four deaths are due to cardio-vascular disease, cancer, and accidents and other violent causes. As far as morbidity is concerned, disorders such as diabetes, hypertension, chronic respiratory disease, osteoporosis and some musculo-skeletal disorders are also major problems.

Extensive medical research over the past few decades has probed the causes and mechanisms of these non-communicable diseases. There have been large epidemiological studies within and between populations, basic biochemical and animal studies, intervention trials, and large-scale community-based preventive studies. Findings from this research have indisputably revealed that these NCDs, or events leading to them, have their roots in unhealthy lifestyles or adverse physical and social environments. The major lifestyle factors implicated are unhealthy nutrition, smoking, physical inactivity, excess use of alcohol, and psychosocial stress.

Although there is still much to learn, we have already accumulated a wealth of knowledge for effective preventive action. Actually, so much is now known that the main question in chronic disease prevention is no longer "what should be done?", but "how should it be done?". So the key issue is how best to apply our existing knowledge to effective prevention in real life.

Carefully planned community programmes like the North Karelia Project represent important efforts towards solving this problem. The gaping contrast between existing medical knowledge and the situation in everyday society stems from a host of formidable obstacles to healthy change - cultural, political, economic, psychological, and so on. The aim of community programmes is to build a bridge for people and communities to overcome these obstacles, or at least to minimize them.

There is another powerful argument in favour of community-based preventive programmes: the source of the mass epidemics of NCDs is unhealthy lifestyles, which often first emerge during periods of economic transition. Large portions of society are under at least some risk, so major reductions in disease rates call for widespread changes in the related lifestyles. Moreover, since these are embedded in the community in complex ways, major lifestyle changes are only possible if their determinants in the community are somehow modified.

Identification of the main risk factors in the early 70s prompted moves towards preventive studies and other efforts, including major community-based preventive programmes. The North Karelia Project was launched in 1972, becoming the first ever major community-based project for CVD prevention. It was soon followed by several similar projects. Activities in Europe were coordinated by WHO/EURO, under the Comprehensive Cardiovascular Community Control Programmes ("CCCCP"). The experience was evaluated and published (Puska *et al*, 1988).

In the early 1980s discussion and planning began to focus more on integrated community programmes for chronic disease prevention. This derived from the observation that the principal risk factors/unhealthy lifestyles usually appeared to be related to several chronic diseases ("common risk factors"). In addition, efforts in the community to prevent different types of disorder needed to be integrated. In the European WHO Region this led to initiation of the Countrywide Integrated Noncommunicable Disease Intervention (CINDI) Programme of WHO/EURO. To date, almost 30 countries are involved, and several other programmes are associated with CINDI.

GENERAL PRINCIPLES

A central aim of carefully evaluated community programmes like the North Karelia Project is to forge broad links between basic medical research and the large-scale application of public health programmes. They are thus well-planned, theory-based attempts to overcome the many obstacles to healthy changes and to bridge the gap between medical knowledge and real life situations. A well-monitored programme can thus diminish our uncertainty about the effectiveness of such an approach, inform us about the usefulness of different methods, teach us effective use of the existing resources (services and other community facilities), and reveal any unexpected outcomes. A carefully evaluated community programme serves thereby not only its target area, but also as a study or "demonstration" for wider applications.

Interventions for a community-based intervention study or major demonstration programme need to be well-conceived, and planned and implemented in a systematic manner. The content is determined by the intelligent application and adaptation of existing medical, epidemiological, behavioural and social knowledge to local community settings and situations. Careful monitoring is essential for assessing the usefulness of the intervention for national or other applications.

It needs to be emphasized that even when the framework of an intervention is well-defined and structured on objectives, theoretical frameworks, local community diagnosis and practical considerations, the actual implementation must be flexible enough to respond to changing community situations and to take advantage of any fresh opportunities that arise. Such flexibility has been a strong feature of the North Karelia Project.

The objectives of the project evolved from the public health needs of the community and the intervention strategies were designed using relevant theoretical considerations. Moreover, the project leaders and staff genuinely immersed themselves in the community and among the people, where they developed and adjusted programme activities according to the available local options and circumstances.

A key feature of any community health programme is that it simultaneously applies medical and epidemiological knowledge to identify health problems and target risk factors for selecting intervention objectives, as well as behavioural and social knowledge for designing the actual programme content and activities. This requires interdisciplinary activity throughout the planning and implementation phases, and during the evaluative research.

As previously stated, the general objective of an integrated community-based chronic disease programme is to reduce the rates of major chronic diseases in the community. The intermediate objectives are to reduce the population levels of the main established risk factors. Improvements in early detection, treatment and rehabilitation can also be included in the intermediate objectives. What is needed is thus a strategy that integrates several innovative intervention approaches into a practical programme, which is then itself integrated into the service structure and other local social organizations. The programme must be founded on intersectoral activity, community organization and grassroots participation.

Figure 1 describes the hierarchy of objectives in a community programme such as the North Karelia Project. The general aim or goal is improved health and well-being of the population. The main objectives concern the reduction of specified NCDs. The choice is dependent on local mortality/incidence/prevalence rates and on public concerns.

After the main objectives have been selected, the intermediate objectives are defined. These are derived from the medical/epidemiological/knowledge in the literature relating to the well-established risk factors for the diseases in question, and from the local prevalence rates of those factors. Clear definitions of the main and intermediate objectives are needed in order to decide on the respective indicators and data sources for monitoring and evaluation.

After the intermediate objectives have been settled the immediate objectives or practical programme contents are decided upon. Because the overall task largely concerns the influencing of health behaviours and related lifestyles, behavioural and social theories are required. A sound understanding of the community ("community diagnosis") is also essential, so all practical potentials and opportunities to this end should be pursued.

EPIDEMIOLOGICAL/MEDICAL FRAMEWORK

The main health goal of controlling CVDs, or chronic diseases in general, implies the application of all appropriate action to reducing the burden of disease, including primary prevention, treatment, rehabilitation and other secondary prevention, and related research. However, major success in controlling a chronic disease can only be based on primary prevention, since intervention during the clinical stages of the disease has merely a limited impact. The greatest potential for controlling most NCDs lies in primary prevention; in other words, a "mass epidemic" should be tackled by "mass prevention".

In primary prevention the choice of the main risk factors to be intervened in is derived from the international literature. Smoking, dietary factors and physical activity occupy the main focus. This information then has to be matched with data on the prevalence of these factors in the target population.

In the case of the North Karelia Project this aspect was relatively easy. Back in the early 70s several studies, along with their international conclusions, had identified three main CVD risk factors: elevated serum cholesterol, elevated blood pressure, and smoking. The roles of other possible factors (physical inactivity, obesity, psychosocial stress, alcohol consumption, micronutrients etc.) were more ambiguous. This was in line with the available information even before the project's baseline survey: serum cholesterol and blood pressure levels, as well as smoking rates, were all very high in the North Karelian male population, while many of the more speculative risk factors (e.g. physical inactivity, obesity) were not particularly prevalent.

Once risk factors have been agreed upon, a programme's intervention strategy can be chosen. The "high risk" (or "clinical" or "focused") approach attempts to identify those people with high risk factor levels and to intervene in them. By contrast, the "community" (or "population" or "public health") approach attempts to modify the general risk factor profile of the entire population.

Although an individual's CHD risk, for example, increases with rising risk factor levels (a fact obviously relevant in clinical practice), it is essential to understand that individuals with clinically high risk factor levels are responsible for only a small proportion of the disease cases that occur in the community. In fact most cases arise among people with only moderate risk factor elevations (although they usually have several at once), who far outnumber the much smaller numbers of high risk individuals. This phenomenon repeatedly emerged from the data of the project (Kottke *et al*, 1985).

So from the epidemiological standpoint, major reductions in NCD rates in the community can be achieved only by broad reduction in the levels of the multiple and

generally "common" risk factors. This demands community-wide efforts in promoting lifestyles that are likely to impact the common risk factor levels in the population and thereby reduce the NCD rates. Such lifestyle changes are usually likely to be beneficial for a wide range of non-communicable diseases, as well as to be safe, and to promote health in general.

Accordingly, the North Karelia Project involved a population-based strategy from the very outset: i.e. employing general community activities to influence the risk factor profile of the whole population. The theme was to change North Karelia, not merely a restricted number of high risk individuals. In more technical terms, the task was to shift the entire risk factor distribution to the left rather than influencing the "high risk" end of the distribution.

THE BEHAVIOURAL/SOCIAL FRAMEWORK

Once a programme to promote healthy lifestyle and risk factor changes in the community has been defined, the task enters the realm of the behavioural and social sciences. Medical practice has long been based on the assumption that after identifying the behavioural agents leading to disease, merely informing the subjects concerned is enough to rectify the situation. Numerous studies and everyday practice show that this is seldom the case. Behaviours are embedded in the social and physical environment in complex ways.

Health related lifestyles are largely determined by social forces and other environmental factors. Efforts towards major progress in influencing disease rates in the community have to contend with the environmental forces and structures. The natural and most effective way of changing a population's risk factor levels is to operate through the community: the entire community rather than its individual members should form the target.

Although the task of influencing people's behaviours and lifestyles lies in the domain of the social and behavioural sciences, a persistent and major problem has been the lack of a unifying theory to serve as a guide. Action-oriented people often feel frustrated by the inability of behavioural and social scientists to tell them what they should do. Despite this, there are sound principles in behavioural and social science to guide our way in planning, implementing and evaluating communitybased health programmes. Reference can be made to the old wisdom: "there is nothing so practical as good theory."

The following briefly describes four theoretical, somewhat overlapping frameworks for behavioural change often used and referred to in the North Karelia Project. Finally,

a model used in the North Karelia Project is presented that unifies these approaches in a community-based preventive health programme.

BEHAVIOUR CHANGE APPROACH

This social psychological approach deals with the determinants of an individual's behavioural changes, and is based on Bandura's work on the process of learning (Bandura, 1977). New behaviours tend to originate, at least on trial bases, from change exposure to powerful models; external and self-enforcement, plus cognitive control are the consequent determinants of continued new behaviours. This approach includes elements of the classical field theory of Lewin (1951) and the behavioural intention model of Fishbein & Ajzen (1975).

In another report a framework compatible with this approach has been described in greater detail, using examples from the various activities in North Karelia (McAlister *et al*, 1982). This model emphasizes that programme planning and evaluation should include the following key steps to help individuals modify their behaviour:

1. Improved preventive services to help people identify their risk factors and to provide appropriate attention and services.
2. Information to educate people about the relationship between their behaviours and health.
3. Persuasion to motivate people and promote their intentions to adopt healthy action(s).
4. Training to enhance skills of self-management, environmental control and necessary action.
5. Social support to help people maintain the initial action.
6. Environmental change to create the opportunities for healthy actions and improve unfavourable conditions.
7. Community organization to mobilize the community for broad-ranging changes (through enhanced social support and environment modification) to support the adoption of the new lifestyles in the community.

Step 3, persuasion, is one of the key steps in the model. In the North Karelia Project the credibility of message sources was emphasized (WHO, government, academic expert opinion, health motives etc), as well as various "affective" aspects (references to the petition, "local pride", international interest, etc), and message contents that anticipated counter-arguments and resonated with aspects of the local culture. Persuasion often aims to inspire "community action for change", in which

individuals are encouraged to participate not necessarily for their own sake, but for the common good in their own familiar community context (thus emphasizing incentives beyond those related to their personal longterm disease risk).

As in the Stanford "Three Community Study" (Farquhar *et al*, 1977), there was great stress placed on efforts to teach practical skills for change, such as smoking cessation techniques and ways of buying and cooking healthier foods. For the latter, close co-operation with the local housewives' association has proven invaluable. Activities have been co-ordinated to provide social support, expand options and availability (e.g. production and marketing of healthier foods), and ultimately to organize the community to function in a heathier mode.

THE COMMUNICATION-BEHAVIOUR CHANGE APPROACH

The task of introducing new behaviours into the community is basically achieved by communicating: through popular media channels and via interpersonal approaches. A project disseminates its messages to the population through the mass media, in addition to maintaining direct communication with various community leaders. Well-documented theoretical backgrounds for this approach are provided by Bandura's social learning theory (1977), the classical communication-persuasion model of McGuire (1969), its modification by Flay *et al* (1980), and the beliefattitude-intention model of Ajzen & Fishbein (1980).

The North Karelia Project developed a model (Figure 2), largely in connection with its nationwide TV health education programmes (Puska *et al*, 1987; Puska *et al*, 1981a; Puska *et al*, 1985), that specifies the various steps of behavioural change: from exposure and attention, through comprehension and persuasion, to action and the maintenance of new behaviours. The model further takes into account factors that affect the communicated message, as well as community-related factors that influence the various steps of behavioural change.

The likelihood of positive outcomes is enhanced by careful attention to the factors specified in the model during the planning of the message, and by monitoring or even actively intervening in these factors in the community as necessary (e.g. by encouraging social interaction).

The task of influencing behaviour through mass communication is made extremely difficult by the complexity of the processes involved.

Communication Factors	Behaviour Change	Community Factors
Channels choice	Exposure	Choice of target groups
Importance, relevance source	Attention	Perceived interest Increased interpersonal contacts Involvement of opinion leaders
Simple concepts Match local culture	Comprehension	Opportunity for discussion and feedback
Credible source Emotional components Anticipating counter-arguments	Persuasion	Community activities (target days, local initiatives etc.)
Teaching practical skills Modelling demonstrations Guided practice	Action	Social support Practical help
Cues Positive reinforcement	Maintenance	Environmental factors Social support Community organization

Figure 2. Model of communication behaviour change process in community intervention setting, as used in the planning and evaluation of the North Karelia Projects TV programmes

Generally speaking, when people are exposed to numerous and often conflicting messages, as is usually the case, they tend to maintain their established habits. But with well-designed media interventions in appropriate social contexts, significant effects can be achieved. It has been a common experience in the North Karelia Project that such effects may be limited in relative terms, but because of the large audience can be large overall and thus able to generate a very favourable cost-effect ratio.

INNOVATION-DIFFUSION APPROACH

New lifestyles are innovations that diffuse through the natural networks in a community by communication, and gradually lead to social change. The innovation-diffusion theory argues that while the mass media are more effective in spreading knowledge about innovations and are useful for "agenda-setting" purposes, interpersonal channels are more effective in actually changing attitudes and behaviours. The innovation process occurs in four stages (note the similarity to the previous approach):(a) knowledge, (b) persuasion, (c) decision, and (d) confirmation.

The innovation-diffusion theory classifies people on the basis of their innovativeness: as innovators, early adopters, early majority, late majority, or laggards. The social structure has several norms (system effects) which exert a strong influence on rates of diffusion. Early adoption and a faster diffusion rate are more likely to occur with

modern rather than traditional community norms. Early adopters usually have the greatest social influence in the community and are thus in key positions to influence wider adoption of the innovation.

An agent of change can be a professional attempting to influence this innovation-decision process. The three main types of innovation decision are: (a) optional decisions (made individually), (b) collective decisions (by consensus), and (c) authority decisions (by a superordinate power).

These central principles of innovation-diffusion theory were largely developed by Rogers (1983), and complement the classical idea of a two-step flow of new ideas and attitudes through opinion leaders (Katz & Lazarsfeld, 1955). The simplified model holds that new ideas, often originating in the mass media, are mediated and modified by certain opinion leaders, and that most people are then mainly influenced by interpersonal contacts with these opinion leaders. Some opinion leaders can be identified by their particular expertise or position, while others cannot be distinguished by such formal criteria. Opinion leaders may either favour or resist a particular innovation-diffusion process.

The principles of innovation-diffusion are of great relevance to many community health programmes. A preventive project, as change agent, attempts to spread certain health innovations through the social network to members of the community by communication. The speed of diffusion is a vital aspect. Diffusion can be facilitated by the skilful application of the theoretical principles of the communication process. The degree of community resistance (system effect) is also obviously important.

Systematic use of the opinion leader theory in the North Karelia Project is described later. In fact, the innovation diffusion theory provided a central framework for the project team. Cigarette smoking and high use of dairy fat were deeply embedded in the cultural lifestyle of the area when the project began. So here, the role of the project as a change agent was to promote the diffusion of the lifestyle innovations of quitting smoking and adopting low fat diets, with the purpose of helping prevent heart disease in individual citizens and the community overall. The theoretical rules of innovation diffusion were applied during the intervention to facilitate the process.

COMMUNITY ORGANIZATION/SOCIAL POLICY

Broad-ranging and permanent changes in the community can ultimately only be achieved through the existing community structures. Every community has a complex network of social organizations, both official and unofficial, that exercise great influence over the behaviour and lifestyles of its citizens.

The community organization approach emphasizes efforts to influence individuals through the modification of organizations. The concept involves community self-

development (the community initially detects a problem, then organizes itself to cope with it) as well as the outside influences needed to promote the reorganization.

Community organization strategies are important for effective community-based prevention and health promotion programmes (Bracht, 1990). In the case of the North Karelia Project community organization occupied a key position, since the community petition provided a favourable climate for community reorganization. However, the project team provided the external impetus and resources for change in the community, and thus the principles of persuasion and the role of the change agent have been of central importance.

The impact of efforts depends largely on the degree to which existing community organizations regard the proposed actions as suiting their particular needs. Incentives for the proposed collaboration are therefore important in community self-development.

It is vital throughout a programme (but particularly at the start) that the project team cultivates close contacts with representatives of a great many community organizations. In the North Karelia Project, the team has had close and often personal contacts with professionals in the mass media (newspapers, radio), in health and other services (administrators, doctors, nurses, teachers, social workers, schools, teachers etc), with business leaders (in dairies, sausage factories, bakeries, groceries, etc), with key members of voluntary organizations (heart association, housewives' organization, labour unions, sports associations etc), and with local political decision- makers (provincial and municipal leaders).

Such contacts allow practical and appropriate forms of collaboration to be developed within the context of each organization's particular needs. The obvious aim is for the changes thereby initiated to ultimately influence the general lifestyle in the community. Successful community organization paves the way for social policies favouring healthy change (Milio, 1981), a phenomenon repeatedly seen in North Karelia and throughout Finland. The project became associated with healthy public policy in many ways, by contributing to anti-smoking legislation, for instance.

UNIFIED MODEL

The approaches described above are unified in Figure 3 to depict the behavioural/social model of community intervention found to be most relevant for the North Karelia Project. The external input from the project affects the community via mass media communication to the population at large (where its effect is amplified through interpersonal communication), though even more so through the formal and informal opinion leaders associated with various community organizations.

This two-pronged emphasis aims to spread and expand knowledge, to persuade, to teach practical skills, and to provide the necessary social and environmental support for the performance and maintenance of these health skills in the population. The acquisition and maintenance of new behaviours ultimately results in a more favourable risk factor profile, reduced disease rates, and improved health of the population.
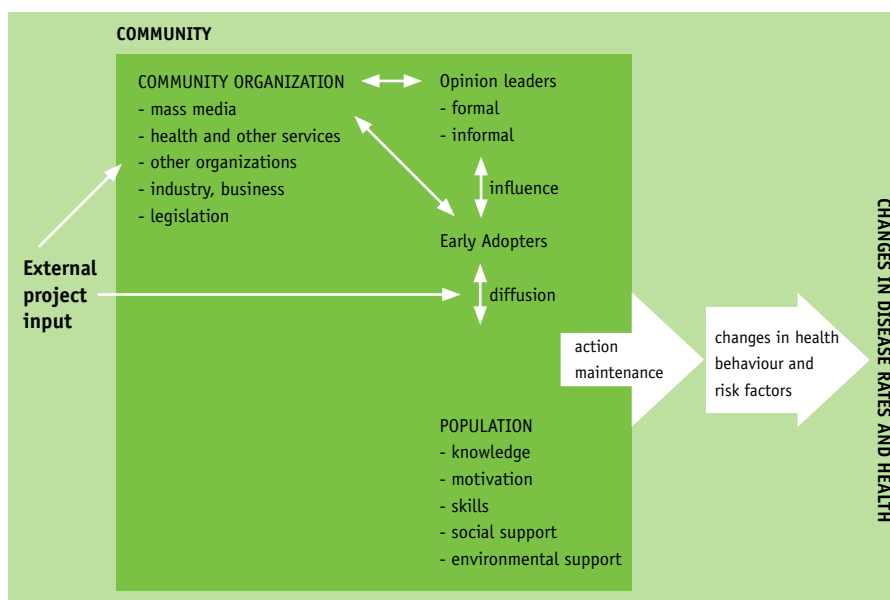
Figure 3. Unified model of community intervation, as used in the North Karelia Project

ELEMENTS OF THE PROJECT

The practical framework of a community programme like the North Karelia Project has three components: (1) planning, (2) intervention or programme implementation, and (3) evaluation. Although they ideally occur sequentially, as in the original phase of the project, these elements are often accomplished simultaneously, as was so in the continuation phase.

PLANNING

The prime elements in the project planning are (1) definition of objectives, (2) community analysis, and (3) establishment of the project organization and other preparatory steps. The following briefly discusses some major aspects of these elements, with reference to North Karelia.

(1) Definition of objectives

The main objectives of a programme are usually set by the actual and/or perceived health needs of the community. They usually concern the most common and serious NCDs. The intermediate objectives are decided on the basis of the current medical/epidemiological knowledge on how to influence the health problem(s) at issue, and on the local prevalence rates of the risk factors.

Finally, the practical objectives and actual intervention measures emerge from careful analysis of the community and from knowledge of the strategic determinants of the intermediate objectives. The outcome of the analysis is naturally influenced by the choice of theoretical behavioural/social frameworks, as discussed previously.

(2) Community analysis

As far as possible, the community analysis ("community diagnosis") should give a comprehensive understanding of the situation at the start of the programme (Haglund, 1983). It needs to provide the basis for selecting priorities, and particularly for deciding appropriate and effective methods for the intervention. Existing data from previous studies, statistics, and expert opinions should be assembled and reviewed. Later on, the baseline survey findings can be used to complement the picture. Interviewing key local people is vitally important. Special focus groups with representatives in the community can provide invaluable insights into local lifestyles and how they might be influenced.

The community analysis needs to incorporate epidemiological information from the area, i.e. the mortality and morbidity rates of various health problems in the total population and specific subgroups, and the prevalence rates of the factors potentially influencing these disorders in the target population. Certain geographic, demographic and socioeconomic factors should be assessed. Knowledge about the various lifestyles related to the risk factors is needed, as is information on the features of the community which (may) influence these behaviour complexes, on the community leaders and avenues of social interaction/communication, and on other factors relevant to the adopted behavioural/social framework.

Because much of the success of such programmes hinges on the support of the local population, information is needed on how people and their representatives perceive the problems and feel about the possibility of solving them. The programme also needs the co-operation of the local decision-makers and health personnel, so their opinions and attitudes should be surveyed at the outset. In addition, community resources and the service structure need to be considered when working out the actual forms of programme implementation.
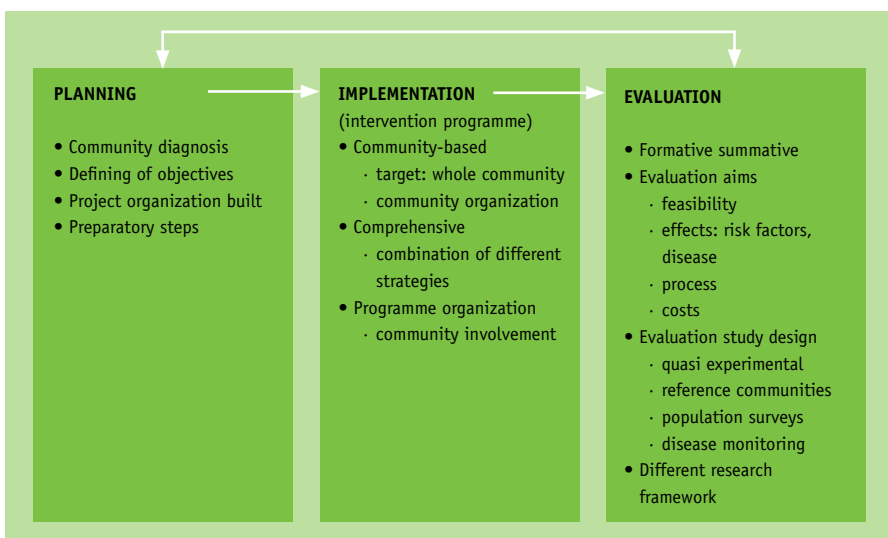
Figure 4. The major elements in the community-based project

(3) Establisbment of project organization and other preparatory steps

The establishment of a project organization and the preparatory steps for launching the programme must be carefully planned. The organization needs an enthusiastic and competent leadership, backed up by the appropriate institutional support. Besides possessing the obvious professional skills, the project team must cultivate and maintain good contacts with several important sectors of the community; a broad and relevant local representation in the organization is essential if the community is to feel a genuine sense of ownership about the project.

The establishment of an integrated NCD community prevention programme extends beyond the usual health care activities. It involves official bodies other than health authorities and has to be founded on a major policy decision. Since such a programme contains many societal and political components, its strategic and tactical features must be shaped to accord with the local epidemiological, health care and sociopolitical situation.

The following steps and elements are an essential part of a programme plan. For each, the best (or alternative) solutions which are feasible for each community should be elaborated in detail:

- making initial decisions and commitments
- choosing the community (if not given for historical reasons)
- establishing societal bases and intersectoral collaboration
- initial funding commitments and plans
- establishing the project team and the focal point(s)

- establishing the steering committee and other management
- ensuring the collaboration of the medical community
- building up intersectoral collaboration, partnership and community involvement.

IMPLEMENTATION OF THE INTERVENTION PROGRAMME

The goal is to systematically implement the programme according to its aims and principles. Within the overall framework, actual implementation needs to be sufficiently flexible to adjust to any unforseen opportunities arising in the community.

Integrating the programme into local society is important because it strengthens community participation and improves the availability of community resources. Thus while the project team usually sets the objectives and develops the general framework, practical activities are carried out mainly by citizens, groups and organizations in the community. The programme catalyses this work by providing materials, training, the necessary official support, media involvement, and follow-up.

Programme activities are usually simple and practical in order to facilitate their enactment by the widest spectrum of the community. Rather than highly sophisticated services for a few people, simple basic services are generally provided for the largest possible stratum of the population. This eases information dissemination and personnel training. Integrating the intervention measures not only conserves project resources, but also - by avoiding duplication and overlapping activities - means better use of community resources, too.

In identifying and mobilizing community resources, the programme works closely with community agencies and voluntary organizations. Thus participation in the program's preventive activities comes to form part of the regular work of the health professional, and is not simply an extra job or hobby. A community programme can often combine authority decisions with training and motivation of personnel. Close personal contacts between the project team and the local health personnel are important in promoting motivation and compliance.

The use of a large network of organizations and opinion leaders can encourage population participation. Many such organizations appreciate being able to contribute to the success of an important health project. Numerous personal contacts need to be made, local problems discussed, and the possibility of practical contributions assessed. The public interest and support generated by the activities via the media can encourage further intervention activities.

Because generating widespread motivation and support in the general populace forms a cornerstone of successful intervention, much of the practical work of the

project tends to be shouldered by lay people and voluntary organizations. In settings such as North Karelia, trained and motivated public health nurses can be vital to an intervention programme. The role of medical doctors can also be very important, though in many programmes they act primarily as medical experts within the general framework.

EVALUATION

Evaluation can be divided into internal and formative vs external and summative evaluation. Internal evaluation is carried out during and within the programme to provide rapid feed-back to the programme workers and management. An overlapping concept is formative evaluation, which provides data during the programme about the experience with the various programme components and thus helps to develop ("formulate") the programme further. The summative evaluation of the programme assesses over a given time the overall effects and other findings; this is usually done by an expert group in some way external to the daily community work.

The evaluation can be categorized, as it was in the North Karelia Project, in terms of programme assessment, as follows:

1. feasibility/performance
2. effects (behaviours/risk factors, disease rates/mortality rates)
3. process
4. costs
5. other consequences.

The evaluation principles and procedures applied in the North Karelia Project are discussed in the following chapter.

PRACTICAL INTERVENTION ACTIVITIES

The practical intervention activities were integrated into the existing service structure and social organization of the area, as described earlier. The role of the project organization was to define the objectives, to train, to coordinate and to promote programme activities, as well as to assess the results, while most of the actual work was done by the community itself. Community involvement and individual participation was the key.

In the intervention, practical skills were taught, social support for change provided and environmental modifications arranged as part of the comprehensive community organization aimed at healthy change. Previously described theoretical frameworks were applied in planning and evaluation.

In the original project plan, intervention activities were categorized as follows, and are also described in detail in the WHO monograph (Puska *et al*, 1981b):

(1)   General public information
- mass media
- health education materials
- campaigns

(2)   Organization of services
- primary health care
- other health care
- other services (schools, social services)

(3)   Personnel training programmes
- health personnel
- other personnel
- lay leaders

(4)   Environmental changes

(5)   Information (monitoring) systems

The following sub-programmes were initially defined:

(1)   Anti-smoking

(2)   Nutrition

(3)   Hypertension

(4)   Coronary heart disease and acute myocardial infarction (AMI)

(5)   Rehabilitation (secondary prevention)

(6)   Screening (for risk factors)

Later on in the project, the intervention activities were often grouped under the following main categories:

(1)   Media activities (general media campaigns etc.)

(2)   Health service activities (especially primary health care)

(3)   Community organization activities (campaigns and activities in partnership with various organizations in the community)

(4)   Environmental and policy activities (often introduced via community partnership activities, e.g. with food manufacturers).

The following specific target programmes formed central features of the continuation phase of the project:

(1) Anti-smoking

(2) Cholesterol lowering nutrition

(3) Blood pressure lowering (increasingly emphasizing non-pharmacological interventions)

The later years saw greater emphasis being placed on increased leisure time physical activity, and other aspects of health promotion were also included (psychosocial, weight reduction, alcohol etc).

During the later phase, many of the project's intervention activities have taken the form of specific sub-programmes, often related to specific funds and resources. Some of these sub-projects are as follows:

- North Karelia Cholesterol Project
- Several anti-smoking projects, e.g. Stop Smoking and Smokefree North Karelia
- North Karelia Berry projects
- Several Worksite Projects
- North Karelia Youth Projects

Details and experiences concerning some of these intervention activities are discussed in other Chapters.

A general intervention trend over the 25 years of the project has been an evolution from somewhat more risk factor/primary health careoriented intervention towards more health promotion/community mobilizing interventions which have utilized innovative and positive media messages, and often competitions, too (i.e. positive incentives).

A COMMUNITY PROGRAMME AS NATIONAL DEMONSTRATION PROJECT

In principle, a community-based project can vary from a relatively restricted academic study, or local effort, to a major programme with strong nationwide involvement. The North Karelia Project definitely falls into the latter category. At the very outset the national health authorities decided that the North Karelia Project would be a pilot for all Finland.

One advantage of an intervention programme in a small community is that an intensive intervention virtually certain to reach every inhabitant can be used. However, there are also major disadvantages: many important environmental decisions can only

be made at the higher provincial or national level. This problem involves legislation as well as nonpublic sectors such as the food industry. Another disadvantage with a smaller community is the restricted applicability of the experiences to the national level.

In national demonstration projects like the North Karelia Project, the aim is to take a relatively large community (county, province, or other large geographically defined area) in which the comprehensive intervention can be implemented in a well-conceived way and subjected to careful evaluation. In addition to innovative educational interventions, community organization and major environmental modifications are used - measures with the potential to be implemented nationwide.

Important measures which are perhaps regarded as innovative and somewhat controversial are often difficult to introduce rapidly on the national scale, so they are first tested in the demonstration community, which thus acts as a "pilot" area for the nation as a whole. With proper evaluation, this national pilot area can provide sound information on feasibility, effects and other experiences of the measures applied. And when several measures are implemented in an integrated and comprehensive manner, the area may be used to assess the overall impact and experiences of an intervention package made up of several mutually supportive activities.

Thus the term "pilot" implies that implementation first takes place in a restricted area and then later on, if experiences are positive, nationwide. The terms "demonstration" or "model" have the connotation that the preventive activities are applied in a more planned and "better" way in that area - to demonstrate or show good implementation and to learn from the experiences. So nationwide activities and those in the demonstration area may well take place together and be supportive of each other, as is usually the case with demonstration projects in the industrialized countries.

Following the initial phase of the project (1972-77), the activities became largely nationwide in scale, although North Karelia continued to act as a demonstration or model area serving the nationwide efforts. This continued as a central principle when Finland joined the WHO/ CINDI Programme. National policy-making has since incorporated the use of North Karelia as a national demonstration area.

Like the North Karelia Project, many current demonstration projects first started as a "pilot" activity, but later clearly became more of a "demonstration" for ongoing national activities (Puska *et al*, 1988).

The advantage of such projects is that they allow us to demonstrate the work and have the experiences on a more limited scale before nationwide implementation. And while generating results and experiences, they are also powerful sources of inspiration, training and intellectual resources for action on the national level.

Visibility is another major practical advantage of national demonstration projects. Instead of trying to convince national decision-makers or attract the media with theoretical arguments, reference can be made to a practical example: "Look how it is done there. Prevention is possible and it works".

In summary, a national demonstration project is used

- to test different methods of disease prevention applied simultaneously and systematically in the same community
- to evaluate the feasibility, effects and other experiences of a major, comprehensive effort
- to be a source of public and professional inspiration, visibility, training and other intellectual resources.

For a national demonstration project to be useful and effective, two important rules exist. Firstly, the project must be meticulously and professionally planned, implemented and evaluated. Secondly, the project should have not only the sound support of the national health authorities, but also close operational links with them, because communication needs to flow both ways continuously.

In the case of the North Karelia Project, its location at the National Public Health Institute has served this need well. Relevant national considerations have continuously been taken into account in the demonstration project, while the policy and decision makers have been kept up-to-date and knowledgeable about the project.

As far as the nationwide application of a demonstration project goes, experience has shown that it often does not proceed as expected. In theory one would first test the intervention package, which would then be available for nationwide implementation. In real life, however, nationwide developments are going on all the time, with the demonstration project continuously feeding in useful know-how as and when needed. Major summative evaluation results merge at certain points of time and are of particular importance.

The overall use of a national demonstration programme is as follows. With relevant medical information and resources and a public desire for change, a major national health problem can be initially tackled using a carefully designed and evaluated demonstration programme. This, in turn, gives valuable information on the potentials for prevention and health promotion in the society concerned. The practical findings and visible experiences can then guide the applied activities as they spread across the country through the general diffusion of ideas and national policy decisions.

REFERENCES

Ajzen I, Fishben M (1980) *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, N.J.: Prentice-Hall

Bandura A (1977) *Social learning theory*. Englewood Cliffs, N.J.: Prentice-Hall

Bracht N (1990) *Community organization strategies for health promotion*. New York: Sage

Farquhar JW, Maccoby N, Wood PD, Alexander JK, Breitrose H, Brown BW, Jr., Haskell WL, McAlister AL, Meyer AJ, Nash JD, Stern MP (1977) Community education for cardiovascular health. *Lancet* **1:** 1192-5

Fishbein M, Ajzen I (1975) *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, Mass: Addison-Wesley Pub. Co.

Flay BR, DiTecco D, Schlegel RP (1980) Mass media in health promotion: an analysis using an extended information-processing model. *Health Educ Q* **7:** 127-47

Haglund BJ (1983) Community diagnosis. A theoretical model for prevention in primary health care. *Scand J Prim Health Care* **1:** 12-19

Katz E, Lazarsfeld PF (1955) *Personal influence; the part played by people in the flow of mass communications*. Glencoe, Ill.: Free Press

Kottke TE, Puska P, Salonen JT, Tuomilehto J, Nissinen A (1985) Projected effects of high-risk versus population-based prevention strategies in coronary heart disease. *Am J Epidemiol* **121:** 697-704

Lewin K (1951) *Field theory in social science*. New York: Harper & Row

McAlister A, Puska P, Salonen JT, Tuomilehto J, Koskela K (1982) Theory and action for health promotion illustrations from the North Karelia Project. *Am J Public Health* **72:** 43-50

McGuire W (1969) *The nature of attitudes and attitude change*. Vol. 3. Reading, Mass.: Addison-Wesley Pub. Co.

Milio N (1981) *Promoting Health Through Public Policy*. Philadelphia: FA Davis Co.

Puska P, Leparski E, World Health Organization Regional Office for Europe (1988) *Comprehensive cardiovascular community control programmes in Europe*. Copenhagen: World Health Organization

Puska P, McAlister A, Niemensivu H, Piha T, Wiio J, Koskela K (1987) A television format for national health promotion: Finland's "Keys to Health". *Public Health Rep* **102:** 263-9

Puska P, McAlister A, Pekkola J, Koskela K (1981a) Television in health promotion: evaluation of a national programme in Finland. *Int J Health Educ* **24:** 238-50

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo L, Kottke TE (1981b) *Community control of cardiovascular diseases : evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland, 1972-1977*: Published on behalf of the National Public Health Laboratory of Finland by the World Health Organization, Regional Office for Europe

Puska P, Wiio J, McAlister A, Koskela K, Smolander A, Pekkola J, Maccoby N (1985) Planned use of mass media in national health promotion: the "Keys to Health" TV program in 1982 in Finland. *Can J Public Health* **76:** 336-42

Rogers EM (1983) *Diffusion of innovations*, 3rd edn. New York (NY): Free Press

4. EVALUATION

Pekka Puska

EVALUATION PRINCIPLES

In order to maximize the impact of the North Karelia intervention and what could be learned from it, a commitment to thorough scientific evaluation was made during the planning phase of the Project. Public health needs on the national level, especially the potentials for widespread CVD prevention, were the priority considerations underlying this commitment.

Evaluation in the applied framework was divided into formative/internal and summative/external evaluation. The former means that during and in connection with various intervention activities, various forms of evaluation were built in. Some of these were more formal "hard science" studies, while "softer" forms of evaluation were also commonly used to extract as much as possible from the experiences.

Summative evaluation means that over a given period of time, major evaluation work via large field studies conducted by certain external agencies (University of Kuopio, National Public Health Institute) has accumulated and summed up the overall results and experiences. Because the original project was designed for five years, the first summative evaluation covered the period 1972-1977 (Puska *et al*, 1981). Thereafter the major population surveys were carried out at 5-year intervals, which thus came to define the interval for the main summative evaluations.

The evaluation aims of the project fall within the following programme assessment categories:

1. feasibility/performance
2. effects (behaviours and risk factors, disease rates)
3. process
4. costs
5. other consequences

The following discusses the main principles applied in these various aspects of evaluation:

FEASIBILITY/PERFORMANCE

Programme feasibility or performance evaluation assesses the extent to which it has been possible to implement the planned activities, i.e. what actually happened in the community. It takes account of the amount of resources that the project had available, how they were used in the community, and how well the activities reached the target populations.

Feasibility evaluation is especially important in a large and comprehensive programme where the community itself carries out the activities over a large geographical area. Before the issue of effects can be meaningfully addressed, the actual intervention must be defined. The feasibility assessment can be based on records of activities, on statistical data within the community, or on survey and other data (project statistics) collected during and after specific programme periods.

EFFECT

The effect evaluation assesses the extent to which the main and intermediate objectives of the programme were achieved. Thus, indicators of the different objectives first need to be defined, and then measured in the community at the outset and after the given programme period(s). The effect assessment should satisfy two questions in particular: 1. Did the programme modify target behaviours and risk factors (and other possible indicators of intermediate objectives)? And if so: 2. Were these modifications associated with changes in NCD rates (mortality/incidence)?

Since the target of the programme is usually the whole community, information is collected to represent the whole population. For prevalence data (behaviours, risk factors), a representative population sample is surveyed at the outset and at the main summative evaluation points. Independent cross-sectional population samples are used so that the baseline measurements or selective loss at follow-up do not influence the findings of the subsequent follow-ups.

Relatively large sample sizes are used to detect changes in risk factor means that would be small for individuals but meaningful for the health of the population as a whole. Large sample sizes also enable interesting sub-group analyses.

Comparison of results from baseline and follow-up surveys reveals the changes that have taken place in the target community during the programme period. However, changes over several years could well be partly or even entirely due to causes other than the intervention programme. For this reason a reference area is often used, which should be as similar to the programme area as possible ("matched"), but without the input of the programme. This study design can be called "quasi experimental", since

the study is able to control the experimental intervention and choice of reference area, but not the allocation of units to these areas (Campbell *et al*, 1963).

The baseline and follow-up surveys should be carried out in the programme and reference areas simultaneously and with strict adherence to identical methodology and sampling procedures. There are several problems with the use of a reference area. One is that a major national demonstration programme is likely to have an impact in the reference area, too. To eliminate the possibility of unexpected events in the reference area (that would harm the comparison), the whole country (i.e. the remainder of it) is often used as a reference area.

In major community programmes, mortality rates are collated by disease category and analyzed for the area involved. Regression-based trends are usually calculated to eliminate the random annual variation. Additional information for assessing disease changes can be extracted from hospital discharge data or special disease registers.

PROCESS

Process evaluation of a programme concerns itself with changes in the intervening variables and with change trends over time and in sub-groups of the population. The central task is to gain a realistic perspective of what has been happening between the input (i.e. the work of the project) and the output (changes in behaviours and risk factors), which is naturally related to the behavioural/social framework adopted and the definitions of the intended intervening (independent) variables. Measurement of these factors builds up a picture of how the change process in the community has led (or not) to the intended behavioural and risk factor changes.

Process variables include factors such as exposure to the various intervention measures, changes in health knowledge, attitudes and intentions, social support and environmental aspects etc. Process evaluation is also interested to learn how changes take place over time in different variables and population sub-groups. At its best, process evaluation is really interdisciplinary work, which often leans heavily on the behavioural/social sciences.

COST

Cost evaluation examines the total project resources and how they were allocated. It can also be used to assess the costs to the community, e.g. the total community costs or, more specifically, the extra costs borne by the community. Moreover, in addition to the direct community costs (i.e. mainly health service related costs), estimations can be made of the indirect community costs and savings related to the programme.

In a major national pilot or demonstration programme, attempts should be also made to assess consequences of the programme other than those intended. If the programme involves the community deeply and leads to major lifestyle changes, it is quite possible for the process to result in other changes, too. For example, other health effects can occur. There may be positive or negative developments in people's symptoms and subjective health. (Positive changes in health-related lifestyles are usually associated with improved general health of the population). Socioeconomic, social and emotional consequences, either positive or negative, may also emerge. Data from the population surveys can often be exploited to examine such phenomena.

EVALUATION TOOLS IN THE PROJECT

GENERAL

Comprehensive and detailed information has been available on disease/ health status in the province of North Karelia and on its determinants and relevant trends. The sources of this information for evaluating the North Karelia Project can be summarized as follows:

Mortality: official mortality statistics

Incidence of major chronic diseases:
- Acute myocardial infarction register and stroke register (WHO MONICA criteria, National Public Health Institute)
- Cancer register (National Cancer Register, Finnish Cancer Society)

Morbidity:
- Disability data (National Pensions Institution)
- Hospital discharge information and health care utilization information (National Data Sources)
- Population survey data (National Public Health Institute) concerning diagnosed diseases, symptoms

Risk factors: population surveys (National Public Health Institute)

Health-related lifestyles: annual health behaviour surveys (National Public Health Institute)

Subjective health, quality of life: population surveys (National Public Health Institute)

Intervention process: population surveys (National Public Health Institute) and other data

The use of these data sources, the methods of data collection and the materials are described later in the respective chapters, with the exception of the main population risk factor surveys. Because references to these surveys are scattered throughout the book, the main methods and materials used are described later in this chapter.

Much of the evaluation concerns the extent of achievement of the desired effects, and is thus related to the planned objectives. The main objectives in North Karelia were a reduction of CVDs and other major NCDs, and improved health of the population. Chronic disease (cardiovascular and cancer) rates are determined by mortality data (North Karelia and the rest of Finland) and from specific disease registers (Myocardial Infarction Register in North Karelia and National Cancer Register). The general health and well-being of the population is monitored by the five-year cross-sectional population surveys and by the annual health behaviour postal surveys (North Karelia and all Finland). These surveys are also used to measure other indicators of general morbidity (e.g. symptoms).

The intermediate objectives concern changes in risk factors and lifestyles. These are monitored by the five-year cross-sectional population surveys (in North Karelia and other monitoring areas) and by the annual health behaviour survey (North Karelia and all Finland).

Various intervention process indicators (e.g. preventive practices by health personnel, exposure to project activities, social support and interaction, behaviour change intentions, environmental influences) are also measured by the above mentioned surveys. A supplementary questionnaire is included for process evaluation in North Karelia in connection with the annual health behaviour survey. In addition, various other data sources in the community are used, as well as special ad hoc surveys and studies, to build up a more comprehensive picture of the change process in the community. For example, several published studies based on in-depth or theme interviews have been carried out to gain a more profound understanding of the nature of the change process.

In the original project phase (1972-77) the neighbouring province of Kuopio was chosen as the reference area for the programme, and this comparison was emphasized in the report of that period (Puska et al. 1981). However, there were already several indicators that the "net changes" between the two areas were likely to be conservative estimates of the true effect. Firstly, Kuopio had a new medical school established in 1972, with experts and groups active in prevention. Secondly, it was the neighbouring province, so the project was likely to have an influence there.

After 1977 the situation changed further. The North Karelia Project became actively involved in preventive work nationwide, e.g. through several major TV risk

reduction programme series, other media activities, health policy activities etc. This meant that neither Kuopio province nor any other area of Finland could be a "true reference area" any longer. Risk factor monitoring has nevertheless continued in Kuopio province, with other monitoring areas gradually being included. Developments are now monitored throughout the country as far as possible, in addition to North Karelia.

Process evaluation, as well as other forms of study described later in the book, set out to assess the extent to which disease changes are related to risk factor changes, and the determinants of risk factor and lifestyle changes.

RISK FACTOR SURVEYS

Six cross-sectional population surveys (in 1972, 1977, 1982, 1987,1992 and 1997) assessed risk factor levels in North Karelia and Kuopio during the Project period. In 1982, 1987, 1992 and 1997 an area of southwestern Finland was also surveyed.

For each survey, an independent random sample was drawn from the population register. In the 1972 and 1977 surveys a random sample of 6.6 % of the population born during 1913-1947 (25-59 years in 1972) was drawn in both areas. In 1982, 1987, 1992 and 1997 the sample involved people aged 25-64 years. The samples were stratified according to the WHO MONICA protocol so that at least 250 subjects of each sex and ten-year age group were chosen in North Karelia, Kuopio and southwestern Finland. The common age range in all six surveys was 30-59 years.

The survey methods were carefully standardized and comply with most international recommendations. They also followed the WHO MONICA protocol in 1982, 1987, 1992 and 1997, when they were comparable with the methods used in 1972 and 1977. The actual methods are described in greater detail in a 1981 monograph (Puska *et al*, 1981), while the MONICA methods appear in the respective publications (Tunstall-Pedoe *et al*, 2003).

The surveys have included a self-administered questionnaire (mainly items on socioeconomic factors, medical history, health behaviour and psychosocial factors) and measurements of height, weight and blood pressure. A venous blood specimen has been taken to determine serum total cholesterol and HDL-cholesterol. In 1982 and 1987 serum thiocyanate concentrations, and in 1992 serum cotinine, were also determined.

The questionnaire and invitation to the examinations were always sent about 10 days beforehand. The examinations usually took place at the local health centre, where specially trained nurses took the measurements and checked the questionnaire. Every survey has adhered to the same methods as closely as possible, and each area has been

treated identically (e.g. blood samples from the different areas have been analyzed in mixed order).

Casual blood pressure is measured from the right arm after five minutes sitting. The fifth phase of the Korotkoff sounds has always been recorded as the diastolic pressure. In 1972 and 1977, a shorter cuff bladder (23 cm) was used than in 1982, 1987, 1992 and 1997 (42 cm). All cholesterol determinations have been made in a central laboratory standardized against national and international reference laboratories.

Smoking has been assessed by responses to a standard set of questions in a self-administered questionnaire. The participants were thereby classified into three categories:

- Current smokers - those who had been smoking regularly (cigarettes, cigars or pipe; at least once a day, on average) for at least one year and had smoked during the preceding month.
- Ex-smokers - those who had smoked regularly but had stopped a month or more before the survey.
- Never smokers - those who had never smoked regularly.

The measurement methods were pre-tested. The nurses were thoroughly trained before the surveys, during which their performance was monitored. A variety of validation studies has been carried out, and information has also been collected on non-participants.

Participation rates were very high, over 90 %, at the first survey in 1972. They have decreased slightly over time, but are still quite satisfactory.

REFERENCES

Campbell DT, Stanley JC, Gage NL (1963) *Experimental and quasi-experimental designs for research*: Rand McNally Chicago

Puska P, Tuomilehto J, Salonen J, Nissinen A, Virtamo J, Björkqvist S, Koskela K, Neittaanmäki L, Takalo L, Kottke TE (1981) *Community control of cardiovascular diseases : evaluation of a comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland, 1972-1977*: Published on behalf of the National Public Health Laboratory of Finland by the World Health Organization, Regional Office for Europe

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

5. THE INTERVENTION IN PRACTICE

Arja Muuttoranta, Vesa Korpelainen and Pekka Puska

INTRODUCTION

The North Karelia Project was planned as a comprehensive intervention founded on knowledge of the risk factors and understanding of relevant behavioural and social theories. The target risk factors were selected on the basis of available epidemiological knowledge about their role, and on information about their occurrence in the local population.

Practical intervention activities have been integrated into the province's existing service structure and social organization. While the project has defined the objectives, trained the personnel, coordinated and promoted the activities, and assessed the results, most of the actual work on the ground has been done by the community itself. Community involvement and individual participation were the key concepts in implementation.

Practical activities have been planned jointly by the project research team and the field office team. The prime intervention approaches have been persuasion, teaching practical skills, and social and environmental support for change. The work of the field office has largely been devoted to media activities (materials, mass media, campaigns), promoting preventive services (primary health care etc.), training professionals and other workers, facilitating environmental changes (smokefree areas, supermarket campaigns, advising food manufacturers and caterers etc.), monitoring and feed-back.

This chapter describes the practical aspects of the intervention by the project field office team in North Karelia. The office also helps perform the evaluation surveys and certain special trials and studies. The description is closest to the situation in the late 80s and early 90s, although the role and basic features of the field office have been consistent throughout most of the project.

ORGANIZATION AND RESOURCES OF THE PROJECT FIELD OFFICE

The field office of the North Karelia Project has always been linked to the Department of Social and Health Affairs of the North Karelian provincial administration, and in the early years was actually located there. Since the early 80s the field office

team has had a separate home, most recently in an apartment overlooking Joensuu's central market place and owned by the North Karelia Project Research Foundation.

The work of the project office is supervised by the project director and the intervention working group, which consists of the key researchers and the field office staff. They meet monthly for discussions and to decide on aspects of the implementation. Day-to-day work at the project office is led by the executive manager of the North Karelia Project.

The office team has varied in size according to the need and extent of activities and current financial resources. However, the basic team has always had an Executive Manager, office secretaries, health work organizers (mainly public health nurses) and behavioural/social experts.

The performance of the project office team is evaluated from time to time. All staff members have periodically kept records of their own work, although there tends to be some difficulty in classifying and assessing this. Memos of meetings and other documents of the intervention working group have also been used for these evaluations.

The workload varies according to its nature and location, and the office staff have proved flexible in adapting their working hours to current intervention needs. Every office member has put in overtime at some phase of the project, and there have never been major problems in arranging activities to suit the needs of the community and the resources of the office staff.

1990 and 1991 were special years for process evaluation. In 1990 the North Karelia Project employed nine full-time and eight part-time field office staff, who worked a total of over 18 000 hours that year. In 1992 the six full-timers and five part-timers employed accumulated about 12 000 working hours.

Project office work can be divided into four main areas: 40-50 % is classified as "community organization work" (i.e. related to planning and coordination of community activities), 6-9 % as "administrative work", 20-25 % as "health education planning", and 25-30 % as "health education in action" (counselling, health education meetings, risk factor measurements in the field etc.). Most staff members are ready to engage in any kind of work demanded by the actual situation.

Project office work includes a variety of activities which support the objectives and general goals. The principles are planned in collaboration with the researchers, mostly within the intervention working group mentioned earlier. In 1990 this group was convened 15 times and in 1991 ten times.

Certain activities are initiated as special sub-projects of the overall intervention. In 1990 there were six separate subprojects: the Cholesterol Project, the Smokefree Campaign, "My Choice"/School Health Programme, the Work Site Health Programme, the Health Fair, and the Berry and Vegetable Project.

Over the years the activity devoted to separate projects and campaigns has fluctuated greatly. Numerous specific needs have arisen from time to time, against an uneven background of financial resources and demands. Not surprisingly, some specific issues have received more attention than others, although the office team has always upheld as a priority the need to sustain the interest of the local population in the Project.

STAFF DUTIES

Collaboration with many kinds of community organization, and at many levels, requires different kinds of personnel. The project co-ordinators must be able to negotiate with experts and community workers of all types. The initial step is always to seek out common benefits arising from the collaboration. Comprehensive engagement with community organizations ultimately impresses the project on the lives of ordinary people. It has been essential for the project staff to work in the community - alongside local people and involved in everyday life. The project work has been highly visible in the form of cholesterol and blood pressure measuring, nutrition counselling and other practical guidance, and in media campaigns advising people how to change their lifestyles.

The executive manager of such a project is mainly responsible for personnel administration, financial issues, general office work, and for certain community organization activities. In the North Karelia Project he has also acted as secretary of the intervention working group. The main skills needed for the job are a keen ability to negotiate and organize, and a good medical and managerial background for coping with a diversity of experts and community representatives.

The project workers who plan the programmes and campaigns, and who collaborate with the experts, have to understand the basic principles of behaviour, mass-communication, the medical background of chronic diseases, and business and social relationships. They also need to be familiar with theories like innovation-diffusion and synergy.

Staff members working directly with local people (clients/patients) must have sound knowledge of the medical and epidemiological background of the chronic diseases, and of human behaviour, as well as technical skills for clinical measurements, e.g. for serum cholesterol and blood pressure. Public health nurses have occupied this role in the North Karelia Project, and the variety of tasks in the surveys has given them a wide working experience.

Nothing goes well if there are problems with office and secretarial services. Fortunately, the project has been blessed with skilled secretaries who have managed book-keeping, general correspondence, mailing of materials and general office duties.

MAIN ACTIVITY AREAS

The main areas for practical intervention are media activities, preventive services, training of professionals and other workers, environmental changes, monitoring and feed-back.

MEDIA ACTIVITIES

The production of health education material has been a priority throughout the North Karelia Project. Leaflets, books, posters etc. have been planned by the project director and other researchers together with project workers and community representatives. Sometimes this work has been assisted by advertising companies and various collaborators. The printed materials are important aids for developing social contacts and various practical activities. They have also been sold to other areas of Finland, thereby supplementing project finances.

The Cholesterol Project published a magazine of its own, "Suoraan Sydämeen" (Straight to the Heart), five times during the years 1989-1992. The magazine was financed through advertising. Most of the videotapes were made by the Youth Project, for smoking prevention and nutrition counselling.

The radio and TV-campaigns produced by the project have been directed against smoking and at enhancing knowledge about healthy lifestyles. The TV-campaigns were planned by the project director in collaboration with the programme editors. Although these programmes were broadcast nationwide, the studio audiences were from North Karelia.

The local press, and some national publications too, have been kept well-informed of activities and findings. Press conferences have been arranged and hundred of news stories and articles published during the project period. Topical items have usually been released at press briefings, because journalists prefer to write their own stories. This guarantees as far as possible that the issues are actually read by the public, because the articles have personal styles and tend to be somewhat livelier than the original press releases.

PREVENTIVE SERVICES

Preventive health services are linked to the daily work of health centres and hospitals. This has been a particularly active arena for the North Karelia Project. Doctors, nurses and other health professionals all need to understand the importance of systematic measurements, counselling, persuasion, and follow-up of people's health related habits. A variety of treatment guidelines and model programmes have formed the backbone of training in these areas.

In association with staff of the local health services, various preventive activities and guidelines have been developed. These have been implemented by local authority decisions and through the training and motivation of personnel. The community is routinely informed of such developments.

Most of the training of professionals and other workers by the North Karelia Project has been via seminars on current topics. Numerous seminars have been arranged for medical doctors, nurses, home economics teachers, canteen-supervisors, nutritional workers etc. over the years. Practical activities have often been included, e.g. cholesterol measuring, exhibitions, food tasting. Researchers at the National Public Health Institute have often been invited to present the latest results of the population surveys or smaller studies.

The staff of the North Karelia Project have often given lectures and had meetings with school children, voluntary organizations, visitors to the project etc. Collaboration between the project and other institutions responsible for training professionals has been very active, with the project participating in their training and educational work (e.g. nursing schools).

ENVIRONMENTAL CHANGES

The North Karelia Project encourages work sites, schools, homes ect. to create smoke-free areas. The earlier sign - "no smoking" - was modified to a positive term -"smoke-free". Nowadays, work sites, classes, airports, sports clubs, and indeed most indoor public facilities throughout the land are smoke-free. Supportive cards, stickers and posters have been supplied by the project.

Supermarkets wanting to organize special health campaigns or 'health days' offering cholesterol and blood pressure measurements have provided the opportunity to counsel people right where they buy their daily food, and also to liase with the supermarkets.

Collaboration with food manufacturers and caterers is routine daily work for the North Karelia Project. In addition to presenting seminars, this has involved issues such as legislation, labelling, mass communication and advertising using health arguments, food processing, new product development, pricing policy, information exchange, campaigns and financing of the project's programmes. The underlying purpose of this work has been to help people buy healthy products at competitive prices, while the main specific objectives have been to decrease saturated fat intake and boost the consumption of vegetables, vegetable oil and berries.

MONITORING AND SPECIAL STUDIES

The National Public Health Institute is responsible for the general follow-up and monitoring, which is based on mortality data, diseases registers, population risk factor surveys, and health behaviour surveys etc. The project field office is also actively involved with many aspects relating to the process and formative evaluations. The health behaviour surveys have questions about the person's exposure to various intervention activities, which provides immediate feed-back.

The health education materials and media campaigns rely heavily on the results of the monitoring. People are told plenty about favourable lifestyle and risk factor trends and the associated reductions in mortality and disease rates.

To promote general interest and expand overall resources, the project has initiated several trials and special studies in support of other activities. Among other things, these trials have tested a variety of drugs for high blood pressure or cholesterol, as well as nicotine patches, nicotine chewing-gums, special diets etc.

SPECIAL INTERVENTION ASPECTS

Competitions as a framework for organizing campaigns have been a great success in the health education work. The project has arranged numerous competitions in collaboration with the food-industry, the media, schools, sports clubs, voluntary organizations etc.

The North Karelia Project staff have been actively involved members of many voluntary organizations. This has been a good way of deepening collaboration and keeping it flexible.

People's life-styles have both cultural and practical dimensions. It may be difficult for a person to make major changes in his/her life-style if the corresponding changes are not apparent in the community or society at large. Timely and appropriate decisions and actions are needed from the government so that healthy choices are available and the public sufficiently informed. The Project has been a major and diverse contributor to many policy decisions on the national and local levels. The fact that the project director represented North Karelia in the National Parliament from 1987-1991 was important in this respect.

The cooperation of the local health services and health personnel has guaranteeed a firm foundation for the project activities. Numerous community organizations have also contributed greatly over the years. Because project activities have been integrated into the existing health services and broad community participation has been a key feature, the overall costs of the programme have been kept modest.

ADMINISTRATION AND FINANCING OF THE FIELD OFFICE WORK

As mentioned earlier, the project office has been loosely connected with the provincial administration, which has provided some basic resources. The present field office facilities are owned by the North Karelia Project Research Foundation. This Foundation and a special North Karelia Project Support Association are non-governmental organizations controlled by the project team in practice. These bodies help with administration and finance.

In the national context, the National Public Health Institute (current site of the project director and many of the researchers) has coordinated and overseen the overall task.

The money to employ staff and finance the work has come from various sources, often on an annual basis. The most important current contributors are as follows:

- The Finnish Slot Machine Association: Funds allocated by the Government, especially for basic field office costs (executive manager etc.)
- Ministry of Health: Funds from tobacco taxes, especially to finance certain anti-smoking and health education programmes
- The National Public Health Institute: particularly costs related to field surveys, international aspects and project coordination
- Food manufacturers, pharmaceutical industry etc: Funds to support special field trials and campaigns.

In addition to these core funds, many of the actual programme intervention costs are absorbed by the collaborating organizations. As stressed earlier, the direct project funds are used mainly for "catalyzing" the intervention activities in North Karelia.

Table 1. Intervention aims according to different performers in community intervention programme model used in the North Karelia Project

INTERVENTION: PERFORMER AIM	PROJECT DIRECTLY	COMMUNITY ORGANIZATION				
		A	B	C	D	E
INFORMATION	++	++	++	++	++	•
PERSUASION	++	++	++	++	++	+
PRACTICAL SKILLS	++	++	++	++	++	•
SOCIAL AND ENVIRONMENTAL SUPPORT	++	+	+	++	++	++
COMMUNITY ORGANIZATION						
MASS MEDIA	++	*	+	++	++	+
HEALTH & OTHER SERVICES	++	+	*	+	•	++
OTHER ORGANIZATION	++	++	+	*	+	+
INDUSTRY, BUSINESS	++	++	+	++	*	++
LEGISLATION	+	++	+	+	+	*

++ Strong potential influence
+ Weak potential influence
• No influence
* Not applicable

II

RISK FACTORS
AND
HEALTH BEHAVIOUR

6. THIRTY-FIVE-YEAR TRENDS IN CORONARY RISK FACTORS IN NORTH KARELIA AND OTHER AREAS OF FINLAND

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INTRODUCTION

The unequivocal role of serum cholesterol, blood pressure and smoking as risk factors for cardiovascular diseases (CVD) was established in the 1960s and 1970s by laboratory and epidemiological studies and clinical trials. That time Finland suffered the highest coronary mortality in the world (Keys 1970), with its eastern province of North Karelia being the worst afflicted.

Knowledge of the main risk factors and the urgency of this predicament led, in 1972, to the launch of the North Karelia Project - a comprehensive community-based programme designed to prevent CVD through general lifestyle and risk factor changes, and including detailed scientific evaluation (Puska et al. 1985). The central aim has been to determine the extent to which risk factors can be modified in whole populations, and whether such change leads to reduced coronary heart disease mortality in those populations. The original aim of the North Karelia Project was to test the feasibility and effects of a community based programme for preventing cardiovascular diseases within that province. However, it was not long before measures dedicated to the same goals were being initiated throughout the country, and since 1977 the North Karelia Project has been actively involved in these, too. Examples include the national anti-smoking legislation which was enacted in the late 1970s, and the treatment of blood pressure that became widespread around that time. Nutritional policies for disease prevention and health improvement were evolved during the1980s. Since 1978 the North Karelia Project has co-produced several major TV series devoted to risk factor reduction.

Later North Karelia has served as a national demonstration area for innovations in chronic disease prevention and health promotion. While most of the sub-programmes in the main project have been evaluated in normal ways, the overall development in risk factors has been monitored by risk factor surveys, on which several reports are available (Puska et al. 1983, Vartiainen et al. 2000).

This chapter describes the changes in cardiovascular risk factors over 35 years (1972 to 2007) in North Karelia, as well as in other areas of Finland monitored by similar population surveys. There is emphasis on the assessment of the persistence of changes in North Karelia, as well as on nationwide developments.

MATERIAL AND METHODS

Five-year interval cross-sectional population surveys (every five years:1972, 1977, 1982, 1987, 1992, 1997, 2002, and 2007) were used to assess CHD risk factor levels in the eastern provinces of North Karelia and Kuopio. The third area in southwestern Finland that was included from 1982 onwards incorporates the city of Turku, a small town (Loimaa) and 9 nearby rural municipalities. North Karelia has about 180 000 citizens, Kuopio province 250 000 and the southwestern survey area about 210 000. Helsinki capital area was included since 1992 and Oulu province in the Northern part of Finland since 1997. Independent random samples were drawn from the population register for each survey.

The materials and methods of these surveys are described in an earlier chapter. The sample sizes and participation rates in the surveys are described in Table 1. The present analysis concerns subjects aged 30-59 years.

Analysis of variance was applied to the means in five years intervals. For proportions, a log-linear model was employed as the statistical method.

RESULTS

Serum total cholesterol

Serum total cholesterol levels have declined significantly in eastern Finland since 1972 (Table 2). In North Karelia cholesterol declined 21% in men and 23% in women. During the first five years the decline was greater in North Karelia than in the reference area in men. A remarkable decline in cholesterol levels was also observed in southwestern Finland after 1982. There was a levelling off in the decline between 1997 and 2002, but in the past five years cholesterol levels have again declined about five percent. The observed trend in serum total cholesterol was very similar among both men and women. However, throughout the years the mean serum total cholesterol was lower among women than among men. In the last 2007 survey, the pooled mean cholesterol level in men was 5.39 mmol/l and in women 5.18 mmol/l. In men, there were no differences in the cholesterol level among the areas but in women the highest

levels were in the northern Oulu province and the lowest in Southwestern Finland. Overall, the population cholesterol distribution has shifted to the left.

Table 1. Samples and participation rates for population aged 30-59 years by area and gender in the National FINRISK Study in years 1972-2007.

	Men		Women	
	Sample	**Participation rate**	**Sample**	**Participation rate**
	n	**%**	**n**	**%**
North Karelia				
1972	1959	94	2056	96
1977	2063	87	2020	91
1982	1599	77	1511	84
1987	1521	79	1485	87
1992	759	69	750	81
1997	747	72	761	76
2002	779	67 (63*)	769	76 (72*)
2007	616	62 (58*)	611	70 (65*)
Northern Savo (Kuopio)				
1972	2918	91	2949	94
1977	2933	89	2996	92
1982	1459	83	1143	88
1987	762	82	745	87
1992	767	76	734	85
1997	766	70	753	81
2002	754	66 (60*)	754	78 (74*)
2007	615	65 (59*)	617	71 (66*)
Southwestern Finland				
1982	1506	82	1487	87
1987	756	77	761	83
1992	747	75	720	85
1997	770	69	758	75
2002	766	66 (58*)	761	75 (68*)
2007	592	58 (54*)	585	73 (70*)
Helsinki and Vantaa				
1992	751	70	734	74
1997	769	63	777	72
2002	767	62 (56*)	761	71 (65*)
2007	602	57 (52)	601	(69 (64*)
Oulu province				
1997	766	66	752	76
2002	748	65 (59*)	744	77 (72*)
2007	603	64 (61*)	611	(69 (65*)

* participation rate for those who both returned the questionnaire and went through the health check

Table 2. The mean and categories of total serum cholesterol by area, year and sex.

		Men							Women						
	N	Mean	SD	-5.0 mmol/l	5.0-6.49 mmol/l	6.5-7.99 mmol/l	8.0- mmol/l	N	Mean	SD	-5.0 mmol/l	5.0-6.49 mmol/l	6.5-7.99 mmol/l	8.0- mmol/l
North Karelia county															
1972	1742	6.92	1.32	6	34	41	20	1880	6.81	1.37	7	36	38	18
1977	1762	6.52	1.22	11	41	37	11	1817	6.40	1.35	13	44	31	11
1982	1229	6.30	1.18	12	47	32	8	1268	6.11	1.32	20	46	25	9
1987	1138	6.25	1.19	14	49	30	8	1246	5.98	1.24	22	48	24	6
1992	519	5.88	1.09	21	52	25	3	600	5.56	1.09	33	50	14	3
1997	537	5.65	1.08	28	50	20	3	573	5.55	1.10	32	49	16	3
2002	492	5.74	1.12	24	55	18	2	551	5.47	0.98	35	52	11	1
2007	357	5.45	1.0	36	54	9	2	397	5.24	1.01	46	47	6	1
Northern Savo county															
1972	2513	6.68	1.21	7	40	41	13	2607	6.66	1.29	9	39	37	14
1977	2601	6.58	1.23	8	42	38	11	2731	6.33	1.28	14	45	31	10
1982	1206	6.26	1.21	13	51	28	8	1001	6.01	1.28	21	48	24	7
1987	599	6.20	1.24	16	47	29	9	629	5.86	1.17	22	53	20	5
1992	581	5.91	1.08	20	52	24	4	619	5.53	1.03	32	50	17	1
1997	539	5.65	1.00	25	58	16	2	611	5.41	0.98	37	47	14	1
2002	449	5.69	1.17	25	55	18	2	555	5.45	0.95	33	53	12	1
2007	365	5.34	1.03	41	52	6	2	409	5.19	0.97	47	47	5	1
Southwestern Finland															
1982	1233	6.06	1.11	16	52	26	5	1291	5.93	1.19	21	50	23	6
1987	566	6.03	1.19	18	50	27	6	612	5.80	1.21	27	47	21	5
1992	562	5.80	1.08	23	55	19	3	609	5.49	1.09	36	47	15	2
1997	530	5.49	1.01	31	54	14	1	568	5.39	0.95	36	52	11	1
2002	488	5.68	1.07	27	51	21	2	518	5.36	0.99	38	49	11	2
2007	317	5.35	0.98	35	59	5	1	403	5.09	0.93	49	48	3	0
Helsinki and Vantaa cities															
1992	527	5.69	1.08	28	50	20	2	542	5.36	1.04	39	48	11	2
1997	481	5.51	1.10	31	53	13	2	557	5.31	0.96	40	48	12	0
2002	428	5.60	1.14	29	54	15	2	489	5.29	0.99	42	48	9	2
2007	314	5.40	0.90	33	59	8	1	383	5.13	0.91	48	48	4	0
Oulu province															
1997	505	5.73	1.02	24	54	21	1	565	5.59	1.03	29	54	15	2
2002	438	5.72	1.07	24	56	19	2	534	5.52	0.95	30	56	13	1
2007	367	5.43	1.00	38	53	9	1	397	5.24	0.91	42	54	4	0

	Men							Women						
ANOVA	72-77	77-82	82-87	87-92	92-97	97-02	02-07	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.001	0.182	< 0.001	0.005	< 0.001	0.002	0.278	< 0.001	< 0.001	< 0.001	0.019	< 0.001	< 0.001	< 0.001
Year	< 0.001	< 0.001	0.044	< 0.001	< 0.001	0.017	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.063	< 0.001
Area x year	< 0.001	0.553	0.357	0.376	0.536	0.463	0.647	0.160	0.570	0.977	0.246	0.278	0.489	0.483

With Bonferroni correction the highest accepted individual p-value at error rate of 0.05 would be 0.0071 (0.05/7).
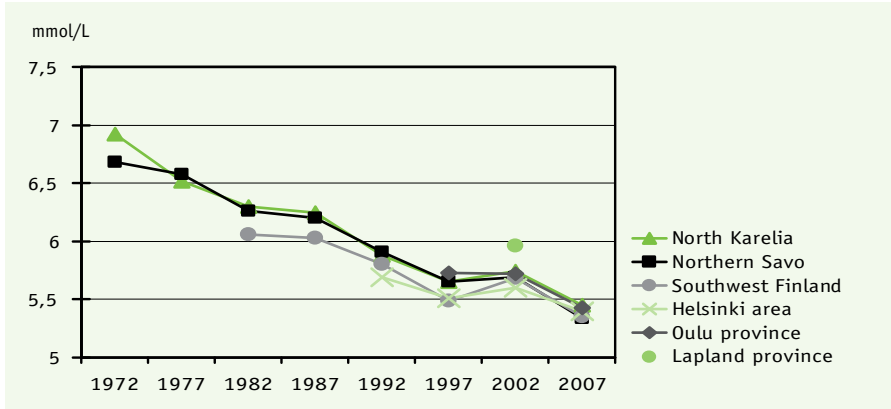
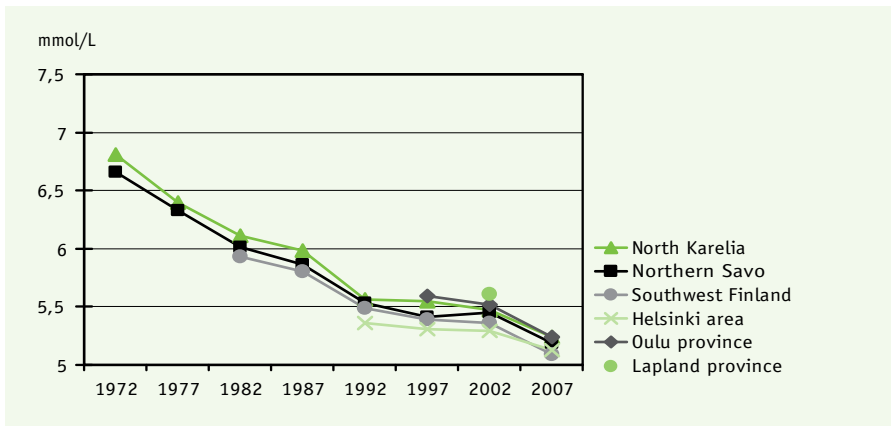**Figure1. Serum cholesterol in men aged 30-59 years**

Figure 2. Serum cholesterol in women aged 30-59 years

Blood pressure

During the first five years of the project systolic and diastolic blood pressure declined faster in North Karelia than in the reference area both in men and women. Thereafter the development has been about the same in different areas. Systolic blood pressure levels declined in North Karelia 12 mmHg in men and 21 mmHg in women from 1972 to 2002 (Table 3). In the last five years the decline has stopped in all areas. In women systolic blood pressure declined until 1997 but not between 1997 and 2002, although again a small decline (1.8 mmHg) from 2002 to 2007 was statistically significant. The pooled mean for five survey areas in 2007 for systolic blood pressure among men was 137.7 mmHg in men and 129.9 mmHg in women in 2007.

Both in both men and women, diastolic blood pressure declined until 2002 but not in the last five years from 2002 to 2007 (Table 4). The mean diastolic blood pressure in the pooled areas was 83.1 mmHg in men and 77.3 mmHg in women.

The proportion of men having diastolic blood pressure of 100 mmHg or more declined from 26 % to 9 % and for women from 29 % to 3 %.
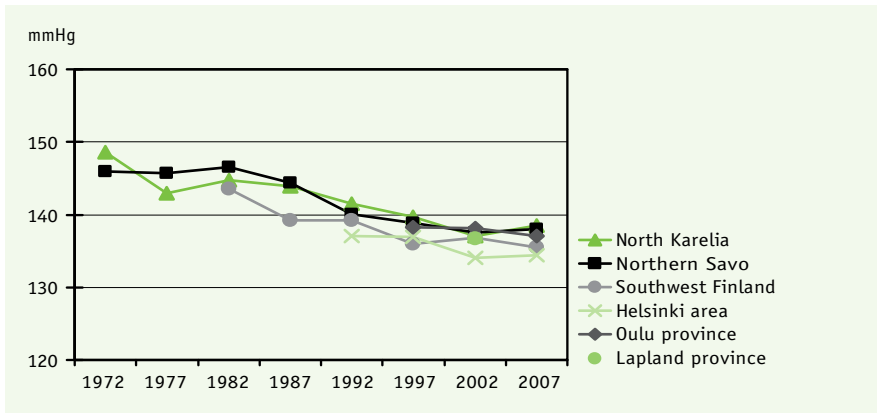
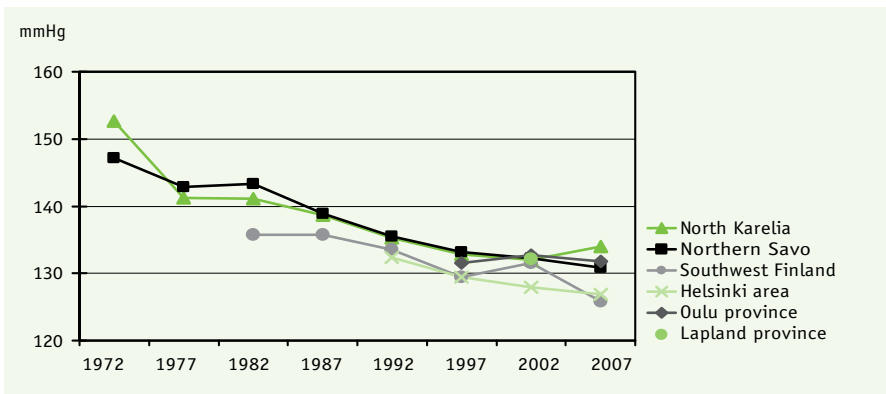**Figure 3. Systolic blood pressure in men aged 30-59**

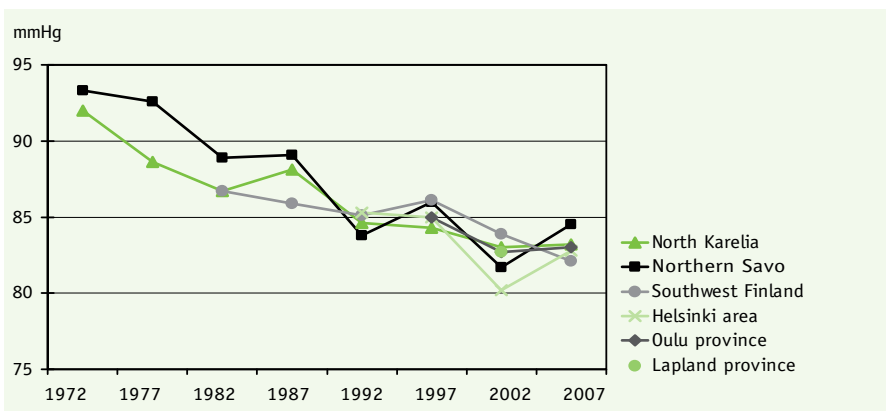**Figure 4. Systolic blood pressure in women aged 30-59 years**

Figure 5. Diastolic blood pressure in men aged 30-59 years

Table 3. The mean and categories of systolic blood pressure by area, year and sex.

	Men							Women						
	N	Mean	SD	-129 mmHg	130-139 mmHg	140-159 mmHg	160- mmHg	N	Mean	SD	-129 mmHg	130-139 mmHg	140-159 mmHg	160- mmHg
North Karelia county														
1972	1744	148.6	21.0	16	19	39	26	1887	152.6	26.0	18	17	29	36
1977	1765	142.9	17.7	21	22	41	16	1834	141.2	21.1	31	19	33	17
1982	1227	144.7	19.2	21	21	36	22	1267	141.1	19.7	31	19	31	19
1987	1139	143.9	18.9	22	21	38	19	1249	138.7	20.6	36	19	28	17
1992	521	141.5	19.2	28	23	31	17	611	135.3	20.9	45	16	25	14
1997	539	139.7	19.6	32	22	30	17	576	132.8	19.1	48	18	23	11
2002	493	137.1	17.8	36	22	30	12	550	132.0	21.1	52	17	19	12
2007	356	138.5	17.5	31	23	34	12	395	134.0	20.4	46	17	27	11
Northern Savo county														
1972	2520	146.0	21.0	20	22	36	23	2621	147.2	25.5	25	18	29	28
1977	2607	145.7	19.2	19	21	39	22	2747	142.9	22.1	29	19	32	20
1982	1207	146.5	18.3	17	19	42	23	999	143.3	22.3	29	19	32	20
1987	599	144.4	18.5	20	20	39	21	631	138.9	20.5	36	19	29	17
1992	582	140.1	18.2	29	24	30	17	622	135.5	21.7	45	17	25	13
1997	539	138.9	17.4	30	27	32	11	610	133.2	18.0	46	20	26	9
2002	449	137.5	18.0	36	23	29	12	554	132.3	20.3	50	19	21	10
2007	365	138.0	17.8	34	23	32	12	409	130.9	18.4	51	19	22	8
Southwestern Finland														
1982	1231	143.6	19.0	22	23	36	20	1293	135.7	20.0	42	20	24	14
1987	566	139.2	16.7	27	26	34	13	614	135.7	21.1	41	22	25	13
1992	562	139.2	16.7	25	28	35	11	612	133.5	19.4	48	21	21	10
1997	530	136.0	16.4	35	25	32	8	569	129.3	18.9	55	17	20	8
2002	448	136.8	17.4	38	23	29	10	519	131.6	18.9	53	16	21	10
2007	321	135.5	17.4	40	22	29	9	407	125.9	16.1	61	19	17	3
Helsinki and Vantaa cities														
1992	527	137.0	17.4	34	26	29	11	545	132.4	19.1	48	23	20	9
1997	482	136.9	18.7	38	20	29	13	560	129.4	18.1	55	19	20	6
2002	429	134.1	16.7	40	22	30	8	493	127.9	18.3	58	20	15	7
2007	316	134.4	17.0	40	25	27	8	383	126.9	17.7	57	21	17	5
Oulu province														
1997	507	138.2	18.7	31	27	29	13	573	131.5	18.8	51	18	21	9
2002	439	138.1	17.7	33	24	32	11	534	132.7	19.0	48	19	24	9
2007	365	137.0	17.3	35	23	32	10	399	131.8	19.0	50	20	22	8

Men

ANOVA	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.543	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Year	< 0.001	0.013	0.009	0.023	0.001	0.004	0.839
Area x year	< 0.001	0.934	< 0.001	< 0.001	0.155	0.117	< 0.487

Women

ANOVA	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Year	< 0.001	0.777	< 0.001	< 0.001	< 0.001	0.610	0.005
Area x year	< 0.001	0.793	0.005	0.686	0.408	0.101	< 0.001

With Bonferroni correction the highest accepted individual p-value at error rate of 0.05 would be 0.0071 (0.05/7).

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Table 4. The mean and categories of diastolic blood pressure by area, year and sex.

	Men							Women						
	N	Mean	SD	-79 mmHg	80-89 mmHg	90-99 mmHg	100- mmHg	N	Mean	SD	-79 mmHg	80-89 mmHg	90-99 mmHg	100- mmHg
North Karelia county														
1972	1742	92.0	12.2	13	27	34	26	1886	92.4	13.5	15	27	29	29
1977	1764	88.6	11.0	19	32	33	17	1834	86.3	10.9	24	36	28	11
1982	1227	86.7	12.7	27	30	26	17	1267	84.5	12.0	33	33	22	11
1987	1139	88.1	11.8	22	31	30	17	1249	83.2	11.5	36	3	19	9
1992	521	84.6	12.4	33	36	21	11	610	79.5	11.3	49	32	14	5
1997	539	84.3	11.7	35	33	22	11	576	80.2	11.3	47	32	15	5
2002	493	83.0	11.6	36	33	22	10	550	77.6	11.6	56	28	12	4
2007	356	83.2	12.1	34	36	21	9	395	77.9	11.7	55	27	15	3
Northern Savo county														
1972	2520	93.3	11.8	9	27	38	27	2620	91.3	12.1	14	29	34	23
1977	2607	92.6	11.9	11	31	30	28	2747	88.4	11.9	22	33	27	18
1982	1207	88.9	13.3	22	28	29	21	999	84.8	11.9	33	32	23	11
1987	599	89.1	11.1	19	31	31	19	631	83.9	11.3	33	36	22	10
1992	582	83.8	11.9	33	36	20	11	622	79.7	11.9	49	29	15	7
1997	539	86.0	11.8	27	32	27	14	611	80.9	11.0	44	34	17	5
2002	449	81.7	11.6	40	35	18	6	554	76.5	11.4	59	27	12	3
2007	365	84.5	11.6	31	36	22	11	409	78.5	10.9	50	33	14	2
Southwestern Finland														
1982	1231	86.7	12.3	26	32	26	16	1293	81.0	11.7	45	31	18	7
1987	566	85.9	85.1	27	35	25	12	614	81.9	11.1	41	35	17	8
1992	562	85.1	12.3	30	33	25	12	612	81.2	11.0	43	33	18	6
1997	530	86.1	10.7	25	37	28	10	569	81.0	10.2	42	36	17	4
2002	448	84.0	10.7	33	37	22	7	519	79.3	11.0	51	30	16	3
2007	321	82.1	12.3	38	33	21	9	407	76.0	11.1	60	28	10	3
Helsinki and Vantaa cities														
1992	527	85.3	12.0	31	31	25	13	545	81.3	11.9	44	32	17	7
1997	482	85.0	12.1	29	35	24	12	560	80.4	10.8	47	33	14	6
2002	429	80.2	11.7	49	28	16	7	493	75.5	10.9	63	26	10	2
2007	316	82.8	11.2	36	36	21	7	383	76.4	10.4	61	26	12	1
Oulu province														
1997	507	85.0	11.7	30	34	26	10	573	80.3	11.0	46	33	15	6
2002	439	82.7	12.0	36	35	20	9	534	77.6	11.5	55	28	13	3
2007	365	83.0	11.1	36	34	23	7	397	77.7	10.8	55	30	12	3

	Men							Women						
ANOVA	72-77	77-82	82-87	87-92	92-97	97-02	02-07	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	< 0.001	< 0.001	< 0.001	0.176	0.096	< 0.001	0.026	0.007	< 0.001	< 0.001	0.260	0.037	< 0.001	0.002
Year	< 0.001	< 0.001	0.804	< 0.001	0.139	< 0.001	0.035	< 0.001	< 0.001	0.119	< 0.001	0.847	< 0.001	0.984
Area x year	< 0.001	0.045	0.010	< 0.001	0.025	0.003	0.001	< 0.001	< 0.001	0.007	< 0.001	0.085	0.002	< 0.001

* With Bonferroni correction the highest accepted individual p-value at error rate of 0.05 would be 0.0071 (0.05/7).
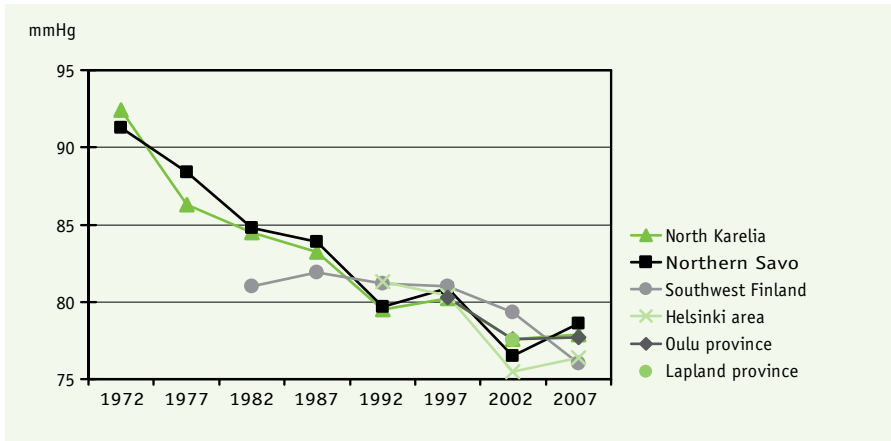
**Figure 6. Diastolic blood pressure in women aged 30-59 years**

Smoking

Smoking declined more decisively in North Karelia than Kuopio during the first ten years of the project. (Table 5). In North Karelia, 52 % of men were smokers in 1972 and 31 % in 2007. Until 1997 the prevalence of smoking among men declined significantly in all survey areas. The proportion of smokers declined in the 1970s mainly because smokers stopped smoking and later mainly because the proportion of never-smokers increased. Later on, the differences in smoking prevalence between areas diminished, and slightly over 30 % of men in all areas were smokers in all areas in 1997. During the last five-year period from 1997 to 2002, the smoking prevalence among men increased somewhat but declined back in 2007. The pooled smoking prevalence for five survey areas was 30% in 2007.

Among women, the smoking prevalence increased slowly until 2002, especially in the North Karelia and Northern Savo areas. In the past five years from 2002 to 2007, smoking did not increase anymore and the differences between the areas diminished. The pooled prevalence for five survey areas was 21% in 2007. Until 1997, the prevalence of ex-smokers increased continuously in women, but in the latest survey the proportion of ex-smokers did not increase any more.

Table 5. Smoking by area, year and sex

Survey areas	Men				Women			
	N	Smoker (%)	Ex-smoker (%)	Never smoker (%)	N	Smoker (%)	Ex-smoker (%)	Never smoker (%)
North Karelia county								
1972	1802	52	20	28	1955	10	2	88
1977	1733	44	27	29	1824	10	5	85
1982	1185	36	30	34	1238	15	8	77
1987	1157	36	28	36	1274	15	12	73
1992	517	32	25	43	610	17	13	70
1997	535	31	26	43	573	16	16	68
2002	523	33	25	42	586	22	14	63
2007	384	31	27	42	428	18	22	60
Northern Savo county								
1972	2566	50	22	29	2693	11	3	86
1977	2557	44	27	28	2729	12	6	82
1982	1181	42	24	34	986	15	8	77
1987	606	41	24	35	636	15	11	74
1992	582	37	26	37	620	19	14	67
1997	538	31	30	39	610	17	16	67
2002	499	38	24	38	591	20	18	62
2007	395	30	26	45	438	22	24	54
Southwestern Finland								
1982	1198	39	28	32	1275	22	11	67
1987	576	38	27	34	25	23	13	64
1992	561	39	28	33	612	23	15	62
1997	529	34	26	41	569	22	16	62
2002	508	34	22	43	569	25	15	60
2007	341	31	25	45	426	20	17	63
Helsinki and Vantaa cities								
1992	527	36	27	37	543	30	15	55
1997	483	33	28	39	561	26	19	54
2002	473	40	20	40	537	27	21	53
2007	346	31	25	44	415	25	23	52
Oulu province								
1997	499	32	23	45	564	20	18	62
2002	487	34	26	40	567	21	19	61
2007	386	26	29	45	422	21	21	58

Logistic regression analyses for smoking prevalence. Both never smokers and ex-smokers regarded as non-smokers.

	Men							Women						
LOGISTIC	72-77	77-82	82-87	87-92	92-97	97-02	02-07	**LOGISTIC**	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.275	0.008	0.001	0.008	0.181	0.297	0.612	**Area**	0.018	0.120	< 0.001	< 0.001	< 0.001	< 0.001	0.177
Year	< 0.001	< 0.001	0.661	0.191	0.012	0.006	0.021	**Year**	0.824	< 0.001	0.813	0.113	0.149	0.004	0.980
Area x year	0.188	0.013	0.964	0.414	0.563	0.443	0.495	**Area x year**	0.466	0.234	0.875	0.428	0.915	0.316	0.258

* With Bonferroni correction the highest accepted individual p-value at error rate of 0.05 would be 0.0071 (0.05/7).
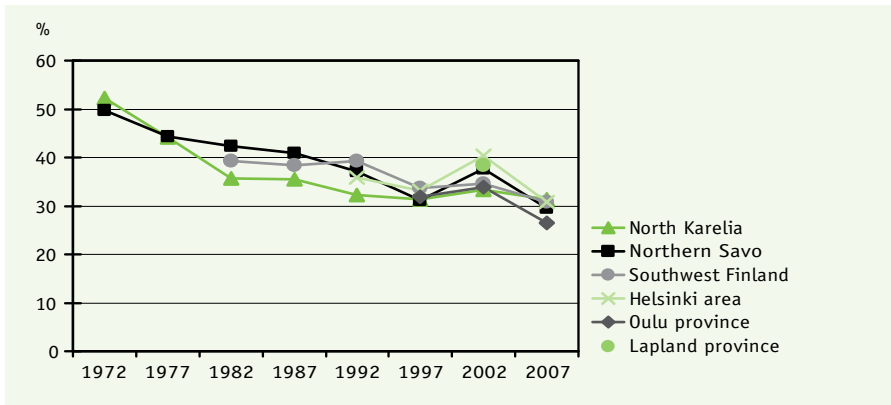
Figure 7. Smoking in men aged 30-59 years
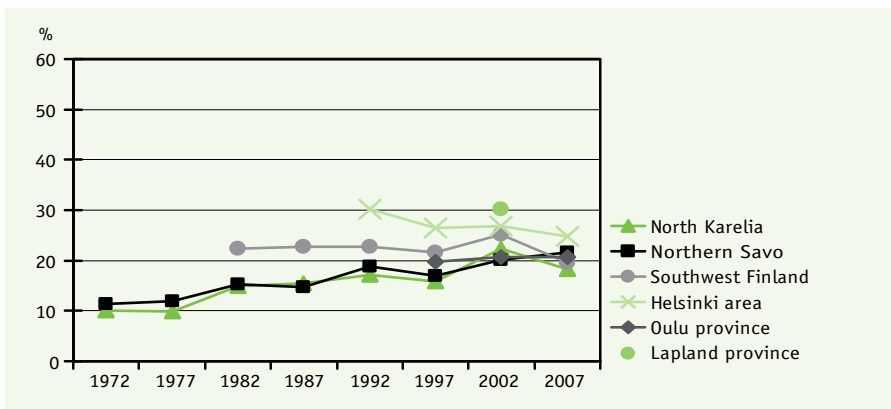
Figure 8. Smoking in women aged 30-59 years

Body mass index

Among men, the mean body mass index has increased continuously since 1972 (Table 6). Between the surveys in 1987 and 1992 some levelling off was observed, but after that the increase continued until 2002. No increase in body mass index was observed between 2002 and 2007. The pooled mean body mass index was 27.2 kg/m² in men in 2007.

Among women, the BMI decreased significantly in eastern Finland between 1972 and 1982. Since then, there was a slightly increasing trend in BMI. During the last five years the pooled mean for five survey areas increased from 26.3 kg/m² in 2002 to 26.5 kg/m² in 2007, but this increase was not statistically significant. Among women, there was a greater fluctuation in mean BMI between the survey years and areas than among men.

The prevalence of obesity (BMI ≥ 30) has increased constantly among men since 1972. Among women, the prevalence in eastern Finland first declined slightly in the 1970s, but started to increase again in the 1990s. The prevalence of obese persons was significantly lower in southwestern Finland and in the capital area compared to eastern Finland and northern Finland. The pooled prevalence of obesity for five survey areas both among men and women was 21% in 2007.
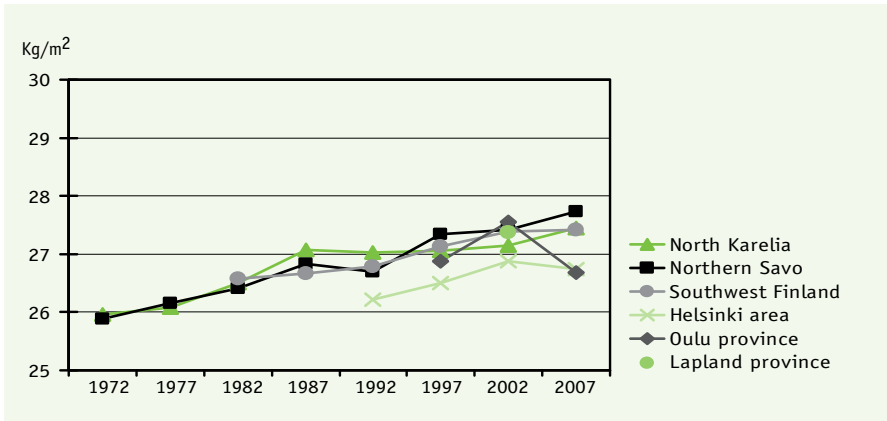
Figure 9. Body mass index in men aged 30-59
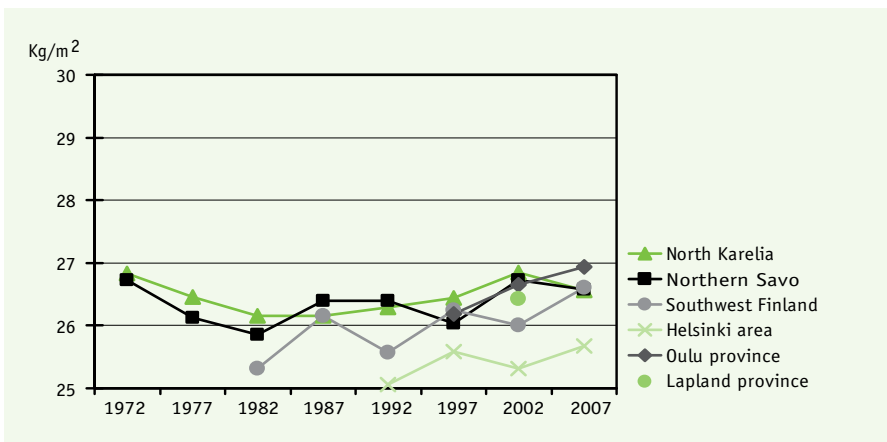
Figure 10. Body mass index in women aged 30-59 years

Table 6. The mean and categories of body mass index (BMI) by area, year and sex.

Survey areas	Men						Women					
	N	Mean	SD	-24.9 kg/m²	25.0-29.9 kg/m²	30.0- kg/m²	N	Mean	SD	-24.9 kg/m²	25.0-29.9 kg/m²	30.0- kg/m²
North Karelia county												
1972	1748	26.0	3.4	43	46	11	1888	26.8	4.7	40	39	22
1977	1767	26.1	4.7	42	46	12	1835	26.5	4.7	43	37	20
1982	1229	26.5	3.6	37	49	15	1270	26.1	4.8	48	34	18
1987	1138	27.1	4.0	32	48	20	1247	26.2	4.8	48	33	19
1992	521	27.0	4.0	35	44	21	611	26.3	4.9	48	34	18
1997	539	27.0	4.1	32	50	18	576	26.4	5.3	49	31	20
2002	497	27.1	4.3	31	48	20	553	26.8	5.3	46	31	23
2007	357	27.4	4.5	30	47	23	396	26.6	5.5	46	33	21
Northern Savo county												
1972	2520	25.9	3.3	43	45	11	2621	26.7	4.6	40	38	22
1977	2604	26.2	3.5	40	47	13	2747	26.1	4.7	47	35	19
1982	1206	26.4	3.8	37	47	16	1001	25.9	4.4	49	36	16
1987	599	26.8	3.5	33	52	16	632	26.4	5.0	47	33	19
1992	582	26.7	4.0	37	44	20	621	26.4	5.0	47	31	22
1997	537	27.3	4.1	31	46	23	609	26.0	4.8	47	36	17
2002	454	27.4	4.0	31	48	22	554	26.7	5.1	44	35	21
2007	365	27.7	4.4	27	47	26	410	26.6	5.2	44	34	22
Southwestern Finland												
1982	1231	26.6	3.8	37	46	17	1293	25.3	4.3	54	33	13
1987	566	26.7	3.5	34	51	15	614	26.1	4.7	47	34	18
1992	562	26.8	3.9	35	45	20	612	25.6	4.8	53	32	16
1997	530	27.1	4.0	29	52	18	569	26.2	5.0	47	36	18
2002	454	27.4	4.4	31	46	23	520	26.0	5.1	51	32	18
2007	322	27.4	4.2	30	49	21	407	26.6	5.4	45	34	21
Helsinki and Vantaa cities												
1992	527	26.2	3.7	41	43	16	545	25.1	4.5	58	28	14
1997	483	26.5	4.1	39	44	17	560	25.6	4.8	53	29	18
2002	432	26.9	4.2	34	44	21	497	25.3	4.3	55	33	13
2007	316	26.7	3.8	35	47	18	383	25.7	5.0	55	30	15
Oulu province												
1997	507	26.9	3.7	32	51	18	573	26.2	4.9	50	32	18
2002	442	27.5	4.0	26	52	22	534	26.6	5.0	44	35	21
2007	365	26.7	3.8	35	47	17	399	26.9	5.6	45	31	24

ANOVA Men	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.809	0.401	0.551	0.055	< 0.001	0.002	0.004
Year	0.004	< 0.001	0.002	0.944	0.015	0.017	0.543
Area x year	0.368	0.891	0.113	0.847	0.217	0.413	0.026

ANOVA Women	72-77	77-82	82-87	87-92	92-97	97-02	02-07
Area	0.081	0.012	0.012	0.008	< 0.001	< 0.001	< 0.001
Year	< 0.001	0.010	< 0.001	0.588	0.213	0.218	0.291
Area x year	0.170	0.971	0.007	0.084	0.028	0.067	0.254

* With Bonferroni correction the highest accepted individual p-value at error rate of 0.05 would be 0.0071 (0.05/7).

DISCUSSION

Cardiovascular risk factor reduction in the entire population was a major priority for the North Karelia Project, as it has later been for the nationwide chronic disease prevention strategies. Initially (1972-1977), the major comparison in the effect evaluation of the project was against the neighbouring province of Kuopio. Blood pressure and cholesterol declined more in North Karelia in the first five year period and smoking in the first ten years, since when the developments in these risk factors have been more or less similar in the different areas. The function of demonstration programmes is also changing. In 1970's it was important to investigate whether the risk factor profile of the whole community could be changed. Because this has since been demonstrated frequently (Puska and Vartiainen 2008, Vartiainen et al 1991), the role of community programmes is now more to develop and test innovations designed for further improvements in chronic disease prevention, and to serve as training sites for health professionals. The idea of community programmes has successfully entered general public health consciousness. In many countries the national strategy for cardiovascular disease prevention is based at least partly on demonstration programmes, a development which is stressed in the WHO/CINDI programme and in later years in WHO Noncommunicable Diseases strategies.

Saturated fat consumption used to be very high in Finland. In the late 1960s the Finnish diet was highly atherogenic, with about 23% of energy intake coming from saturated fats. In 1980s there was still about 20% of energy intake from saturated fats, and the use of polyunsaturated fats was very low. In the last survey in 2007 the saturated fats intake had declined to 12% of energy intake and polyunsaturated fats increased.

Gradually there has been a wholesale shift from butter to margarine and from full-fat to low-fat milk (Pietinen et al 2001). These observed dietary changes accord well with the falls in cholesterol level. There were some signs that declines in cholesterol were leveling off in the early 1980s, especially among men. The 1980s saw further decreases in the use of traditional sources of saturated fats like butter and fatty milk, but there have been simultaneous increases in the consumption of dairy products such as cheeses and new types of milk fat, which probably account for the only minor changes in serum cholesterol level from 1982 to 1987.

However, during this period positive results from the Lipid Research Clinics cholesterol trial (Lipid Research Clinics Program 1984) were published, and the National Cholesterol Consensus Conference was held in the U.S. These enhanced the interest in cholesterol issues, and many other countries began considering new activities in

nutrition policy. In 1987 the Finnish Cardiac Society and Internists' Association made their recommendations on cholesterol levels and screening for the population, on the basis of which "normal" cholesterol is less than 5 mmol/l (193 mg/dl), "elevated" from 5 to 6.5 mmol/l (251 mg/dl), and "greatly elevated" from 6.5 mmol/l upwards. It was recommended that adults over 20 years old be screened every five years.

These recommendations stimulated public interest in cholesterol and nutritional issues, and the medical community appeared to have no major problem in accepting them. However, the dairy industry launched a major advertising campaign against the cholesterol hypothesis, attacking the North Karelia Project and questioning the proposed role of saturated fats in atherosclerosis. This controversy further raised the profile of healthy nutrition. Fortunately, most people appear to have placed greater trust in the medical and nutritional community judging by the major reduction in cholesterol levels over the last five years, which mirrored a decline in milk fat consumption and a rise in vegetable oil use.

There was another period of concern: serum cholesterol level did not decline between 1997 and 2002. The 2007 survey results showed that the decline in population blood cholesterol level continues. This was parallel with the changes in saturated and polyunsaturated fat intake. The total intake of saturated fat has declined in Finland from 22% of energy intake to 13% between 1972 and 2007. No change in intake of saturated fats was observed between 1997 and 2002, when also no changes in serum cholesterol occurred, but again between 2002 and 2007 intake of saturated fats declined and polyunsaturated increased, following about a 5% decline in serum cholesterol. Saturated fatty acids play the key role in the regulation of serum cholesterol. Also, the intake of dietary cholesterol and the trans-fatty acids increases the serum cholesterol levels. In Finland, the role of trans-fatty acids is marginal, as the proportional intake of trans-fatty acids is only 0.5 energy percent compared to the 12 energy percent of saturated fat intake.

During the last thirty years, the greatest change in health behaviour in Finland has indisputably been the changes in diet, especially in the type and amount of fat and the intake of fresh vegetables and fruit. In the early 1970s, Finland was a country with much dairy farming. Butter and milk production was subsidized and all vegetable oil was imported. The domestic vegetable oil industry was developed in the late 1970s and the popularity of vegetable oil grew remarkably in the 1980s. People are very well aware of the role of the type of fat, and can avoid fatty milk products and spread with high saturated fat content, as well as food products high in cholesterol.

The sources of saturated fats have changed during the last thirty years. Earlier, when the choice of food products used was smaller than nowadays, the main sources

of saturated fats were butter, other milk products and meat, while today the main sources are meat dishes, cheese and spreads. Also, different pastries, both salty and sweet, are more important sources of saturated fats in the diet. The role of milk itself has decreased and been replaced by other milk products such as ice cream, yoghurt and puddings. As the variety of food stuffs has increased and people are increasingly consuming highly processed food, it is more difficult for them to be fully aware of fat content of diet.

Smoking declined more in North Karelia than Kuopio province, and the decline was fastest in the 1970s. The main indicator of this decline was the growing proportion of ex-smokers. In the 1980s the proportion of ex-smokers remained more or less constant, or even declined, while the percentage of never smokers has risen. Fewer young men started smoking in the 1960s and 70s than in the previous decades.

In Finland, many tobacco control initiatives have been carried out since the beginning of the 1970's. The national tobacco legislation was initially passed in 1977. The legislation has been amended in 1995, and again in 2006. At the moment, the Finnish tobacco legislation is rather strict, prohibiting all forms of tobacco advertising, smoking in public indoor places, workplace sites and restaurants the sales of tobacco products to people under 18 years of age, and the sale of smokeless tobacco. Also, warnings on tobacco packages are obligatory and 0.5 % of the tobacco tax is designated for tobacco control. Smoking among men has declined remarkably since 1972. In women there has been an increase in smoking from about 10% to 20%. However, in the past five years there have been signs of a levelling off in the smoking increase in women. Birth cohort analyses from the Health Behaviour among the Finnish Adult Population Survey data indicated that onset of smoking increased in the birth cohorts born from 1916 to the 1950s (Helakorpi et al 2005). But this increase was cut down in the later cohorts who were in the smoking initiation age during and after the first tobacco law. This obviously explains why smoking in women never increased to a higher level in Finland. It may be that we have now passed the peak of the tobacco epidemic in Finland.

Only part of the decline in blood pressure can be explained by drug treatment, because the whole distribution has been shifted to the left. As the mean body mass index has increased, especially in men, and alcohol consumption has also risen, these cannot explain the phenomenon. The fall in salt consumption during the last 20 years (Laatikainen et al 2006) may have favoured the change in blood pressure, along with the rise in polyunsaturated fat consumption (Iacono et al. 1983).

In 1982 blood pressure and cholesterol levels were still higher in eastern than in southwestern Finland, but have diminished during the last ten years. It thus appears that the risk factor profile in Finland is becoming more homogeneous.

The findings overall show there has been a major decline in risk factor levels, which was particularly steep in North Karelia during the initial project years. Thereafter, and associated with numerous nationwide activities, major risk factor reductions have occurred throughout Finland. It is also clear that the sustained activity in the demonstration area of North Karelia continues to be reflected in marked persistence of the initial changes, and with fresh efforts towards further improvements.

REFERENCES

Helakorpi S, Martelin T, Torppa J, Patja K, Vartiainen E, Uutela A (2004). Did Finland's Tobacco Control Act of 1976 have an impact on ever smoking? An examination based on male and female cohort trends. J Epidemiol Community Health 58: 649-654.

Iacono JM, Puska P, Dougherty RM, Pietinen P, Vartiainen E, Leino U et al (1983). Effect of dietary fat on blood pressure in a rural Finnish population. Am J Clin Nutr 38: 860-869.

Keys AB (1970). Coronary heart disease in seven countries. American Heart Association: New York,.

Laatikainen T, Pietinen P, Valsta L, Sundvall J, Reinivuo H, Tuomilehto J (2006). Sodium in the Finnish diet: 20-year trends in urinary sodium excretion among the adult population. Eur J Clin Nutr 60: 965-970.

Lipid Research Clinics Program (1984). The Lipid Research Clinics Coronary Primary Prevention Trial results. I. Reduction in incidence of coronary heart disease. JAMA 251: 351-364.

Pietinen P, Lahti-Koski M, Vartiainen E, Puska P (2001). Nutrition and cardiovascular disease in Finland since the early 1970s: a success story. J Nutr Health Aging 5: 150-154.

Puska P, Salonen JT, Nissinen A, Tuomilehto J, Vartiainen E, Korhonen H et al (1983). Change in risk factors for coronary heart disease during 10 years of a community intervention programme (North Karelia project). Br Med J (Clin Res Ed) 287: 1840-1844.

Puska P, Nissinen A, Tuomilehto J, Salonen JT, Koskela K, McAlister A et al (1985). The community-based strategy to prevent coronary heart disease: conclusions from the ten years of the North Karelia project. Annu Rev Public Health 6: 147-193.

Puska P, Vartiainen E (2009). Community based studies in high income countries. In: Detels R, Beaglehole R, Lansang MA, Gulliford M (eds). Oxford Textbook of Public Health, 5th edn. Oxford University Press: Oxford.

Tuomilehto J, Geboers J, Salonen JT, Nissinen A, Kuulasmaa K, Puska P (1986). Decline in cardiovascular mortality in North Karelia and other parts of Finland. Br Med J (Clin Res Ed) 293: 1068-1071.

Vartiainen E, Heath G, Ford E (1991). Assessing population-based programs to reduce blood cholesterol level and saturated fats. Int J Technol Assess Health Care 7: 315-326.

7. HEALTH BEHAVIOUR AND RELATED TRENDS

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INTRODUCTION

Trends in health behaviour in the province of North Karelia from 1972 to 1977 were monitored through the biannual postal surveys. The aim of the surveys was to get information for continuous planning, feed-back and evaluation of the North Karelia Project. The methods and some of the results of these surveys were reported in the WHO Monograph on the North Karelia Project in 1972–1977 (Puska et al., 1981).

Since 1978, the National Public Health Institute has monitored the health behaviour of the Finnish adult population by annual postal surveys. In this connection, an extra sample has been surveyed annually in North Karelia. The extra sample from North Karelia has been used as an important tool for the intervention, management and evaluation of the North Karelia Project. The primary purpose of the follow-up was to acquire information on health behaviour among the adult population, specifically on smoking and changes in smoking. In addition to smoking, dietary habits were a central objective of the follow-up. The survey also dealt with alcohol consumption, dental hygiene, physical activity, self-rated health and use of health services.

This chapter reviews the changes across time in health behaviour among the North Karelian adult population in 1972–2004. Since only restricted comparable information is available for the period 1972–77, more detailed results are given for the period 1978–2004. The health behaviour variables presented concern current smoking, dietary habits, physical activity, consumption of alcohol, time of last blood pressure measurement, and time of last blood cholesterol test. Some references are given to Finland health behaviour trends that have been published in respective reports (e.g. Helakorpi et al., 2004).

METHODS

The baseline survey of the North Karelia Project was carried out in spring 1972. From 1972 to 1977 the data was collected biannually by postal questionnaires using independent random samples of 25- to 59- year old people in the province of North Karelia. The average response rate was 87 per cent.

Since 1978 the study material was collected annually through a postal survey. Independent random samples of Finnish adult population from the age group 15 to 64 were drawn from the National Population Register. The sample size has been about 5,000 for the national sample and 1,200 for the North Karelian sample. In the year 1996 the North Karelia sample size was exceptionally 1,900. A questionnaire was mailed out in April; another one was mailed to the non-respondents after about one month. Since 1986 yet another questionnaire was mailed in June to those who had not responded. Since 1998 three reminders have been mailed out. The average response rate has been 73 per cent in the Province North Karelia. In this report, respondents younger than 25 years or older than 59 years were excluded from study in order to maintain comparability between the surveys in North Karelia in 1972–2004 (Table 1).

Table 1. Numbers of respondents in the health behaviour surveys in North Karelia, aged 25–59 years by gender in 1972–2004.

Year or year group	Men	Women	Total
(baseline survey) spring 1972	2234	2292	4526
autumn 1972	1182	1118	2300
1973	2043	2128	4171
1974	2303	2227	4530
1975	2322	2310	4632
1976	2295	2191	4486
1978–79	740	630	1370
1980–81	793	633	1426
1983	391	323	714
1984–85	692	614	1306
1986–87	736	685	1421
1988–89	640	643	1283
1990–91	631	659	1290
1992–93	601	613	1214
1994–95	602	628	1230
1996	459	461	920
1998	296	289	585
2000	268	298	566
2004	241	307	548

RESULTS

Smoking

The proportion of current smokers (those who had smoked regularly for at least one year and had smoked during previous month) was 51 per cent among men in spring 1972 (in the baseline survey). This proportion decreased until 1980. Since that period the recorded prevalence of smoking varied between 35 per cent and 40 per cent. In the mid-1990s prevalence of smoking among men aged 25–59 years was in North Karelia 30 per cent and the corresponding proportion in the national sample among men was 34 per cent. At the beginning of the 2000s prevalence of current smoking in North Karelia was 31 per cent and the corresponding prevalence in Finland among men was 33 per cent.

Among women the proportion of current smokers in North Karelia was about 12 per cent in the seventies. From 1980 to 1987 the prevalence of current smokers among women was under 16 per cent, while it increased to 19 per cent at the end of 1980s. In the mid-1990s the proportion of current smoking among women was about 22 per cent. At the beginning of the 2000s the prevalence of female current smoking in North Karelia was 18 per cent and in Finland as a whole, 22 per cent. Female smoking was lower in North Karelia than the national level during the entire follow-up period (Figure 1).
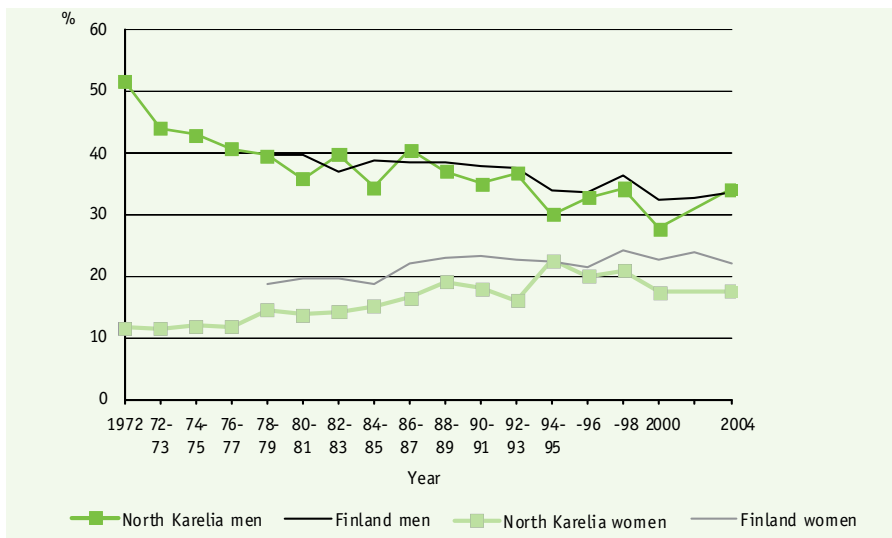
Figure 1. Proportion (%) of current smokers among 25–59-year-old population in North Karelia and in Finland, by gender in 1972–2004.

Among current smokers, almost 60 per cent of men and women reported that they want to quit smoking. From the end of the 1970s to the mid 1990s about one-third of current smokers reported that a doctor or nurse had advised them to quit smoking. Among current smoking men nearly one fifth reported in 1972–79 that they had tried to quit smoking during the last six months. The correspondent prevalence among women was on average 35 per cent. From 1980 to the mid- 1990s about 10 per cent of men and 20 per cent of women had tried to quit during the last six months. At the beginning of the 2000s the corresponding prevalence was over 20 per cent (Figure 2).
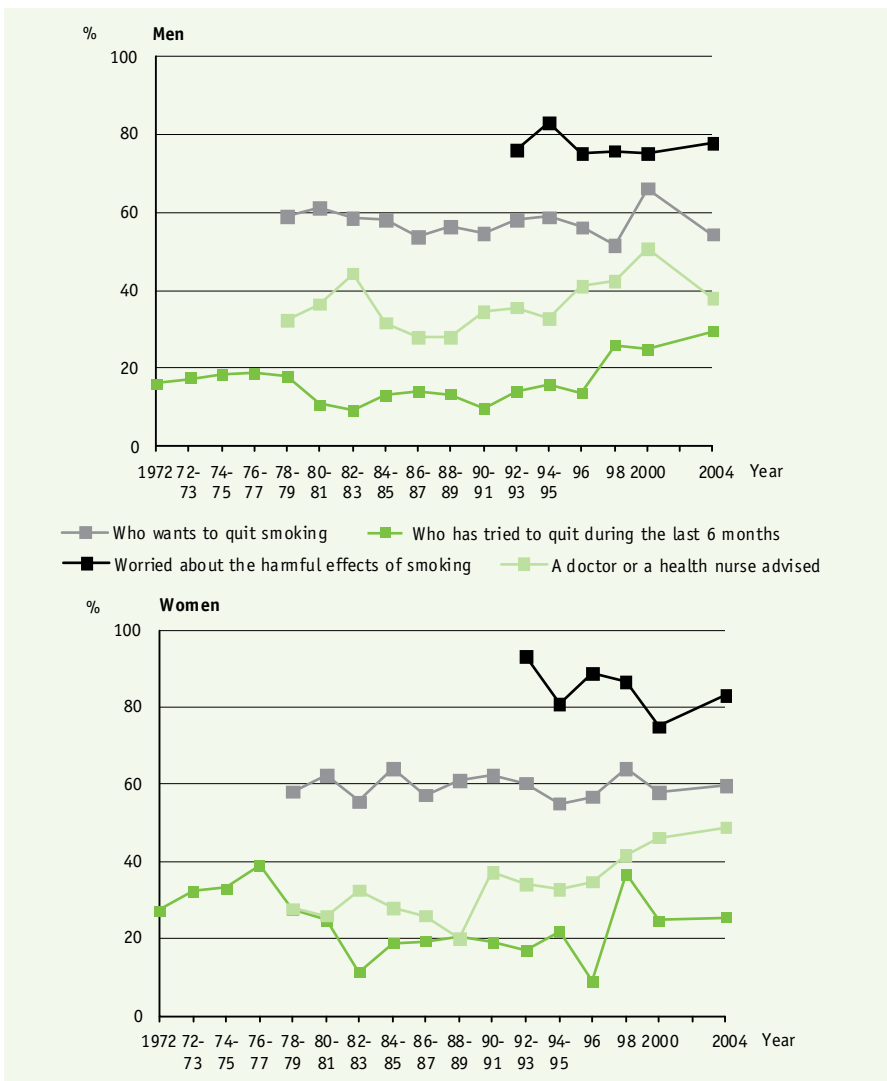
Figure 2. Proportion (%) of current smokers by gender, assessing that they had tried to quit in the past six months, wanted to quit, were concerned about health hazards of smoking, and had been advised to quit. North Karelia in 1972–2004.

Dietary habits

Dietary habits have markedly changed in the direction of dietary recommendations. During the study period the consumption of butter and high fat milk dramatically decreased. At home the use of vegetable oil for cooking and consumption of fresh vegetables have increased in 1972–2004.

In the spring 1972 in North Karelia 86 per cent of men and 82 per cent of women reported to use mainly butter on bread. At the beginning of the 2000s, only 10 per cent of men and four per cent of women consumed butter on bread. Among men 42 per cent and among women 47 per cent used low fat spread (margarine with a fat content lower than 60 per cent) on bread (Figures 3 and 4). On the national level, at the beginning of the 2000s, the prevalence of butter consumption on bread was five per cent among men and three per cent among women; and the consumption of low fat spread was 40 per cent among men and 42 per cent among women. In the spring of 1972 in North Karelia only two per cent of the population used vegetable oil for cooking. In 1973–87 the prevalence was about six per cent. At the beginning of the 2000s about 40 per cent of the North Karelian population used vegetable oil for cooking (Figure 5).
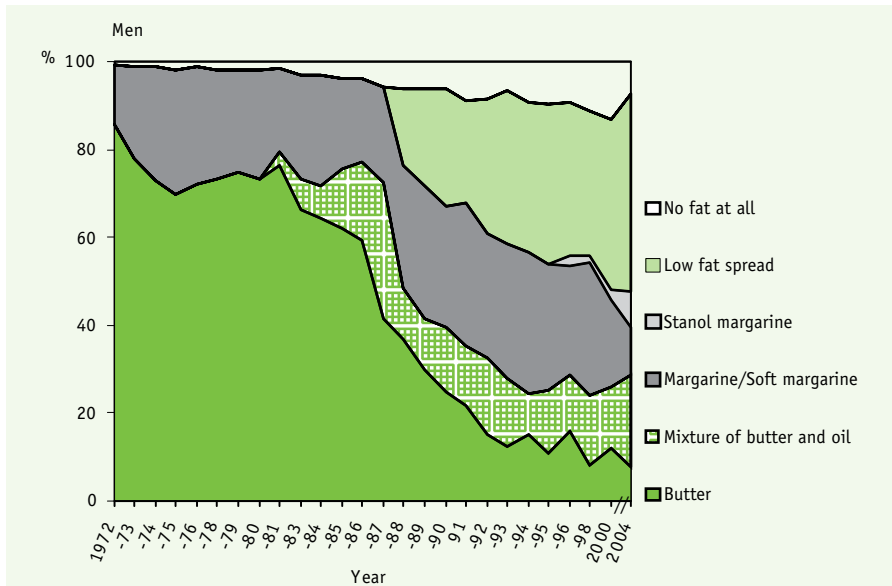
Figure 3. Type of bread spread among 25–59-year-old men in North Karelia in 1972–2004.
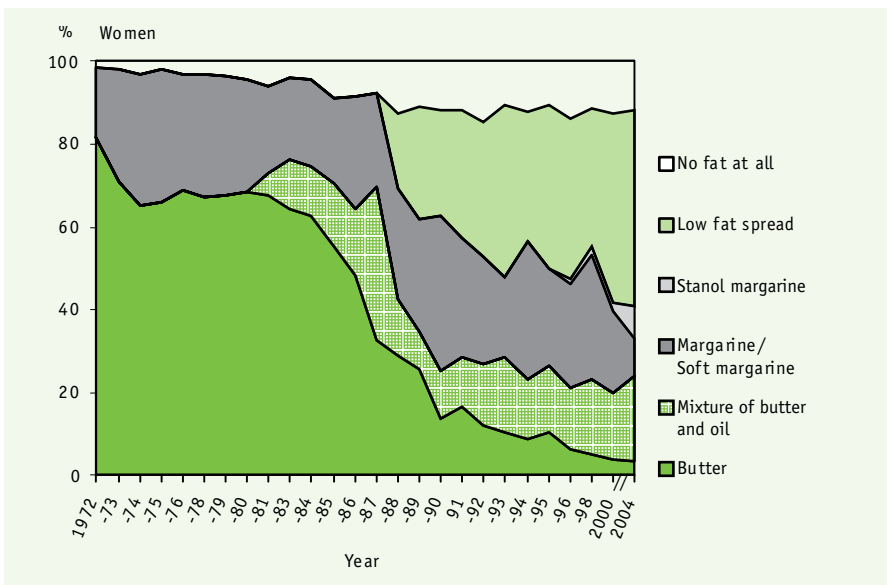
Figure 4. Type of bread spread among 25–59-year-old women in North Karelia in 1972–2004.
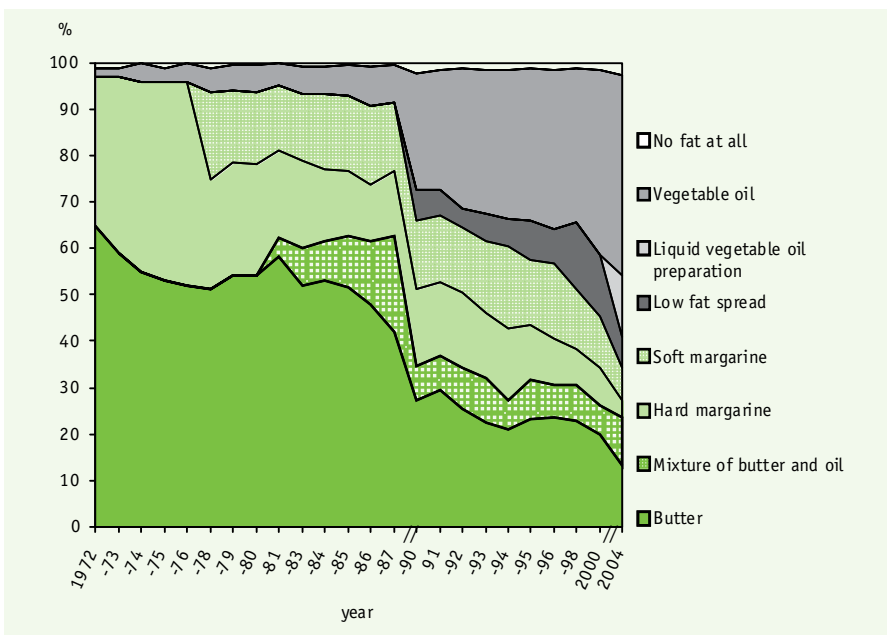
Figure 5. Fat used for cooking at home among 25–59-year-old population in North Karelia in 1972–2004.
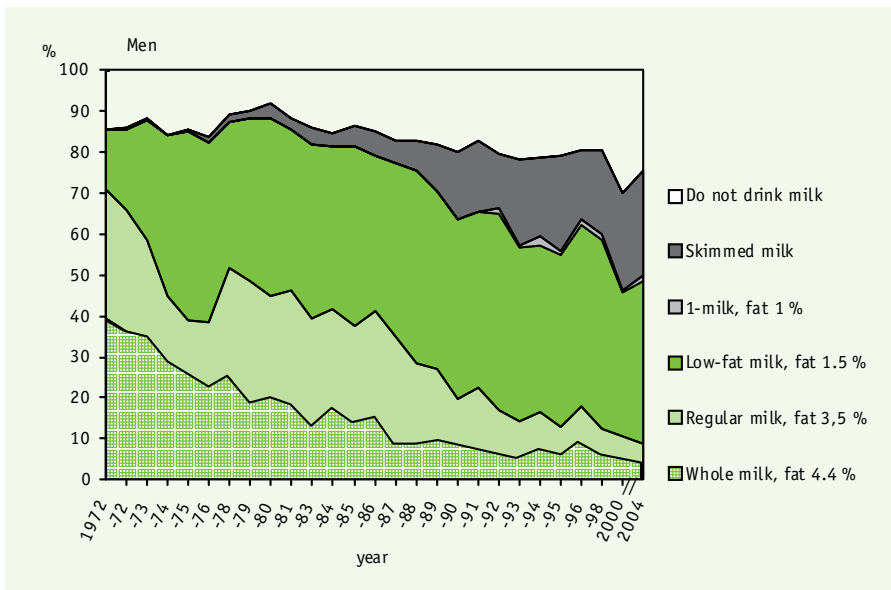
Figure 6. Type of milk usually consumed among 25–59-year-old men in North Karelia in 1972–2004.
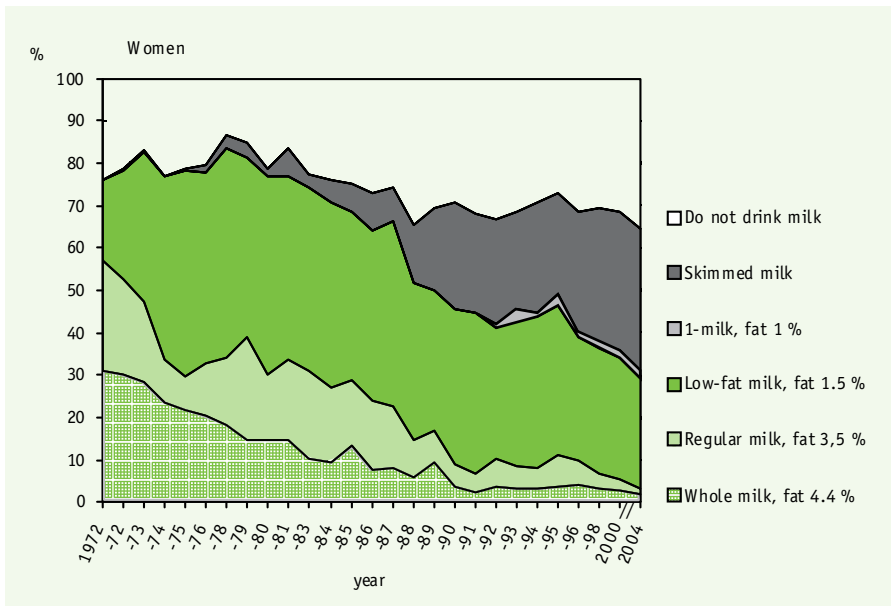
Figure 7. Type of milk usually consumed among 25–59-year-old women in North Karelia in 1972–2004.

Consumption of whole milk (fat 4.4 per cent) and consumption of "regular" milk (fat 3.9 per cent) were combined into one group: the consumption of high fat milk. In spring 1972, 71 per cent of men and 57 per cent of women drank high fat milk.

By 1993 the consumption of high fat milk among men had decreased to 14 per cent and among women to 9 per cent. Consumption of "low fat" milk (fat 2.5 per cent) increased from 1972 to 1976 among both men and women. In 1976 the fat percentage of low fat milk was changed from 2.5 to 2.9 and consumption of this decreased. After 1982 the fat percentage of "low fat" milk was reduced to 1.9 and since the mid-1990s the fat percentage has been 1.5. At the beginning of 2000s about 40 per cent of men and about 30 per cent of women used low-fat milk. Use of skimmed milk has increased among men and women since the 1980s. In 2000, 24 per cent of men and 33 per cent of women used skimmed milk in North Karelia. (Figures 6 and 7.) In the national sample, 29 per cent of men and 37 per cent of women drank skimmed milk in 2000.

From 1979 onwards, the consumption of vegetables was assessed as the eating of vegetables (potatoes excluded) in a salad or as such. From 1979 to 2004, among men, the prevalence of eating vegetables 6–7 days a week changed from 10 per cent to 26 per cent, and among women the corresponding prevalence changed from 12 per cent to 47 per cent. The figure describing consumption of vegetables match also the trends in use of butter on bread, and the change of consumption of skimmed milk during the study period (Figure 8).

The survey questionnaire also asked people to report whether they have made any changes in their diet due to health reasons during the preceding year. From 1979 to 2004 the most commonly reported changes in dietary habits were reduction in the use of fat and increased consumption of vegetables, changed quality of fat and decreased consumption of salt and sugar. In 1987–1993 greater changes in dietary habits took place, especially among men. In the 1993 slightly over half of men and 70 per cent of women reported that they had changed some dietary habits during the preceding year. Among men, 30 per cent, and among women, 44 per cent, reported that they had reduced their use of fat during the previous year. Among men, 30 per cent, and among women, 37 per cent, had increased their consumption of vegetables (Figure 9).

Physical activity

The proportion of people who partook in leisure time physical activity at least 2–3 times a week increased between 1978 and 2004. The increase among men was from 35 per cent to 58 per cent and among women it was from 40 per cent to 72 per cent (Figure 10). In the national sample the correspondent changes were, among men, from 41 per cent to 58 per cent, and among women, from 39 per cent to 65 percent.

In 1979–1986 in North Karelia the proportion of people reporting that they walked or cycled at least 15 minutes per day to or from work changed among men from 30 per cent to 20 per cent, and among women from 70 per cent to 50 per cent. Since 1986 the correspondent proportion has been about 20 per cent among men and 50 per cent among women (Figure 10).
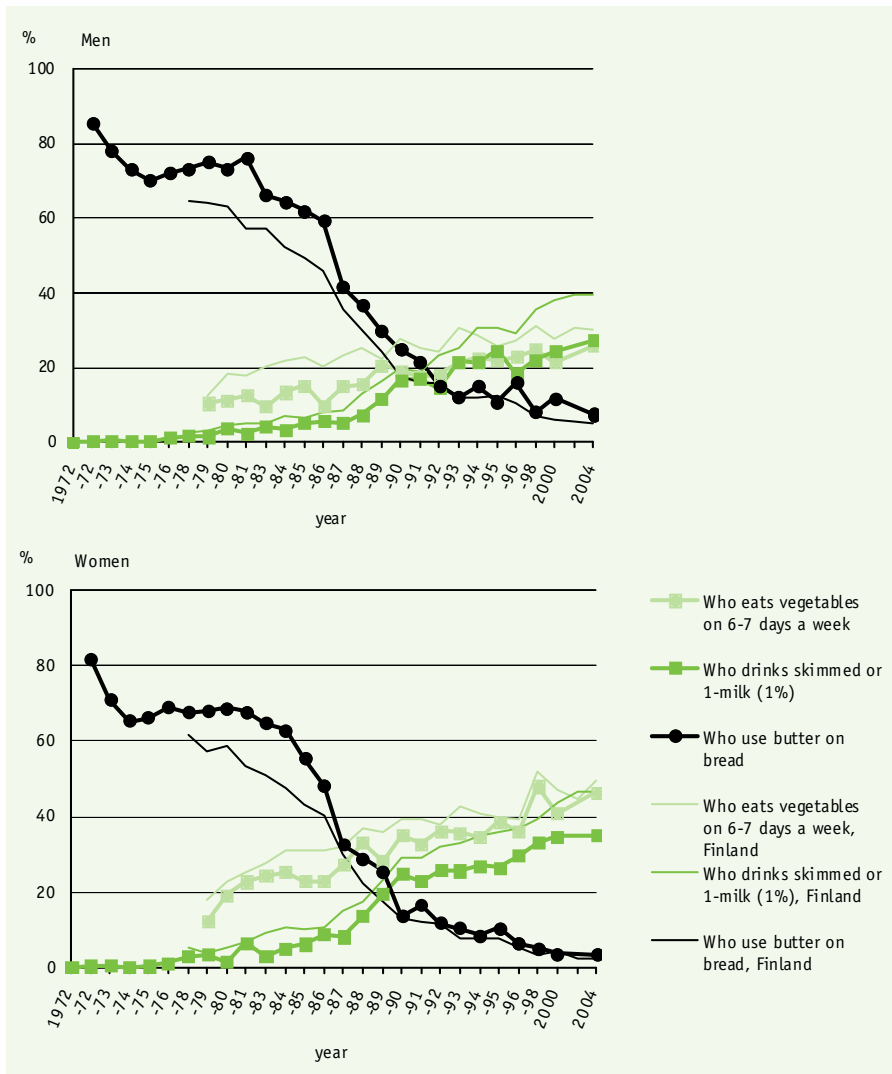
Figure 8. Proportion (%) of those eating vegetables daily, drinking skimmed or 1-milk (1% fat) and using butter on bread among 25–59-year-old population in North Karelia and in Finland, by gender in 1972–2004.
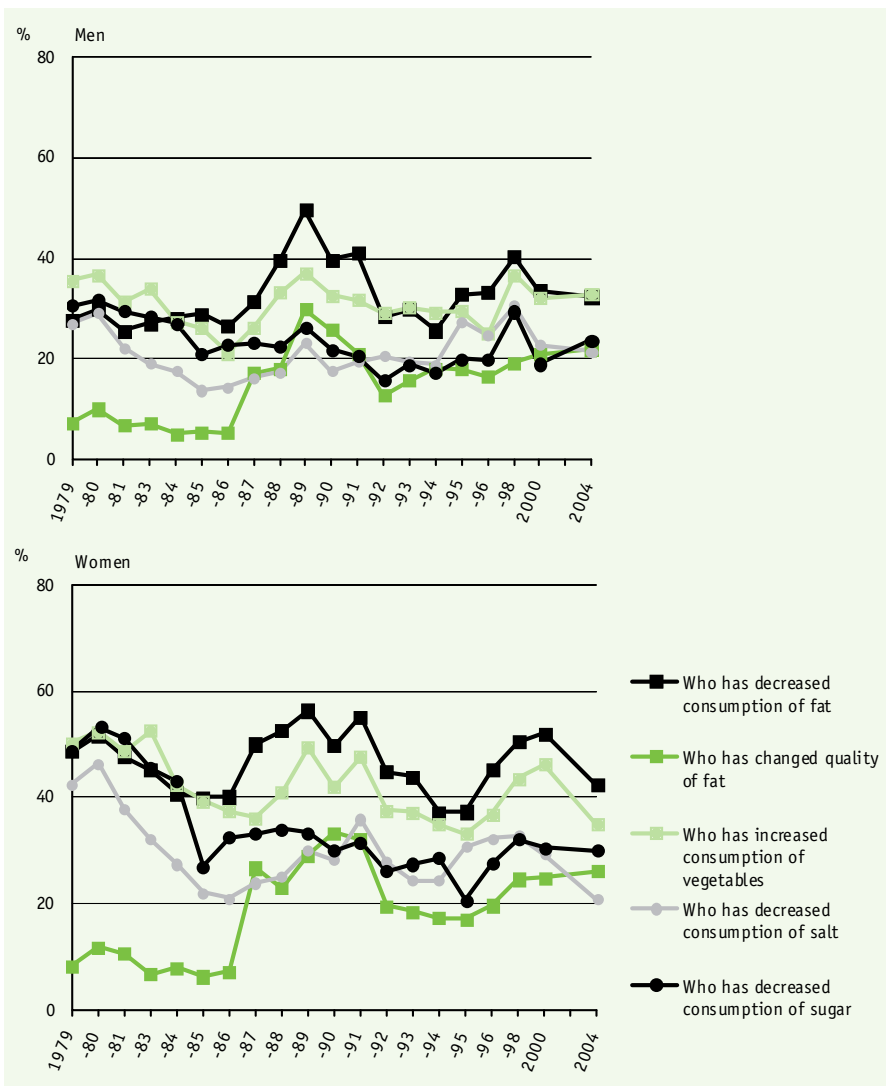
Figure 9. Proportion (%) of those who reported changes in some dietary habits in North Karelia in 1979–2004.

Alcohol consumption

The proportion of people reporting that they used alcohol was about 85 per cent among men in 1983–2004. Among women the use of any alcohol increased from 65 per cent to 88 per cent in 1983–2004. The proportions of those who drank beer increased among men and women. The proportion of those who had drunk beer during the last week changed among men from 45 per cent to 65 per cent between
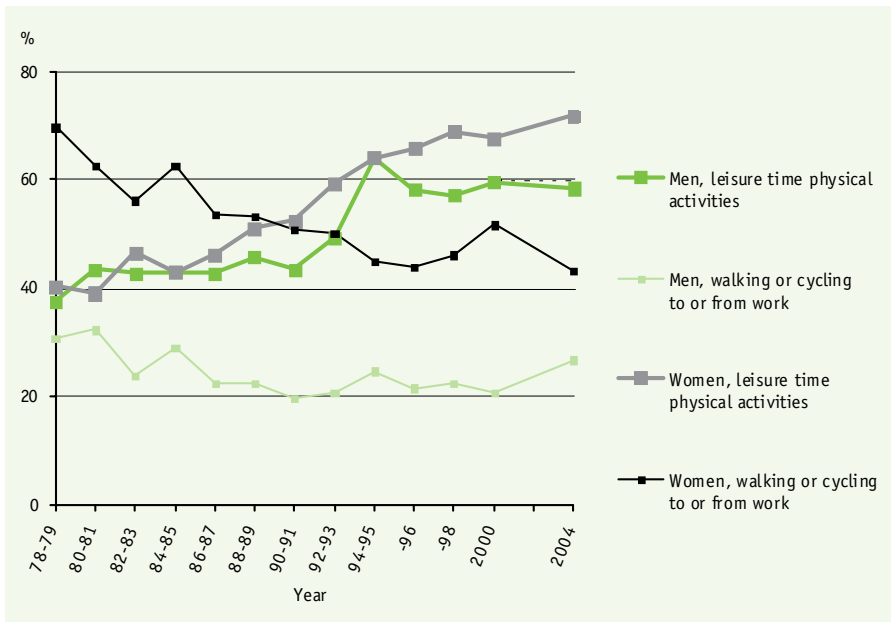
Figure 10. Proportion (%) of those undergoing leisure time physical activities at least 2–3 times a week and those walking or cycling at least 15 minutes per day to or from work in the population aged 25–59 years in North Karelia in 1978–2004.

1978–2004. The corresponding proportion among women changed from 15 per cent to 40 per cent from 1978 to the mid-1990s. After 1995 the use of beer decreased among women, while the use of cider increased. (Figure 11.)

The proportion of those who had drunk strong alcohol during the preceding week remained at the same level among people in North Karelia during the study period. However, the proportion of people who had drunk wine during the preceding week increased among both men and women, from 15 per cent to 25 per cent, and from 15 per cent to 27 per cent, respectively, between 1983 and 2004. (Figure 11.)

Blood pressure and cholesterol measurements

In spring 1972, 28 per cent of men and 44 per cent of women reported that their blood pressure had been measured during the previous half year. Among men 17 per cent reported in 1972 that their blood pressure had never been measured or that they were unaware about it. The corresponding prevalence among women was five per cent. Between 1973 and 1998 almost half of men and 60 per cent of women reported that their blood pressure had been measured during the previous six months. In 1998
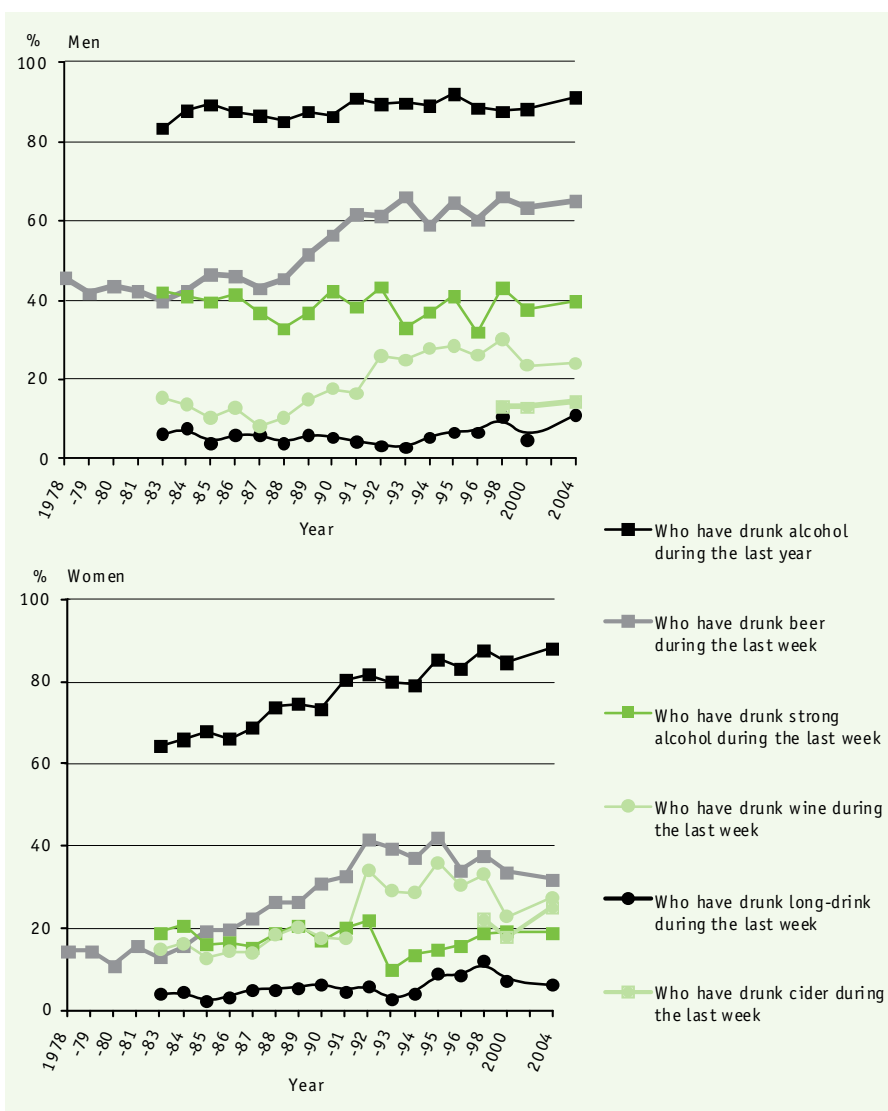
Figure 11. Proportion (%) of those, by gender, who had drunk alcohol during the past year and those who had drunk beer, wine, long drinks, cider or spirits during the past week, in North Karelia in 1978–2004.

under two per cent of men and women reported that their blood pressure had never measured (Figures 12 and 13).

In spring 1972 in North Karelia eight per cent of men and six per cent of women reported that their serum cholesterol had been measured during the previous half year. Among men and women about 80 per cent reported in 1972 that their serum cholesterol had never measured or they were unaware about it. The blood
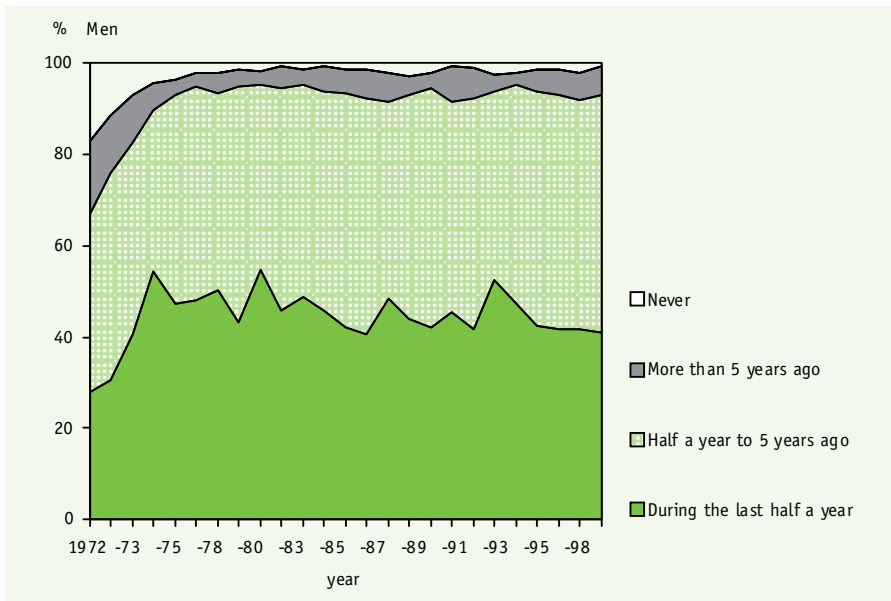
Figure 12. Time of last blood pressure measurement among 25–59-year-old men in North Karelia in 1972–1998 (%).
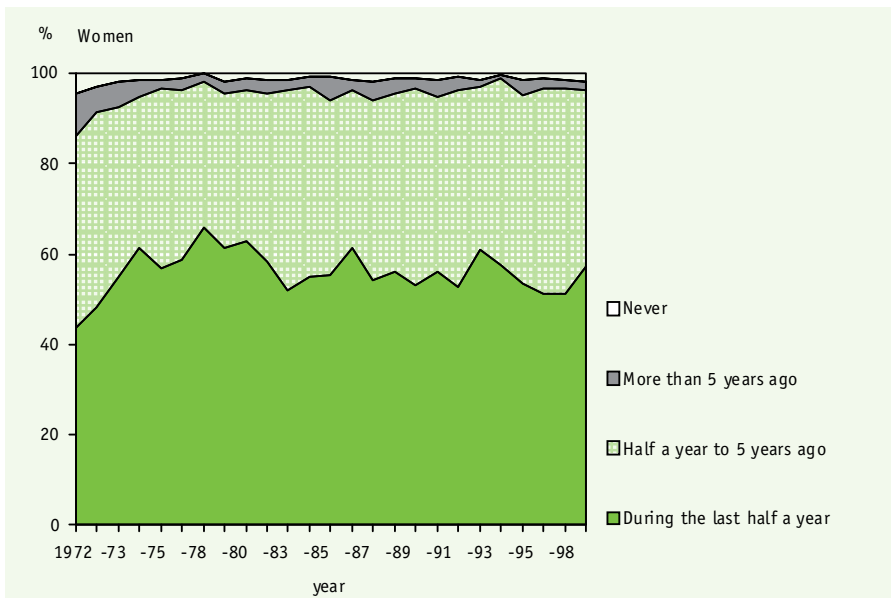
Figure 13. Time of last blood pressure measurement among 25–59-year-old women in North Karelia in 1972–1998 (%).

cholesterol measurements increased sharply between 1972–1978 and again between 1988–1989.

The proportion of those who told that their serum cholesterol had never been tested decreased so that since 1990 about 20 per cent of men and 15 per cent of women reported that their serum cholesterol had never been measured. Until the end of 1980s the prevalence of serum cholesterol testing was more common among men than among women, while since 1988 it has been almost equal (Figures 14 and 15).

DISCUSSION

Changes in health behaviour in North Karelia have been substantial over the study period, particularly in regard to dietary habits. In 1972 over 80 per cent of the province's citizens used mainly butter on bread, while this had declined to just five per cent in 2004. The prevalence of high fat milk consumption dropped among men from 70 per cent to 9 per cent, and among women from nearly 60 per cent to 3 per cent. However, the alcohol consumption in North Karelia grew during the study period, mostly in regard to wine and beer. Leisure time physical activity increased steadily.

The prevalence of smoking among men decreased from 51 per cent to 31 per cent. Smoking among women in North Karelia increased from 12 per cent to 22 per cent in 1994 and has thereafter reduced to 18 per cent and remained at a lower level than in the national sample. It should be noted that the standard criteria used for current smoking here are broader than for daily smoking. Thus the respective rates for daily smoking at the beginning of 2000s were 28 per cent for men and 15 per cent for women in North Karelia.

Blood pressure measurements increased in 1972–1974, especially among men, and the rate has since remained high and surprisingly stable. Blood cholesterol testing also increased sharply during the initial project phase between1972–1978, and then again in connection with the North Karelia Cholesterol Project in 1988–1989. The level reached, i.e. some 80 per cent of population having a cholesterol measurement at least within five years, is quite high.

Although the postal survey used for health behaviour monitoring cannot supply very detailed data on health related lifestyles, the trends observed are likely to be largely valid because the method has stayed very similar throughout. The more detailed published reports provide a good deal of extra information on health behaviour in different subgroups of the population (Helakorpi et al., 1993, Helakorpi et al., 2001).

This chapter presents the main results of the health behaviour surveys in North Karelia. A similar monitoring system, as explained earlier, has been operational for all of Finland since 1978. It was introduced after the usefulness of such a system became evident from the original North Karelia Project experiences.
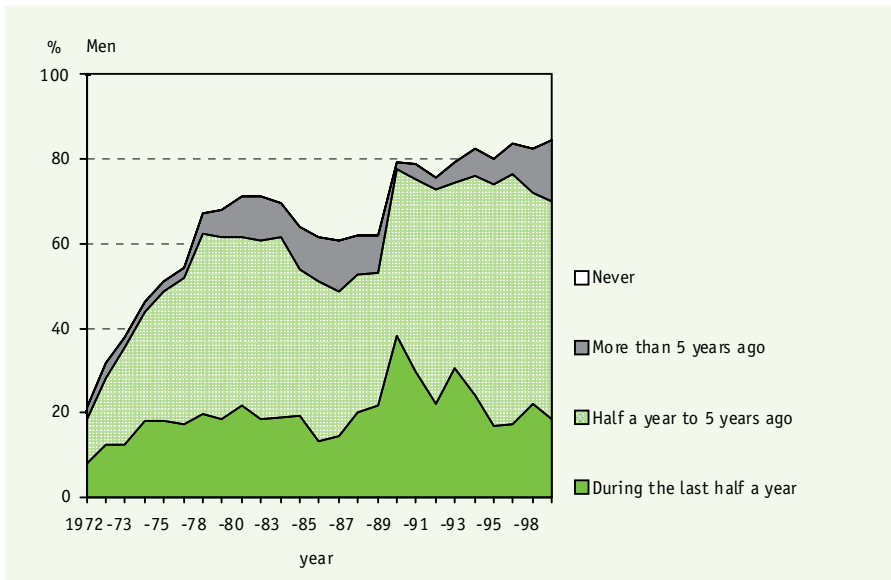
Figure 14. Time of most recent blood cholesterol tests among 25–59-year-old men in North Karelia by gender in 1972–1998 (%).
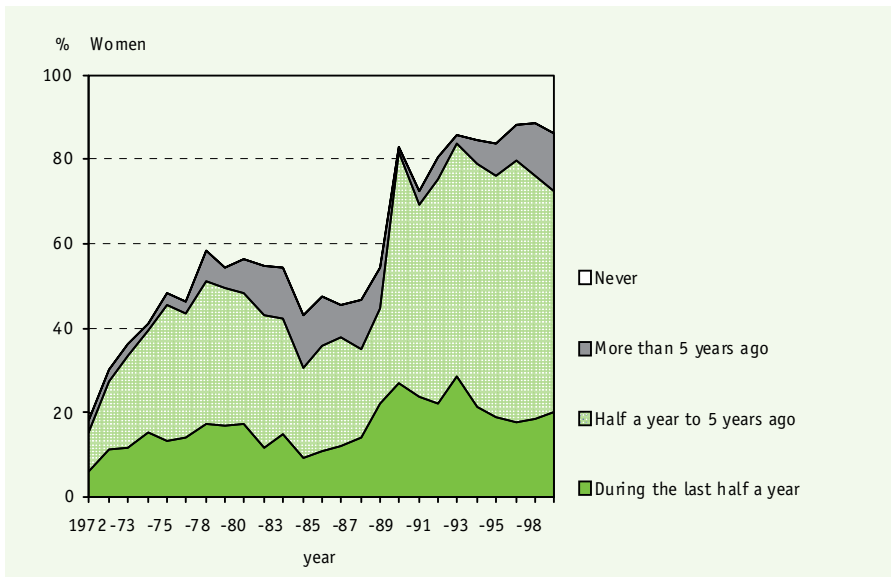

Figure 15. Time of most recent blood cholesterol tests among 25–59-year-old women in North Karelia in 1972–1998 (%).

The results presented in this chapter show overall very major and positive health behaviour changes in North Karelia. These changes are generally in line with the aims of intervention carried by the North Karelia Project. They thus give dramatic evidence

of the possibility of major healthier lifestyle changes among the population. They also give the important background for the risk factor, disease and mortality changes presented in other chapters.

Information presented in this book shows how in many ways North Karelia, not only led by international standards an extremely high risk factor and CVD mortality level, but also a generally worse health behaviour pattern than in the country as a whole. This chapter makes only brief references to the national trends that, particularly since the 1980s, have been very positive in all of Finland. For tobacco, the level in North Karelia has generally stayed below the national average. For diet, in spite of the great improvement in North Karelia, surveyed consumption patterns are healthier in the more urban parts of South Western Finland.

It should be noted, however, that although the results show that the behaviours targeted by the Project have generally changed in a very positive way, not all trends have been positive. The negative trends concern alcohol consumption and obesity. The increase in obesity seems mainly to concern the younger generation, and is related to reduced daily physical activity, and with the increased consumption of soft drinks and some unhealthy food items (pizzas etc.). However, for physical activity it should be noted leisure time physical activity has generally greatly increased.

In addition to serving project evaluation needs, the health behaviour monitoring system has proved a remarkably useful tool of intervention, both in North Karelia and nationwide. The favourable trends have been communicated back to people via the media and health education materials, in order to encourage and reinforce attitudes towards the recommended lifestyle changes. On occasions, the survey has also been deployed to raise concerns and direct health promotion activities for subgroups in particular need. Ensuring that the latest trends in health and health education remain newsworthy issues has proved a very helpful strategy for keeping health-related lifestyles firmly within the "public agenda".

REFERENCES

Helakorpi S, Berg M-A, Puska P. (1993) Health Behaviour among North Karelian Adult Population in 1992–93. Publications of the National Public Health Institute B11/1993. Helsinki.

Helakorpi S, Uutela A, Nummela O, Korpelainen V, Puska P. (2001) Health Behaviour and Health among North Karelian Adult Population, Spring 2000. Publications of the National Public Health Institute B2/2001 (pdf) (in Finnish with English summary).

Helakorpi S, Uutela A, Prättälä R, Puska P. (2000) Health Behaviour and Health among Finnish Adult Population, Spring 2000. Publications of the National Public Health Institute B8/2000. (in Finnish with English summary).

Helakorpi S, Patja K, Prättälä R, Aro A.R, Uutela A. (2004) Health Behaviour and Health among the Finnish Adult Population, Spring 2004. Publications of the National Public Health Institute, B13/2004 (in Finnish with English abstract)

Puska P, Rimpelä M, Sievers K, Tuomilehto J, Virtamo J, Prunnila T, Karjalainen Y. (1973) Pohjois-Karjala projektin peruskartoitus: toteutus ja taulukot. Kuopion korkeakoulun julkaisuja B1/1973. Kuopio.

Puska P, Rimpelä M, Tuomilehto J, Virtamo J, Karjalainen,Y. (1973) Pohjois-Karjala projektin tilannekartoitus n:o 1- syksy 1972. Kuopion korkeakoulun julkaisuja B5/1973. Kuopio.

WHO. Community control of cardiovascular diseases. Evaluation of the comprehensive community programme for control of cardiovascular diseases in North Karelia, Finland 1972–1977. (1981) World Health Organization, Regional Office for Europe, Copenhagen.

8. DIETARY CHANGES

Pirjo Pietinen, Liisa Valsta and Merja Paturi

The start of important nutrition policy events reach back to the 1940s, when e.g. the law of free school lunches for all primary school pupils was decreed. Since launching the Nordic nutrition recommendations in 1968, the National Nutrition Council has published national nutrition recommendations, dietary guidelines and action plans regularly.

Enrichment of foods started in the 1940s, when the adding of vitamins A and D to margarine and the enrichment of salt with iodine were started. Vitamin D enrichment has been recently again in focus when the enrichment of margarines and liquid milk products with vitamin D was revised in 2003. An internationally interesting decision was the start of selenium supplementation of all fertilizers in Finland in 1985. The intake of selenium has more than doubled since the 1970s.

Dietary and health monitoring has a long history in Finland. Food balance sheet data has been collected systematically since 1950 (Ministry of Agriculture and Forestry), and large dietary surveys have been carried out since the late 1960s, first by the Social Insurance Institution and then by the National Public Health Institute. Since 1982, dietary surveys have been carried out every fifth year as a part of the National FINRISK Studies by the National Public Health Institute. The latest FINDIET survey was carried out in 2007.

The Finnish diet has changed remarkably during the past decades. Since many of the most important changes took place already in the 1960s and 1970s, the trends based on Food Balance Sheets since 1950s are shown in Figure 1. There has been a particularly big decrease in the consumption of potatoes and fats, and an increase in fruit and vegetables. More detailed Figures (2-8) show the changes since the late 1970s. Vegetable consumption has tripled since then. Vegetable margarines and butter/oil mixtures have mostly replaced butter, and low-fat milk and skimmed milk have replaced fatty milks. However, the consumption of yoghurt and cheese has increased considerably. Fruit juices as well as juices with added sugar have become popular, and the consumption of soft drinks and alcohol has increased. There have been relatively small changes in beef and pork consumption, while chicken consumption has increased. Most of the meat consumed is very lean pork.
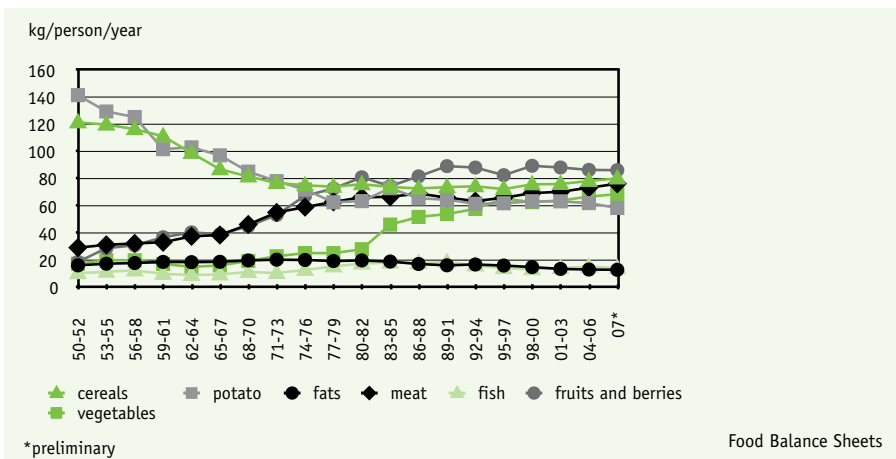
kg/person/year

Legend: cereals · potato · fats · meat · fish · fruits and berries · vegetables

*preliminary

Food Balance Sheets

Figure 1. Food consumption in Finland 1950-2007*

Kg/person/year

Legend: cereals · potato · sugars · fruits and berries · vegetables

*preliminary

Food Balance Sheets
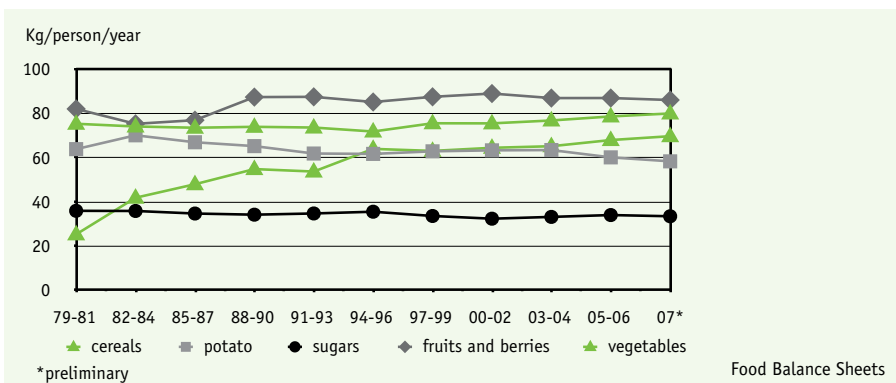
Figure 2. Plant food consumption in Finland

kg/person/year

Legend: fats,total · butter · margarine · butter/oil-mixture · oils

*preliminary

Food Balance Sheets
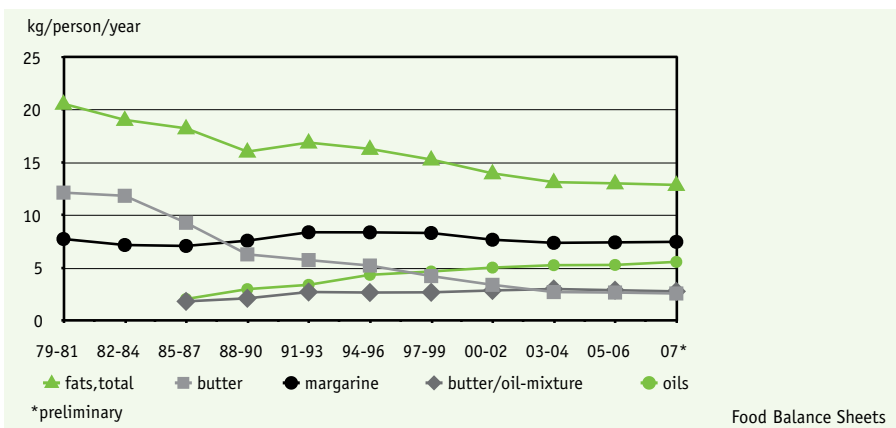
Figure 3. Fat consumption in Finland

104

Kg/person/year
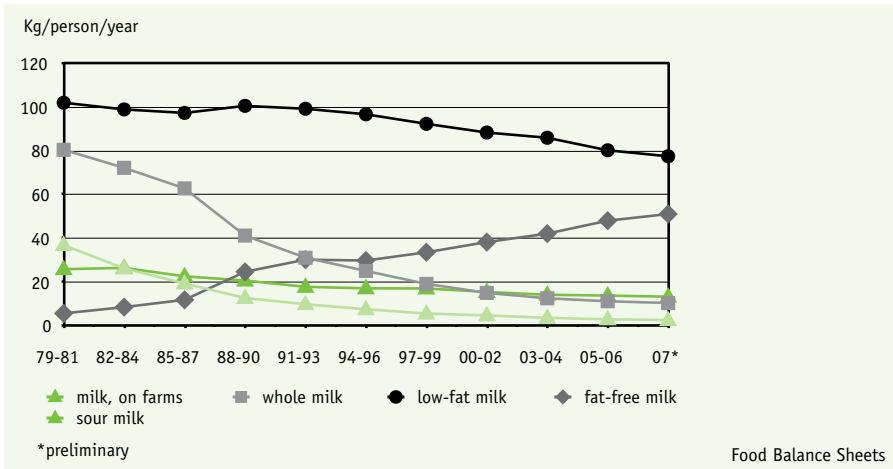
Figure 4. Milk and sour milk consumption in Finland

Kg/person/year
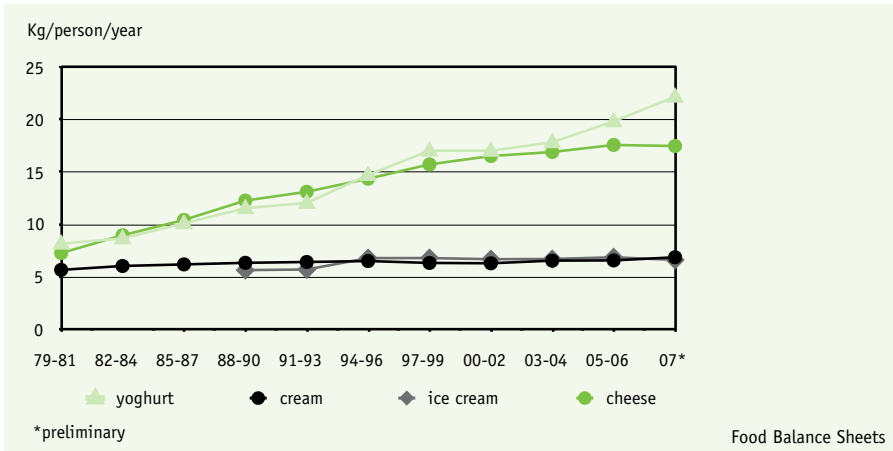
Figure 5. Milk product consumption in Finland

Kg/person/year
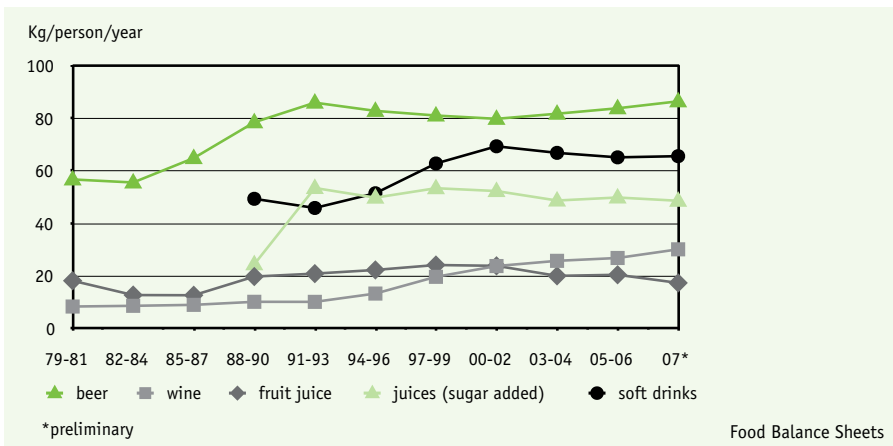
Figure 6. Beverage consumption in Finland

kg/person/year
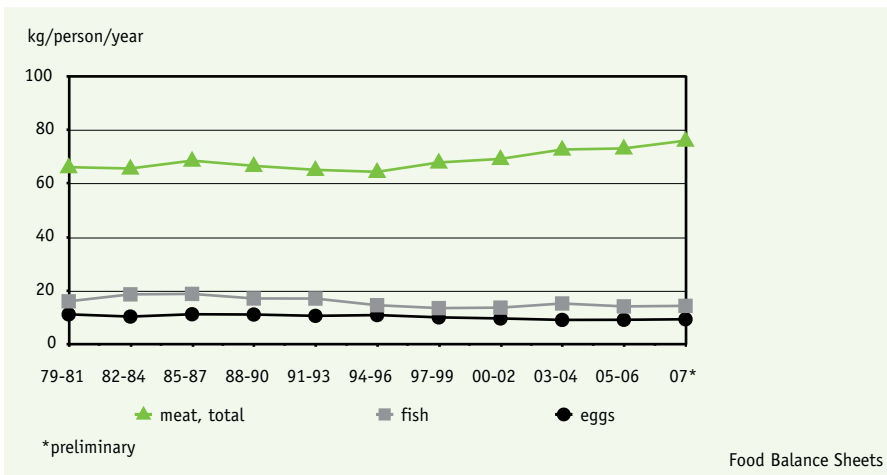
Figure 7. Meat, fish and egg consumption in Finland

Food Balance Sheets

kg/person/year
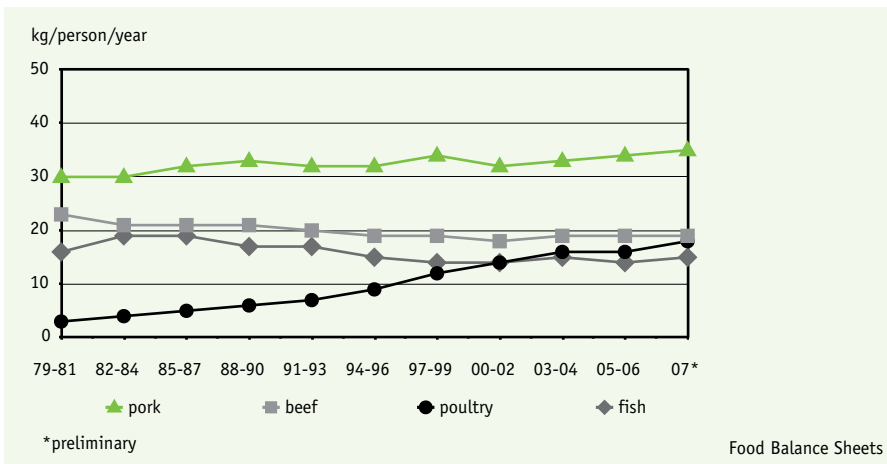
Figure 8. Pork, beef, poultry and fish consumption in Finland

Food Balance Sheets

E%

Recommendations

Total fat (25-35 E%)
SFA (~10 E%)
MUFA (10-15 E%)
PUFA (5-10 E%)

Year
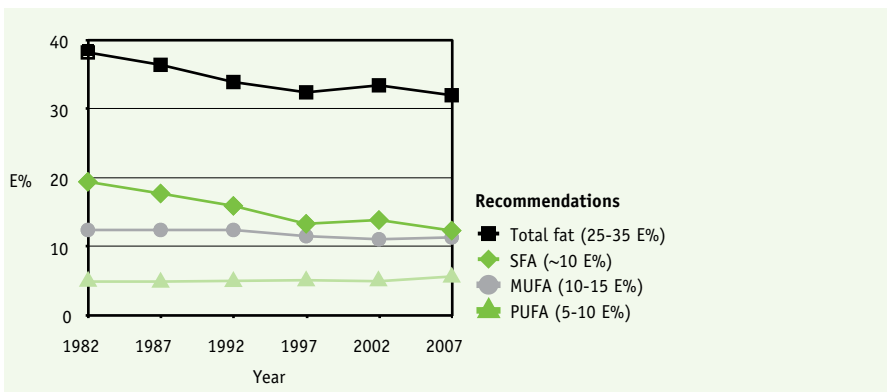
Figure 9. Fat intake in Finland 1982-2007
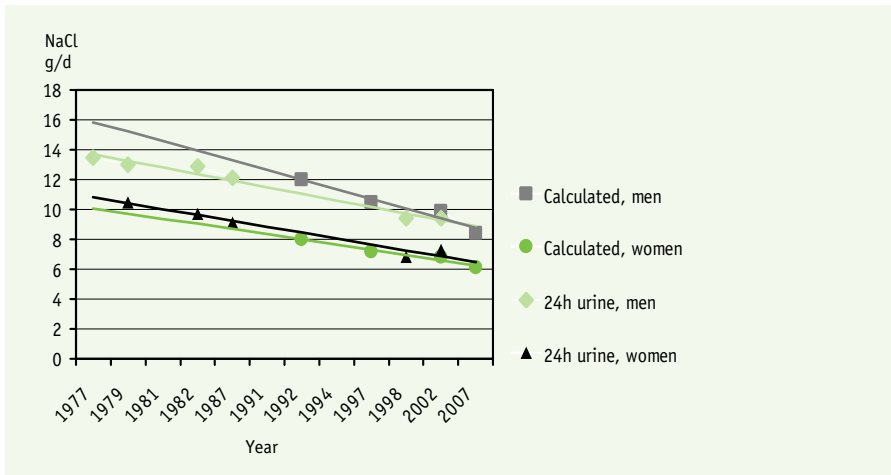
Figure 10. Salt intake in Finland 1977-2007

The favourable trends in food intake are reflected in the intake of fats from the early 1970s to 2007 (Figure 9). The intake of total fat has decreased from about 38 % of energy (E%) to 31-32 E%, the recommendation being 25-35 E%. The proportion of saturated fatty acids has decreased from about 20 E% to 12-13 E% (recommendation about 10 E%), and polyunsaturated fatty acids increased from 3 E% to 5-6 E% (recommendation 5-10 E%). The share of monounsaturated fatty acids has been quite stable and within the recommended range, 10-15 E%. The intake of trans fatty acids is very low, only 0.4 E% (recommendation less than 1 E%).

The sources of fats have changed remarkably. Decades ago saturated fatty acids came from milk, butter and meat, while now the sources are plenty and mostly hidden in foods. Most of the unsaturated fatty acids come from soft fats spreads and oils used in cooking.

The Finnish diet has traditionally been quite salty, and consequently, high blood pressure is a commonly found risk factor. However, there has been a marked decrease in salt intake since the late 1970s when special attention started to be paid to this problem (Figure 10). Systematic work has been done to lower salt intake by educating the public and by working with the food industry. In addition, national legislation was revised to enable the labelling of products with reduced salt content such as bread, sausages, cheese and breakfast cereals.

Salt intake in the population has been monitored in connection with the FINRISK studies both with 24-hour urines and by calculating salt intake from the dietary data. There has been about a 20% decrease in salt intake during the past 30 years, salt intake now being 7-8 g in women and 9-10 g in men (Figure 10). The Finnish

recommendation given by the National Nutrition Council is 6 g for women and 7 g for men. The most important sources of salt in the diet are bread, processed meat and fish, and cheeses. The share of household salt has decreased over time, and the share of salt used by food industry and catering has increased.

In conclusion, the Finnish diet has changed remarkably during the past decades. This is reflected in favourable changes in cardiovascular risk factors and, thus, in improved heart health. However, even though the quality of the diet has improved, being overweight and obesity have become a bigger health problem, as can be seen in other chapters in this book. Everyday physical activity has decreased, the price of food has decreased, portion sizes have increased, and also the availability of unhealthy foods such as sugary beverages, sweets and snack food has increased. These are the new challenges we are facing now.

REFERENCES

Balance sheets for food commodities. Information centre of the Ministry of Agriculture and Forestry.

Laatikainen T, Pietinen P, Valsta L, Sundvall J, Reinivuo H, Tuomilehto J (2006) Sodium in the Finnish diet : 20-year trends in urinary sodium excretion among the adult population. Eur J Clin Nutr 60:965-970.

Reinivuo H, Valsta L, Laatikainen T, Tuomilehto J, Pietinen P (2006) Sodium in the Finnish diet: trends in sodium intake and comparison between intake and 24-hour excretion of sodium. Eur J Clin Nutr 60:1160-1167.

Paturi M, Tapanainen H, Reinivuo H, Pietinen P (Eds.)(2008) Finravinto 2007 -tutkimus – The National FINDIET 2007 Survey. Publications of the National Public Health Institute, B23/2008. Available at: http://www.ktl.fi/attachments/suomi/julkaisut/julkaisusarja_b/2008/2008b23.pdf (in Finnish, with English tables, figures and summaries)

9. HYPERTENSION CONTROL

Aulikki Nissinen and Jaakko Tuomilehto

INTRODUCTION

The association between hypertension control and cardiovascular morbidity and mortality was first exposed in the 1960s (Veterans Adminstration Cooperative Study, 1967 and 1970). At the same time, studies were revealing that the control of hypertension at the community level remained a considerable problem. In many countries roughly half of the hypertensive individuals at the general population level were aware of their elevated blood pressure; half of these were under treatment, and half of those under treatment were adequately controlled (Wilberg and Barrow 1972, Hypertension detection and follow-up cooperative study group 1978). In the early 1970s this was also the prevailing situation in North Karelia (Tuomilehto et al. 1980).

In 1971 the WHO expert group proposed a cooperative study of community-based pilot programmes for hypertension control (WHO 1971). It was emphasized that pilot programmes should first be established and carefully evaluated before a nationwide programme was implemented. A total of 16 centers joined the study. One of these was North Karelia, where a hypertension programme was an integral part of the North Karelia Project.

THE HYPERTENSION PROGRAMME OF THE NORTH KARELIA PROJECT

The Hypertension programme was an essential part of the North Karelia Project aimed at reduction of the prevalence of high blood pressure in the population. The specific objectives were: (1) to detect as many hypertensive people as possible; (2) to control blood pressure in as many of them as possible; (3) to establish uniform and appropriate diagnostic and therapeutic methods among physicians; and (4) to gather information on the epidemiology of hypertension and on hypertension-related functions of the health services. Hypertension programme activities were targeted at the entire population, and at reorganizing the care of hypertensive patients.

Health education

Hypertension mostly fell within the project's general health education programme. The specific issues targeted for improved public awareness were:
- hypertension as a risk factor for cardiovascular diseases
- the importance of proper treatment for hypertension
- the services offered for screening, treatment and monitoring of hypertension.

The public received the majority of its health education from newspapers and the radio. However, the bulk of the educational material on hypertension was given to individuals with high blood pressure visiting the health centers. Health centers also passed relevant material supplied to them by interest groups such as pharmaceutical companies and the Finnish Heart Association.

Services for hypertensive individuals

The hypertension programme was integrated into existing health care. Special hypertension clinics were set up in each local health center to deal with the influx of hypertensive clients. The clinics were run by public health nurses who were trained by the Project and assumed the principal responsibility for monitoring of patients. The nurses also offered training to the local health personnel that emphasized the importance of streamlining the activities planned. The training goals were to standardize physicians' diagnostic and therapeutic methods and practices, and to unify the techniques employed by nurses for the monitoring and health education of hypertensive patients. Training of the health personnel took the form of seminars, written guidelines and personal contacts.

Hypertension cases

One of the first tasks of the intervention was to register the hypertensive patients already in contact with health services. Thereafter, detection was a gradual process based on the systematic blood pressure measurement of everyone who visited a physician or public health nurse in the area and who had not been checked recently. Actual screening programmes were often run simultaneously. For example, blood pressure was measured at the obligatory x-ray screening for pulmonary tuberculosis, at the health examination for general cardiovascular risk in men, at cervical cancer screening in women, and at other ad hoc screening procedures.

Treatment and monitoring of patients

Most of the patients were seen at a local health center, where physicians were responsible for the diagnosis and treatment. Very few hypertensive patients were treated at hospital. It was realized at the planning stage that due to the large number of patients it would be impossible to organize the monitoring of hypertensive patients solely through physician-based activities, and that the public health nurses would have to be capable of participating in this task. The hypertension clinics were thus established in the primary health care. If a person had elevated blood pressure in the screening, he or she was asked to visit the hypertension clinic for re-measurement. During these visits (usually three), the nurse inquired about the medical history, and checked smoking, dietary and exercise habits, consumption of salt and drugs, etc. If elevated blood pressure persisted at the third re-measurement, the nurse advised the subject to visit the physician.

The physician's appointment involved checking the medical history, taking samples for laboratory tests and performing a clinical examination. The physician decided on any necessary treatment and the intensity of monitoring. Hypertensive patients usually visited the physician twice a year and the public health nurse two or three times.

The health education material given to hypertensive persons in the clinics covered the following issues:

- elevated blood pressure as a risk factor for cardiovascular diseases,
- the importance of the proper treatment for high blood pressure,
- the importance of regular monitoring,
- the role of smoking and diet on the development of cardiovascular diseases,
- the influence of weight reduction on blood pressure level.

The possible benefit to blood pressure of reducing salt consumption was not included in health education until the late 1970s.

Information system

The hypertension register of the North Karelia Project was established at the start of the programme to serve its overall evaluation needs. The purpose was to register all hypertensive persons in North Karelia and serve the process of monitoring them (Nissinen et al. 1981). By 1988 some 22 000 hypertensive patients had been recorded in the project's register for North Karelia. The register was used to ensure annual follow-ups and to accumulate the respective monitoring data.

In addition to this, each public health nurse in the hypertension clinics kept her own manual record of routine work. This included a patient card for each subject, where observations were made during each visit. The hypertension register, by contrast, was updated only once a year. Another component of the information system was a personal notebook given to each hypertensive patient upon registration. The subject was advised to show the notebook in contacts with health personnel, thereby informing physicians and nurses that he/she was already registered.

Evolution of the hypertension care

North Karelia

After the first five years of the Project, the hypertension programme continued comprehensively over the next two decades. Reorganizing the hypertension control services took place during the first two years of the Project, while the training of health care personnel continued in collaboration with the local and provincial authorities. Training included instructions in practical programme tasks as well as pharmacological and other aspects of hypertension control. After 1982 the operation of the provincial register ceased and the monitoring of hypertensives was left to the health centers, with continuous background support from the Project. There has since been increasing orientation towards the non-pharmacological control of hypertension: salt and weight reduction, and changes in the amount and quality of dietary fat.

Parallel to the national implementation, some further activities were tested in North Karelia, which maintained its role as a national demonstration area until the late 1990s. One of the activities after the Project was the North Karelia Salt Project, which produced information for the national authorities about the exceptionally high level of salt intake in the area, as well as obstacles to the attempt to change people's behaviour in terms of salt intake (Tuomilehto et al 1981, Tuomilehto et al 2001).

National activities

The national implementation of the activities in hypertension control started in the late 1970s after careful evaluation of the effects and experiences of the Project. (Nissinen et al. 2004). The activities started by The National Hypertension Committee were nominated by the Ministry of Health already in 1976. The Committee (1978) made practical recommendations for the detection, diagnosis and treatment of hypertension among the entire population. Also the responsibilities of different authorities and other interest groups were defined. The purpose was to make a local plan for each of the 12 provinces in Finland. This activity took hypertension as a

public health problem onto the national agenda, and the practical recommendations formed an excellent basis for reorganizing the care, if needed. The plan emphasized the collaboration between community health centers in primary care and the specialized hospitals.

The work of the Committee created several activities, of which worth mentioning is a national meeting in 1980 for salt as a risk of hypertension. Representatives of the food industry, health and nutritional science, health care and relevant administration started the dialogue on the health consequences of excess salt intake and of possible activities for controlling the problem. Increasing awareness among the population at large has guaranteed a continuous demand for less salty products, which eventually have become available in a wide variety. Labelling of food products, including sodium and salt, started in the late 1980s, when also food products were classified according to salt content into three categories, strong, normal and reduced salt content by the Ministry of Trade and Industry. Salt intake has gradually decreased in Finland, but is still higher than the recommended 5-6 g NaCl/ day (Laatikainen et al 2006).

The role of medical society has become more prominent since the 1990s. The evidence-based guidelines for the diagnosis, treatment and follow-up of hypertensive patients were developed for health care first in 1994 and later in 2000. Special guidelines for prevention of hypertension were agreed upon in 1994 (Finnish Heart Foundation, 1994). And the new evidence-based guidelines were established in 2004, with updates every two years (Jula 2006).

RESULTS OF HYPERTENSION CARE

North Karelia 1972-1977

The results from the first five years (from 1972 to 1977) of the Project showed that hypertension awareness among the general population increased, both systolic and diastolic blood pressures decreased and the treatment was more effective in North Karelia than in the reference area (Table 1, Tuomilehto et al. 1980). According to a separate analysis, the programme proved to be cost effective (Nissinen et al 1986).

Table 1. Mean blood pressure, prevalence, awareness and antihypertensive drug treatment of hypertension, and adequate control of treatment among the 30-59 year old population in North Karelia and reference area (Kuopio) from 1972 to 1977.

		North Karelia		Kuopio	
		1972	1977	1972	1977
Blood pressure (mmHg)					
	Men	149/92	143/89	146/93	146/93
	Women	153/92	141/86	147/91	143/88
Prevalence of hypertension (%)[1]					
	Men	44	30	45	40
	Women	49	28	42	32
Prevalence of antihypertensive drug treatment (%)					
	Men	4	10	4	10
	Women	10	14	9	13
Awareness of hypertension [1] among hypertensive persons					
	Men	32	64	29	51
	Women	59	80	56	73
Control of blood pressure among hypertensive persons with antihypertensive drug treatment					
	Men	2	8	1	3
	Women	2	17	2	9

1) Hypertensive person: Systolic blood pressure >160 mmHg and /or diastolic blood pressure > 95mmHg or under antihypertensive drug treatment

National development 1982-2002

The twenty years of development on blood pressure levels and hypertension care from 1982 to 2002 are presented in the comparison of three different areas in Finland, from North Karelia and Kuopio (eastern Finland) and Turku-Loimaa from southwestern Finland (Kastarinen et al 2006). Mean systolic and diastolic blood pressure and the prevalence of hypertension decreased significantly in all areas (Figure 1 and Figure 2).

The proportion of men in the entire population using antihypertensive drugs increased significantly in all areas, but no change was observed among women (Figure 3). The proportion of treated hypertensive subjects with adequately controlled blood pressure (SBP < 140 mmHg and DBP < 90 mmHg) increased significantly from 14 to 33% in men and from 11 to 32% in women. The unsatisfactory treatment of hypertension was mainly due to the lack of control of systolic blood pressure. Further analysis showed that 34% of the entire population currently not on hypertensive drug treatment should have been prescribed such a treatment within a year according to the 2003 ESH-ESC guidelines (Guidelines Committee 2003).
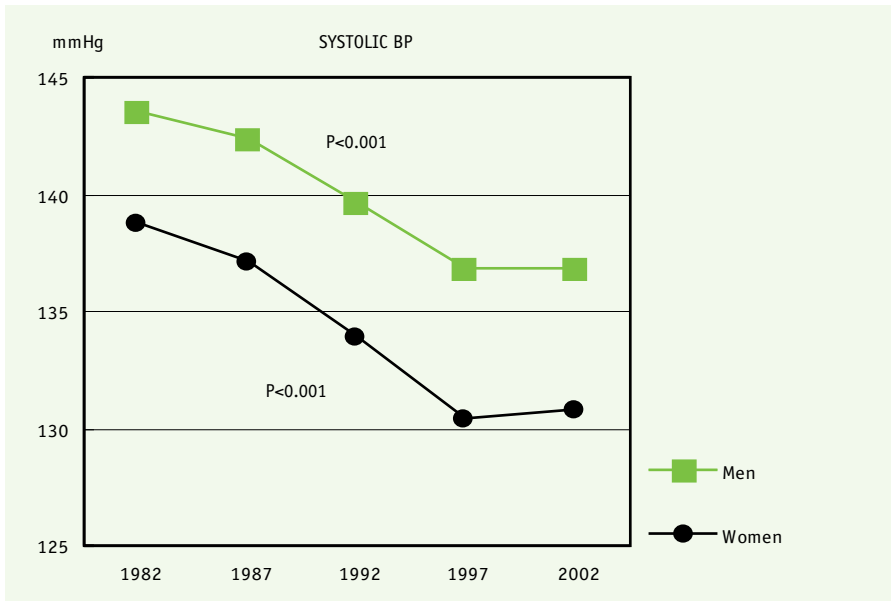
Figure 1. Mean systolic blood pressure (mmHg) by sex and year in the national FINRISK Study during 1982-2002 (Kastarinen et al 2006)
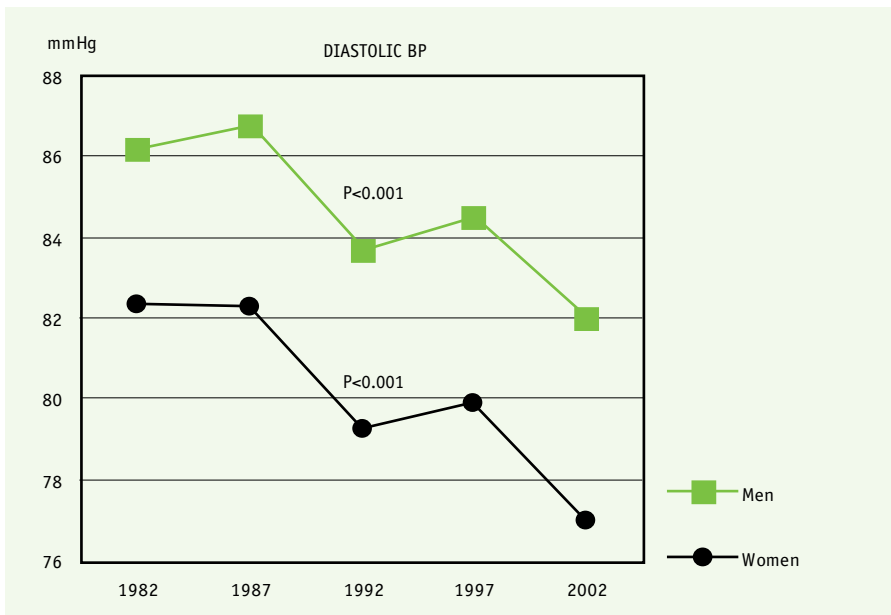

Figure 2. Mean diastolic blood pressure (mmHg) by sex and year in the national FINRISK Study during 1982-2002 (Kastarinen et al 2006)
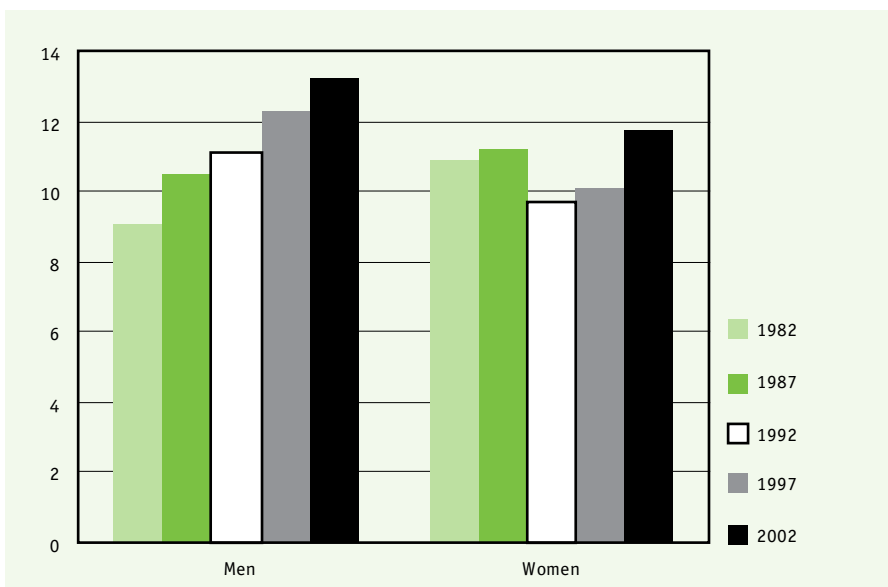
The indications of some life style factors were also analyzed in four groups according to their blood pressure level and antihypertensive treatment status: normotensive, unaware hypertensive, aware but untreated hypertensive, treated hypertensive subjects (Kastarinen et al 2007). For these analysis the three areas were pooled together. The results show that mean body mass index (BMI) increased significantly in all groups except in untreated hypertensive women. Alcohol intake increased in all men but especially in hypertensive women. The 24-h urinary sodium excretion increased significantly in all blood pressure groups. And the proportion of subjects with a recommended level of leisure time physical activity increased significantly and similarly in all the groups.
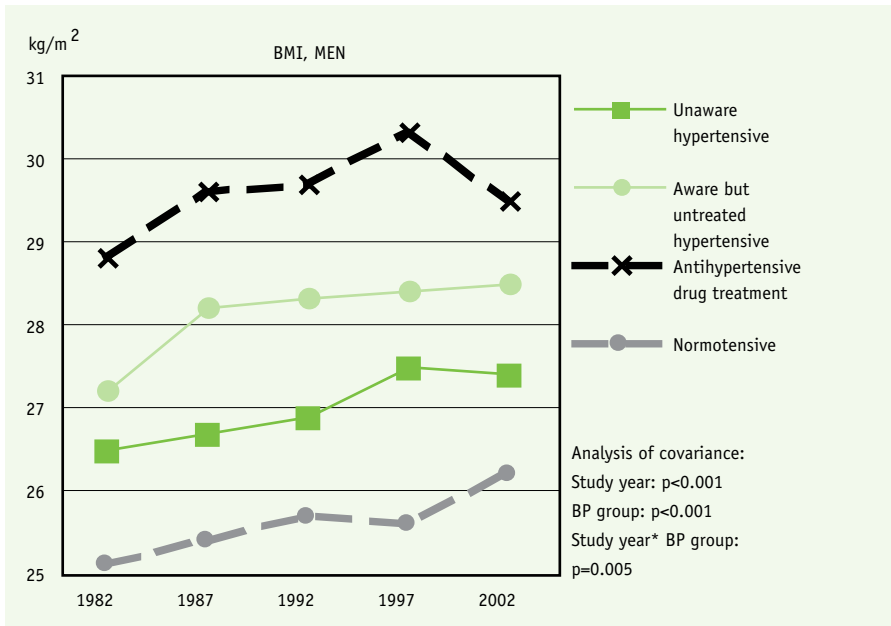
Figure 4. Mean body mass index (kg/m²) and its change from 1982 to 2002 according to blood pressure status among men (Kastarinen et al 2007)
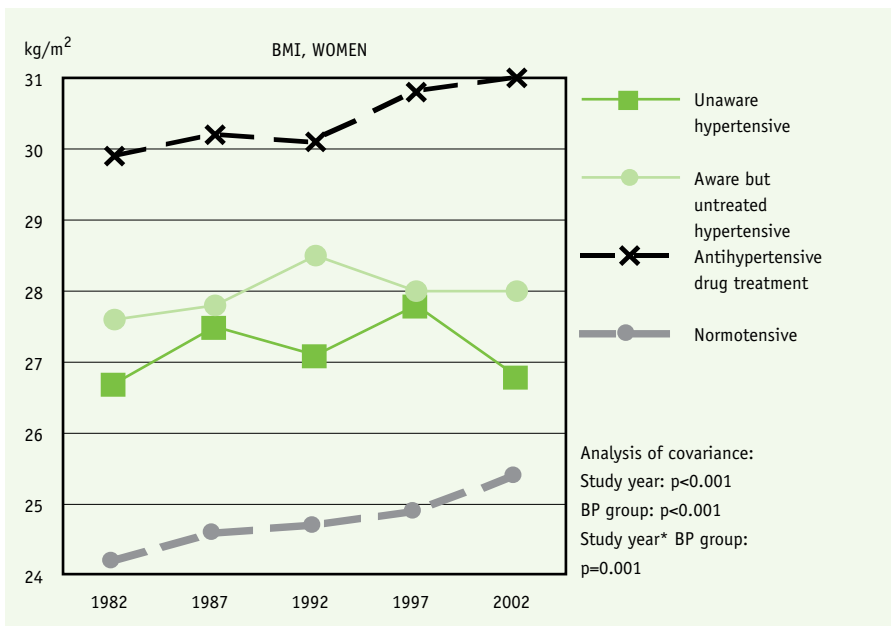

Figure 5. Mean body mass index (kg/m²) and its change from 1982 to 2002 according to blood pressure status among women (Kastarinen et al 2007)

DISCUSSION

The hypertension control programme of the North Karelia Project is one of the few carefully planned and evaluated community-based control actions for hypertension care. It was found to be both feasible and effective: hypertension care improved markedly and hypertension was brought under control in a considerable proportion of hypertensive persons during the period from 1972 to 1977 (Tuomilehto et al. 1980, Nissinen et al. 1981, Nissinen et al. 1983). The programme had a clearly favourable effect on the blood pressure control of hypertensive persons in the community and on the general blood pressure level of the population as a whole. During the follow-up period 1977 to 1982, hypertension care was maintained but no further improvements noted. In the province of Kuopio, the initial reference area, the improvement in hypertension care began later, and more or less in line with the nationwide trend during the observation period (Nissinen et al. 1988). Overall, most of the favourable trends in hypertension were probably due partly to the reorganizing of the hypertension care system and partly to the intensive health education in the community.

Since the start of the hypertension programme of the North Karelia Project in the early 1970s knowledge on the consequences of elevated blood pressure has accumulated. New information has infuenced the development of guidelines for both primary prevention and tratment of hypertension. For instance, the blood pressure values in defining hypertension have become lower, which has modified the treatmet practicies. At the same time new drugs have been introduced. During the last three decades betablockers from the 1970s, ACE inhibitors, and calcium channel blockers, have become the main stay of therapy Finland (Nissinen et al 2004). These new regimens have increased the costs of hypertension care, which has warrant from the authorities for seeking methods to control the costs. One example from the early 1980s of a factor which possibly had a significantly moderating influence in this context is the change in hypertension care policies which took place between 1977 and 1982. The new nationwide recommendations introduced in 1978 contained relatively strict eligibility criteria for free antihypertensive drug treatment, which meant that in practice drug treatment was initiated at higher blood pressure threshold levels than before. These new criteria probably resulted in fewer treated patients, especially among women between 1977 and 1982. Since the 1980s the actions to regulate resources needed for hypertension care have resulted in a situation where the patients themselves cover a considerable part of the costs of drug treatment, which currently is among the highest proportion in the European Community. Even though the bulk of patients can afford the costs, the most vulnerable groups of society are in danger of becoming noncompliant due to costs of drugs.

Hypertension care has improved significantly in both men and women in Finland since the 1980s. Despite the simultaneous decrease in the prevalence of hypertension, half of the men and a third of women were still classified as hypertensive in 2002, when using European guidelines for the definition of hypertension (Guidelines Committee 2003). The rates of awareness, treatment and control of hypertension have increased significantly, but in 2002 only two thirds of hypertensive subjects were aware of their condition; half of those who were aware were on antihypertensive drug treatment and only a third of those were adequatly controlled (Kasterinen et al 2006).

Some lifestyle factors affecting blood pressure have developed favourably in both hypertensives and normotensives (Kastarinen et al 2007). Leisure time physical activity has incresed and salt intake decreased. Even though the effects of smoking per se on blood pressure according to current knowledge is small, the reduction of smoking among hypertensive subjects in cardiovascular risk is of major importance. In contrast to these encouraging findings, mean BMI and alcohol intake have inreased significantly. These findings indicate that there is an obvious need for intensifying activities in health care torwards comprehensive patient counselling on lifestyle, like diet and physical activity among patients with or without antihypertensive drug treatment. Minor changes in treatment and proper follow-up of the patients contribute to significant benefits in terms of blood pressure control and cardiovascular risk as the controlled trial by Kastarinen et al. in primary care in Finland has shown (2002).

Despite a marked improvement of control of hypertension in Finland, the country still has a very high blood pressure level in international comparison (Wolf-Maier et al 2003, Antikainen et al 2006). Thus intensified effort using both 'the population approach' and 'the high risk approach' are needed to improve the situation further. This includes effective antihypertensive drug treatment as well as lifestyle counselling among patients, and health promotion at population level. These measures, combined with effective monitoring, provide the foundation for the control of hypertension in the population.

REFERENCES

Antikainen RL, Moltchanov VA, Chukwuma C Sr, Kuulasmaa KA, Marques-Vidal PM, Sans S, Wilhelmsen L, Tuomilehto JO; for the WHO MONICA Project (2006). Trends in the prevalence, awareness, treatment and control of hypertension: the WHO MONICA Project. *Eur J Cardiovasc Prev Rehabil* **13**: 13-29.

Finnish Heart Foundation (1994). Working Group Report on Primary Prevention of Hypertension. *Suomen Lääkärilehti* **49**:1821-1928.

Guidelines Committee (2003). European Society of Hypertension- European Society of Cardiology quidelines for management of arterial hypertension. *J Hypertension* **21**: 1011-1053.

Hypertension Detection and Follow-up Cooperative Study Group (1978). Mild hypertensives in the hypertension detection and follow-up program. *Ann NY Acad Sci* **304**:254-266.

Jula A, Kantola I, Koivisto P, Luostarinen E, Mervaala E, Niskanen L, Olkinuora J, Pyörälä K, Ruskoaho H, Tikkanen I, Tuomilehto J, Fyhrquist F, Keinänen-Kiukaanniemi S, Kukkonen-Harjula K, Majahalme S, Nieminen M, Nissinen A, Pentikäinen P, Romo M, Takala J, Tikkanen T, Turjanmaa V. (2006) Kaypä hoito –suosituksen tiivistelmä: Kohonnut verenpaine. *Duodecim* **122**: 339-40.

Kastarinen M for the LIHEF Study Group (2002) Nonpharmacological treatment of hypertension in primary health care: a 2-year open randomised controlled trial of lifestyle intervention against hypertension in eastern Finland *J Hypertension* **20**:2505-2512.

Kastarinen M, Antikainen R, Laatikainen T, Salomaa V, Tuomilehto J, Nissinen A, Vartiainen E (2006) *J Hypertension* **24**: 829-836.

Kastarinen M, Laatikainen T, Salomaa V, Jousilahti P, Antikainen R, Tuomilehto J, Nissinen A, Vartiainen E (2007). Trends in lifestyle factors affecting blood pressure in hypertensive and normotensive Finns during 1982-2002. *J Hypertens* **25:** 299-305.

Laatikainen T, Pietinen P, Valsta L, Sundvall J, Reinivuo H, Tuomilehto J. (2006) Sodium in the Finnish diet: 20-year trends in urinary sodium excretion among the adult population. *Eur J Clin Nutr* **60**: 965-70.

Nissinen A, Tuomilehto J, Elo J et al. (1983). Implementation of a hypertension control program in the County of North Karelia, Finland. *Public Health Rep* **96**:503-514.

Nissinen A, Tuomilehto J, Elo J et al. (1983) North Karelia (Finland) Hypertension Detection Project. Five-year follow-up of hypertensive cohort. *Hypertension* **5**:564-572.

Nissinen A, Tuomilehto J, Korhonen H et al. (1988). Ten-year result of hypertension care in the community. Follow-up of the North Karelia Hypertension Control Program. *Am J Epidemiol* **127**:488-499.

Nissinen A, Kastarinen M, Tuomilehto J (2004) Community control of hypertension- experiences from Finland. *J Hum Hypertension* **18**:553-556.

Nissinen A, Tuomilehto J, Kottke TE, Puska P (1986) Cost-effectiveness of North Karelia Hypertension Program 1972-1977. *Med Care* **24**: 767- 780

Tuomilehto J, Nissinen A, Salonen JT et al. (1980). Community programme for control of hypertension in North Karelia, Finland. *Lancet* **2**:900-904.

Tuomilehto J, Jousilahti P, Rastenyte D, Molchanov V, Tanskanen A, Pietinen P, Nissinen A (2001) Urinary sodium excretion and cardiovascular mortality in Finland: a prospective study. *Lancet* **357**: 848- 851.

Tuomilehto J, Puska P, Tanskanen A et al. (1981) A community-based intervention study on the feasibility and effects of the reduction of salt intake in North Karelia, Finland. *Acta Cardiol* **36**:83-104.

Veterans Administration Cooperative Study Group on Antihypertensive Agents. (1967) Effects of treatment on morbidity in hypertension: results in patients with diastolic blood pressure averaging 115 through 129 mmHg. *JAMA* **202**:1028-1034.

Veterans Administration Cooperative Study Group on Antihypertensive Agents (1970). Effects of treatment on morbidity in hypertension: 11. results in patients with diastolic blood pressure averaging 90 through 114 mmHg. *JAMA* **213**:1143-1152.

Wilberg J, Barrow J. (1972) Hypertension - a community problem. *Am J Med* **52**:653-663.

Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense H-W, Joffres M, Kastarinen M, Poulter N, Primatesta P, Rodriguez-Artalejo F, Stegmayr B, Thamm M, Tuomilehto J, Vanuzzo D, Vescio F. (2003) Hypertension Prevalence and Blood Pressure Levels in 6 European Countries, Canada, and the United States. *JAMA* **289**: 2362-2369.

World Health Organization (1971). *Community control of stroke and hypertension*. Report of a WHO meeting CVD/72.1, Gothenburg . WHO, Geneva.

III

MORTALITY, MORBIDITY AND GENERAL HEALTH

10. MORTALITY TRENDS

Pekka Puska, Jorma Torppa and Veikko Salomaa

BACKGROUND

The North Karelia Project was launched when mortality rates of CVD - especially of coronary heart disease (CHD), but also of cerebrovascular stroke - were exceptionally high in Finland, particularly in the eastern regions (Karvonen et al 1967, Pisa and Uemura 1982, Keys and Aravanis 1980).

The main objective at the outset was to achieve a substantial decline in this mortality, especially among middle-aged men. When the project joined the WHO/CINDI programme later on, there was a greater emphasis on the more integrated needs of noncommunicable disease (NCD) prevention. Also, over the years the emphasis shifted onto the national level.

Early publications from the North Karelia Project team reported a major decline in CHD mortality. The analyses also showed that in the 1970s this decline was significantly greater than in the reference province of Kuopio (Salonen et al 1983). After the original Project period the activity has concerned all of Finland, but there has still been special attention on North Karelia.

This chapter presents and analyzes over 30 year trends in mortality in North Karelia and all of Finland.

MATERIAL AND METHODS

The mortality data for North Karelia and all of Finland were obtained from the Central Statistical Office of Finland, which reviews the diagnoses made by local doctors on individual death certificates according to the International Classification of Diseases (ICD). The 8th revision of the ICD was used in Finland from 1969 to 1986, the 9th revision from 1987 to 1995 and the 10th revision since the beginning of 1996. The following ICD-9 codes, and the corresponding ICD-8 and ICD-10 codes, were used for the mortality categories: cardiovascular diseases 390-459, ischemic heart disease 410-414, cancers 140-208, and lung cancer 162.

The mortality rates were calculated on the basis of population data from the national population registry. Age adjustment was done using the European standard population

as standard. The mortality trends for North Karelia and Finland, their changes and the 95 % confidence intervals, were calculated using a general linear models procedure (GLM procedure of the SAS statistical software, SAS Institute 1985). To calculate the differences between the trends and their statistical significance, the logarithms of the mortality rates were used as dependent variables. Year, area and year-area interaction were used as independent variables.

RESULTS

For the most primary objective of the North Karelia Project, i.e. reduction of the extremely high CHD mortality, Figure 1 shows the dramatic reduction in the age standardized rates. In 35 years the annual age-adjusted CHD mortality rate among the 35-64 year old male population in North Karelia declined by 85 %. But the reduction also concerned CVD as a whole, and for men also many cancers (especially the tobacco related), and all causes of mortality among both sexes, as the summary table 1 shows.
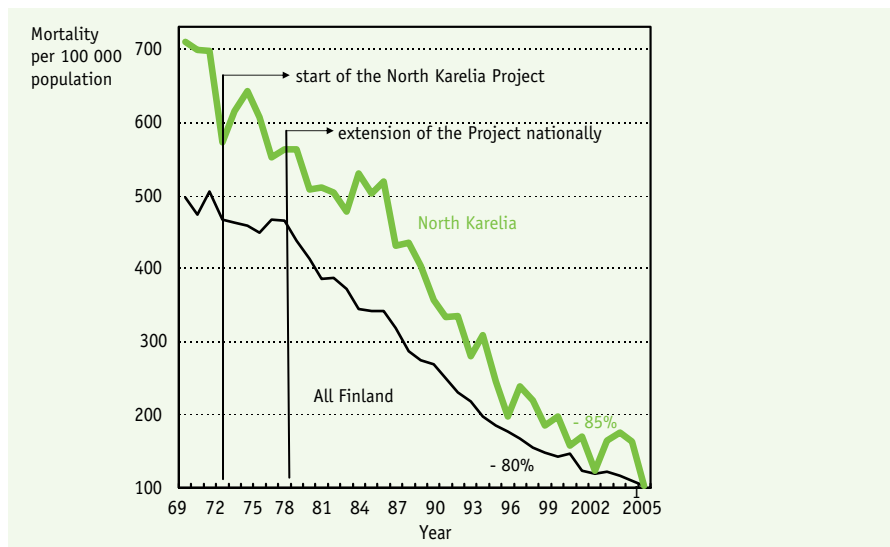

Figure 1. Age-adjusted mortality rates of coronary heart disease in North Karelia

Table 1. Mortality changes among men in North Karelia from 1969-71 to 2006 (per 100 000, men 35-64 years).

Mortality category	Change in mortality rate from 1969-71 to 2006
Cardiovascular	80 %
ischaemic heart disease	85 %
cerebrovascular stroke	69 %
Cancer	67 %
All causes	63 %

When the CVD and cancer mortality rates among the male population aged 35-64 years in North Karelia and all of Finland are divided into the four sub-periods (Figures 2 and 3) it can be seen that the 1970s saw a sharper decline in CHD among men in North Karelia than in all of Finland. Thereafter a greater decline started also in other Finland, while for some years the decline levelled off in North Karelia. Since mid 1980's the decline has been very steep, indeed, in all of Finland, but with North Karelia starting to reach the national average.
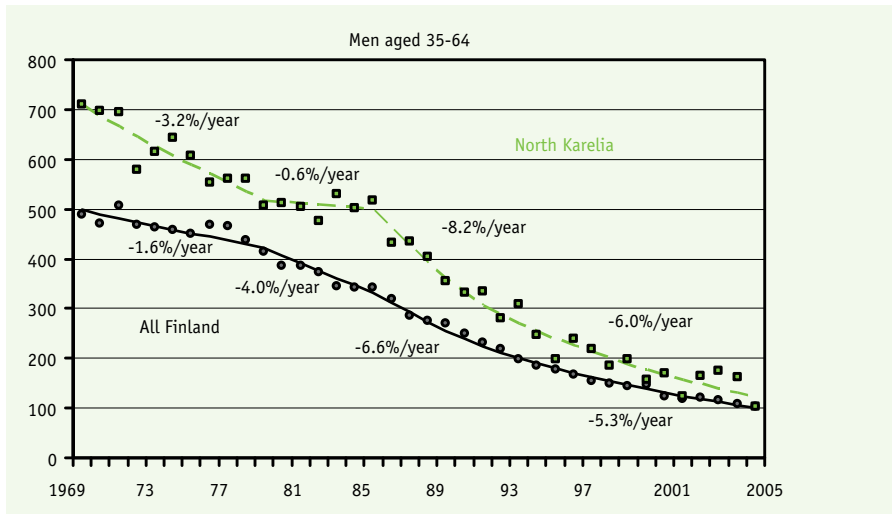

Figure 2. Decline in CHD mortality in Finland and in North Karelia in 1969-2006 with four sub-periods (men 35-64 years).
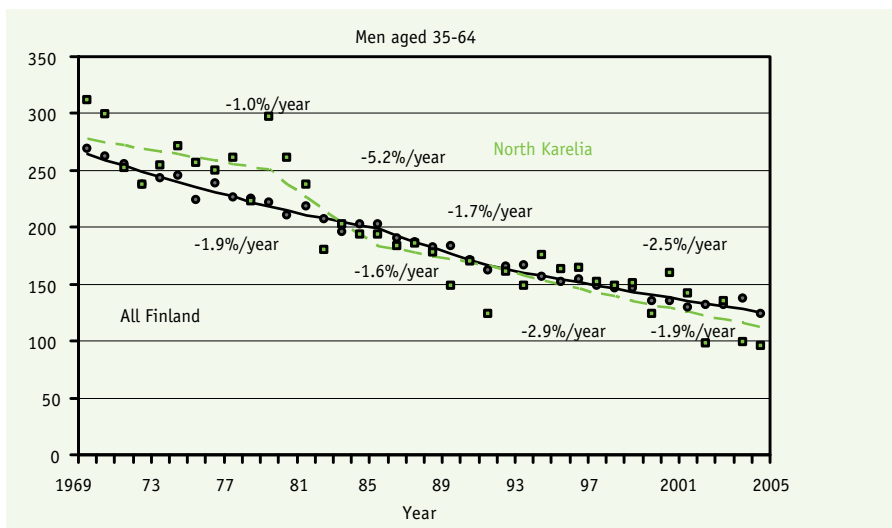

Figure 3. Decline in cancer mortality in Finland and in North Karelia in 1969-2006 with four sub-periods (men 35-64 years).
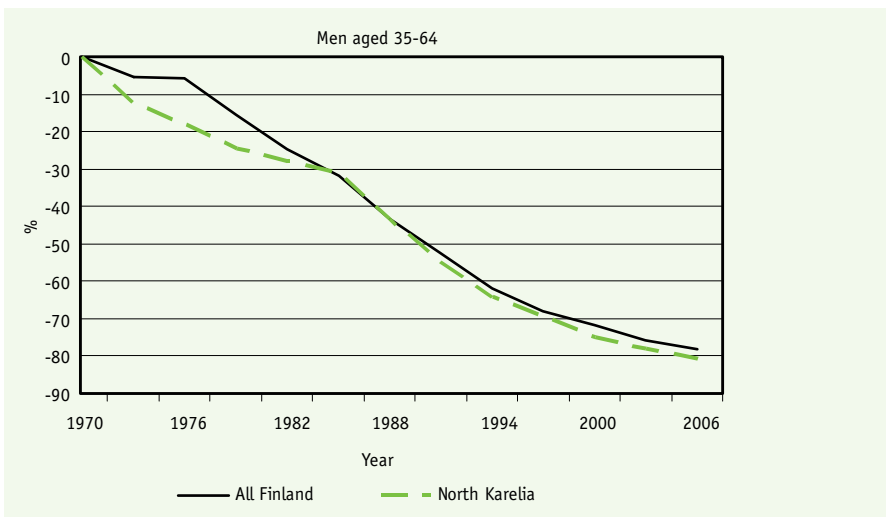
127

Figure 4. Decline in CHD mortality in Finland and in North Karelia between 1970 and 2006 (men aged 35-64).
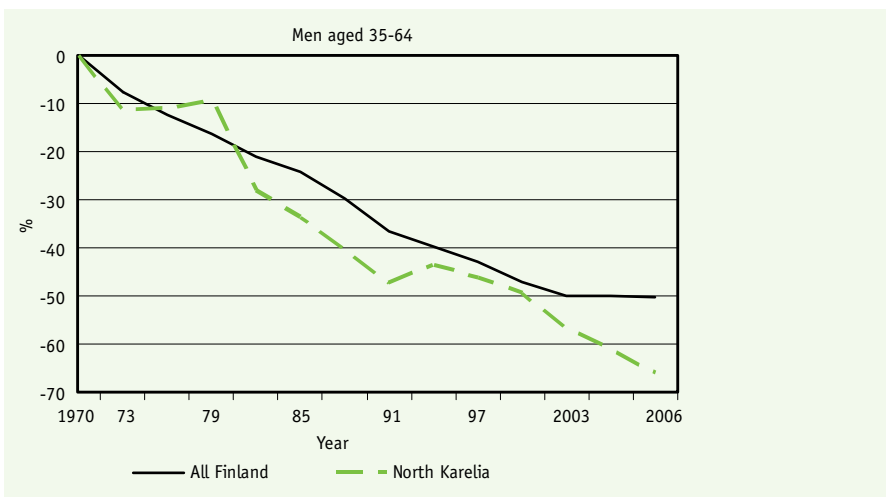
Figure 5. Decline in cancer mortality in Finland and in North Karelia between 1970 and 2006 (men aged 35-64).

Cancer mortality in the 1970's was in North Karelia higher than in all of Finland. However, in the 1980's a steep decline took place in North Karelia, mainly due to reduction in lung cancer mortality. Thereafter decline has continued with North Karelian rates a little lower than in all Finland (Figure 3).

The mortality data on time trends have been used in Figures 4 and 5 to illustrate the relative (i.e. percentage) change in CHD and cancer mortality among men after the pre-programme period. Figure 4 shows how the decline in CHD mortality was

during the "pilot project" period (in the 1970's) greater in North Karelia than in all of Finland, and how the decline thereafter accelerated also in all of Finland following the North Karelian example.

Figure 6 shows the decline in CHD mortality in North Karelia in 10 year age groups. The relative decline was clearly greater among the younger age groups, especially in men. But it was also remarkable in the age group 65-74.
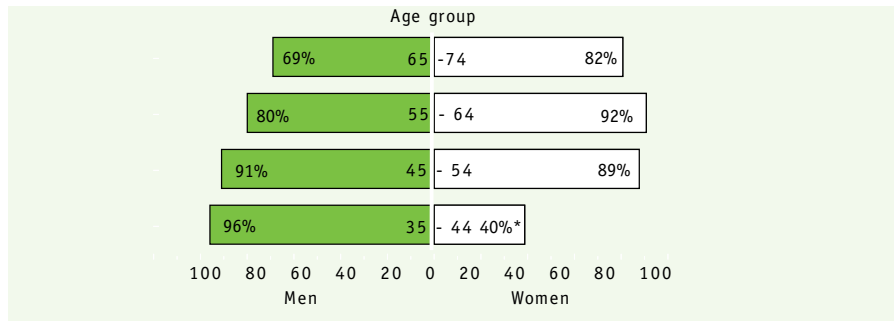
Figure 6. Percent decline in CHD mortality in North Karelia from 1969-71 to 2006 in different age groups. *)very few cases.

Tables 2 and 3 show the age-adjusted mortality rates among the 35-64 year old male and female population in all of Finland and in North Karelia in 1969-71 (pre-programme period) and in 2006. Before the programme began the mortality in Finnish males was exceptionally high; the approximate male/female ratio for CHD was 5, for cancer 2, and for total mortality 3. The mortality rates in North Karelia were generally higher than in all of Finland, except for women's cancer and violent deaths.

From 1969-71 to 2006 a substantial decline was seen in all major causes of mortality, except for violent causes and female cancers. The decline in CVD mortality (over 80 % in men and 83 % in women) was due to reduced mortality from both ischaemic heart disease and cerebrovascular disease.

Mortality	All Finland	North Karelia
All Causes		
1969-71	1328	1567
2006	583	572
% Change	-56	-63
Cardiovascular diseases		892
1969-71	680	182
2006	172	-80
% Change	-75	
Ischaemic heart disease		
1969-71	489	701
2006	103	103
% Change	-79	-85
Cerebrovascular disease		
1969-71	98	93
2006	26	29
% Change	-73	-69
Cancer		
1969-71	262	288
2006	124	96
% Change	-53	-67
Violent causes		
1969-71	202	226
2006	145	144
% Change	-28	-36

Mortality	All Finland	North Karelia
All Causes		
1969-71	497	526
2006	252	256
% Change	-49	-51
Cardiovascular diseases		
1969-71	217	278
2006	45	46
% Change	-79	-83
Ischaemic heart disease		
1969-71	88	126
2006	15	13
% Change	-83	-90
Cerebrovascular disease		
1969-71	73	68
2006	16	12
% Change	-78	-82
Cancer		
1969-71	147	126
2006	104	92
% Change	-29	-27
Violent causes		
1969-71	42	32
2006	44	51
% Change	+5	+59

Table 4 shows the average annual number of deaths from all causes and from CVD in North Karelia and all of Finland, in 1969-71 and in 2006. It can be seen

that in 2006, compared to the annual numbers in 1969-71, there were 4478 fewer deaths annually in all of Finland and 370 fewer in North Karelia among men aged 35-74 years, although the age structure had over the years markedly shifted so that the number of older people had greatly increased. For women the respective figures were 4476 and 245. In North Karelia 83 % and in all of Finland 95 % of this decline was due to reductions in cardiovascular deaths.

Over the project period in this age group the number of deaths was about 243.000 less in all of Finland compared to the numbers if mortality had stayed at the pre-programme level. Similarly, if the rates had stayed at the pre-programme level, in 2006, with the current age structure, there would have been some 14 000 CVD deaths more in the age group 35-74. Almost half of that would have been before 64 years of age. Life expectancy at birth rose from 66.4/74.6 years (males/females) in 1971, to 75.8/82.8 years in 2006, and in North Karelia from 64/72 to 75/81.

Table 4. Annual number of all deaths and cardiovascular deaths in North Karelia and in all of Finland in 1969-71 and in 2006.

	Men				Women			
	All Causes		CVD		All Causes		CVD	
	35-64	65-74	35-64	65-74	35-64	65-74	35-64	65-74
NORTH KARELIA								
1969-71	479	313	273	185	184	264	99	169
2006	234	188	76	89	96	107	18	35
Difference	245	125	197	96	88	157	81	134
ALL FINLAND								
1969-71	9617	6831	4910	3820	4407	5835	1957	3561
2006	6804	5166	2036	2100	2962	2804	535	875
Difference	2813	1665	2874	1720	1445	3031	1422	2686

DISCUSSION

The findings show a marked decline in the mortality rates. The decline in CHD mortality started in North Karelia very soon after the intervention began. In the 70s there was a significantly steeper decrease in North Karelia than in all of Finland or Kuopio (Salonen et al 1981), which corresponds with the clearly greater reduction in the risk factors there during the decade. Thereafter the trend somewhat levelled off in North Karelia, and was soon caught up by the steeper decline in all of Finland.

Thereafter the decline has again been very steep both in North Karelia and in all of Finland. In 2006 the CHD mortality rate in North Karelia (men aged 35-64) was 85 % lower, and in all of Finland it was 79 % lower, than the preprogramme (1969-71) rate.

The development in CVD mortality was very similar among women, too. In fact, the relative decline was, if anything, a little greater than among the men.

A major decrease also took place in cerebrovascular disease mortality. Thus the decline in total cardiovascular disease mortality was of the same magnitude as for ischaemic heart disease.

The decline in cancer mortality in North Karelia became more pronounced than in all of Finland only after the first 10-year period. Also the overall cancer mortality among men was very great both in North Karelia and in all of Finland (67 % vs. 53 %). The relative decline in cancer mortality in North Karelia over this period was considerable. This was to a great extent due to the reduction in tobacco related cancers (esp. lung cancer) that dominated the cancer situation among men at the onset of the project.

Although the mortality data are based on routine sources, they are likely to be quite valid for the middle-aged population. For site-specific cancers the numbers of deaths in North Karelia are small. The reduction in lung cancer mortality, however, was significantly greater than in all of Finland, which accords with the smoking figures. The proportion of male smokers has declined in all of Finland since the early 1960s, but in the 1970s the decrease was considerably greater in North Karelia than in the reference area (Salonen et al 1983). Allowing for a relatively long incubation period, the impressive downward trend of lung cancer mortality in North Karelia, particularly during the 1980s, is in good agreement with the smoking changes.

Changes in violent deaths were generally quite small. Among women the numbers were especially small in North Karelia at the outset. Generally, traffic accident mortality has decreased, while alcohol-related accident mortality has increased, along with the overall rise in alcohol consumption. It is worth mentioning that a prospective study of the 1972 population sample found that serum cholesterol was not associated with risk of violent death, while smoking and alcohol consumption were positively associated (Vartiainen et al 1994).

Overall, there has been a remarkable decline in mortality among the middle-aged population in association with the risk factor reduction. This has particularly concerned CVD in both sexes, and cancer among men. Some 243 000 premature cardiovascular deaths (before 75 years) have been prevented in the whole of Finland over a 35 year period. The public health picture is extremely improved. Life expectancy has increased by some ten years – and mostly healthy years, as other results show.

Separate analyses have shown that the observed reductions in population risk factor levels can explain most of the decline in CHD mortality (Vartiainen et al.

1994). Of the single risk factors, reduction in serum cholesterol level had the greatest impact.

It is thus likely that most of the extraordinary decline in CVD and cancer rates has been due to the reduction achieved in target risk factors, i.e. it is due to primary prevention. Concurrent improvements in therapy have also naturally contributed to these favourable developments (Laatikainen et al 2005).

The North Karelia Project was started with the strong belief, shared by its young and dedicated team, that some prevention of the high CVD rates in North Karelia is possible. Professor Martti Karvonen, in his speech on National Heart Day in Joensuu in 1970, said that the heart disease rate could be halved by elimination of the known risk factors. Now, some 35 years later the annual heart disease mortality rate among the working age population is 85 % lower. And the same reduction concerned also CVD mortality as a whole. Furthermore, with the great reduction in smoking, cancer mortality among men declined steeply. The decline still seems to continue but to maintain it will clearly be a challenge in the future.

With these reductions in major causes of death and with no major changes in other causes of death, these changes were reflected in the remarkable reduction of age-specific all-cause mortality and the increase in life expectancy. This is such a dramatic change in the public health picture that the project team at the outset could hardly have believed it would occur. Thus the North Karelia experience is a powerful demonstration of how an epidemic of chronic noncommunicable diseases can, indeed, change much, when the population risk factors and determinants change. This also shows how population based prevention through changes in lifestyles and environments is by far the most cost effective and sustainable way of controlling the epidemic of cardiovascular diseases, and of improving public health.

REFERENCES

Karvonen M, Blomqvist G, Kallio V, Orma E, Punsar S, Rautaharju P *et al* (1967). Men in rural East and West Finland. *Acta Med Scand* **460:** 169-190.

Keys A, Aravanis C (1980). *Seven countries : a multivariate analysis of death and coronary heart disease.* Harvard Univ. Press: Cambridge, xi, 381 p.pp.

Laatikainen T, Critchley J, Vartiainen E, Salomaa V, Ketonen M, Capewell S (2005). Explaining the decline in coronary heart disease mortality in Finland between 1982 and 1997. *Am J Epidemiol* **162:** 764-773.

Pisa Z, Uemura K (1982). Trends of mortality from ischaemic heart disease and other cardiovascular diseases in 27 countries, 1968-1977. *World Health Stat Q* **35:** 11-47.

Salonen JT, Puska P, Kottke TE (1981). Smoking, blood pressure and serum cholesterol as risk factors of acute myocardial infarction and death among men in Eastern Finland. *Eur Heart J* **2:** 365-373.

Salonen JT, Puska P, Kottke TE, Tuomilehto J, Nissinen A (1983). Decline in mortality from coronary heart disease in Finland from 1969 to 1979. *Br Med J (Clin Res Ed)* **286:** 1857-1860.

Vartiainen E, Puska P, Pekkanen J, Tuomilehto J, Josilahti J: Changes in risk factors explain changes in mortality from ischemic heart disease in Finland. *BMJ* **309**:23-7.

Vartiainen E, Puska P, Pekkanen J, Tuomilehto J, Lönnqvist J, Ehnholm C (1994). Serum cholesterol concentration and mortality from accidents, suicide, and other violent causes. *BMJ* **309:** 445-447.

11. TRENDS IN ACUTE MYOCARDIAL INFARCTION AND STROKE EVENTS IN NORTH KARELIA AND IN ALL FINLAND

Veikko Salomaa, Rauni Pääkkönen and Jorma Torppa

BACKGROUND AND AIMS

The original objective of the North Karelia Project was to reduce the exceptionally high coronary heart disease (CHD) mortality and morbidity in the area. Yet over time it came to be considered as a national demonstration area for a wider range of health promoting activities. Different types of interventions were tested and evaluated in North Karelia, and many of them later became a part of national health policy.

This chapter aims to describe the development of CHD and stroke morbidity and mortality in North Karelia and the whole of Finland, from the early 1970's to the year 2006.

MATERIAL AND METHODS

To monitor the mortality and morbidity of CHD in North Karelia, a population-based myocardial infarction (MI) register has been operational in the province since 1972. The diagnostic criteria of MI events have, naturally, somewhat changed over the years. From 1972 to 1982, the WHO Ischemic Heart Disease (IHD) register criteria (World Health Organization. Regional Office for Europe. 1976) were followed, and from 1983 to 1992 the register followed the WHO MONICA criteria (Salomaa et al 1996, Tunstall-Pedoe et al 1994). From 1993 onwards, the register was called FINAMI, and the events were classified as recommended by an expert group of multiple cardiological organizations in 2005 (Luepker et al 2003, Salomaa et al 2006). Troponins were adopted as the main biomarkers of myocardial injury in Finland between 1997 and 2000. Besides North Karelia, the register has been operational in Kuopio, Turku and Oulu. In Kuopio and Turku, data has been available since 1983, and in Oulu, since 1993. In the following presentation we only include data from the towns of Kuopio and Turku, and in North Karelia from the town of Joensuu, and the surrounding rural areas of Ilomantsi, Juuka and Lieksa. The age group covered was

from 35-64 years. These were the population groups that have been included in the registration over all time and they thus provide the maximum number of years for estimation of longitudinal trends.

A stroke register was operational in North Karelia during the MONICA period, between1983-1992 (Sivenius et al 2004, Tuomilehto et al 1996). It recorded all cases of stroke in the population aged 25-74 years. Besides North Karelia, the stroke register was operating in the neighbouring province of Kuopio and in Turku, in southwestern Finland.

The third source of information was the national cardiovascular disease register (http://www.ktl.fi/cvdr/) (Pajunen et al 2004, Pajunen et al 2005). It is comprised by record linkage of the national causes-of-death register and the national hospital discharge register, and covers all symptomatic cardiovascular events in the country. Data on persons aged 35-64 years were used for the analyses on CHD events, and data on 35-74 year olds for the analyses of stroke cases.

CHD and stroke rates were expressed per 100,000 persons per year, and age-standardized according to the direct method using 5-year age groups, and the European Standard Population. The annual population counts for the denominators were obtained from the National Population Information System. To reduce random fluctuations the local MI register results were presented as 3-year moving averages whereas the numbers for the whole country were presented without smoothing. Case fatality estimates were age-standardized to the combined age distribution of coronary and stroke patients in the MI and stroke registries of the WHO MONICA Project. The 95% confidence intervals (CI) for the event rates were calculated assuming Poisson distribution for the numbers of events. Trends were estimated using log-linear Poisson regression models with the logarithm of the event rate as the dependent variable and the year as an independent variable. The 95% CIs for the trend estimates were calculated from the standard error of the regression coefficient.

RESULTS

Coronary events

CHD mortality rates and trends in North Karelia and the whole of Finland are presented elsewhere this book. The attack rates of MI events in the MI register are presented in Figure 1 a (men) and b (women). Among men, a steady decline averaging 4-5% per year was seen in North Karelia in all three registration periods. In Kuopio, a steep decline of 8.8% per year was observed in the MONICA period. After that the annual average decline was 3.1%. In Turku, southwestern Finland, the attack rate
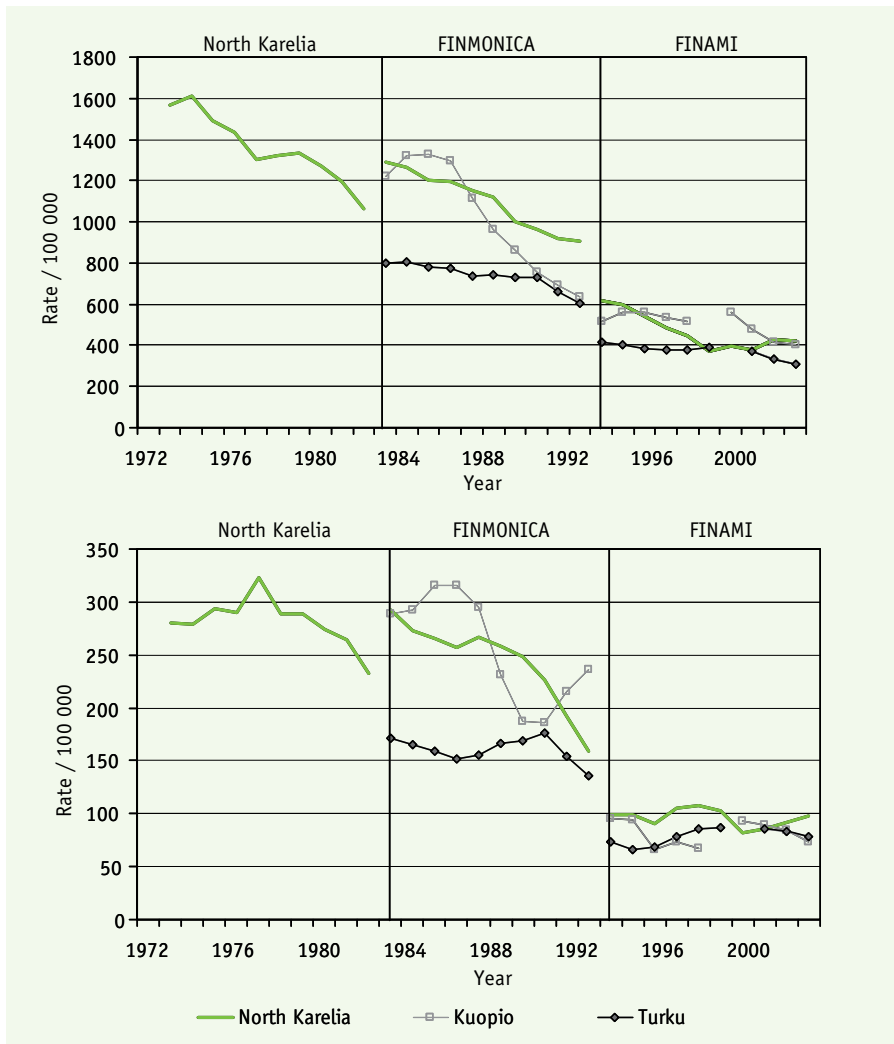
Figure 1. Age-standardized attack rates (per 100 000 inhabitants) of MI events among men (1 a) and women (1 b) aged 35-64years in the North Karelia MI register during 1972-1982, FINMONICA MI register during 1983-1992 and the FINAMI register during 1993-2002.

was lower to start with and the annual average declines were 2.7% in the MONICA period and 2.9% thereafter. All these declines were statistically highly significant. Among women, there was more random variation due to the smaller number of events. Significant declines were seen only during the MONICA period in North Karelia (5.3% per year) and in Kuopio (5.1% per year).

Attack rate trends for the whole country, based on the national CVD register data for the period 1991 – 2006, are depicted in Figure 2. The average declines were 4.0% per year among men and 3.4% per year among women. The trends in the incidence

Figure 2. Age-standardized attack rates of MI events in the national cardiovascular disease register among men and women aged 35-64 years during 1991-2006. The annual average decline is 4.0 % (95% CI 4.1 – 3.8%, p<0.0001) per year among men and 3.4% (95% CI 3.8 – 3.1%, p<0.0001) per year in women.
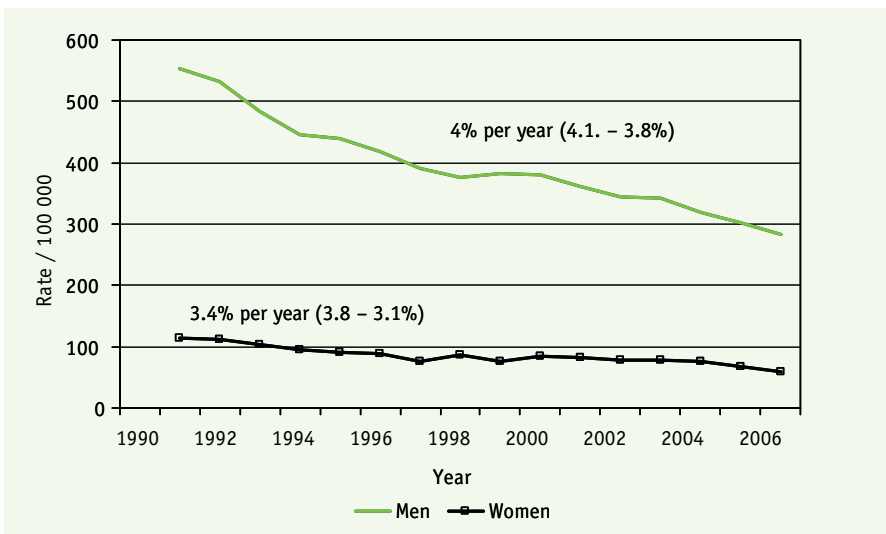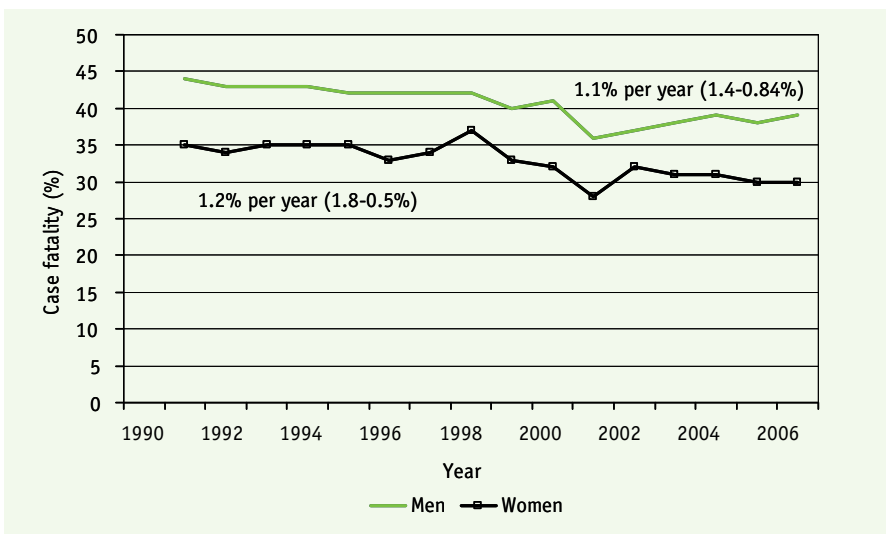

Figure 3. Age-standardized 28-day case fatality of MI events in the national cardiovascular disease register among men and women aged 35-64 years during 1991-2006. The annual average declines were 1.1% (95% CI 1.4 – 0.8%, p<0.0001) per year in men and 1.2% (95% CI 1.8 – 0.5%, p=0.0002) per year in women.

of first MI events were quite similar to the trends in the attack rate, but the level was, of course, somewhat lower.

In the MI register data the 28-day case fatality for MI events did not change significantly in the 1970's and also in the 1980's the declines remained modest in all study areas and for both genders. More recent data from the national CVD register show declining trends, however. Figure 3 depicts the trends in 28-day case fatality for all MI events among men and women from 1991 to the year 2006. The case fatality is clearly higher among men than among women, but similar declining trends can be seen for both genders (1.1% per year among men and 1.2% per year among women).

Strokes

In the 1970's and 1980's it was not always possible to make a reliable distinction between the haemorrhagic and ischaemic types of stroke. Therefore, all strokes are combined in the following presentation. Figure 4 demonstrates the stroke mortality based on the causes-of-death register in men (4 a) and women (4 b) in both North Karelia and the whole of Finland from 1971 to 2006. Due to the small number of cases the mortality rates in North Karelia are presented using three-year moving averages. At the beginning of the 1970's the stroke mortality rate in North Karelia was higher than the national average, but by 2006 the differences had disappeared. Among men, the stroke mortality rate in North Karelia has declined, on average, by 4.4% per year, whereas in the whole country the annual average decline has been 3.5% per year. Among women, the corresponding declines have been 4.1% per year in North Karelia and 4.2% per year in the whole country.

The stroke register was operational in North Karelia only during the MONICA period 1983-1992. No significant changes were observed in the incidence and attack rate of stroke in North Karelia during that period (Tuomilehto et al 1996). Stroke mortality, however, declined significantly in men but not in women (Tuomilehto et al 1996). More recent data can again be obtained from the national CVD register. It shows that the age-standardized incidence of first strokes declined in Finland on average by 2.4% per year among men and by 2.6% per year among women during the period 1992-2006 (Figure 5). The stroke incidence was clearly higher among men than among women. The 28-day case fatality of incident stroke events declined during the same period by 2.8% per year in men, and by 2.7% per year in women (Figure 6).
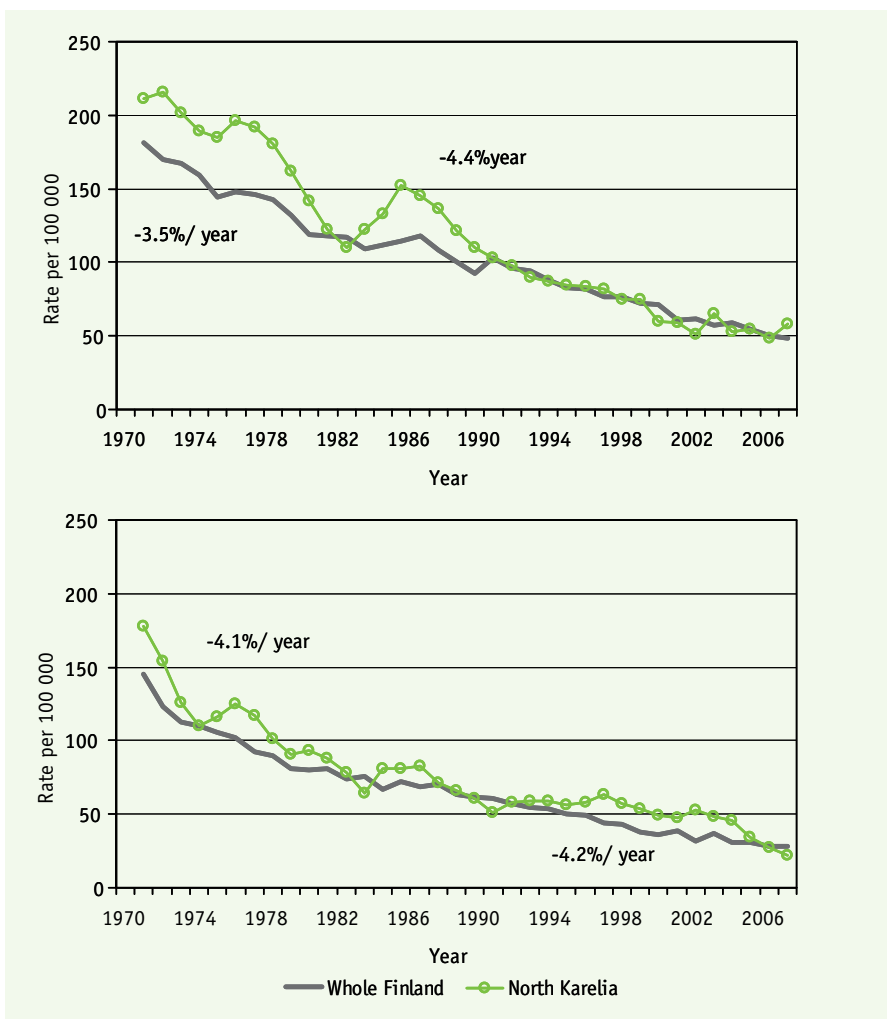
Figure 4. Age-standardized mortality from stroke in men (4 a) and women (4 b) aged 35 – 74 years in North Karelia and in whole Finland during 1971-2006. The annual average declines among men were 4,4% per year in North Karelia and 3.5% per year in whole Finland. Among women the corresponding declines are 4.1% and 4.2% per year.

SUMMARY AND CONCLUSIONS

These data demonstrate major declines in CHD and stroke mortality and morbidity in North Karelia and in the whole of Finland during the period 1972 – 2006. At the beginning of the period of study the case fatality declines were negligible, which suggests that the reduction in mortality was mainly due to improved life styles and better control of risk factors in the community. More recently, the case fatality of

coronary and stroke events also declined, suggesting that both improved treatment and successful prevention efforts have contributed to the continuing decline in cardiovascular mortality in Finland.

Figure 5. The age-standardized incidence of first stroke events in the national cardiovascular disease register among men and women aged 35-74 years in Finland during 1992 – 2006. The annual average declines were 2.4% (95% CI 2.6 – 2.3%, p<0.0001) per year among men and 2.6% (95% CI 2.8 - 2.4%, p<0.0001) per year among women.

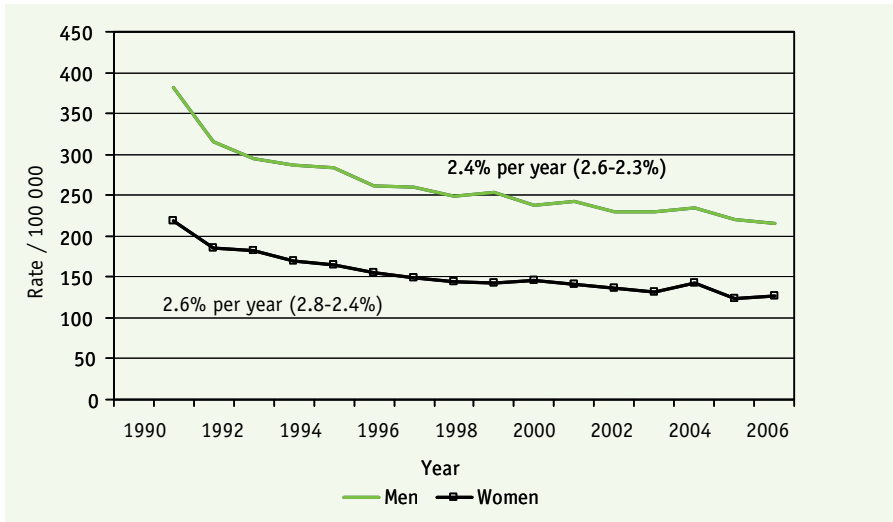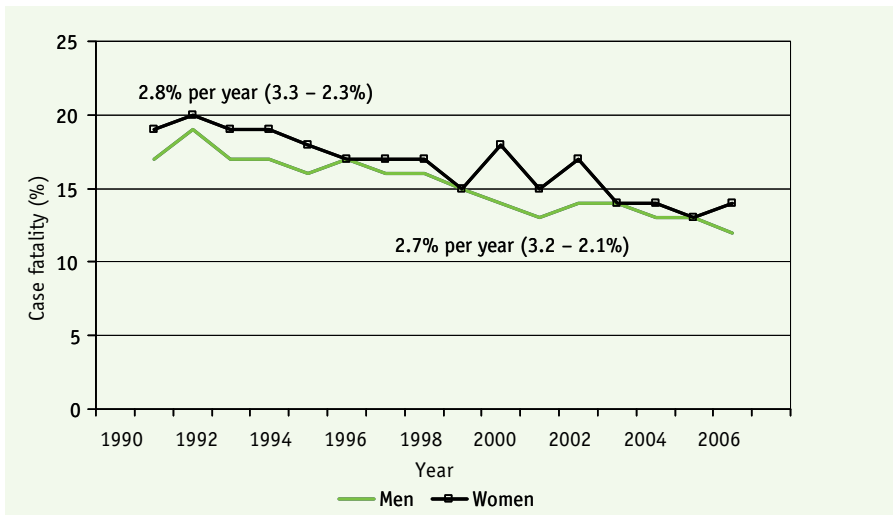**Figure 6. The age-standardized 28-day case fatality of first stroke events in the national cardiovascular disease register among men and women aged 35-74 years in Finland during 1992-2006. The annual average declines were 2.8% (95% CI 3.3 – 2.3%, p<0.0001) in men and 2.7% (95% CI 3.2 – 2.1%, p<0.0001) in women.**

REFERENCES

Luepker RV, Apple FS, Christenson RH, Crow RS, Fortmann SP, Goff D *et al* (2003). Case definitions for acute coronary heart disease in epidemiology and clinical research studies: a statement from the AHA Council on Epidemiology and Prevention; AHA Statistics Committee; World Heart Federation Council on Epidemiology and Prevention; the European Society of Cardiology Working Group on Epidemiology and Prevention; Centers for Disease Control and Prevention; and the National Heart, Lung, and Blood Institute. *Circulation* **108:** 2543-2549.

Pajunen P, Pääkkönen R, Juolevi A, Hämäläinen H, Keskimäki I, Laatikainen T *et al* (2004). Trends in fatal and non-fatal coronary heart disease events in Finland during 1991-2001. *Scand Cardiovasc J* **38:** 340-344.

Pajunen P, Pääkkönen R, Hämäläinen H, Keskimäki I, Laatikainen T, Niemi M *et al* (2005). Trends in fatal and nonfatal strokes among persons aged 35 to > or =85 years during 1991-2002 in Finland. *Stroke* **36:** 244-248.

Salomaa V, Miettinen H, Kuulasmaa K, Niemelä M, Ketonen M, Vuorenmaa T *et al* (1996). Decline of coronary heart disease mortality in Finland during 1983 to 1992: roles of incidence, recurrence, and case-fatality. The FINMONICA MI Register Study. *Circulation* **94:** 3130-3137.

Salomaa V, Ketonen M, Koukkunen H, Immonen-Räihä P, Lehtonen A, Torppa J *et al* (2006). The effect of correcting for troponins on trends in coronary heart disease events in Finland during 1993-2002: the FINAMI study. *Eur Heart J* **27:** 2394-2399.

Sivenius J, Tuomilehto J, Immonen-Räihä P, Kaarisalo M, Sarti C, Torppa J *et al* (2004). Continuous 15-year decrease in incidence and mortality of stroke in Finland: the FINSTROKE study. *Stroke* **35:** 420-425.

Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, Arveiler D, Rajakangas AM, Pajak A (1994). Myocardial infarction and coronary deaths in the World Health Organization MONICA Project. Registration procedures, event rates, and case-fatality rates in 38 populations from 21 countries in four continents. *Circulation* **90:** 583-612.

Tuomilehto J, Rastenyte D, Sivenius J, Sarti C, Immonen-Räihä P, Kaarsalo E *et al* (1996). Ten-year trends in stroke incidence and mortality in the FINMONICA Stroke Study. *Stroke* **27:** 825-832.

World Health Organization. Regional Office for Europe. (1976). *Myocardial infarction community registers : results of a WHO international collaborative study coordinated by the Regional Office for Europe*. WHO Regional Office for Europe: Copenhagen.

12. PREDICTING ISCHEMIC HEART DISEASE MORTALITY WITH THE CLASSICAL RISK FACTORS

Erkki Vartiainen, Pekka Jousilahti, Juha Pekkanen,
Jaakko Tuomilehto and Pekka Puska

INTRODUCTION

Before the start of the North Karelia Project, the prevailing evidence suggested that the three risk factors of smoking, elevated serum cholesterol and elevated blood pressure explained much of the ischemic heart disease (IHD) risk. The majority of the relevant information came from the Framingham Study (Kannel 1988), from other major prospective cohort studies mainly in the U.S. (The Pooling Project Research Group 1978) and from the Seven Countries Study (Pekkanen et al. 1989). This chapter will describe the effect of these three "classical" risk factors on IHD mortality in eastern Finland. The results are based on the prospective follow-up of the original baseline survey cohort of the North Karelia Project.

MATERIAL AND METHODS

The 1972 baseline survey of the North Karelia Project involved a 6.6% random sample of the 25-59 year old population of the province. These analyses were restricted to the 9 765 surveyed persons aged 30-59 years old; those who had reported myocardial infarction during the year preceding the survey were excluded. The methods applied in the survey are described in an earlier chapter.

Baseline risk factor measurements were linked to the IHD mortality data (ICD 410-414) of the National Mortality Register from 1972 to 1987 using the personal social security number. The International Classification of Diseases, 8th revision, was used during the whole follow-up period.

Individuals with all risk factors measured are presented in Table 1. Age standardization was done by the direct method in three age groups (30-39, 40-49, 50-59). In the risk ratio calculations the smallest risk category was assigned the value 1. A logistic regression model was used in multivariate analyses.

Table 1. Subjects of the cohort study.

	MEN				WOMEN			
	30-39	40.49	50-59	TOTAL	30-39	40-49	50-59	TOTAL
SUBJECTS	1621	1770	1264	4655	1652	1861	1588	5101
PERSON YEARS	23704	24739	16008	64451	24545	27260	22525	74330
CORONARY DEATHS	23	130	187	340	4	20	63	87
RISK FACTOR								
INFORMATION AVAILABLE								
SMOKING	1585	1701	1175	4461	1626	1818	1543	4987
BLOOD PRESSURE	1535	1682	1198	4415	1567	1780	1496	4843
CHOLESTEROL	1529	1676	1201	4406	1558	1776	1491	4825
ALL RISK FACTORS	1499	1617	1127	4243	1535	1738	1449	4722
PERSON YEARS	21960	22683	14316	58959	22804	25513	20591	68908
CORONARY DEATHS	19	114	168	301	4	19	53	76

RESULTS

In men, age standardized IHD mortality in the lowest total serum cholesterol category (less than 5 mmol/l) was 1.66 per 1000 person years, while if serum cholesterol exceeded 10 mmol/l the mortality was 17.5 (Figure 1). The risk ratio increased exponentially with the cholesterol level. In women the number of deaths was too small to analyse the lowest cholesterol category, so we pooled the two lowest categories. Mortality in the lowest cholesterol group was then 0.58 per 1000 person years, compared with 5.27 if the level exceeded 10 mmol/l (Figure 2).

In men, systolic blood pressure began elevating the risk for IHD mortality from as low as 120 mm Hg (Figure 3). In women the two lowest categories were pooled because of the sparseness of cases. The risk ratio in the highest systolic blood pressure category compared to the lowest was about seven in men and 14 in women (Figure 4). The effect of diastolic blood pressure on IHD mortality was about the same as systolic pressure, both in men and women (Figures 5 and 6).

Smoking increased the risk in men 2.5-fold (Figure 7). The number of cigarettes smoked in a day seemed to have no impact on mortality. The risk of those who had stopped smoking more than half a year ago was about the same as in the never smokers. By contrast, men who had stopped smoking less than half a year ago had about the same level of risk as the smokers, probably because many of them had restarted smoking during the follow-up period. In women, smoking increased the risk 2-fold (Figure 8). The small number of smokers and cases in women made it impossible to divide women into more categories.
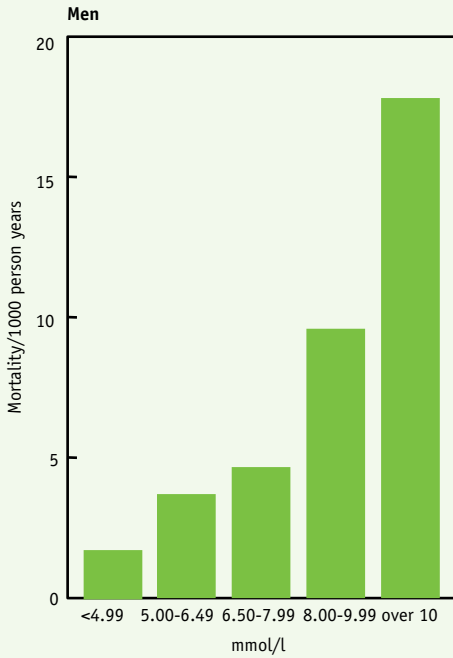
Figure 1. IHD mortality by cholesterol level (Men)
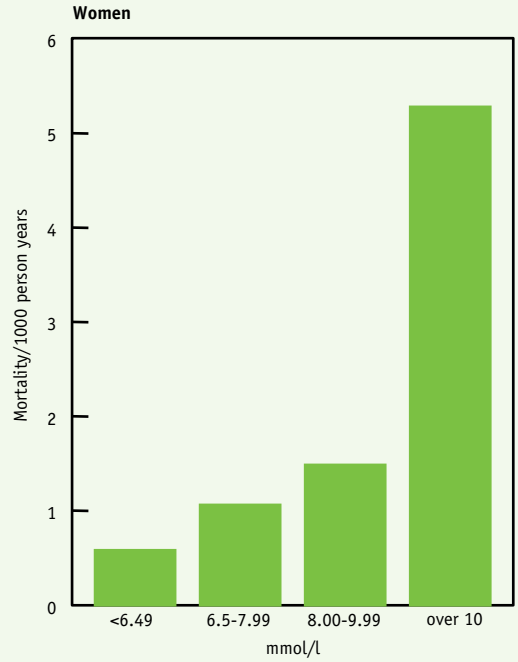
Figure 2. IHD mortality by cholesterol level (Women)

Figure 3. IHD mortality by systolic blood pressure level (Men)

Figure 4. IHD mortality by systolic blood pressure level (Women)

Figure 5. IHD mortality by diastolic blood pressure level (Men)

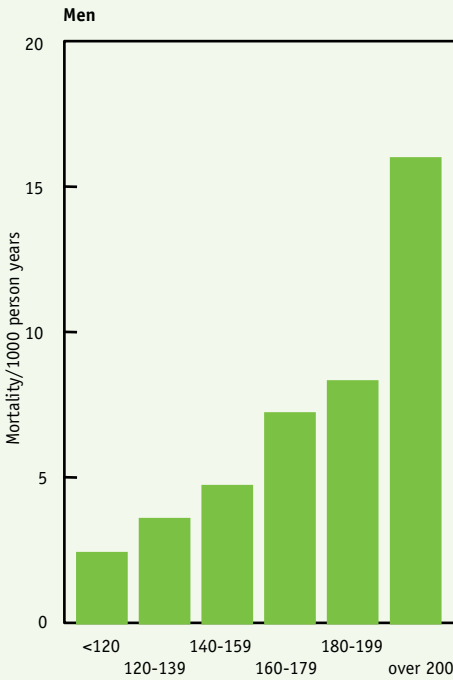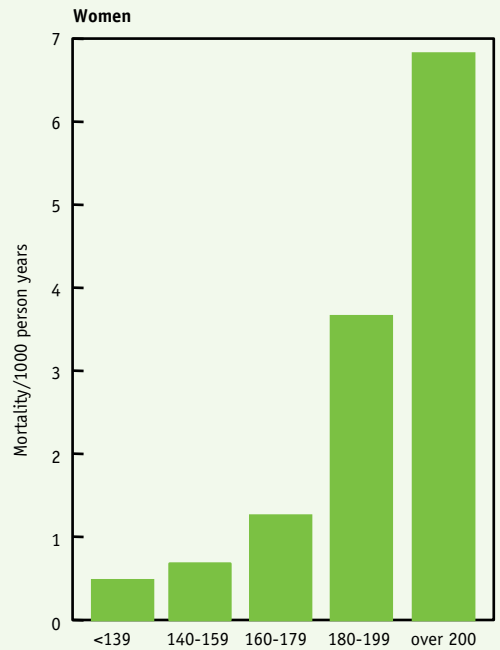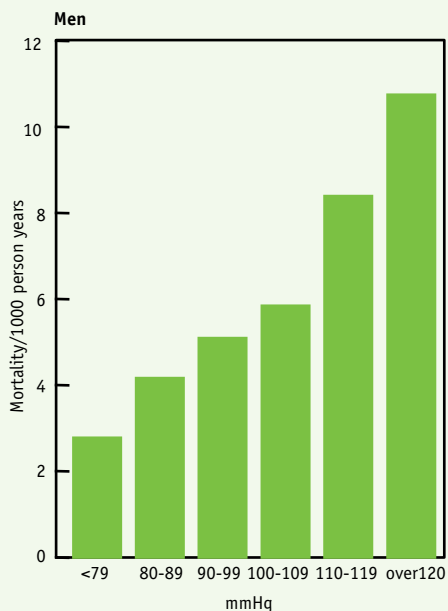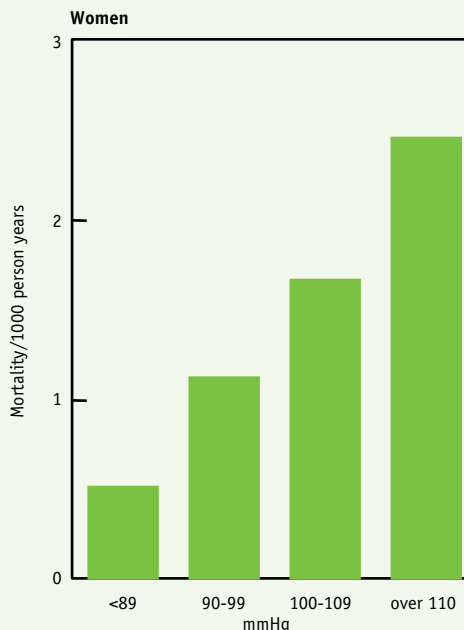**Figure 6. IHD mortality by diastolic blood pressure level (Men)**
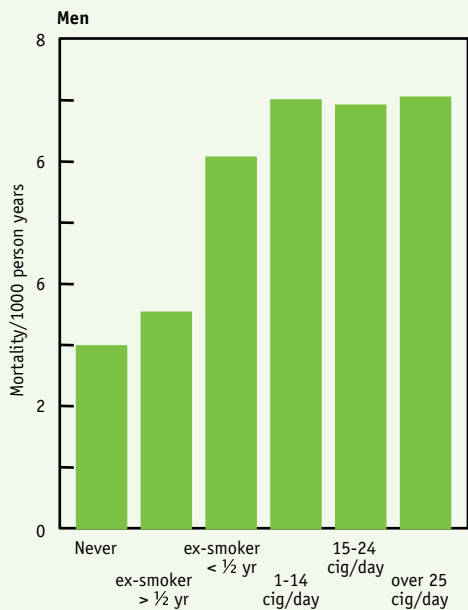

Figure 7. IHD mortality by smoking (Men)
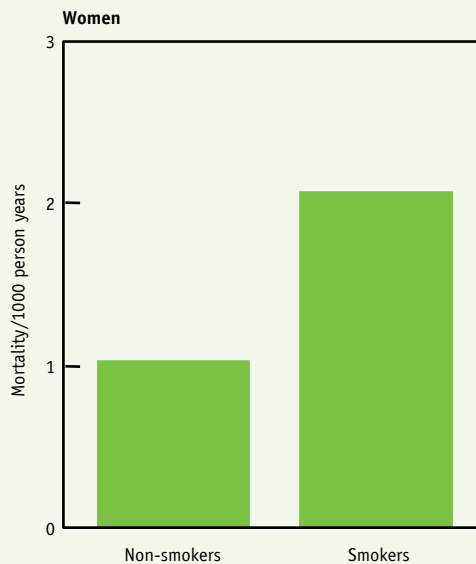
Figure 8. IHD mortality by smoking (Women)

In the multiple logistic regression model all the risk factors had a statistically significant impact (Table 2). The odds ratio of systolic blood pressure was calculated for 10 mmHg intervals and diastolic blood pressure for 5 mm Hg intervals. Cholesterol was calculated for 1 mmol/l intervals and age for every five years. The risk ratios were almost identical in the sexes. However, in the multivariate analysis smoking seemed to be more important in women than men, although the difference in the odds ratio between them was not statistically significant.

The risk of IHD death was 5.24 times higher in men than women. When smoking, serum cholesterol, and systolic and diastolic blood pressure were included in the model the odds ratio fell to 4.61. Hence only 15% of the difference between men and women could be explained by the classical risk factors.

When both systolic and diastolic blood pressure were included at the same time only systolic blood pressure was statistically significant, whereas if they were added in separate models both blood pressures were statistically significant. Thus systolic blood pressure seemed to predict IHD mortality slightly better, and when systolic blood pressure was used diastolic blood pressure did not improve the prediction of risk.

Table 2. Logistic regression model on ischaemic heart disease mortality (odds ratios and 95% confidence intervals)

RISK FACTOR	UNIT	MEN		WOMEN		BOTH
AGE	5 YR	1.67	(1.53;1.82)	1.48	(1.22;1.80)	1.63 (1.50;1.77)
SMOKING	0=NO, 1 =YES	2.23	(1.72;2.89)	3.68	(2.01;6,74)	2.40 (1.88;3.07)
SYSTOLIC BLOOD PRESSURE	10 mmHg	1.16	(1.08;1.24)	1.16	(1.03;1.31)	1.15 (1.09; 1.23)
DIASTOLIC BLOOD PRESSURE	5 mmHg	1.03	(0.96;1.10)	1.05	(0.94;1.20)	1.03 (0.98;1.10)
CHOLESTEROL	1 mmol/l	1.46	(1.33;1.60)	1.39	(1.20;1.60)	1.43 (1.32;1.54)
GENDER	0=WOMAN, 1=MAN	-		-		4.61 (3.42;6.23)

DISCUSSION

These results confirm that the classical risk factors are important predictors of IHD mortality in Finland. They seem to be equally important in both sexes, although in the multivariate analyses smoking was more pronounced in women. This may be the consequence of lower blood pressure and cholesterol level among smoking women, because smoking in eastern Finland in 1972 was relatively rare in women, and more common in the upper social class.

Some other studies have found smoking to be a less obvious risk factor in women. In the Framingham study smoking seemed to be a more important predictor in

men than in women, while a Swedish cohort study observed smoking not to be a significant risk factor in women (Stokes et al. 1987). However, in most cohort studies smoking has increased IHD risk, with the effect apparently greater among the youngest subjects (Corrao et al. 1990). Blood pressure is an independent risk factor for both men and women in all the cohort studies (Corrao et al. 1990).

IHD mortality in middle-aged men is much higher than in women. In this cohort study 7.3 % (N=340) of men and 1.7% (N=87) of women died from IHD during the 15 year follow-up period. The risk factors explained only 15% of this difference. In the international MONICA study men in Finland had 6.2 times higher mortality than women, whereas in Scotland it was 3.3 times higher. In Beijing the risk ratio was smallest, at 1.8. There are no good explanations for these disparities between countries (WHO Monica Project, 1987).

In women it was not possible to assess the difference in mortality between the category with the lowest cholesterol values (below 5 mmol/l) and that with 5-6.5 mmol/l because of the small number of women and deaths at the lower end of the cholesterol distribution. The odds ratios calculated for 1 mmol/l increases in serum cholesterol were about the same in men and in women, suggesting that cholesterol is equally important in men and women.

We also assessed mortality in the group of men with a normal risk factor level in the 1972 survey, i.e. blood cholesterol less than 5 mmol/l, blood pressure below 140/90 mmHg, and no smoking. There were just 95 men in this group and none of them died of IHD during the 20 years of follow-up, which only serves to emphasize the extremely high risk factor level in eastern Finland in the early 1970s.

In summary, high serum cholesterol level, high blood pressure and smoking are important factors explaining the high IHD mortality rates in Finland among both sexes. These findings confirm earlier results from follow-up of the same cohort over a shorter monitoring period. Although these results were achieved during the intervention period of the project, they corroborate the information used in the project planning phase and support the initial choice of target risk factors.

REFERENCES

Corrao JM, Becker RC, Ockene IS, Hamilton GA (1990). Coronary heart disease risk factors in women. *Cardiology* **77**(suppl. 2):8-24.

Kannel W (editorial) (1988). Contribution of the Framingham Study to the Conquest of Coronary Artery Disease. *Am J Cardiol* **62**:1109-1112.

Pekkanen J, Nissinen A, Puska P, Punsar S, Karvonen MJ. (1989) Risk factors and 25 year risk of coronary disease in male population with a high incidence of the disease: the Finnish cohort of the seven countries study. *BMJ* **299**:81-85.

The Pooling Project Research Group (1978). *The relationship of blood pressure, serum cholesterol, smoking habits, relative weight and ECG abnormalities to incidence of major coronary events: Final report of the Pooling Project.* American Heart Association, Dallas. (Amer Heart Assoc Monograph 60.)

Stokes J, Kannel WB, Wolf PA et al. (1987). The relative importance of selected risk factors for various manifestations of cardiovascular disease among men and women from 35-64 years: 30 years of follow-up in the Framingham Study. *Circulation* **75**(suppl. V):V65—V73.

13. EXPLAINING CHD MORTALITY CHANGES BY RISK FACTORS AND TREATMENTS

Tiina Laatikainen, Erkki Vartiainen and Pekka Puska

INTRODUCTION

In Finland and especially in North Karelia the coronary heart disease (CHD) mortality has declined dramatically since the early 1970s (Jousilahti 2003). The National FINRISK Study cohorts since 1972 have been used to estimate to what extent the mortality reduction can be explained by the reduction of a few main cardiovascular risk factors within the population. Until the mid 1980s the risk factor reduction explained almost all of the decline, but since then mortality has declined much faster than might have been expected simply by the risk factor reduction (Vartiainen et al 1994).

Most of the effective cardiological treatments were introduced and increasingly used in the 1980s and 1990s both to treat CHD and to prevent it and its complications. In clinical trials such treatments as coronary artery surgery, angioplasty, thrombolysis, statins, ACE-inhibitors and other medication used in secondary prevention have been shown to reduce the risk of dying (Collins et al 1990, Garg and Yusuf 1995, Pedersen and Scandinavian Simvastatin Survival Study Group 1994). However, less is known about the impact of such treatments on mortality at the population level.

A cell-based CHD mortality model has been developed in Britain to assess the population impact of risk factor reductions and different treatments (Capewell et al 2000). This IMPACT model was used to examine how much of the mortality in Finland between 1982 and 1997, when the observed mortality reduction started to differ from risk factor predicted reduction, could be attributed to evidence-based medical and surgical treatments.

RISK FACTOR CHANGES AND CHD MORTALITY

Methods

In Finland CHD risk factors have been monitored in the population by organizing risk factors surveys for a random sample of the adult population. These surveys were started in North Karelia and Northern Savo in 1972. Main CHD risk factors such as smoking prevalence, blood pressure and serum cholesterol have been measured from participants in these surveys (Vartiainen et al 2000).

The logistic regression model to assess the probability of death predicted by three main risk factors was developed based on prospective follow-up of the survey cohort examined in 1972. The national mortality statistics were linked to the survey cohort. Deaths in which ischaemic heart disease was the underlying cause of death were used as the outcome variables in the logistic regression model. Age, baseline total serum cholesterol concentration, and diastolic blood pressure were included as continuous variables and smoking status as a dichotomous variable. The final logistic regression model for the probability of death was 1/(1+exp (12.73-0.108xage-0.806xsmoking-0.021xdiastolic blood pressure -0.384xcholesterol)) for men.

The average probability of a death from ischaemic heart disease for each year when the risk factor survey was done between 1972-2007 was calculated by including the mean risk factor values observed in the survey in this logistic regression function. The relative importance of each risk factor was estimated separately, by changing in the logistic regression function the value of only that risk factor, and keeping the other risk factors unchanged at the 1972 level. The percentage decline in predicted mortality from ischaemic heart disease compared with the 1972 mortality was then calculated for each survey year.

Data on trends in mortality from ischaemic heart disease were obtained from the national mortality statistics for men and women aged 35-64. Yearly mortality was standardised for age in five-year age groups, with the 1972 population in Finland as a standard population. The percentage decline in mortality from ischaemic heart disease was calculated with the mean of the years 1969-72 as the baseline.

Results

From 1972 to 2007 among men in North Karelia and Northern Savo the total serum cholesterol concentration decreased from 6.9 mmol/l to 5.4 mmol/l (i.e. 1.5 mmol/l), diastolic blood pressure decreased from 92.6mmHg to 83.9 mmHg (i.e. 8.7 mmHg)

and the prevalence of smoking decreased from 51% to 30% (i.e. 21 % -points) (for risk factor reductions see Chapter 6).

Based on the decreases in diastolic blood pressure, cholesterol level and smoking the combined risk declined by 60%. At the same time the observed coronary mortality declined 80% in the same areas (Figure 1).
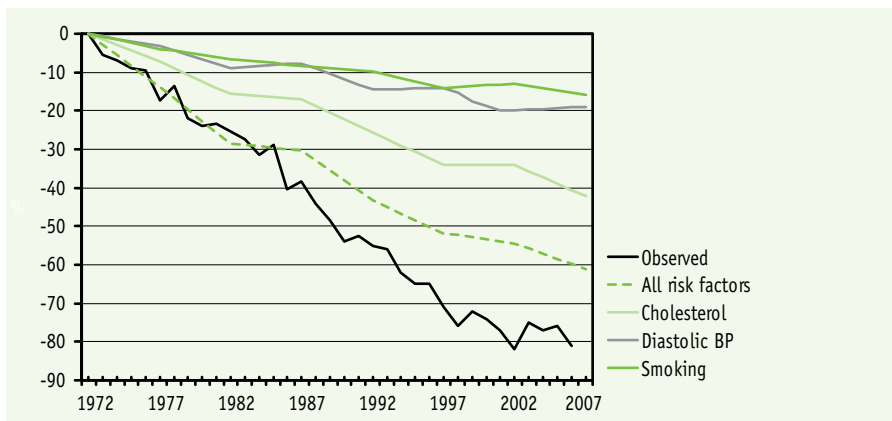
Figure 1. Observed and predicted decline in coronary heart disease mortality in men

IMPACT OF CHANGES IN MEDICAL AND SURGICAL TREATMENTS AND RISK FACTOR REDUCTIONS ON CHD MORTALITY

Methods

Survey areas and risk factor information

For the IMPACT analyses data on population demographics, CHD mortality rates, morbidity rates, risk factor trends and the uptake of different treatments are needed. For the analyses several Finnish data sources were utilized. Analyses were carried out for the populations in North Karelia, the former Kuopio province and for the region around Turku and Loimaa that had each participated in the National FINRISK Study already in 1982, and thus risk factor data was also available for these areas (Vartiainen et al 2000). Prevalences for smoking, diastolic blood pressure and serum total cholesterol in surveys carried out in 1982 and 1997 for the population aged 35-64 years were used.

Mortality, morbidity and treatment data

Mortality data was obtained from the National Causes of Death Register. CHD deaths were defined using ICD coding, 410-414 before 1996, and after that I20-I25.

Morbidity data and prevalence estimated for cardiac patients were obtained from the Hospital Discharge Register, the National FINRISK Study, social insurance data and the FINAMI myocardial infarction register.

Treatment data was obtained mainly by reviewing patients' medical records, but also from the National FINRISK Study and the social insurance register which includes data on reimbursed medicine descriptions. Patients eligible for secondary prevention therapies either after acute myocardial infarction or surgical procedures were determined using the Hospital Discharge Register data and special registers on CABG surgery and angioplasties maintained by the Finnish Heart Association. Data on patients with hypertension, heart failure and angina and data on the uptake of different medical treatments was received from the National FINRISK Study, the Health 2000 Study, social insurance data and the Hospital Discharge Register data.

IMPACT –model

The cell-based IMPACT mortality model has been used in several studies modelling mortality for example in Scotland, England, Wales and New Zealand (Capewell et al 1999, Capewell et al 2000, Unal et al 2004). In brief, in the model the number of deaths expected in 1997 if the 1982 mortality rates would have remained the same was calculated by indirect age standardization. The decline in the actual number of deaths was calculated by subtracting the observed deaths in 1997 from expected deaths using the 1982 mortality rate. The number of deaths prevented or postponed was calculated for specific interventions such as invasive treatments, drug treatments and also for risk factor reduction (Laatikainen et al 2005).

Treatment effects

Data on efficacy of treatments was received from published randomized controlled trials and meta-analyses (Appendices for IMPACT CHD mortality model 2007). Concerning each treatment the absolute mortality benefit was then applied to the appropriate patient group (Capewell et al 2000, Unal et al 2004).

The number of deaths prevented or postponed with each treatment used in 1982 and 1997 was estimated by multiplying 1) the number of patients in that group, 2) the uptake of cardiological treatments, 3) patient adherence and 4) the absolute mortality benefit. The treatment effect was then estimated by subtracting the deaths prevented in 1982 from the ones prevented in 1997.

Risk factor effects

When estimating the effect of risk factor reductions the logistic regression (β) coefficients estimated from Finnish cohorts of the National FINRISK Study were used (2). The number of deaths prevented or postponed was calculated from observed deaths in 1982 by estimating the reduction with observed risk factor reduction between 1982 and 1997, and related β coefficient quantifying the effect for mortality reduction. Calculations were done using the following formula: $d = (1-1/e^{\beta(x_i-x)})n$, where d= deaths prevented or postponed, x_i= initial risk factor mean or prevalence, x= risk factor prevalence in 1997 and β= coefficient from the logistic regression model in the Finnish cohorts.

Results

Coronary heart disease mortality rates declined by 56 % among men and 64% among women aged 35 to 64 years of age between 1982 and 1997. Thus in study areas there were 373 fewer CHD deaths than what would have been expected if the mortality rate had remained as it was in 1982. In risk factors the greatest change was observed in serum cholesterol that declined in overall from 6.2 mmol/l to 5.6 mmol/l (for risk factor reductions see Chapter 6).

Several new medical treatments were introduced, or their use had increased, between 1982 and 1997. Especially, the uptake of medication such as ACE inhibitors and β-blockers for acute treatment of myocardial infarction and, in addition, statins for secondary prevention, had increased remarkably. Also, the number of patients that had gone through CABG surgery or angioplasty was reasonably high in 1997.

Despite the increased occurrence of invasive and medical treatments in 1997, the majority of CHD mortality reduction was still explained by the decline of major risk factors during this period. Together, the decline in the three main risk factors: serum cholesterol, smoking and blood pressure, explained 53 % of the total decline in CHD mortality (Figure 2). The estimated decline in the number of deaths attributable to treatments over and above those achieved in 1982 represented some 23 % of the total CHD decline, invasive treatments and secondary prevention having the largest effect. About 24 % of the decline remained unexplained by the factors included in the model.
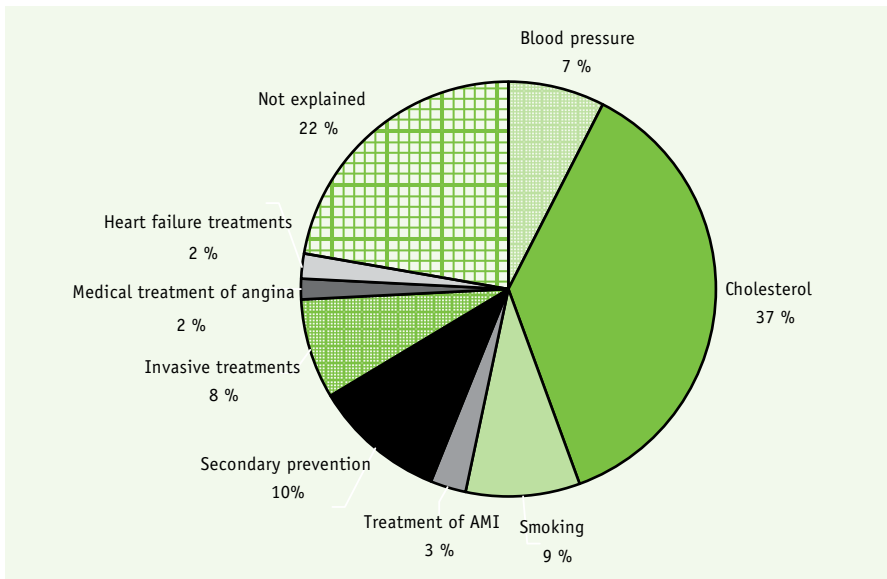
Figure 2. Contribution of treatments and risk factor changes to the decline in CHD mortality in Finland 1982-1997

DISCUSSION

Finnish men had the leading position in coronary heart disease mortality at the end of the 1960s (Thom et al 1992), but the decline in coronary mortality among Finnish men since the 1970s has also been the most rapid in the world (Jousilahti 2003, Kuulasmaa et al 2000, Pajunen et al 2004, Sans et al 1997). About 75% of the observed decline in coronary mortality between 1972 and 2007 in middle-aged men can be explained by decline in blood pressure, cholesterol and smoking. Until the mid-1980s, the observed decline in coronary heart disease mortality can be almost totally explained by the decline in risk factors. Since the mid-1980s, many new treatments and invasive procedures for coronary patients have become more common and their contribution to the decline in observed coronary heart disease mortality has increased.

Between 1982 and 1997 over half of the substantial decline in CHD mortality in Finland was attributable to the reduction of major risk factors. The biggest single contribution was from the large decline in total cholesterol level. Approximately one quarter of the decline was attributable to medical and surgical therapies, especially invasive treatments (CABG surgery and angioplasties) and secondary prevention, both after acute myocardial infarction and surgery.

Compared to other studies, the decline in CHD mortality in Finland is to a larger extent attributable to risk factor reductions. For example, in the United States, New Zealand and UK the contribution of medical treatments was between 40-48 % (Capewell et al 1999, Capewell et al 2000, Unal et al 2004). This can be partly explained by a few factors: a substantially greater decline in population cholesterol levels in Finland, and a quite young survey population (treatments might have greater impact in older age).

Although mortality has declined considerably, and risk factor reductions in Finland explain the majority of the decline, there is still room for improvement. The population total cholesterol and blood pressure levels in Finland are still high compared with those in other Western countries and also smoking rates among the younger age groups remain high. On the other hand, there is evidence of adverse trends in factors contributing to CHD mortality such as increasing trends in obesity, physical inactivity and the increasing prevalence of diabetes (Chapter 6, Chapter 19).

Concerning the invasive and medical treatments, the most substantial contributions were from secondary prevention treatments. As in other studies, the CABG surgery and angioplasties accounted for about 8 % of total decline in mortality (Capewell et al 1999, Capewell et al 2000, Unal et al 2004). A large amount of coronary deaths occur suddenly out of hospital, which naturally limits the effects of hospital interventions at the population level. Also, the interventions are not available for all in need of them, and the uptake levels and compliance to treatments vary a lot. In general, the consistently small contribution of expensive interventional therapies highlights the importance of inexpensive population interventions.

These findings emphasize the importance of a comprehensive strategy that actively promotes primary and secondary prevention programmes for diet and smoking and that also maximizes the population coverage of evidence-based treatments.

REFERENCES

Appendices for IMPACT CHD mortality model. Liverpool: University of Liverpool; 2007 [updated 2007; cited 2008]; Available from: http://www.liv.ac.uk/PublicHealth/sc/bua/impact.html.

Capewell S, Morrison CE, McMurray JJ (1999). Contribution of modern cardiovascular treatment and risk factor changes to the decline in coronary heart disease mortality in Scotland between 1975 and 1994. *Heart* **81:** 380-386.

Capewell S, Beaglehole R, Seddon M, McMurray J (2000). Explanation for the decline in coronary heart disease mortality rates in Auckland, New Zealand, between 1982 and 1993. *Circulation* **102:** 1511-1516.

Collins R, Peto R, MacMahon S, Hebert P, Fiebach NH, Eberlein KA *et al* (1990). Blood pressure, stroke, and coronary heart disease. Part 2, Short-term reductions in blood pressure: overview of randomised drug trials in their epidemiological context. *Lancet* **335:** 827-838.

Garg R, Yusuf S (1995). Overview of randomized trials of angiotensin-converting enzyme inhibitors on mortality and morbidity in patients with heart failure. Collaborative Group on ACE Inhibitor Trials. *JAMA* **273:** 1450-1456.

Jousilahti P (2003). Cardiovascular disease mortality trends in Finland. *Suom Laakaril* **58:** 2969-2971.

Kuulasmaa K, Tunstall-Pedoe H, Dobson A, Fortmann S, Sans S, Tolonen H *et al* (2000). Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project populations. *Lancet* **355:** 675-687.

Laatikainen T, Critchley J, Vartiainen E, Salomaa V, Ketonen M, Capewell S (2005). Explaining the decline in coronary heart disease mortality in Finland between 1982 and 1997. *Am J Epidemiol* **162:** 764-773.

Pajunen P, Paakkonen R, Juolevi A, Hamalainen H, Keskimaki I, Laatikainen T *et al* (2004). Trends in fatal and non-fatal coronary heart disease events in Finland during 1991-2001. *Scand Cardiovasc J* **38:** 340-344.

Pedersen TR, Scandinavian Simvastatin Survival Study Group (1994). Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet* **344:** 1383-1389.

Sans S, Kesteloot H, Kromhout D (1997). The burden of cardiovascular diseases mortality in Europe. Task Force of the European Society of Cardiology on Cardiovascular Mortality and Morbidity Statistics in Europe. *Eur Heart J* **18:** 1231-1248.

Thom T, Epstein F, Feldman J, Leaverton P, Wolz M. Total mortality and mortality from heart disease, cancer and stroke from 1950 to 1987 in 27 countries, National Institutes of Health, 1992.

Unal B, Critchley JA, Capewell S (2004). Explaining the decline in coronary heart disease mortality in England and Wales between 1981 and 2000. *Circulation* **109:** 1101-1107.

Vartiainen E, Puska P, Pekkanen J, Tuomilehto J, Jousilahti P (1994). Changes in risk factors explain changes in mortality from ischaemic heart disease in Finland. *BMJ* **309:** 23-27.

Vartiainen E, Jousilahti P, Alfthan G, Sundvall J, Pietinen P, Puska P (2000). Cardiovascular risk factor changes in Finland, 1972-1997. *Int J Epidemiol* **29:** 49-56.

14. TRENDS IN MOBILITY LIMITATIONS

Päivi Sainio, Tuija Martelin, Harri Rissanen and Seppo Koskinen

INTRODUCTION

Functional capacity refers to a person's ability to perform various tasks, ranging from basic physical functions to social participation. It is formed in the interaction between health conditions and contextual factors (WHO 2001). Impairments in functional capacity refer to contradictions between the individual's own expectations and tasks, or between the external expectations and requirements. On the individual level, disabilities in any components of functioning have adverse effects on the person's quality of life. As a major determinant of need for help, disability also implies a burden to one's family and community as well as to the health and social service system in general. Chronic diseases, health behaviour and living conditions during the life course have a great impact on the development of functioning.

Mobility is an essential part of functioning, and a vital element of independent living and quality of life. While mobility problems, e.g. difficulties in walking or stair climbing, often precede the development of difficulties in more complex tasks, they define a high risk group for whom interventions are beneficial in preventing further decline in functioning (Fried and Guralnik 1997, Guralnik et al 1995).

Although various functional limitations remain a significant problem for older people in particular, many functional restrictions adversely affect both quality of life and work ability in the working-age population (Aromaa and Koskinen 2004, Sainio et al 2008). For example, carrying groceries home from the nearby shop is an everyday life chore and as such a precondition for independent living. One out of five 55–64-year-old women find it difficult to carry a 5 kg shopping bag for a short distance, and furthermore, 10% of them cannot walk fast enough to cross the street safely while the green pedestrian traffic light is on. The prevalence of these difficulties increases dramatically among older women (Sainio et al 2006). As the population is rapidly ageing, it is vitally important to improve the functional capacity of older persons. This will require improvements in the determinants of good functioning during all phases of the life course. If we do not succeed in this, the number of persons aged 55 or over with significant difficulties in mobility will increase by 60% in two decades (Koskinen et al 2008a).

It is important to monitor the changes in functional capacity, in order to provide sufficient health and social services for the rapidly ageing population. In this article, we will examine time trends in mobility restrictions since 1972 in the working age population in North Karelia and other selected areas of Finland.

DATA AND METHODS

Cross-sectional population surveys were performed in 1972, 1977, 1982, 1987, 1992, 1997, 2002, and 2007. The surveys started in the eastern regions North Karelia and Northern Savo (Kuopio province) in 1972 and more areas were included later on: Southwestern Finland (Turku-Loimaa) in 1982, capital area (cities of Helsinki and Vantaa) in 1992, and the province of Oulu in 1997. The surveys and participation rates are described in more detail in Chapter 6.

Questions and response categories on mobility limitations differed between surveys. In this article the analysis of mobility limitations is based on the following questions and response alternatives.

In 1972 and 1977, the survey included the question "Have you had difficulties in climbing stairs?" with two response categories: yes or no. From 1982 onwards, the question was "Do you usually manage the following tasks: climbing stairs (1 flight without resting), walking 500 metres without resting, running 100 metres, running over 500 metres?" In some years the question included a specification of "without help" for some tasks. In 1982–1992 there were two response categories, yes or no. In 1997–2007 three response alternatives were available: no, with difficulties, or without difficulties. The categories "no" and "with difficulties" were combined in our analyses.

The analysis includes subjects aged 30–59 years in 1972 and 1977 and those aged 30–64 from 1982 to 2007. The results are presented by gender and area. Logistic models were used to estimate the adjusted prevalences of mobility limitations. All analyses were performed with SAS 9.1.

RESULTS

Due to changes in the mobility variables as well as in the number of areas included in the study, trends and differences in mobility are presented separately for three periods: 1972–1977, 1982–1992 and 1997–2007.

1972–1977

In 1972, about 16% of women and 15% of men aged 30–59 and living in the eastern regions North Karelia and Northern Savo (Kuopio) reported having difficulties in climbing stairs (Table 1). Difficulties were more common in North Karelia than in Kuopio, and among women than among men in both areas. By the year 1977 the differences between these two areas had disappeared due to contrasting trends: a decline in the prevalence of difficulties in North Karelia and an increase in Northern Savo. In addition, the gender differences had disappeared.

Table 1. Prevalence (%) of difficulties in climbing stairs in the provinces of North Karelia and Northern Savo in 1972–77, women and men aged 30–59 years.

	North Karelia		Northern Savo		Both areas		p-value			
	Women	Men	Women	Men	Women	Men	gender[1]	area[1]	year[1]	year*area[2]
1972	18.0	16.3	14.8	13.4	16.3	14.7	0.03	<0.001	---	---
1977	15.6	15.6	15.7	15.7	15.6	15.6	0.98	0.89	---	---
1972–77	16.8	16.0	15.3	14.5	16.0	15.2	0.12	0.003	0.63	0.002

[1] Model: age, gender, year, area
[2] Model: age, gender, year, area, year*area

1982–1992

In the period 1982–1992, the proportion of participants reporting that they could not climb one flight of stairs without help was about 2% of women and 1% of men aged 30–64 and living in North Karelia, Northern Savo or in Southwestern Finland (Table 2). These prevalences were much lower than in 1972–77, probably due to the different formulation of the questions. A higher prevalence of difficulties was observed in North Karelia and in Northern Savo than in Southwestern Finland, and among women in comparison to men. In general, a roughly similar declining trend was found in all areas during this period.

Table 2. Prevalence (%) of not managing selected mobility tasks without help in the three study areas in 1982–92, women and men aged 30–64 years.

Cannot manage without help	North Karelia		Northern Savo		Southwestern Finland		All three areas		p-value			
	Women	Men	Women	Men	Women	Men	Women	Men	gender[1]	area[1]	year[1]	year*area[2]
Climbing stairs (1 flight)	2.4	1.3	2.5	1.3	1.5	0.8	2.1	1.2	<0.001	0.003	0.04	0.38
Walking 500 m	4.3	4.9	4.5	5.1	2.4	2.8	3.8	4.3	0.06	<0.001	<0.001	0.11
Running 100 m	20.0	15.6	19.9	15.5	16.0	12.3	18.7	14.5	<0.001	<0.001	<0.001	0.22
Running 500 m	55.3	37.2	56.4	38.2	51.8	33.8	54.5	36.4	<0.001	<0.001	0.002	0.10

[1] Model: age, gender, year, area
[2] Model: age, gender, year, area, year*area

On the average, about 4% of the participants reported that they could not manage to walk 500 metres, the proportion being slightly higher among men than among women. Walking difficulties were less common in Southwestern Finland than in North Karelia and Northern Savo. However, a slightly more consistent improvement was found in the latter two areas than in Southwestern Finland (Figures 1a and 1b).

As could be expected, problems in running were quite common. On average, almost 19% of women and 14% of men living in these three areas reported that they could not manage to run 100 metres. The prevalence was smaller in Southwestern Finland than in the two Eastern areas. In general, a declining trend in the prevalence was found in all three areas (Figures 1c and 1d). Roughly similar patterns were found also in the case of running 500 metres. More than one half of women and 36% of men reported that they were not able to run half a kilometre, and the proportion was smaller in Southwestern Finland than in the two Eastern areas.
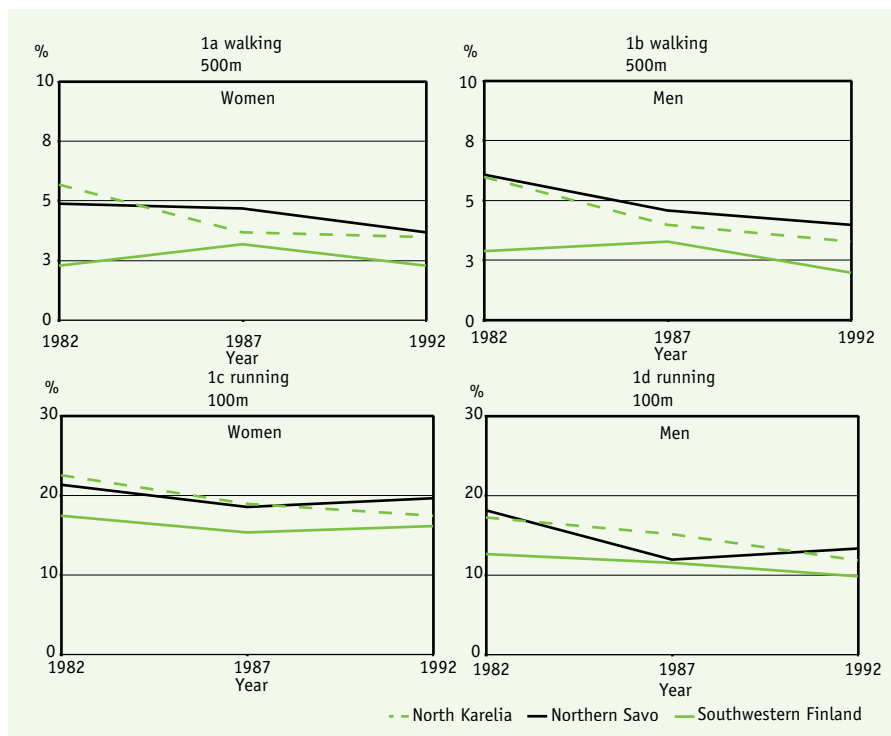

Figure 1. Prevalence (%) of not managing walking 500 metres (a and b) or running 100 metres (c and d) in North Karelia and Northern Savo and in the Southwestern Finland in 1982–1992, men and women aged 30–64 years (age-adjusted).

1997–2007

In the last period findings from the capital area (the cities of Helsinki and Vantaa) as well as from the northern province of Oulu are presented, in addition to North Karelia, Northern Savo and Southwestern Finland. As a result, a more comprehensive picture of the trends in the entire country can be obtained. On average, about 3% of women aged 30–64, and 2% of men, reported inability or difficulties in climbing one flight of stairs (Table 3). No significant regional differences were found, and a roughly similar declining trend was found in all areas. Slightly less than 4% of both women and men, on average, reported inability or difficulties in walking 500 metres. In both genders, problems were less common in Southwestern Finland and the capital area than in the other three areas. In general, the prevalence of walking difficulties declined although the time trends were not quite consistent in all areas (Figures 2a and 2b).

Table 3. Prevalence (%) of inability or difficulties in selected mobility tasks in the five study areas in 1997–2007, women and men aged 30–64 years.

	North Karelia		Northern Savo		South-western Finland		Capital area		Oulu province		All five areas		p-value			
	Wo-men	Men	Wo-men	Men	Wo-men	Men	Wo-men	Men	Wo-men	Men	Wo-men	Men	gen-der1	area1	year1	year* area2
Climbing stairs (1 flight)	2.8	2.1	3.0	2.2	2.3	1.7	2.8	2.0	3.3	2.3	2.8	2.0	<0.001	0.28	0.03	0.56
Walking 500 m	3.9	3.8	4.8	4.6	3.0	2.9	3.0	2.9	3.8	3.7	3.7	3.6	0.68	<0.001	0.01	0.66
Running 100 m	22.8	14.0	22.6	13.8	20.8	12.6	20.5	12.3	22.5	13.8	21.8	13.3	<0.001	0.05	<0.001	0.01
Running 500 m	54.8	33.7	53.6	32.6	51.6	30.8	49.2	28.8	53.7	32.7	52.6	31.8	<0.001	<0.001	<0.001	0.26

[1] Model: age, gender, year, area

[2] Model: age, gender, year, area, year*area

As in the previous period, the gender difference is striking in the prevalence of inability or difficulties in running a short (100m) or a longer (500m) distance, with women reporting these problems clearly more often than men (Table 3). The prevalence of limitations in running was lower in Southwestern Finland and the capital area than in the Eastern or Northern areas. A declining trend was found in the prevalence of inability or difficulties in running 100 metres in all areas except Southwestern Finland; in particular, in 2007, women living in North Karelia had almost reached the level of the capital area (Figures 2c and 2d). Self-reported difficulties in running a longer distance declined in all subgroups.
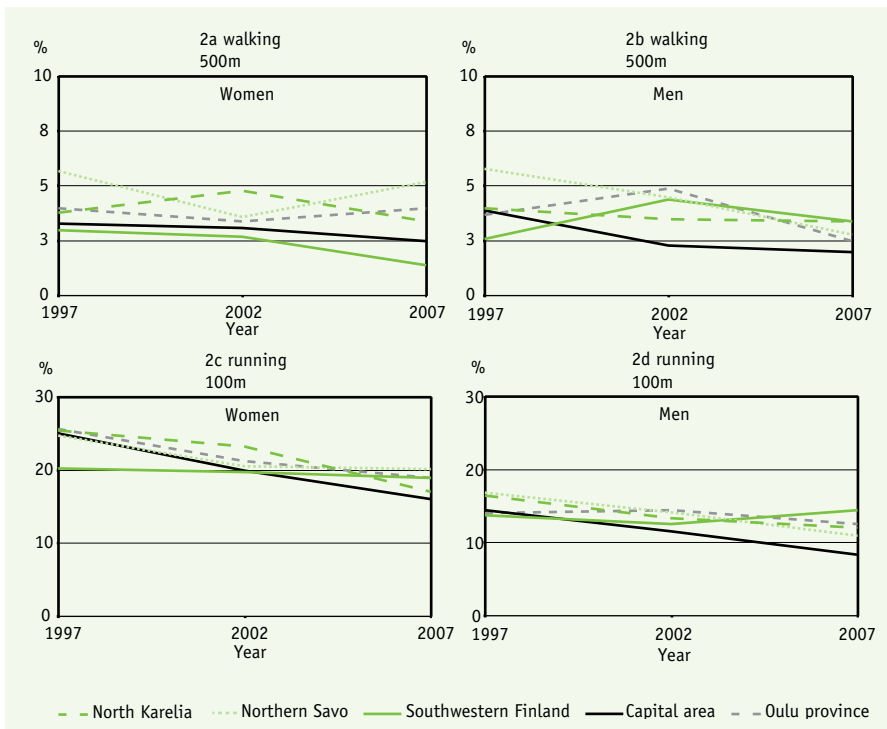
Figure 2. Prevalence (%) of inability or difficulties in walking 500 metres (a and b) or running 100 metres (c and d) in the FINRISK areas in 1997–2007, men and women aged 30–64 years (age-adjusted).

DISCUSSION

Functional capacity in Finland has developed favourably over the last couple of decades according to nationally representative surveys. A smaller proportion of working-age persons perceived their working ability as limited in 2000–01 than twenty years earlier (Koskinen et al 2008b). Also, difficulties in daily activities, for example in dressing, shopping, and cleaning, have decreased markedly at least among persons below 80 years (Aromaa and Koskinen 2004, Martelin et al 2002, Martelin et al 2004).

The prevalence of mobility limitations has declined as well. The proportion of 25–64-year-old persons who cannot walk for 500 metres, decreased by approximately one half from 1979 to 2005 (Martelin et al 2008). A corresponding result has been reported also from a different data set: about ten percent of persons aged 30–64 years experienced difficulties in stair climbing or walking 500 meters in 1978–80, but only 3–4 % in 2000–01 (Aromaa and Koskinen 2004, Martelin et al 2004). According to results from biannual postal surveys, the prevalence of moving outdoors without

difficulties decreased markedly during the period 1993–2007 in the age group 65–84 years, both in men and women (Laitalainen et al 2008).

The results based on FINRISK-surveys confirm these findings, and furthermore, add a new body of evidence by extending the findings to a longer time period. It is unfortunate that the formulation of the questions concerning mobility have been changed over the years, and also that the response alternatives have been altered. Consequently, it is not possible to analyse long term time trends in mobility using a comparable indicator over the whole study period. However, obvious patterns in the time trends and differentials in mobility can be detected. First, there is a general downward trend in the prevalence of difficulties although the changes have not been quite consistent during the study period. In particular, in some cases a faster improvement can be found in North Karelia compared to other regions (climbing stairs in 1972–77; walking in 1982–1992, running during 1997–2007). Secondly, difficulties in mobility tend to be more common in the Eastern and Northern parts of the country than in the South and Southwest. Third, mobility problems are in general more common among women than among men.

The favourable development in mobility can at least partly be attributed to the positive time trends in major determinants of mobility difficulties, i.e. chronic diseases, detrimental health behaviours and adverse occupational exposures (see e.g. Martelin et al 2002, Sainio et al 2007). Cardiovascular diseases (CVD) increase the risk of impaired mobility about threefold (Sainio et al 2007). Consequently, the decline in the CVD risk factor levels (Chapter 6) and the resulting decline in CVD morbidity (Chapter 11) partly explain the observed decrease in mobility limitations. The prevalence of knee osteoarthritis, which also seriously affects mobility, has reduced by 50% during twenty years among Finnish women (Heliövaara et al 2007). Over the same time period arthroplasty has gradually become a fundamental treatment, which has much improved mobility among the patients with osteoarthritis in the hip or knee.

Physical activity maintains and improves functional capacity by different mechanisms: it enhances health, prevents diseases and alleviates their consequences, and reduces excess body fat. Leisure time physical activity increased between 1972 and 2002 among persons aged 25–64 years, but at the same time commuting physical activity decreased (Borodulin et al 2008). Consistent findings are reported in Chapter 7 among North Karelian people. Exposure to heavy physical work load induces damage in lower extremity joints causing mobility restrictions. In Finland, the prevalence of physically demanding work decreased from 60% to 38% in men and from 47% to 25% in women, between 1978 and 2002 (Borodulin et al 2008).

Obesity has adverse effects on mobility, and it affects women more than men (Stenholm et al 2007). Especially harmful is severe obesity (BMI 35 and over). The mean BMI has increased among men during the whole study period and among women since the early 1980s (Chapter 6). However, the prevalence of obesity (BMI 30 and over) has consistently increased among women only in Southwestern Finland and in the province of Oulu, and among men in the eastern regions. In other regions the prevalence of obesity has not changed or the direction of the changes has fluctuated.

To conclude, the prevalence of most common chronic diseases which affect functional capacity has decreased, physical activity in leisure time has increased while exercise related to commuting has decreased, and obesity trends seem to vary according to gender and area. The combined effect of these partly opposing trends in the factors that affect mobility may explain the generally positive development of mobility and the irregularities observed in this general pattern.

The non-participation in the survey has gradually increased during the study period. Jousilahti et al. (2005) have reported that in the FINRISK data sets mortality among non-participating men was twofold and among non-participating women 2.5-fold compared with those who participated in the surveys. These findings suggest that the observed positive trend in mobility may overestimate the true development due to the poorer health of non-participants. Another limitation of this study is that the formulation of the questions on mobility have been changed, preventing continuous analysis throughout the time period. This accentuates the importance of using strictly similar instruments in consecutive surveys when the aim is to monitor time trends.

The projected changes in the population structure emphasise the crucial importance of maintaining and improving functional capacity in all age groups (e.g. Martelin et al 2004). Mobility restrictions often compromise other domains of functional capacity. Furthermore, difficulties in mobility tend to progress, and they lead to a growing need of help and limit one's possibilities to lead an independent life. It is therefore crucially important to prevent restrictions in mobility by influencing the key determinants of mobility. Promoting physical activity and a healthy diet is essential in tackling the growing obesity epidemic. Maintaining good mobility also requires other measures which prevent diseases restricting mobility, as well as good treatment of these diseases. Retaining and improving the remaining mobility of persons with mobility difficulties also involves removing environmental constraints and the provision of adequate aids and rehabilitation services.

REFERENCES

Aromaa A, Koskinen S (2004) ed. *Health and functional capacity in Finland. Baseline results of the Health 2000 health examination survey.* Helsinki: Publications of the National Public Health Institute B12 (http://www.terveys2000.fi/julkaisut/baseline.pdf)

Borodulin K, Laatikainen T, Juolevi A, Jousilahti P (2008) Thirty-year trends of physical activity in relation to age, calendar time and birth cohort in Finnish adults. *Eur J Public Health* **18:**339–44.

Fried LP, Guralnik JM (1997) Disability in older adults: evidence regarding significance, etiology, and risk. *J Am Geriatr Soc* 45:92–100.

Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB (1995) Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. *N Engl J Med* 332:556–61.

Heliövaara M, Impivaara O, Nykyri E, Riihimäki H (2007) Changes in morbidity. In *Musculoskeletal disorders and diseases in Finland,* Kaila-Kangas L (ed), pp 60–69. Helsinki: Publications of the National Public Health Institute B25.

Jousilahti P, Salomaa V, Kuulasmaa K, Niemelä M, Vartiainen E (2005) Total and cause specific mortality among participants and non-participants of population based health surveys: a comprehensive follow up of 54 372 Finnish men and women. *J Epidemiol Community Health* 59:310–5.

Koskinen S, Härkänen T, Martelin T, Rissanen H, Sainio P (2008a) Terveys ja toimintakyky (Health and functional capacity, in Finnish). In the Prime Minister's Office's report on ageing policy. In press.

Koskinen S, Sainio P, Martelin T, Gould R, Järvisalo J (2008b) Has the working ability of the population improved? In *Dimensions of work ability. Results of the Health 2000 Survey,* Gould R, Ilmarinen J, Järvisalo J, Koskinen S (eds), pp 155–64. Helsinki: Finnish Centre for Pensions, The Social Insurance Institution, National Public Health Institute, Finnish Institute of Occupational Health.

Laitalainen, E, Helakorpi S, Uutela A (2008) *Eläkeikäisen väestön terveyskäyttäytyminen ja terveys keväällä 2007 ja niiden muutokset 1993–2007 (Health Behaviour and Health among Finnish Elderly, Spring 2007, with trends 1993–2007*, in Finnish). Helsinki: Publications of the National Public Health Institute B14. (http://www.ktl.fi/attachments/suomi/julkaisut/julkaisusarja_b/2008/2008b14.pdf)

Martelin T, Koskinen S, Kattainen A, Sainio P, Reunanen A, Aromaa A (2002). Changes and differentials in the prevalence of activity limitations among Finns aged 65–74: comparison of the Mini-Finland Health Examination Survey (1978–80) and the FINRISK-97 Senior Survey (1997). *Yearbook of Population Research in Finland* 38:55–75.

Martelin T, Sainio P, Koskinen S (2004) Trends in functional capacity among the ageing population. In *Ageing as a resource,* Kautto M (ed) *Government report on the future, appendix report 5,* pp. 117–31. Helsinki: Prime Minister's Office, Publications 33. (In Finnish, English abstract in: Finland for people of all ages. Government report on the future: demographic trends, population policy, and preparation for changes in the age structure. Prime Minister's Office, Publications

34/2004, Helsinki 2004, p. 104. http://www.vnk.fi/julkaisukansio/2004/j27-28-34-hyva-yhteiskunta-kaikenikaisille/pdf/en.pdf)

Martelin T, Sainio P, Sulander T, Helakorpi S, Tuomi K, Koskinen S (2008) Functional capacity. In *Health inequalities in Finland. Trends in socioeconomic health differences 1980–2005*, Palosuo H, Koskinen S, Lahelma E, Prättälä R, Martelin T, Ostamo A, Keskimäki I, Sihto M, Talala K, Kostiainen E, Linnanmäki E (eds). Helsinki: Publications of the Ministry of Social Affairs and Health. In press.

Sainio P, Koskinen S, Heliövaara M, Martelin T, Härkänen T, Hurri H, Miilunpalo S, Aromaa A (2006) Self-reported and test-based mobility limitations in a representative sample of Finns aged 30+. *Scand J Public Health* 34:378–86.

Sainio P, Martelin T, Koskinen S, Heliövaara M (2007) Educational differences in mobility: the contribution of obesity, physical work load, and chronic conditions. *J Epidemiol Community Health* 61:401–8.

Sainio P, Koskinen S, Martelin T, Gould R (2008) Functional capacity. In *Dimensions of work ability. Results of the Health 2000 Survey,* Gould R, Ilmarinen J, Järvisalo J, Koskinen S (eds), pp 80–90. Helsinki: Finnish Centre for Pensions, The Social Insurance Institution, National Public Health Institute, Finnish Institute of Occupational Health.

Stenholm S, Sainio P, Rantanen T, Alanen E, Koskinen S. (2007) The effect of co-morbidity on the association of high body mass index with walking limitation among men and women aged 55 years and older. *Aging Clinical and Experimental Research*;19:277–283.

WHO (2001) *International classification of functioning, disability and health*. Geneva: World Health Organization.

IV

OTHER RESULTS
AND EXPERIENCES

15. EXPERIENCE WITH MAJOR SUBPROGRAMMES AND EXAMPLES OF INNOVATIVE INTERVENTIONS

Pekka Puska

This chapter describes and discusses a number of major components and sub-programmes of the North Karelia Project. All have been carried out within the theoretical and practical framework described earlier.

What follows is by no means an exhaustive description of the intervention activities in the North Karelia Project, but it does highlight a variety of activities and innovative programmes. The youth programmes are described and discussed separately.

INVOLVEMENT OF HEALTH SERVICES

A major intervention aim was the creation of a service structure to support the community's progress towards the objectives. The main principle throughout has been to exploit the existing service structures, with health services obviously assuming a key role.

With the project's needs in mind, useful existing activities in the health services have been strengthened and new elements created when necessary. The project has prepared several activity models, which have been implemented through official instructions, recommendations, circulars, training meetings, materials, and personal contacts.

The project has developed practical activities on the basis of the set objectives on one hand, and on understanding of the local situation on the other. The functioning of the existing services has been analyzed, while pilot health centres have also been used to develop appropriate and feasible models for work.

Primary health services have played a key role. These are the simple activities that are close to everyday life and in frequent contact with people. In the Finnish health care structure the health centres provide these services.

The project has involved itself extensively in the work of the health centre doctors and public health nurses, each of whom was asked to help modify the risk factors of all patients and clients. Their activities have included inquiring about and recording the

smoking history, advice to stop smoking, inquiry and advice on dietary habits, serum cholesterol and blood pressure measurements and advice to heart disease patients.

Since no extra manpower was obtained for the programme, the new tasks had to be integrated into the normal everyday schedule. Work often had to be re-organized to permit certain nurses or doctors to undertake more of some practical programme tasks. As more resources gradually became available in North Karelia (and throughout Finland), it became progressively easier to realize the new activities.

In the 70s the public health nurses' burden of work increased more than that of the doctors', though the registration of hypertensives generated considerable extra work for them, too, during the initial years. The public health nurses performed more general health education in the field and also undertook the main administrative work for the programme tasks (special offices, screenings, registers, etc). The doctors acted as medical advisors and support personnel.

During the early years of the project the main emphasis was on integrating the basic project needs into the existing service structure. After that it became both possible and necessary to introduce more specialized services to support the basic activities. These were prepared and tested by the project and implemented gradually through the channels mentioned above. For the anti-smoking programme, special smoking cessation services were introduced, while for serum cholesterol reduction, nutrition groups and counselling programmes were developed. Specialized services for hypertension control were also set up.

Usually, a simple inbuilt evaluation was outlined as the activities were specified. To instruct, ensure and check activities at the local level, staff from the Provincial Health Department and the project have frequently visited the local health centres and met the personnel.

Health services were heavily involved in project activities in the early years. This is described and discussed in greater detail in the original project report (Puska et al. 1981). The biggest work load was created by the hypertension programme, described in many publications (e.g. Nissinen et al. 1981, 1986).

During subsequent years many of the activities were integrated and sustained fairly well. Continuous training and other measures have naturally helped in this. The monitoring data, for instance, show that blood pressure measurements in North Karelia remain exceptionally frequent.

At the same time new activities have been introduced and supported by the health services. This particularly refers to the intensified cholesterol lowering activity which began in the late 80s and involved a great increase in serum cholesterol measurements and counselling by health services.

HYPERTENSION CONTROL PROGRAMME

Reduction of the province's generally high blood pressure levels was one of the three intermediate objectives of the North Karelia Project. During the planning it was obvious that a large proportion of people had hypertension and that most were either not even aware of it or not being treated.

Thus in the first phase, and in order to achieve fairly rapid results, much effort was devoted to setting up a systematic programme for detection, treatment and follow-up. A project working group formulated the content of this sub-programme, based on the relevant WHO recommendations.

As part of this sub-programme it was recommended that blood pressure measurements be taken at most contacts with the primary health service and also in connection with special blood pressure measurement activity. Most of the measurements were done by public health nurses, and the project prepared guidelines for the measurement techniques and reference values.

Following the agreed criteria, all people with repeated elevated values were registered in the special hypertension register of the health centre (copy sent to the project's computerized province-wide register). The patients received a personal hypertension follow-up card from the project. Thus repeated blood pressure measurement values were registered (monitored) both in the patient's own card and in their personal record held at the hypertension clinic.

The hypertension clinics at the health centres were mainly operated by a specially-trained public health nurse. In addition to blood pressure values and drug compliance, the nurse also focused on health behaviour and other risk factors relating to blood pressure. The doctors acted as clinical experts within this framework, drawing the initial diagnostic conclusions and initiating and monitoring the antihypertensive drugs etc.

Authority statements, training, instruction materials, patient materials etc. were used to establish and implement this activity. The public health nurses in charge of the hypertension clinics attended very frequent training sessions, during which feed-back was given and discussed.

During the initial five year period of the project nearly 20 000 hypertensives were registered in North Karelia, and this was a major component of the early phase of the project as far as the health centres were concerned. But the effort was justified - the evaluation (partly presented earlier) demonstrated both the feasibility and beneficial results of the hypertension activities.

After that period the centralized provincial register of the project ceased, but monitoring etc. continued at the health centres. Subsequent evaluation showed that

these activities became well integrated into the normal work of the health centres. The frequency of blood pressure measurements and coverage of treatment have remained surprisingly high.

At the end of the 70s more attention began to be drawn to the nonpharmacological control of high blood pressure. A special salt project was initiated using the established channels and methods of the project, including collaboration with the food industry. The results of the salt project demonstrated the feasibility and some initial progress, although changes in the salt consumption at the population level were slow.

During subsequent years the project helped maintain the blood pressure control activity at the health centres. At the same time there was increasing focus on the nonpharmacological measures - particularly dietary changes. In addition to salt, weight reduction and fat modification were emphasized. There was a series of special dietary trials on the potential for dietary control of blood pressure, and particularly on the likely role of fat (Puska et al. 1983).

Overall, the initial blood pressure programme was a major practical activity at the health centres. While it generated plenty of work it also helped to establish and guide the overall project-related work at the health centres. Once established, other activities (e.g. cholesterol control) could start to be emphasized, too. This allowed the strategy for reducing the blood pressure level to start placing more stress on general dietary changes, thereby creating a link with the other project activities to influence the dietary habits of the population.

PERSONNEL TRAINING ACTIVITIES

Another important component of the project has been training of the various personnel groups that have implemented the planned activities in the local settings. Training has thus been based on the defined tasks and activities, and has usually consisted of general information about the health problems, principles for tackling them, performance of the new tasks, measurement techniques, internal monitoring, and practical aspects of the cooperation necessary.

Since the health centre personnel (doctors, public health nurses and other nurses) have occupied such key positions, much of the training has been directed at them. Training has also been given to other health personnel (hospital doctors, teachers, home economics teachers and social workers), and to leaders and counsellors of voluntary organizations and journalists.

An official community leader network was established at the start of the project. This group received project bulletins and other educational materials. Later on, much

larger numbers of local "lay leaders" were trained systematically in order to reinforce change in the community.

Because the basic education of the personnel could not be modified and a great number of workers in the area were involved, the principal training method has been 1-2 day seminars. These have usually been organized jointly by the health department of the province and the project. Voluntary organizations or other agencies have often been involved. Individuals attending the training have been asked to pass on their new knowledge to the other workers at their own health centre. Regular health centre training activities have been encouraged.

Many of the regular training seminars have dealt with specific subprogrammes or activities. Thus the nurses (often with physicians) assigned to hypertension, antismoking, screening or rehabilitation subprogrammes, or to maintaining the AMI and stroke register, have attended regular training seminars. Other seminars have concentrated on more general programme tasks, e.g. general health education.

The participants have usually represented a spectrum of professions related to the activities concerned, though sometimes trainings involve only a single profession. For example, the project initially organized large biannual and later annual two-day seminars for North Karelian doctors. In addition, project representatives have frequently lectured at professional meetings in the area.

Training has always been supported by the distribution of materials, of which the project has developed a great variety. Several guidebooks and other programme materials have been prepared.

The content of training seminars has largely been determined by the project team, the representatives of the provincial health administration, and specialists at the central hospital. Regional and national experts have been used when necessary. Health centre workers or others engaged in practical tasks have always contributed as representitives of the field situation and to provide feed-back.

Over its 25 years, the Project has initiated or been otherwise involved in hundreds of training seminars. Although the nature of the seminars has changed, the focus has always been the discussion of practical tasks (derived from the objectives), action needed, and progress and feedback.

THE PRINT MEDIA

The project has produced a large range of printed materials since 1972. All have been prepared to support particular objectives and community activities/campaigns. Printed materials have always been used to supplement more comprehensive activities

which have usually also been supported by health services and/or voluntary organizations, other types of media etc.

The following list gives some idea of the extent to which the print media were exploited during the five first years of the Project (1972-77)

- local newspaper articles: 1 509
  (877 000 column mm)
- project's information bulletin: 3 000 copies
- posters   22 000 copies
- "wall papers"   22 600 copies
- anti-smoking signs   80 000 copies
- anti-smoking stickers   74 000 copies
- health education leaflets (series 278 000 copies
  of five)
- Fathers' Day cards   97 000 copies

The use of these materials and their coverage are described in more detail in other publications (Puska et al. 1981, Kottke et al. 1984).

After the initial period the press remained interested in the project; newspapers frequently reported on project activities and new findings, and various types of collaboration took place.

A range of printed materials also continued to be produced, particularly posters, leaflets and anti-smoking signs supporting various behavioural modifications and campaigns. Many materials were produced in collaboration with other parties and often sponsored by them. Practically all materials were printed in North Karelia, so the project came to be a good customer of several of the printing companies.

The gradual spead of many of the materials into national use became just one way in which the project work assumed a nationwide dimension. Some materials were distributed in connection with special campaigns, and many (leaflets, self help guide books) were purchased by health centres, other organizations and individuals across Finland.

THE LAY LEADER PROGRAMME

After a few years of implementation, the project team discussed further actions needed to influence the lifestyles in North Karelia on the grassroots level. The relevant theories were considered and attention focused on the principles of the two-step flow of information and of opinion leaders. In every population and community, informal opinion leaders affect attitudes and behaviours in their sphere of influence.

The project team and local representatives considered how this theory could best be used to benefit the programme. The lay leader programme was formulated and launched on the basis of their conclusions.

In every municipality of the province local community leaders and other informants were interviewed to discover the opinion leaders in the local villages. These people were approached, told about the project and invited to be project "assistants". They received initial instructions over a week-end seminar, and then regular contacts and follow-up.

The central idea was to get the lay leaders (active people and members of many organizations) to pay systematic attention to health-related lifestyles (targets of the project) and the necessary environmental changes in their daily lives, and to try to promote the appropriate changes; for example: discussing smoking and diet with people they meet, promoting smoke-free meetings and facilities, urging local grocery storekeepers to improve the availability of cholesterol lowering foods etc.

By 1979 a training meeting for lay workers had taken place in every municipality of North Karelia, and by the end of 1982 almost all had had one or two follow-up training sessions. By this time over 800 people had been recruited as lay workers and participated in the initial training.

This programme worked well in practice and obviously made a useful contribution to the success of the project. The main evaluation results and further details of the implementation are published elsewhere (Puska et al. 1986).

THE WORKSITE PROGRAMMES

Over the years the project became progressively involved with worksite health promotion activities. Various worksites have contacted the project, and numerous activities planned and implemented. These have usually involved simple risk factor measurements and counselling, general information on health promotion, collaborative action (e.g. joint sports activities, weight reduction groups etc.), changes in worksite canteens (e.g. better availability of vegetables, low fat products etc.), and smoking policies at the worksite.

In the 80s, a special worksite project was carried out to gather experiences and learn about the effects of this type of approach. For a TV programme on the project eight middle-sized worksites were chosen in different parts of North Karelia. One smoking worker from each worksite was invited into the studio group of the programme.

During the TV series these people tried to stop smoking, improve their diet, increase physical activity and take up other health promoting activities. Each acted

as the role model for his/her workmates at the worksite, where various supportive activities were also arranged. These included risk factor measurements, counselling, modifications in the food served at the worksite canteen etc.

For the evaluation, eight matched worksites were selected. Risk factors and health behaviours were thus measured at the outset and at the end of this one-year experimental period in all sixteen worksites. The evaluation demonstrated clear benefits, especially on smoking (Puska et al. 1988).

Worksite intervention activities have since been implemented at a variety of worksites, and been used to demonstrate dissemination and community organization.

The experiences generated have often been publicized by the project in the media. Worksite health programmes at many strategic worksites (e.g. bakeries, newspapers) have also exerted favourable influence on the respective organizations. For instance, the largest bakery in North Karelia made major production changes after joining this programme.

THE TV PROGRAMMES

Since 1978, several major nationwide TV series have been broadcast as collaborative efforts between the North Karelia Project and Finnish TV2. In the planning stages, careful attention was paid to to the relevant theories on communication and behaviour change, as discussed earlier in this book.

The TV series broadcast:

Topic	year	number of programmes (appr. 30-45 minutes each)
Stop smoking	1978	7
- " - (repeat)	1979	8
Keys to Health	1980	10
- " -	1982	15
- " -	1984-85	15
Stop smoking	1986	8
	1989	9

The programmes have all used the same format: a group of voluntary high risk people in the studio along with a couple of project experts. The "role models" try to make healthy changes in their lifestyles, with the help of the experts. These experts discuss with the studio group the benefits and necessary skills for the lifestyle changes needed, while also giving advice to the viewers.

The TV programmes were planned by the project but implemented by TV2, which is a public channel and one of the three national TV channels. The programme costs were met by TV2 out of their normal programme funding resources.

The national TV programmes were accompanied by printed materials and various community organization efforts; especially in North Karelia, where advantage was taken of the well-established project networks.

This venture proceeded well, and the viewing rates were high - even among the lower socioeconomic and high risk population groups. The absolute effects have been substantial and thus the cost-benefit ratios have been high; the secondary impacts have also been obvious (Puska et al. 1987, Korhonen et al. 1992). The project's TV programmes have undoubtedly acted as a powerful intervention tool, and been a major avenue for nationwide application of the project work.

QUIT AND WIN CONTESTS

During the STOP SMOKING TV series in 1986 and 1989, major 'Quit & Win' contests were organized. These are designed to increase community participation and incentives for positive action.

In the first contest over 16.000 Finnish smokers participated. The six month abstinence rate of the participants was about 20 %. The second contest was organized jointly between Finland and Estonia.

The general experience has been quite favourable (Korhonen et al. 1992), with the effects being consistently greater in North Karelia than in the rest of Finland.

WHO/CINDI Quit and Win campaigns were arranged since spring 1994. They were based on the above experiences and the first it was carried out in 13 countries, Finland included. Again special efforts took place in North Karelia.

COLLABORATION WITH THE MARTTA (HOUSEWIVES' ORGANIZATION) (AS AN EXAMPLE OF VOLUNTARY ORGANIZATIONS)

There has been close collaboration with the MARTTA housewives' organization, especially for influencing dietary habits in North Karelia. This organization is very influential in rural and semi-rural areas, especially when it comes to the adoption of novel cooking practices.

In addition to the broad on-going collaboration, several specific co-operative programmes have been carried out: "the Parties for Long Life" in the 70s, "the Happy Hearts' Evening" in the 80s, and a weight reduction campaign in the early 1990s. All these programmes have occupied thousands of housewives and their families.

The basic principle of the collaboration has been as follows. The project has first identified the general health needs, and a fairly practical activity then jointly planned;

this has been implemented by the MARTTA organization and supported by the project. Printed support materials have usually been prepared. The formative evaluation has been arranged jointly by the MARTTA organization and the project.

CHOLESTEROL LOWERING COMPETITIONS BETWEEN VILLAGES – AN EXAMPLE OF INNOVATIVE CAMPAIGNING

When the intensified cholesterol lowering activities were being planned in the late 80s, cholesterol levels tended to be highest in the more remote rural areas, where more traditional diets high in dairy fat prevailed. Based on this phenomenon and the notion of genuine community action, the project announced a competition involving dietary changes for cholesterol lowering between villages willing to participate.

The project team first wanted to stage a demonstration competition between a couple of villages, but it turned out that 40 of them wanted to join in. The first competition was between seven villages. The project undertook the initial cholesterol measurements in the adult villagers, who thereafter organized various activities among themselves to promote cholesterol-lowering dietary changes. After a little over two months the cholesterol levels were remeasured. The winning village had an average cholesterol reduction of 11 %, and the mean reduction of all the participating villages was about 5%.

So that more villages could join in, the competition was repeated half a year later, again with a good outcome. The experiences have been exploited in the media to demonstrate the feasibility of cholesterol reduction.

THE BERRY PROJECT

Over the years many individuals and community leaders have voiced economic concerns about staging a project of this type in an area which was initially substantially devoted to dairy farming. With people sharply reducing their consumption of butter and fatty dairy products, economic problems have emerged for dairy farmers and the dairy industry. The other side of the coin is that people complying with the health message have consumed progressively more fruit and vegetables, much of which has been imported produce.

During their discussions, the community and project representatives considered the feasibility of growing tasty, nutritious berries in the North Karelian climate. The focus of attention were black and red currants and strawberries, in addition to the wild berries growing in the large forest areas.

In 1985 a major collaborative project was conceived with inputs from berry farmers, the berry industry, various commercial sectors and the health authorities; it was financed by the Ministry of Agriculture and the Ministry of Commerce. Over a five-year period innovative activities took place to promote the consumption of local berries and berry projects. Information and education was involved, but also sales campaigns, new product development and various supportive activities.

Local berry consumption has subsequently gradually risen; in several parts of the province berry growing has increased substantially, and many farmers have switched from dairy to berry production.

A report on the original berry project describing the approach and outcomes has been published (Kuusipalo et al. 1986). Based on the favourable experiences the local berry farmers again contacted the project, and a new berry project has recently been launched to lend further support to this beneficial change process.

COLLABORATION WITH FOOD MANUFACTURERS AND SUPERMARKETS

Since its inception, lively collaboration has taken place between the project and sections of the food industry. In the 70s this mainly concerned the promotion of low fat dairy products along with the dairies, the promotion of low fat sausages with the local sausage factory and, in the late 70s, the reduction of salt in a number of food items. Many collaborative campaigns have also taken place in and with the supermarkets and their branch stores.

In the late 1980s, intensive activities began to promote further dietary changes aimed at lowering cholesterol levels, which were still high. There was close collaboration between the project and manufacturers of vegetable oil-containing products. One major break-through was the successful development of a domestic rape seed oil.

In partnership with the industry, the use of vegetable oil (particularly rape seed oil) in cooking was promoted. There was also intensive activity devoted to the development and marketing of various fatty spreads with high contents of vegetable oil and often reduced amounts of total fat. Collaboration with the biggest bakery in North Karelia, for example, resulted in an almost complete change from butter use to vegetable oil margarine.

ANTI-SMOKING POLICIES/LEGISLATION

In the early years of the North Karelia Project, one of the anti-smoking goals was to increase the number and accessibility of non-smoking areas. This was achieved by various types of message, and by distributing large numbers of "no smoking" signs and stickers. A very popular sign was "NO SMOKING HERE - we participate in the North Karelia Project". The project also discouraged the display of tobacco advertisements and other promotional materials.

In 1977 the Finnish National Parliament finally passed an anti-smoking law that had been under discussion for several years. Project representatives had actively participated in this discussion, with the director of the project being invited to the parliamentary committee hearings.

The new law eliminated all tobacco advertising in Finland from 1978 on and prohibited smoking in most public places indoors. It prohibited the sale of tobacco to youngsters obviously younger than 16 years, and required health warnings on cigarette packages etc. It also stipulated that 0.5 % of tobacco taxes be devoted to anti-smoking programmes and research (the project was subsequently granted some of this money).

The late 80s and early 90s saw intensifying discussions to improve the legislation, and project representatives were once again actively involved. Finally, in June 1994, parliament passed major amendments prohibiting worksite smoking except in individual offices and special smoking rooms, as well as the sale of tobacco to those below 18 years of age etc.

Over the years the project has also carried out intensive campaigns to promote smoke-free worksites and maximize indoor smoke-free areas. This was achieved through consultations, trainings, promotional campaigns (e.g. via local radio, awarding prizes etc.) and by distributing signs. This time the main sign read "SMOKE-FREE AREA - smoke-free North Karelia". The governor of North Karelia, along with various decision makers and opinion leaders, formerly endorsed this initiative, which was directed at worksites and municipalities.

LEGISLATIVE AND POLICY CONTRIBUTIONS

During the project several of its leading members have been active in various health and health research policy functions.

The project contributed to the passage of the anti-smoking legislation in 1977, as described earlier, and was also involved in the development and availability of commercial mixtures of butter and vegetable oil. In addition, project members occasionlly

participated in certain health policy planning activities (concerning health education, hypertension care etc.).

On the local level in North Karelia, the project was in frequent contact with municipal and local health centre decision makers. These sometimes took place formally, but often as closer personal contacts - as did much of the community organization work. In the 70s formal surveys also took place among local decision makers and health personnel (Puska et al. 1981).

In the 80s the project remained active in national health policy. Moving the project coordination centre to the National Public Health Institute was a great help, since the institute is a major national expert agency under the Ministry of Health. Another obviously important factor was that the project director was elected to represent North Karelia in the National Parliament for the period 1987-91.

In the late 80s and early 90s the project was especially active in facilitating the production and marketing of healthier foodstuffs. Another major goal was to reinforce the anti-smoking legislation, which finally succeeded in 1994.

REFERENCES

Korhonen HJ, Niemensivu H, Piha T et al. (1992). National TV smoking cessation programme and contest in Finland. *Prev Med* **21**:74-87.

Kottke TE, Nissinen A, Puska P, Salonen J, Tuomilehto J. (1984). Message dissermination for a community-based cardiovascular disease prevention program (the North Karelia Project). *Scand J Prim Health Care* **2**:99-104.

Kuusipalo J, Mikkola M, Moisio S, Puska P. (1986). The East Finland Berry and Vegetable Project: A health-related structural intervention programme. *Health Promot* **1**:385-391.

Nissinen A, Tuomilehto J, Elo J, Salonen JT, Puska P. (1981). Implementation of a hypertension control program in the county of North Karelia, Finland. *Public Health Rep* **96**:503-514.

Nissinen A, Tuomilehto J, Kottke T Puska P. (1986). Cost-effectiveness of the North Karelia hypertension program 1972-1977. *Med Care* **24**:767-780.

Puska P, Neittaanmäki L, Tuomilehto J. (1981). Survey of local health personnel and decision makers concerning the North Karelia Project. A community program for control of cardiovascular diseseases. *Prev Med* **10**:564-576.

Puska P, Iacono JM, Nissinen A, Korhonen HJ, Vartiainen E, Pietinen P, Dougherty R, Leino U, Mutanen M, Moisio S, Huttunen J. (1983). Controlled, randomized trial of the effect of dietary fat on blood pressure. *Lancet* **1**:1-5.

Puska P, Koskela K, McAlister A, Mäyränen H, Smolander A, Moisio S, Viri L, Korpelainen V, Rogers EM. (1986). Use of lay opinion leaders to promote diffusion of health innovations in a community programme: lessons learned from the North Karelia Project. *WHO Bull* **64**:437-446.

Puska P, McAlister A, Niemensivu H, Piha T, Wiio J, Koskela K. (1987). A television format for national health promotion: Finland's "Keys to Health". *Public Health Rep* **102**:263-269.

Puska P, Niemensivu H, Puhakka P, Alhainen L, Koskela K, Moisio S, Viri L. (1988). Results of a one-year worksite and mass media based intervention on health behaviour and chronic disease risk factors. *Scand J Soc Med* **16**:241-250.

16. YOUTH PROGRAMMES

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INTRODUCTION

Cardiovascular and other chronic diseases comprise the major public health problem in most of the industrialized world, and in the 1980s it became increasingly apparent that activities to prevent them should start in childhood (Wynder *et al* 1989). There are strong epidemiological justifications for aiming health-promotion at young people. The first argument for starting primary prevention early in life is the early onset of many chronic diseases; the second is that major risk factors and their related behavioural patterns begin in childhood and youth. The serum cholesterol level of Finnish children is known to be extremely high in international comparisons (Knuiman *et al* 1980, Vartiainen *et al* 1982).

Four different studies have been carried out in association with the North Karelia Project to assess the extent to which cardiovascular risk factors can be prevented in childhood and adolescence. The first two studies were family-based, while the other two were more community and school-based programmes. All were designed and conducted in pursuit of the overall aims of the North Karelia Project. Two other studies are also reviewed: smoking prevention programme in schools in Helsinki and the Smokefree Class Competition for adolescents.

DIETARY STUDIES WITH FAMILIES

The main purpose of the family studies was to assess whether the serum cholesterol and blood pressure of children can be influenced by dietary modification. The first dietary intervention involved 30 free-living families in rural North Karelia and consisted of a two-week baseline period, a six-week intervention period, and a six-week switch-back period. During the intervention the parents were instructed to eat a low-fat diet with high ratios of polyunsaturated to saturated (P/S) fats, and to keep food records every second day. There were 16 children aged 13 to 15 years (8 boys and 8 girls) in 12 families. The parents were told that the intervention diet would also be healthy for their children, although the children's diet was not monitored. Among the parents, the proportion of energy from fat decreased from 39% at baseline to

24% during the intervention period and returned to 36% during the switch-back period. The respective P/S ratios were 0.13, 1.17, and 0.16. The serum total cholesterol values of the parents decreased from 6.4 mmol/l to 4.9 mmol/l (23%) and those of the children from 5.6 mmol/l to 4.9 mmol/l (13%). In both parents and children, but more so in the parents, the values rose again during switch-back.

Children participated more actively in the second study (Vartiainen *et al* 1986). Their diets were monitored via dietary records kept on three days of each period. The families involved had 36 children aged 8-18 years, and lived in two semi-rural communities in North Karelia. After a baseline period of two weeks on a conventional diet, the proportion of energy derived from fat declined during the 12-week intervention period from the baseline level of 35% to 24%, while the ratio of polyunsaturated/saturated fats increased from 0.18 to 0.61 (Table 1). The children were then free to revert to their normal diet during a five week switch-back period. Mean serum total cholesterol decreased by 15% during the intervention and then rose almost back to the initial level during the switch-back period (Table 2).

Similar changes were observed in high-density lipoprotein (HDL) cholesterol and also, to some extent, in apolipoproteins Al, All and B. Blood pressure was not significantly affected, although systolic blood pressure tended to decrease during intervention but did not increase again during the switch-back period.

Thus the high serum cholesterol levels observed in many Finnish epidemiological studies seem to be caused mainly by the typical Finnish diet and are amenable to dietary modification. The next issue concerns the extent to which the diet can be improved in an entire population. This continues to be a principal aim of the first and second North Karelia Youth Projects.

THE FIRST NORTH KARELIA YOUTH PROJECT (1978-1980)

Introduction

The aim of the first North Karelia Youth Project, implemented between 1978 and 1980, was to assess whether a community and school-based educational intervention could be feasible and effective in preventing smoking, and for influencing habits which affect serum cholesterol and blood pressure levels. The study protocol was designed using the framework of the World Health Organization (WHO) protocol Atherosclerosis Precursors in Children (WHO 1978) and the international Know Your Body programme (Wynder et al. 1981). Following the initiation of similar planning in other European centers, the study also joined the WHO collaborative study

Health Promotion in Youth. The principles and actual methods of the North Karelia Youth Project have been described in greater detail elsewhere (Puska et al. 1982). This report concerns the effects of the intervention on smoking, diet, serum cholesterol, and blood pressure levels.

Table 1. Means of nutrients in grams and percent of energy intake

	Baseline N=36	Intervention N=36	Switch back N=36
Proteins			
g	82	78	68
%	14	15	13
Carbohydrates			
g	310	319	285
%	51	60	53
Fats			
g	94	55	91
%	35	24	34
Saturated fats			
g	52	23	44
%	20	10	19
Monounsaturated			
g	30	17	25
%	11	7	11
Polyunsaturated			
g	9	13	9
%	3	6	4
Cholesterol mg	408	274	359
P/S ratio	0.18	0.61	0.20
Kcal	2373	2033	2099

Table 2. Means of serum lipids and apoproteins and blood pressure at he end of the three periods

	Baseline	Intervention	Switch back
Cholesterol (mmol/l)	4.94	4.18 ***	4.65 ***
HDL-cholesterol (mmol/l	1.45	1.20 ***	1.41 ***
Triglyserides (mmol/l)	0.86	1.00	0.91
APO AI (mg/dl)	143	131*	142 ***
APO AII (mg/dl)	37.3	35.9 *	37.3 *
APO B (mg/dl)	77.5	72.8*	79.2 ***
Systolic blood pressure	118	114 ***	113
Diastolic blood pressure	72	69 ***	68
* P<0.05,*** P<0.001			

A two-year programme was carried out among school children in North Karelia who were in the 7th grade (13 years old) in 1978. The full intervention programme was implemented by project team members in the two direct intervention schools. A further aim of the project was to assess whether an intervention in all schools in the province, based on local activities following administrative and training measures, would be feasible and have similar effects. Thus the same measures were recommended to other schools in North Karelia and the training and materials were made available.

The purpose of the smoking prevention programme was to enhance the perceived social desirability of non-smoking and to teach children the skills of resisting social pressures associated with smoking. The programme used 14 and 15-year-old peer leaders of both sexes as the primary agents for delivering the non-smoking message in the classroom. These youngsters served as positive role models for those likely to start smoking. Ten sessions were held in the direct intervention schools, while five sessions covered the main elements of the programme in the province-wide intervention.

The goal of the dietary intervention was to lower serum cholesterol levels by reducing total fat consumption and increasing polyunsaturated fatty acid consumption, reducing dietary cholesterol, and increasing the fiber content of the diet. Blood pressure was to be influenced mainly by the reduction of sodium intake. Prevention of obesity was also an objective, although it was given less emphasis because obesity rates were not very high.

In Finland, all children are provided a free school lunch. In the two direct intervention schools, butter used on bread was replaced by soft margarine (with P/S ratio > 1), and whole milk (2.9 to 3.9% fat) by skimmed milk (fat <0.05%), butter milk (fat <0.08%), or water. Vegetable oil was used for salad dressings and cooking. Low-fat meat products were offered when possible. The use of fish, poultry and a variety of vegetables and fresh salads was promoted. Egg yolks were avoided. Food manufacturers serving the schools were requested to reduce the salt content of their products, and the salt used in cooking was substituted by a special mineral salt which had approximately 30% of the sodium replaced by magnesium and potassium. These changes were also recommended for the other local schools and for meals at home.

In the direct intervention schools, a nutritionist visited the homes of the children in the upper 15th percentile of the cholesterol and blood pressure distributions. Healthy diet was also discussed during school lessons. Parent gatherings, leaflets, posters, written recommendations, a project magazine, and the general mass media were used to promote behavioural change. Screening results were explained to the children by a nurse, and a special health passport was used. A school nurse repeated the screening once or twice a year and gave advice and counselling to children using the health passport. Behavioural changes in different school classes were monitored by repeated small surveys and were displayed as charts and discussed at school.

Study design and measurements

The baseline survey in 1978 involved the two direct intervention schools (one urban, one rural), two matched schools representing the rest of the North Karelia (one urban,

one rural), and two more matched schools (one urban, one rural) in a reference area in another province of eastern Finland. Matching was based on the population and socioeconomic features of the municipalities. All the children in the 7th grade of these six schools and their parents were studied, and the composition of the school meals was also examined.

There was a follow-up survey immediately after the two-year programme in autumn 1980, with the same measurements as in the baseline survey. Four more follow-up surveys were done, mainly to assess smoking status: in 1981, 1982, 1986 and the last in 1993 when the subjects were 28 years old. There were 966 children in the 7th grade in 1978; 62 of them left school during the intervention period, leaving 904 children in the study. All of the children participated in the baseline survey, and the response rate was sustained at a high level also in the follow-ups, being 85%, 81%, 84%, 75% and 71%. Smoking was assessed by a questionnaire. Serum cholesterol was measured by Liebermann-Burchard reaction in the first survey and enzymatically in the second.

Results

Smoking

The percentages of students who reported smoking at least once or twice a month in the different school groups are shown in Figure 1. In the baseline survey, before the programme began in the 7th grade, 4-9% of the schoolchildren were smokers by this criterion. The proportion who smoked rose in the reference schools twice as much as in the intervention schools. In 1980, immediately after the intervention programme had finished in the 9th grade, 20% of the students reported smoking in both types of intervention school, while in the reference schools the respective proportion was 30%. (Vartiainen *et al* 1990, Paavola 2006).

In the six-month and two-year follow-ups after the programme, the overall smoking prevalence increased in all the school groups, but a significant difference between the intervention groups and the control group still existed. At the eight-year follow-up when the subjects were 21-year-olds, there were significantly fewer smokers in the schools with teacher-led programmes (30%) compared to the control group (43%). In the 15-year follow-up when the subjects were 28-year-olds, there were no more significant differences in smoking between the intervention and control schools: there were 33 % smokers in the health-educator-led intervention group, 31 % in the teacher-led intervention group, and 37 % in the control group (Paavola 2006).

Among the students who were non-smokers at the baseline, significantly fewer students at the intervention schools compared to the control schools started to smoke until the age of 21. Still at the latest follow-up, at the age of 28, the difference in the smoking onset between the intervention and control schools remained statistically significant, when all smokers were taken into the analysis: 30.8 % in the health-educator led programme, 29.3 % in the teacher-led programme, and 41.2 % in the control schools (p=0.026).
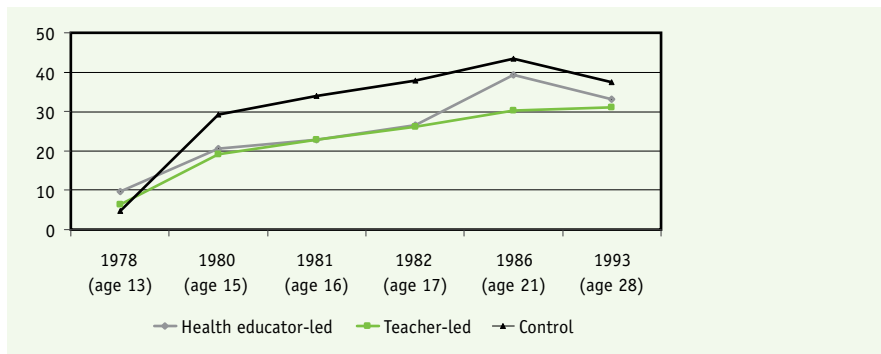
Figure 1. Smokers (%) in follow-up surveys by three groups in 1978-1993

Diet and Total Serum Cholesterol

The changes in the school diet are shown in Table 3. In all three school groups before the intervention, about 37% of the daily energy from school meals was derived from fat. This subsequently decreased by about 5% in all the school groups. The P/S ratio rose in the direct intervention school diet from 0.13 to 0.60. The main reason for this was that butter was replaced by soft margarine and fatty milk by skimmed milk, and vegetable oil was used for cooking and salads. In addition, the dietary cholesterol decreased more in the intervention school diets.

There was a clear decrease in the daily amount of fat obtained from milk and butter in the direct intervention schools (Table 4). Among boys the decrease was 17% (from 48 g to 40 g), and among girls 46% (from 35 g to 19 g). The main reason was the change in the type of milk the children usually drank at home and school. The proportion of children who had switched from full-fat milk (4.9% fat) or from "normal" milk (3.9%) to low-fat milk was 12% in boys and 20% in girls.

Table 3. Content of school meals in 1978 and in 1980

| | ENERGY (kcal/MEAL) | | | PROPORTION OF TOTAL ENERGY (%) | | | | | | | | |
| | | | | PROTEINS | | | FATS | | | CARBOHYDRATES | | |
	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE
DIRECT INTERVENTION	503	463	-04	18.5	18.0	-0.5	36.5	32	-4.5	45	50	+5
COUNTRY-WIDE INTERVENTION	548	523	-25	15.5	16.5	+1.0	36.5	31.5	-5	49	52	+3
REFERENCE SCHOOLS	514	549	+35	18.5	17.5	-1.0	38	33	-5	43.5	49.5	+6

| | | P/S RATIO | | DIETARY CHOLESTEROL (mg/4.2 MJ) (1000 kcal) | | | IRON AND VITAMIN C (mg/100 kcal) | | | | | |
| | | | | | | | IRON | | | VITAMIN C | | |
	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE	1978	1980	CHANGE
DIRECT INTERVENTION	0.13	0.6	0.47	212	168	-44	8.5	11.0	+2.5	57	74	+17
COUNTY-WIDE INTERVENTION	0.14	0.17	+0.03	239	199	-40	10.2	8.5	-1,7	66	60	~-5
REFERENCE SCHOOLS	0.14	0.15	+0.01	255	223	-32	10.4	11.2	+0.8	62	62	0

Table 4. Means of daily milk fat consumption in 1987 and 1980 and the change in two years

| | Boys | | | | Girls | | | |
	Direct intervention	County-wide intervention	Reference area	ANOVA	Direct intervention	County-wide intervention	Reference area	ANOVA
Milk fat in 1979	48	53	54	NS	35	36	40	NS
Milk fat in 1980	40	52	57	p<0.001	19	33	35	P<0.01
Change	-8	-1	+3	P<0.01	-16	-3	-5	P<0.01
N	159	148	128		135	135	146	

The average total serum cholesterol was 5.1 mmol/l at the outset. This declined by about 0.5 mmol/l among boys in all three groups of schools, but among girls the decrease was 0.43 mmol/l in the direct intervention schools, 0.35 mmol/l in the province-wide intervention schools, and 0.21 mmol/l in the reference area schools. The difference between the girls of the direct intervention and reference area schools was significant (p<0.01) (Table 5). Covariance analysis using the base line serum cholesterol value as covariate did not change the observed difference between the school groups, and neither did adding differences in sexual maturity, height and weight into the covariance analyses. No effect on blood pressure was apparent.

Table 5. Serum total cholesterol (mmol) in 1978 and 1980 and the unadjusted and adjusted change in different school groups

	Boys				Girls			
	Direct intervention	County-wide intervention	Reference area	ANOVA	Direct intervention	County-wide intervention	Reference area	ANOVA
Cholesterol in 1978	5.08	5.21	5.15	ns	5.12	5.12	5.07	ns
Cholesterol in 1980	4.55	4.71	4.60	ns	4.69	4.76	4.86	ns
Unadjusted change	-0.53	-0.50	-0.54	ns	-0.43	-0.35	-0.21	P<0.05
Adjusted change *	-0.57	-0.44	-0.55	ns	-0.44	-0.34	-0.22	P<0.05
	149	148	123		131	131	139	

* Adjusted by cholesterol in 1978, change in sexual maturity, height and weight

THE SECOND NORTH KARELIA YOUTH PROJECT

Based on the experiences from the family dietary intervention studies and the first Youth Project, the second North Karelia Youth Project was launched in 1984 and 32 schools were enrolled. The study included about 8000 children in two age cohorts. Most of the intervention objectives remained the same as in the first youth project (Vartiainen *et al* 1986).

Smoking and drinking are closely related habits in adolescence, and social influence and resistance-training programmes which seem to be effective in smoking prevention also appear to prevent heavy drinking.

Understanding of the psychosocial processes involved in the onset of unhealthy behaviours has drawn attention to the utility of supplementing a preventive programme with efforts to improve relationships in the family and at school, and to reinforce social support and skills for coping with stress.

Against this background, the objectives of the programme are listed below:

Health behaviour:
- Prevent smoking
- Prevent alcohol use and abuse
- Improve nutrition:
  a. Decrease total fat intake
  b. Increase the use of polyunsaturated fats and the ratio of polyunsaturated/saturated fats (P/S ratio)
  c. Decrease salt intake
  d. Decrease sugar intake
- Promote physically active life-styles

Biological risk factors:
- Decrease serum cholesterol
- Decrease blood pressure

General sociopsychological factors:
- Promote positive social relations with peer group, adults at school and parents
- Improve problem solving, coping skills, and social relationships

Smoking and alcohol use

The intervention programme included peer leadership and training for social pressure resistance. At the start of each school year each class was asked to form small groups and each group to vote a leader. A short, two-hour group leader training session by project staff was organized in the direct programme group. Group leaders assisted teachers in conducting role plays, encouraged their classmates to participate in project activities, and also served as role models.

Students were instructed about the nature of peer pressure and were taught how to resist pressures to smoke and abuse alcohol. Training included descriptions of peer pressures and demonstrations of resistance techniques on videotapes, accompanied by classroom practice of these techniques. There was also information about parental and other adult influences, correction of normative expectations, and activities focused on decision-making about tobacco and alcohol use, and on developing stress-coping skills and identifying resources for help. The programme comprised seven sessions in the 7th grade, five in the 8th grade, and three sessions in the 9th grade.

Nutrition education

During the seventh grade all students participated in home economics classes. One lesson concerned diet, serum cholesterol and coronary heart disease. All the meals prepared in the home economics class contained less than 30% fat, and the P/S ratio exceeded 0.5. Teachers received special training to facilitate these changes. In the 9th grade one session focused on understanding food choices, and on eating behaviours and consequences. Students filled in a behaviour food record, and during the follow-up session individual dietary habits and the appropriate healthy changes were discussed.

School lunches

Modifications in the school lunch were intended to reduce serum cholesterol and lower blood pressure. In Finnish schools a daily lunch is provided free to pupils. Formal support for the changes was obtained from the national, provincial, and local administrations. Practical aspects were the subject of repeated discussions between the project nutritionist and the kitchen personnel. Training was provided and written explanations provided. The following recommendations were given to the school lunch services:

- Use soft margarine on bread
- Use skimmed milk
- Use vegetable oil in cooking and salads
- Use low-fat meat, fish, and poultry
- Decrease the use of salt

Health screening

A health screening session is normally conducted for all 8th grade students within the school's health care programme. In the project, special training was given in a one-day seminar, during which the health education component of the screening was discussed. Children's blood pressure was measured. Students found smoking in school were sent to the school nurse for a session at which the health hazards of smoking were briefly discussed, but most attention was focused on the pupil's life situation. The main aim of this has been to provide social support for stopping smoking and for coping with the pressures or stress that may induce it.

Mass media

A TV series of 15 programmes called "Keys to Health" was broadcast during the 1984-85 school year. Eight volunteer parents of children in the seventh grade at the direct programme schools participated in the studio group. A health education programme was carried out simultaneously at the workplaces of these parents. Local and district newspapers were involved in the project, which provided them with a series of articles. A WHO meeting on prevention of non-communicable disease risk factors in children was held at the start of the intervention period and used to generate wide publicity for the programme in the newspapers. Feedback on the outcomes of the surveys was made available to the media.

Evaluation design

The aim of the evaluation is to assess the feasibility and effects of the intervention programme. The study design is shown in Figure 2. Three groups of schools were selected. In the first, direct intervention was carried out by project workers, teachers and trained peer leaders. In the second group the intervention was done mainly by the teachers, with training and assistance from the project's health educators. Teachers were provided written and audiovisual materials. The third control group consisted of eight schools where the normal health education was given.

School year	Grades		
	7th	8th	9th
1983-84			0
1984-85	X0		
1985-86	X	X	
1986-87	(X)	X	X0
1987-88	(X)	(X)	X0-0

0 survey
X intervention
(X) intervention continues if shown feasible and effective

Figure 2. Study design in the second North Karelia Youth Project

The programme was applied to two age cohorts from 7th to 9th grades. In 1984, before the intervention began, the project conducted surveys of students leaving the 9th grade. A similar survey of the first age cohort to participate in the intervention programme took place in 1987, and another in 1988 for the second age cohort. Internal monitoring of the first age cohort at the end of the 7th grade (after one school year of intervention) was carried out in spring 1985.

The surveys took place as follows:
1. All ninth graders of the study schools in 1984, 1987 and 1988 (n = 4253) were requested to participate in a 45-minute questionnaire session at which they were to complete a 63-item self-report to identify the following items: school, class, sex, age, and aspects of behaviour.

2. From each school 16 boys and 16 girls were randomly selected for medical examination. The variables measured were: height, weight, blood pressure (by manual and/or automated methods), sexual maturity (Tanner's scale), serum total cholesterol, HDL cholesterol, and thiocyanate. Serum fatty acids were also analyzed among students at the direct intervention and control schools.

3. Children participating in the medical examination filled in an additional questionnaire assessing their health knowledge, social normative beliefs, social norms, peer pressure, skills for resisting social pressures, social support, and relationship with parents.

4. Parents of these children filled in a questionnaire on socioeconomic variables, their own health behaviour, health beliefs, risk factors, and the child's diseases and health.

5. Twenty-four-hour dietary recall was collected in the direct intervention and control schools from the children who participated in the medical study.

6. The nutritional content of the school diet was calculated over one month, based on the stock book kept by the school kitchen staff.

The present Chapter presents the effects of the programme on smoking, drinking, dietary behaviour, school diet, and serum total cholesterol.

Results

Smoking

The short-term effects of the programme were assessed by a survey among seventh graders in spring, after one school year of the programme. At the direct programme schools 8.4% of students reported smoking at least once a week, at the teacher-led programme school 10.9%, and at the reference schools 15.5%. The direct programme schools had 49% fewer smokers and the teacher-led programme schools 30% fewer than the reference schools.

Self-reported smoking rates in the ninth grade prior to the programme and in the next two age cohorts participating in the programme are shown in Table 6. Daily smoking increased more or less equally in all the school groups, from 22% in 1984 to 26% in 1988, indicating that the programme effect observed in the seventh grade seemed no longer to exist in the ninth grade.

Table 6. Reported daily smoking rate in the 9ᵗʰ grade before the programme (1984) and in the two age cohorts (1987, l988)

	Direct programme{%}	Teacher-led programme	Reference schools
1984	21.3	21.8	23.9
1987	23.3	25.3	27.5
1988	21.9	26.9	25.2

° Loglinear model: year, p<0.001; school group, p<0.05; year times school group, N.S.

Diet

Based on the questionnaire, a dietary habits index was calculated. The children were awarded one point for each of the following habits: used margarine, light spread, or nothing on bread at home or at school; drank skimmed milk at school or at home; used vegetable oils with salads; ate vegetables at least three times a week; ate berries or fruits at least three times a week; did not add salt to food at the table.

Dietary habits assumed a positive trend in each of the school groups. The changes were greater in the direct programme and teacher-led programme schools than in the reference schools. Dietary trends in girls tended to be slightly more favorable than in boys, but the overall improvement was almost equal (Figure 3).
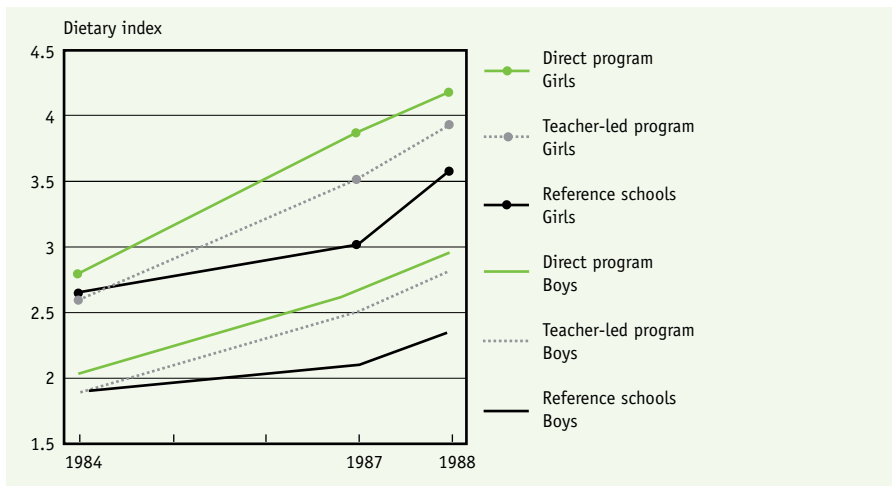
Figure 3. Dietary changes in different school groups in boys and girls

In the direct programme and reference schools the content of school lunches was calculated over a one-month period based on the stock book kept by the school kitchen staff (Table 7). In the direct programme schools the fat proportion decreased from 34.0 % to 31.4 %. There was no change in the reference schools. The polyunsaturated/saturated fat ratio improved in programme schools, but was unchanged in the reference schools.

Table 7. School lunch content in the direct programme and control schools before and after the programme

	Direct programme		Reference	
	Before	After	Before	After
Proteins Fats Carbohydrates	17.7 %: 34.0% 48.3%	20.9% 31.4% 48.6%	18.7% 37.0 % 44.1%	19.1 % 36.3% 44.6 %
Iron	1.8 mg/MJ	2.1 mg/MJ	1.8 mg/MJ	1.9 mg/MJ
Vitamin C	14.7 mg/MJ	17.7 mg/MJ	16.5 mg/MJ	15.0 mg/MJ
Sugar	7.0%	5.8%	3.5 %	5.6 %
P/S ratio	0.16	0.25	0.16	0.14

The mean total serum cholesterol fell from 4.67 mmol/l (179 mg/dl) to 4.55 mmol/l (176 mg/dl) – a reduction of 2.6% and similar in all the school groups. Systolic blood pressure declined faster in the direct programme than in the teacher-led or reference schools (Figure 4). No effect was seen on diastolic blood pressure.
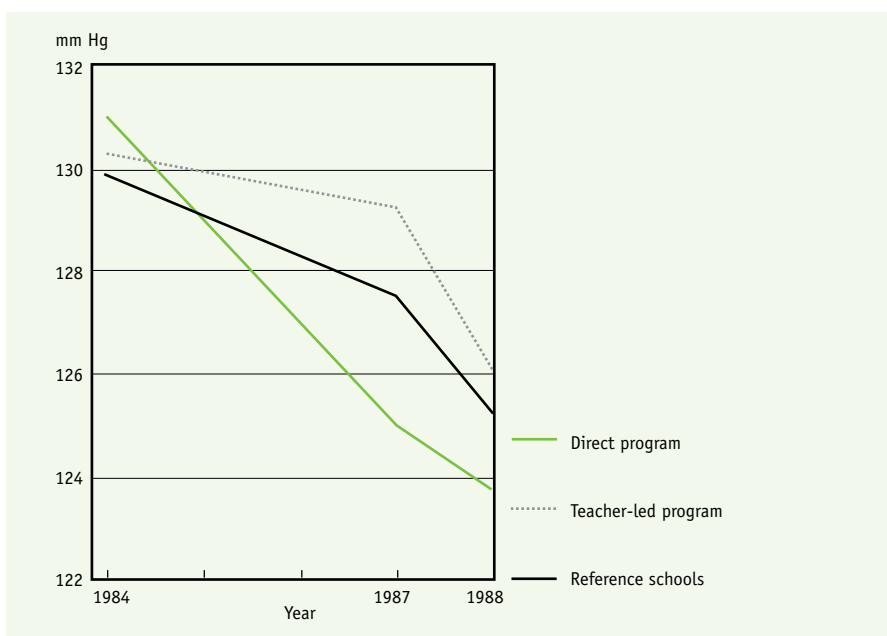
Figure 4. Change in systolic blood pressure by intervention groups and year

SMOKING PREVENTION PROGRAMME IN SCHOOLS IN HELSINKI

Introduction

During the last decades, many smoking prevention activities for adolescents have been implemented. Prevention programmes are very commonly situated in schools, because schools are very natural places to provide health education (Thomas 2006). Since prevention programmes providing solely information appear to be ineffective, other prevention programmes therefore have been developed. Social influence approaches use normative education methods and resistance skills training. With this approach a number of studies have accomplished some short-term positive results, some long-term results have been reached as well. Also, several studies indicate that with school-community incorporated programmes setting smoking rates can be deducted. However, many smoking prevention programmes have failed to accomplish positive results.

The aim of the smoking prevention programme called European Smoking prevention Framework Approach (ESFA) was to reach adolescents at four levels: the individual level, parental level, school level, and out-of- school level. The ESFA programme is based on the Attitude, Social influence, self-Efficacy model (ASE) (de Vries et al 2003), which is developed from the social learning theory, theory of reasoned action and theory of planned behavior, including measurements of social modeling and social pressure. The programme was followed through in Denmark, Finland, the Netherlands, Portugal, Spain, and the UK.

Methods

In Finland, 2745 students within 27 secondary schools in Helsinki participated in the ESFA programme (Vartiainen et al 2007). Schools were randomized in experimental (13) or control groups (14). Experimental schools received the prevention programme and control schools usual health education curriculum. A total of 25 students changed school during the programme and were excluded from the study.

The number of participants at the baseline survey was 2816. Due to dropouts caused by absenteeism, change of schools, uncompleted and non-returned questionnaires at 7th grade 2 745 students participated 2 732 in the 8th grade and 2606 in the 9th grade. The average age of the respondents was 13.8 and 52.0% of them were boys.

The programme lasted from seventh grade to ninth grade. Data were collected in seventh, eight and ninth grades. Students were invited to participate and to read the introductory letter. The students filled in the questionnaires during teacher-led

classroom sessions, and put them in envelopes and collected them into a post bag. The bag was closed in front of the students and immediately mailed to researchers. The bar-code allowed students identification.

Teachers were trained for the programme. They participated in 2-3 training days during each programme year. Training days included information about the programme, smoking prevention and practical training for lessons. Teachers received manuals about the programme, information during visits, and phone calls from a researcher.

The programme included 14 lessons of information about smoking, and refusal skills training led by an outside drama group. Adolescents attended five lessons each year during the first and second years, and four lessons during the third year. Smoking prevention was also integrated into regular subjects like maths, Finnish and geography. In the third year one smoking cessation lesson was given by school nurses. During the first and second years students hung up self-made antismoking posters in public places and received newsletters, while other young people described their ways of refusing smoking. To elicit these descriptions a behavioural journalism technique was used (McAlister 1995). Students also had an opportunity to participate in non-smoking contests.

Parents and school personnel were offered information about the programme. Those who were smokers were given information about cessation, and they were motivated to take part in Quit & Win contest. In Finland about 90% of the adolescents aged 15 take part in parish confirmation classes and camps. Therefore, during the third year parish confirmation camps were included in the programme too. Leaders of the camps were informed about the programme and trained to motivate students to participate in antismoking activities. In the third year school dentists were involved in the programme as well. During regular two-minutes dentists' appointments trained dentists informed students about hazards of smoking and how smoking affects their gums and teeth.

Results

Weekly smoking increased less in the programme than in the control schools. After the first year of intervention in the eight grade 18.7% smoked at least weekly in the programme school and 23.5% in the control schools. The statistically significant odds ratio for the programme effect was 1.33, which was adjusted by the small baseline difference in smoking at the baseline. In the 9th grade weekly smoking prevalence was 25.6% in the intervention and 35.2% in the control schools (OR 1.30), which was also statistically significant.

Among never-smokers at the baseline smoking onset was more frequent in the control group than in the experimental group. At 8th grade 4.3% of students in the experimental group started to smoke weekly, in the control group 8.9% (OR 2.18), and in the 9th grade in the experimental group 14.2%, and in the control group 19.7%.

Program effect [1] 8th OR = 0.47(0.30-0.71) 51%
                    9th OR = 0.68(0.51-0.89) 28%

The OR for weekly smoking for experimental school compared to control school pupils
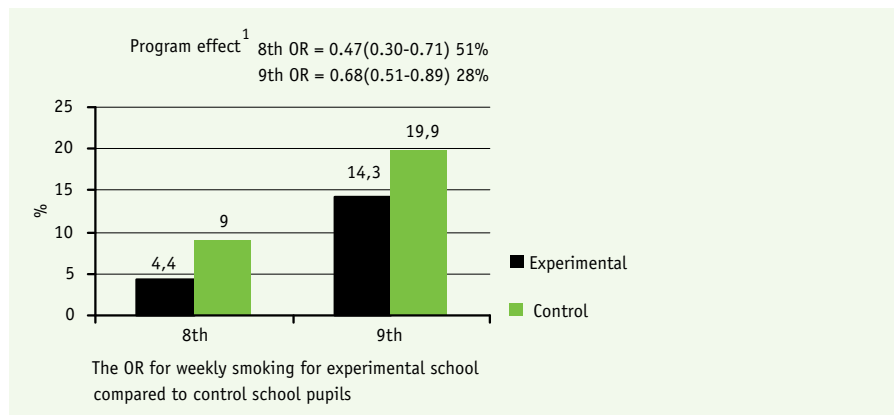
Figure 5. Percentage of weekly smokers (Baseline smokers excluded)

Discussion

This programme prevented the onset of smoking in adolescents. One aim of the European ESFA project was to create large community programmes as well. In Finland for practical reasons only the capital area was chosen for the programme, so some randomized selected schools were situated close to each other. Therefore, we could not exploit the community programme fully, like utilizing strong media involvement. The strength of this programme was that collaboration with the participatory crew succeeded well. The school bureau of Helsinki and headmasters in different schools supported the programme well and therefore, made it possible to carry out the programme successfully.

Teachers participated in 2-3 training days per year. That was a large investment, however, we believe that trained teachers can benefit from the information and educational material they received for the duration of their careers.

It is difficult to say whether it is more effective to employ outsiders to organize smoking prevention activities than to let school personnel provide it. Refusal skills training was organized by a drama group, although this increased costs. According to students' positive feedback we believe it was worth it, and therefore it is recommended if schools can provide capital for it. Since one aim of the Finnish National Health

Program is to halve adolescent smoking prevalence by 2015, this kind of smoking prevention programme should be part of the normal curriculum in schools.

With this prevention programme we could partly affect those pupils at greatest risk of starting smoking However, it is equivocal to say whether this programme will have any long-term affects on adolescent smoking. In future we need more adolescent smoking prevention programmes, which are tailored to those youths who have special needs, like pupils who have poor school achievement, whose parents, or one of their parents, are smokers, and whose best friend, or friends, are smokers. Also prevention programmes should be targeted at pupils who have not experienced smoking yet. This way prevention programmes could be the most effective, especially on those at highest risk of starting smoking. Moreover, long-term smoking prevention programmes which last up to adulthood are needed. That way we can better ensure that adolescents can abstain from smoking for a longer period and that the risk of onset decreases, because it is rare to start smoking after age of twenty.

SMOKEFREE CLASS COMPETITION

The Smokefree Class Competition is a school-based smoking prevention project, which was first established in Finland, where it has been organised annually since 1989. The competition has been carried out at European level since 1997. The European Commission has provided co-funding for the competition, first in the framework of the European Network on Young People and Tobacco (ENYPAT). This has enabled the programme to be developed and disseminated on a European scale. All countries have has different complementary funding sources, e.g. governmental institutions and NGOs. Practically, the European competition has been coordinated by IFT-Nord, Germany. The participation rate has increased a lot from 1997 to 2008. In 1997, seven countries and 3821 classes participated in the Competition. In 2008 there were 19 countries and 28 609 classes with 648 000 pupils taking part. (www.smokefreeclass.info)

The goals of the Smokefree Class Competition are: 1) delay or prevention the onset of smoking, and 2) cessation of smoking of the pupils who have already experimented with smoking in order to hinder them from becoming regular smokers. The main idea is that the classes decide themselves to be non-smoking for a period of six months. Target groups are pupils aged 11-14, since this is the age group where pupils start to experiment with smoking. Classes in which pupils refrain from smoking can participate in a national and international prize draw with attractive prizes. The rules may vary between countries. The Internet is used to intensify communication between

the classes of the various participating countries. The European main prize has been a trip for one class to another European country.

The purpose is to reinforce non-smoking behaviour as the standard behaviour. Social norms within the peer groups are influenced in a way that non-smoking becomes more common in classes than smoking. The main idea is that positive reinforcement enhances the probability of producing a desired behaviour.

Discussions on smoking and further creative class activities in class are interactive ways to address the subject of non-smoking. Pupils are not only informed about the harmful effects of smoking but also encouraged to engage themselves in creative activities to learn more about smoking, motives for smoking onset, and the environmental, physical and ecological consequences of smoking.

In the study of the Smokefree Class Competition in Germany (Wiborg & Hanewinkel, 2002) it was found that the effect of competition was especially strong among those of the young who were non-smokers at the baseline, in the seventh grade. In a six-month follow-up after the competition had finished, smoking had increased significantly more in the control groups than in the intervention groups. These results are comparable with those of a Finnish study (Vartiainen *et al*, 1996). In another study from Germany on the Smokefree Class Competition (Schulze *et al*, 2005) no effect of the competition was found in smoking in an 18-month follow-up. However, in that study immediate effects were not studied, and "drop-outs" were not analysed separately. In a Dutch study (Crone *et al*, 2003) the results showed a favourable effect of the competition in short-term, but in the one-year follow-up the effect was weakened, being no longer significant. In Norway the competition-based programme was also found to be successful, the results showing lower smoking prevalence among participants, especially among girls (Svoen & Schei, 1999).

Several successful smoking prevention programmes have included rewarding elements as well as pledges and other forms of public commitment as part of the programme. However, experiences seem to indicate that programmes directed to young people should be continued during adolescence and that one single campaign is very unlikely to have a long-term effect. Therefore, school-based prevention programs need to be embedded in a comprehensive tobacco prevention strategy, including different age appropriate programmes.

SUMMARY

The two family-based studies show that the high blood cholesterol level prevailing among Finnish children can be reduced by dietary changes. They also show that

parents occupy a key position: in the first study only the parents' diet was actively changed, though they were told that their children could adopt the same diet. In the second study the diets of both parents and children were actively changed; however, the serum cholesterol of the children fell by about the same amount in both studies.

In the first community-based study it was possible to change the diet more in the direct programme than in the control schools. The changes were greater among the girls than the boys, and this was reflected in blood cholesterol levels. In the second programme, dietary changes were greater in the direct programme and teacher-led programme schools than in the reference schools. However, the change in serum cholesterol was equal in all the school groups. It is likely that the differences in the dietary changes between the school groups were too small to reveal any effects on cholesterol level.

Cholesterol decreased in all the school groups, which is obviously a consequence of changes in the Finnish diet. Over recent years several cholesterol debates have emerged in Finland. Updated fat legislation allows manufacturers to produce a novel variety of fatty spreads and related products. The Finnish Heart Association ran a national nutrition campaign focused on cardiovascular disease. The National Board of Education produced national recommendations for the school lunch service covering the amount and type of fat in school meals. These recommendations mirrored those of our own programme. Health Behaviour among the Finnish Adult Population Survey reveals positive changes in the diets of Finns. All things considered, it is quite obvious that the observed changes in cholesterol level among young people are real changes, and related to general dietary changes nationwide.

Many studies over the past 30 years have demonstrated that programmes based on the social influence approach can prevent the onset of smoking, at least in short-term follow-up, and most show that it is possible to delay the onset. However, while we are still not completely clear about the most important components and mediating factors in these programmes, they are the best thing available and should be used on a routine basis in schools. Moves have begun in Finland to ensure that these programmes become installed as a normal part of the curriculum in as many schools as possible.

REFERENCES

Crone MR, Reijneveld SA, Willemsen MC, van Leerdam FJ, Spruijt RD, Sing RA (2003) Prevention of smoking in adolescents with lower education: a school based intervention study. *J Epidemiol Community Health* **57**, 675-80.

De Vries H, Mudde A, Kremers S, Wetzels J, Uiters E, Ariza C, Vitória PD, Fielder A, Holm K, Janssen K, Lehtovuori R, Candel M (2003) The European Smoking Prevention Framework Approach (ESFA): short-term effects. *Health Educ Res* **18**(6):649-63

Knuiman JT, Hermus RJJ, Hautvast JGAJ. (1980) Serum total and high density lipoprotein (HDL) cholesterol concentrations in rural and urban boys from 16 countries. *Atherosclerosis* **36**:529-537.

McAlister A. (1995) Behavioral journalism: Beyond the marketing model for health communication. *Am J Health Promot* **9**: 417-420

Paavola M (2006) *Smoking from Adolescence to Adulthood. A 15-year Follow-up of the North Karelia Youth Project*. Doctoral dissertation. (Publications of the National Public Health Institute A16/2006)

Puska P, Vartiainen E, Pallonen U, Salonen JT, Pöyhiä P, Koskela K, McAlister A (1982) The North Karelia Youth Project: evaluation of two years of intervention on health behavior and CVD risk factors among 13- to 15-year-old children. *Prev Med* **11**:550-570.

Report of the 95th Prevention of Adult Atherosclerosis during Childhood (1989) Ross Conference on Pediatric Research. Ross Laboratories. Columbus, Ohio 43216.

Schulze A, Mons U, Edler L, Potschke-Langer M (2006) Lack of sustainable prevention effect of the "Smoke-Free Class Competition" on German pupils. *Prev Med* **42**:33-9.

Svoen N, Schei E (1999) Adolescent smoking prevention-primary health care in cooperation with local schools. A controlled intervention study. *Scand J Prim Health Care* **17**, 54-8.

Thomas R, Perera R (2006) School-based programmes for preventing smoking. *Cochrane Database Syst Rev* **3**: CD001293.

Vartiainen E, Pallonen U, McAlister A, Puska P (1990) Eight-year follow-up results of an adolescent smoking prevention programme: the North Karelia Youth Project. *Am J Public Health* **80**:78-79.

Vartiainen E, Pennanen M, Haukkala A, Dijk F, Lehtovuori R, De Vries H (2007) The effects of a three-year smoking prevention programme in secondary schools in Helsinki. *Eur J Public Health*. **17**:249-56.

Vartiainen E, Puska P, Pietinen P, Nissinen A, Leino U, Uusitalo U (1986) Effects of dietary fat modifications on serum lipids and blood pressure in children. Acta Paediatr Scand **75**:396-401.

Vartiainen E, Puska P, Salonen JT (1982) Serum total cholesterol, HDL cholesterol and blood pressure levels in 13-year-old children in eastern Finland. *Acta Med Scand* **211**:95-103.

Vartiainen E, Puska P Tossavainen K, Viri L, Niskanen E, Moisio S, McAlister A, Pallonen U (1986) The North Karelia Youth Project (1984-88), prevention of non-communicable diseases: risk factors in youth. *Health Promot* **1**:269-283.

Vartiainen E, Saukko A, Paavola M, Vertio H (1996) 'No Smoking Class' competitions in Finland: their value in delaying the onset of smoking in adolescence. *Health Promotion International* **11**, 189-192.

Wiborg G, Hanewinkel R (2002) Effectiveness of the "Smoke-Free Class Competition" in delaying the onset of smoking in adolescence. *Prev Med* **35**, 241-9.

WHO *Study of the Precursors of Atherosclerosis: Protocol of a WHO collaborative project.* (1978) WHO/CVD/L World Health Organization, Geneva.

Wynder EL, Berenson GS, Strong WB, Williams C, Haley NJ, Nicklas M, Mancini M, Okuni M (1989) An American Health Foundation monograph on. coronary artery disease prevention: cholesterol, a pediatric perspective. *Prev Med* **18**:323 -409.

Wynder EL, Williams CL, Laakso K, Lewenstein M (1981) Screening for risk factors for chronic disease in children from fifteen countries. *Prev Med* **10**:121-32.

17. THE PROJECT EXPERIENCE IN THE EYES OF LOCAL HEALTH WORKERS

Ritva Mäki and Risto Jukola

PUBLIC HEALTH NURSE (RITVA MÄKI)

I have worked as a public health nurse at a North Karelian health centre since the the project was launched, which coincided with the introduction of new national public health legislation. The North Karelia Project transformed the activities of public health nurses in many ways. Previously they had largely worked with children and pregnant women at the maternity and child clinics, but the new project activities meant that they now had to involve themselves more with prevention and health education among adults.

In the beginning, many of the adults, particularly men, were somewhat embarrassed to be visiting a former maternity and child clinic. Fortunately, humour managed to dissolve the initial discomfort, and nowadays visits and contacts with the preventive and health promotion services are an integrated, routine feature of life in the province.

One of the first principal activities of the project was the launch of the hypertension programme. The reorganization of hypertension care requiredd new roles and duties of the public health nurses. Special hypertension offices (clinics) were established at the health centres, and the public health nurses assumed the main responsibility for them. People with elevated blood pressure based on the project criteria were registered, and blood pressure levels regularly monitored. In connection with these measurements we discussed with the subjects their lifestyles and health behaviour, and any appropriate adjustments they could make.

This task was challenging, but it was also diverse and rewarding. Most North Karelians at that time made their livelihood from farming, particularly dairy farming. Many hypertensive and coronary patients felt it difficult to "abandon" the dairy products from their own farm and buy vegetable margarine from the local store. Moreover, the availability of healthy food products was far poorer than now.

For example, the choice of vegetables and low fat dairy and meat products was very narrow. The main task of the public health nurse in cardiovascular disease prevention

was to teach people the practical skills to modify their health behaviour. For this purpose the project provided excellent training.

Before the project began I had worked for two years at the local community hospital, where most of the myocardial infarction patients were young or middle-aged men. I saw how much distress and economic hardship was caused when the father of the family was disabled by heart disease.

When I was treating these patients I often wondered what could be done for the health of the men before they were struck with the disease, and also how to prevent new attacks. When I carried my hospital experience into my new job as a public health nurse, I was very keen about the project activities being planned for working-aged men. The same enthusiasm emerged among my colleagues throughout North Karelia in our discussions at various project training seminars.

As public health nurses we built up a very good picture of people's everyday life on our rounds of the community: at counselling centres, at schools and in homes. Many families had had their lives seriously disrupted by disease. The systematic task of preventing heart disease we saw as the most meaningful, not only for the health of the population, but also in the context of our own overall work.

The rehabilitation (secondary prevention) work among heart disease patients began at health centres on the project's initiative. The rehabilitation groups were usually run by the public health nurse and a physiotherapist. We received training from the project on group dynamics and counselling. In the beginning we were somewhat afraid of urging infarction patients to do physical exercise, because we had earlier been taught that heart patients should be confined to bed for some time after an attack. But the training, and later on our experiences, gave us courage and confidence. Physical exercise, relaxation and health education on risk factors and health behaviours were important parts of the programme for the rehabilitation groups.

The North Karelia Project introduced regular risk factor screenings of the adult population, and these became part of our work. The project also persuaded the public health nurses to undertake an increasing number and variety of speaking engagements and advisory functions (lectures at courses, talks to heart clubs, health education groups etc).

Because smoking is such a prominent risk factor for cardiovascular diseases, when I announced my first smoking cessation group so many smokers applied that they had to be split into two groups. The work to reduce smoking remains a major activity, and is still a very fruitful one.

At the end of the 70s the North Karelia Project started its youth project, which focused on the teaching and learning of healthy lifestyles in childhood and youth.

The youth projects influenced the work of the public health nurses in schools, as well as school meals, home economics teaching, general attitudes among young people towards smoking and alcohol, and school health education in general. The youth projects have generated a wealth of new ideas and measures for assisting the work of the school public health nurses. They have also provided excellent training.

The North Karelia Project has published a large volume and variety of health education materials, much used by public health nurses in their work. There have been publications on how to stop smoking, physical activity, moderate alcohol consumption, regular health examinations (risk factor measurements) and how to avoid stress. All have been most useful in providing a firm foundation for the nurses' primary work of health education and counselling.

The advice and recommendations of the project also continue to be beneficial in child and maternity counselling, in school, student and occupational health care, and also in work with senior citizens.

Research and evaluation results have been reported at regular intervals, providing fresh feed-back about the effects of the public health work on the health situation in the population. The critical review of the evaluation findings also helps personnel adjust their work practices to emphasize areas where results have not been so good.

Many of the activities introduced by the North Karelia Project have gradually assumed an essential role in normal health centre work. The lessons learned have been gradually assimilated into people's everyday habits. Apart from the health education work, this process has been backed up by effective media coverage and support, by collaboration with food manufacturers, and by legislation.

While I have often had to defend the recommendations of the project, I have always been able to rely on the firm support of the research findings and highly positive feedback from my clients.

HEALTH CENTRE PHYSICIAN (RISTO JUKOLA)

I have worked as the chief physician at a North Karelian health centre from the start of the project. The bulk of primary health care in North Karelia is delivered by these municipal health centres, which employ general practitioners, public health nurses and the other personnel necessary to provide comprehensive primary health care to the municipality.

The North Karelia Project began in the same year as a reorganized health centre system was introduced by a national public health act. Thus the project brought the necessary content to this new administrative framework and directed the work.

The following summarizes what I consider we have gained from the work of the Project over the years and what we have given to it.

What did we gain from the project?

The clear scientific picture of the mortality and morbidity allowed us to appreciate the depth of the crisis in North Karelia: the project statistics and international comparisons opened our eyes to what was a major epidemic of cardiovascular diseases. This naturally focused and fortified our belief that something had to be done about it, and perhaps could be.

We were given a scientific and theoretical basis from which to influence the lifestyle of our citizens. The project team made it clear that changing the disease situation appreciably would largely depend on significantly modifying the risk-related lifestyles of the population. The project built up an epidemiological framework for this and also created theoretical perspectives for influencing the local lifestyles.

Practical programmes were evolved for carrying out health education within the scope of primary health care work. Based on the theoretical models developed by the project, often with our collaboration, several very practical programmes were planned for integration into normal health centre activities. These ideas were communicated in the form of guideline papers, discussed at the various training seminars and adjusted according to the expert advice received. The implementation was also integrated into the administrative frameworks. In addition, the Project gave us the necessary feedback.

We received influential support for developing our preventive health work. In the early years of high morbidity and scarce health care resources, the health authorities were naturally very concerned to provide the necessary therapy to the numerous patients. The Project gave us influential support when we emphasized the need for simultaneous preventive activities. This meant new posts to be filled, as well as additional financial resources and facilities.

Our epidemiological understanding of major chronic diseases was enhanced. In the years prior to the project cardiovascular diseases were regarded as a natural part of everyday life in North Karelia; manifestations of heart disease were taken as an inevitable sign of aging. The project reversed these perceptions and helped us understand the epidemiology and causal factors. We started to learn how atherosclerotic cardiovascular diseases develop, what their main causal risk factors are, and how we could actually prevent them by eliminating these factors.

We developed friendships and channels of influence. The Project organized numerous meetings and seminars for North Karelian doctors. We learned to know each

other better, and there was a feeling of a common task and commitment. The Project also had broad and effective links with national experts and health authorities, as well as with many international experts and organizations. We were also exposed to many of these contacts, which gave us new avenues of influence. Having the background of the project often made it easier for us to contact the national health authorities and raise our problems and needs.

We perceived new importance and meaning in our work. We were no longer merely treating the patients appearing in front of us - now we could significantly contribute to the fight against new chronic disease epidemics. The health centre physicians occupied a key position as local experts in the work of the Project, and were much in demand as consultants by a variety of local organizations. Many of the project's practical studies have involved local health centres in various ways, which often allowed health centre doctors to have direct contact with the scientific work. This provided an interesting contrast to routine patient care.

What did we give to the Project?

We gave our population for intervention and research purposes. In numerous ways we helped the Project gain full access to our population for the preventive work and the necessary surveys and other investigations.

The project had access to our personnel when needed. The evaluation surveys, many other project investigations and numerous other activities needed the practical help of our staff. We always tried to make them available whenever possible.

Our health centre facilities were also made available. The Project had no offices in the province's municipalities. The local health centre building thus often became the local facility for project activities; not only the population surveys and many other specific trials, but also numerous intervention activities. The facilities and other resources were at their disposal whenever possible.

The project received our own work input. Achievement of the project objectives very much depended on the work of all the personnel at the health centres. Whenever time dictated a competition of needs we tried to do the project-related work as much as possible. This particularly concerned the huge efforts that went into the detection, treatment and follow-up of hypertension, as well as the measurement of other risk factors, and counselling etc.

The cooperation was good. We always tried to cooperate as far as possible with the project and its representatives. It was obvious to us that effective collaboration was a mutual interest.

The Project received a mixture of criticism and approval. We gave feedback to project team members and other representatives whenever we met (personal contacts or training seminars). They got realistic, constructive criticism about our experiences, but we also expressed our gratitude and satisfaction whenever possible.

CONCLUSION

Finally, I conclude that we received much more from the Project than we gave. Another way to express it is that the project enabled us to produce more health than we would have by merely treating disease.

18. THE COST OF
CARDIOVASCULAR DISEASES

Urpo Kiiskinen

INTRODUCTION

The remarkable decline in CVD mortality and morbidity since the early 1970s has definitely had a substantial economic impact on Finnish society. The data available to us do not permit a full-scale economic evaluation, including analysis of cost-effectiveness or cost-benefit, which would define the economic efficiency of the preventive activities undertaken in the framework of the North Karelia Project. This chapter focuses instead on the changes in the economic impact of CVD. Using the standard cost-of-illness methodology, the annual costs imposed by CVD on society as a whole were estimated for the years 1972, 1977, 1982, 1987 and 1992.

METHODOLOGY

Costs associated with certain forms of illness are typically divided into three categories; direct, indirect and intangible costs. Direct costs are the value of health service resources devoted to the disease. This item includes the actual expenditures on hospitalization, outpatient care, drug therapy, rehabilitation, and the like. Indirect costs are derived from the time lost from activities in which an individual would have participated while in a normal state of health. Indirect costs are generally assumed to equal the value of output lost due to premature death or to the reduced productivity caused by the illness (Hodgson and Meiners 1982, Max et al 1990).

The category of intangible costs is made up of the non-economic consequences of illness. The "pain, grief and suffering" experienced by the patient, family and friends because of his/her morbidity or death undoubtedly diminish the welfare of those involved, and must therefore be considered as the real social costs of illness. However, although they constitute a genuine and potentially large component of total costs, these intangible factors are omitted from this study because of the considerable difficulties in measuring and assigning values to them.

Prevalence and incidence-based costs

Two approaches can be used to estimate the cost-of-illness. In the prevalence approach, both the direct and indirect costs resulting from disease are assigned to the years in which they are borne. The value of expected future production losses caused by premature mortality are assigned to the year of death. The prevalence approach provides an estimate of economic burden for a period of time (usually a year) imposed by the prevalence of the disease during the same period (Hartunian et al 1981, Max et al 1990).

The incidence approach provides an estimate of lifetime costs-of-illness. The rationale of this approach is that the lifetime stream of costs associated with an illness should be assigned to the year of onset of a disease. Information on the incident population is combined with knowledge of the likely course of an illness and the costs at each stage of it (Hartunian et al 1981, Max et al 1990).

Since this study focuses on the aggregated category consisting of diseases with diverse prognosis and needs for medical care, it is impossible to meet the data requirements of incidence-based costing. This study is therefore based on the prevalence approach.

Direct costs

Estimation of the direct costs of CVD was limited by the insufficiency of regional statistics stretching 20 years back in time. Thus only the three most important components of total direct cost - the costs of hospitalization, outpatient care and drug therapy of CVD patients - were included in the analysis. The estimation procedures and data sources for each direct cost item are described in brief.

Hospital inpatient care

The costs of hospital bed-day by diagnosis were 'not available for the estimation of hospitalization costs generated by CVD. It is unlikely that the cost of a CVD-related bed-day would equal the average cost. It also appeared that reliable data on the average cost per day both by type of hospital and by specialty were not available for all the years under analysis. Therefore, the average unit cost by type of hospital was used as a proxy. Hospitals were split into three categories, in which the costs clearly differed from one type to another: university hospitals, health centre wards and other general hospitals.

In order to capture the full resource cost of one day of hospitalization, the capital costs must be included in the calculation. The relative magnitude of the capital costs

for each category of hospital was estimated as the ratio of total annual capital costs to operating costs (Sairaalaliitto 1991, Suomen kaupunkiliitto et al 1992). The operating cost per bedday was increased by this ratio.

Regional data on the number of CVD-related hospital bed-days by type of hospital were obtained from the hospital discharge register (Stakes 1993). Patient days spent in mental care institutions or in the psychiatric specialty unit of a hospital with a CVD diagnosis were omitted from the data, since in most cases the original reason for hospitalization was mental disorders. Furthermore, as these hospitalization periods were markedly longer than the average stay due to CVD they would have been a potential source of bias.

Outpatient care

The number of visits to physicians is based on the health centre utilization survey conducted during 1989 and 1990 (Aro 1991). This survey indicated that 7.7 % of all visits to health centre physicians were made because of CVD. It was assumed that CVD patients accounted for the same proportion of visits to general hospital outpatient departments. ency Total numbers of visits and their respective average costs were obtained from hospital and health centre statistics (Suomen kaupunkiliitto et al 1992, Suomen kuntaliitto 1993).

The capital costs were added to operating unit costs in the manner previously outlined. The average cost of a visit to a health centre is a rough estimate based on the total number of visits - not only to doctors but also to nurses and laboratory and X-ray examinations etc. It was therefore assumed that the proportion of CVD-related visits to physicians also applied to these other types of visit; dental appointments were excluded from the total visits.

The total cost of CVD outpatient care was allocated to age groups, genders and regions on the basis of the numbers of persons entitled to reimbursement of CVD drug expenses by the Social Insurance Institution (SII).

Drugs

The costs of CVD drug therapy were derived from the Finnish statistics on medicines (Lääkelaitos and Kansaneläkelaitos 1993, Nordic Council on Medicines and Nordiska läkemedelsnämnden 1993). Since the monetary value of drugs recorded in the statistics is based on pharmacies' purchase prices, i.e. wholesale prices, it underestimates the actual resource costs of drug therapy by the retail portion of costs. In order to arrive at the full costs (approximated by the retail price) of CVD-related drug

consumption, an adjustment multiplier of 1.7 for 1992 and 1.6 for earlier years of the study was introduced (estimate provided by the National Agency for Medicines). For the purposes of this study only the sales to pharmacies were accepted, because the value of hospital sales was already covered by the average cost of a hospital bed-day; the inclusion of that portion of the drug costs would have lead to double counting.

During the study period most drugs used for treating CVD were subject to preferential reimbursement within the national sickness insurance scheme. The number of diseases comprehensively covered in this way has increased from two in 1972 to four in 1992. The total value of drug usage is allocated by age group, gender and region on the basis of the distribution of recipients of SII refunds for CVD drug therapy costs.

Indirect costs

According to the human capital approach the indirect costs consist of the value of the reduced productivity of persons suffering from CVD. The most important factor is the time lost from work. In this study the estimates for the duration of reduced productivity were derived from the information on sickness absence, disability pensions and premature deaths. However, time lost from work is not the only potential source of indirect costs. Reduction in productivity may also occur if illness lessens the productivity of persons while on the job, and this, in addition to absenteeism, may also have adverse effects on the productivity of coworkers. Furthermore, the value of leisure time activities lost due to CVD is an indirect cost, which can be of major importance to persons without market earnings, such as young children, housewives and retired persons. However, lack of data prevents us from estimating indirect costs other than the value of lost working time.

The indirect costs of CVD were estimated using the human capital approach, which is based on the assumption that earnings reflect the individual's productivity. In that sense, the value of the individual's output is equal to the maximum amount the employer is willing to pay in the form of salaries and related costs for his/her labour input. This controversial assumption is of crucial importance in human capital theory. The annual value of an individual's output was calculated using the age and sex specific annual gross income (Tilastokeskus 1993a, Tilastokeskus 1993b), adjusted for employers contribution to social security schemes and operating surplus (Tilastokeskus 1993c).

Sickness absence

The working time lost due to CVD was estimated on the basis of the sex and age-specific sickness allowance statistics of the Social Insurance Institution (Kansaneläkelaitos 1993a). Sickness allowance is paid for six days per week after a waiting period of seven working days, not counting the day on which incapacity began. Since a normal week has only five working days, 5/6 of the days covered by the sickness insurance are working days. The number of covered days was increased by 7.5 days times the number of sickness allowance spells in order to include the uncovered waiting period in the total absence days. The number of work loss years is approximated by assuming 220 working days per year.

Thus the value of production lost due to CVD-related sickness absence is simply the number of lost working years multiplied by the mean value of an individual's annual production. The estimate for the lost working time due to CVD-related sickness absence is an underestimate, because of absence periods shorter than the uncovered waiting period. It is also possible that in some cases the sickness allowance is not requested in the first place.

Disability pensions

The value of production lost due to CVD-related disability pensions was estimated using the disease-, age-, sex- and province-specific data provided by SII (Kansaneläkelaitos 1993). The average number of disability pensions at the end of the year under analysis and the preceding year was used as an approximation of the lost labour input in years.

In estimating the value of potential production lost due to CVD-related disability pensions, account was taken of the individual's likelihood of being employed if the CVD had not occurred (Tilastokeskus 1992). This adjustment was made to eliminate the effect of unemployment and labour force participation rates on the results (Pekurinen 1992). Since reliable regional labour statistics were not available, probabilities were assumed to be constant over all the provinces of Finland.

Premature deaths

The estimates for working years and potential production lost because of premature deaths caused by the CVD were based on the standard procedure for calculating the expected number of life years lost. The expected number of working years lost before the age of 65 was estimated on the basis of survival probabilities and the number of deaths from CVD. Survival probabilities by age, sex and cause of death were

obtained from life tables published by Statistics Finland (Tilastokeskus 1993d) , and the number of CVD-deaths from the statistics on causes of death (Tilastokeskus 1993e).

The present value of an individual's life-time production was estimated by discounting the expected value of future years' production to its present value taking into account the survival probability (risk of CVD death removed), the probability of being employed and the anticipated increase in productivity. A discount rate of 5% and a productivity growth rate of 2% per annum were used for the present value computation.

RESULTS

The costs of CVD were inflated to the 1992 price level (Tilastokeskus 1993d) and then converted to US dollars using an exchange rate of I USD = 5,5 FIM. The costs are shown separately for both genders and two age groups: 35-64 years (representing the adult, working-age population), and 65 or older, (representing the retired elderly population).

Direct costs

In addition to the monetary cost of CVD-related hospital inpatient care, the magnitude of hospital utilization is demonstrated in terms of hospitalization periods and bed-days (Table 1).

The number of hospitalizations of North Karelians aged 35 to 64 increased in the 1970s and early 1980s, but has since been on the decrease. The figure for men in all Finland has clearly grown, but for women has slightly fallen. The statistics for the elderly population inevitably indicate an increasing amount of CVD-related hospitalizations for both sexes in the regions analysed.

The number of days spent in hospital by 35-64-year-old men rose over the first five-year-period, but has been falling ever since. Among women this figure has declined over the entire study period. There were some fluctuations among the elderly, but overall there was a clear increase in numbers of bed-days from 1972 to 1990.

The cost of CVD hospitalization among the working age population has tended to rise since 1972, and among the elderly has more than tripled over the study period.

The cost of CVD-related outpatient care has been estimated only for 1991, due to the lack of reliable data. Rough estimates for 1991 are presented to give an idea of the relative importance of outpatient service utilization in calculations of the total economic burden of CVD. As seen in the estimates given in Table 5, the cost of

CVD-related visits to outpatient departments was about 150 million dollars in 1991 (1992 prices).

Table 1.Number of CVD-related hospitalizations, bed-days and the cost of hospital inpatient care in Finland

Year	Number of hospitalization periods				Number of bed-days				Cost of hospitalization (USD million)			
	35-64		65+		35-64		65+		35-64		65+	
	North Kare-lia	All Fin-land	North Kare-lia	All Fin-land	North Karelia	All Finland	North Karelia	All Finland	North Kare-lia	All Fin-land	North Kare-lia	All Fin-land
Men												
1972	1200	24 300	1 100	26 000	11 000	292 000	13 000	494 00	1.2	35.9	1.5	55.1
1977	1600	28 800	1 100	24 000	14 000	356 000	25 000	543 000	2.0	59.6	3.0	77.1
1982	1600	30 100	1 700	31 300	13 000	306 000	31 000	708 000	2.3	56.6	4.6	106.4
1987	1700	36 100	1 700	37 600	13 000	297 000	37 000	693 000	3.0	75.3	5.6	122.7
1990	1600	35 300	2 000	40 500	12 000	276 000	33 000	876 000	3.4	81.3	6.2	184.9
Women												
1972	900	23 700	1 300	35 200	14 000	242 000	22 000	870 000	1.7	29.1	2.3	93.5
1977	1 200	24 700	1 400	34 300	9 000	215 000	41 000	1 098 000	1.4	34.7	4.7	142.0
1982	1 300	22 900	2 300	46 000	8 000	178 000	105 000	1 777 000	1.3	33.6	12.3	245.9
1987	1 000	23 500	2 600	57 100	6 000	161 000	87 000	1 575 000	1.5	39.8	12.3	258.0
1990	900	21 400	2 700	59 500	6 000	148 000	82 000	2 003 000	1.7	41.2	13.6	365.4

Reliable statistics on medicine sales have been available since 1978 only. Changes in classification may have had some minor effects on the comparability of the results from different years. The total costs of drug therapy, as estimated in this study, have expanded from 110 million dollars in 1978 to about 180 million dollars in 1992. Table 2 shows the development of costs by gender and age-group. Since 1982 the cost estimates for all categories in Table 2 have had a rising trend. The consumption of drugs (in monetary terms) in 1992 was on a clearly higher level in most age-sex categories than back in 1978.

Indirect costs

The indirect economic consequences of CVD are presented, using both the number of potential working years lost (Table 3) and the monetary value of lost production (Table 4).

Table 2. The estimated costs of CVD drug therapy in Finland (USD million)

| Year | Cost of CVD drug therapy (USD million) | | | |
| | 35-64 | | 65+ | |
	North Karelia	All Finland	North Karelia	All Finland
Men				
1978	1.1	20.8	0.6	14.1
1982	1.0	20.7	0.6	16.0
1987	1.4	29.1	1.0	24.4
1992	1.9	39.1	1.6	36.5
Women				
1978	1.7	32.8	1.9	43.9
1982	1.2	26.5	1.9	26.1
1987	1.2	27.5	2.4	57.3
1992	1.4	32.9	3.1	71.5

Table 3. The estimated number of years lost from work due to CVD in Finland

| Year | Number of expected working (prior to 65 years of age) years lost | | | | | | | |
| | Sickness absence | | Disability pensions | | Premature mortality | | Total | |
	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland	North Karelia	All Finland
Men								
1972	466	6 900	2 196	27 962	2 181	41 335	4 843	76 197
1977	159	4 632	2 291	34 807	1 916	39 612	4 366	79 051
1982	136	4 202	1 765	29 350	1 635	33 155	3 536	66 707
1987	163	3 550	1 520	27 967	1 636	28 160	3 319	59 677
1992	142	3 621	1 455	26 957	1 100	25 193	2 697	55 771
Women								
1972	54	8 842	1 440	21 505	730	12 323	2 764	42 630
1977	139	3 994	1 756	29 041	392	10 336	2 287	43 371
1982	140	3 159	1 127	20 586	278	8001	1 545	31 746
1987	58	2 321	762	15 818	220	7 673	1 040	25 812
1992	8	1 834	623	13 664	283	5 990	992	21 488

Table 4. The value of potential production lost due to CVD in Finland

Year	Value of lost working time (USD million)							
	Sickness absence		Disability pension		Premature mortality		Total	
	North Karelia	All Finland	North Karelia	All Finland	No rth Karelia	All Finland	North Karelia	All Finland
Men								
1972	13.8	205.1	51.8	724.0	43.6	906.5	109.1	1 835.6
1977	4.7	146.5	48.2	802.9	33.9	770.1	86.7	1 719.5
1982	4.7	150.5	41.2	741.0	31.9	704.4	77.8	1 595.8
1987	6.1	142.5	32.9	672.1	31.2	602.3	70.2	1 294.0
1992	5.8	159.4	30.9	605.6	21.0	529.0	57.7	1244.0
Women								
1972	11.2	166.9	13.8	221.9	6.1	112.7	31.1	501.5
1977	2.6	81.0	16.3	300.0	3.3	94.8	22.2	475.8
1982	3.0	71.0	11.5	229.8	2.6	84.2	17.1	385.0
1987	1.5	63.9	8.1	191.7	2.2	90.4	11.8	346.1
1992	2.5	57.5	7.2	172.0	3.5	79.3	13.2	308.8

Among 35-64-year-old men disability pensions and premature deaths have been almost equally important causes of lost working years. Short term absence from work as sickness leave due to CVD has accounted for less than 10 % of total work loss time. The total number of male working years lost has declined by 45 % in North Karelia, while the downward trend nationwide has been 25%.

Among women, the significance of early death as the cause of lost working years has been modest by comparison. In 1992 early death accounted for less than 30 % of the total years of lost female labour potential, with another approximately two-thirds due to disability pensions. Among women the total years lost from work has fallen by 65 % in North Karelia since 1972, while the concurrent average decline in all Finland has been 50 %.

The estimated value of potential production lost due to CVD is reported in Table 4. The difference in the monetary value of lost productivity between men and women was greater than the difference in the expected number of working years lost. This can be explained partly by the higher annual earnings of men and partly by the lower labour force participation rate of women. In 1992 the total indirect cost of CVD in Finland was approximately 1.6 billion dollars.

COST SUMMARY AND DISCUSSION

Although the cost estimates presented here do not include all the elements of social cost, they certainly represent the main tangible cost items incurred by CVD. Most cost elements are accurately estimated as a whole, but many assumptions had to be made for the age, sex, and regional distributions.

The breakdown of the social costs related to CVD in 1992 is presented in Table 5, both in total and per capita terms. It can be seen that the value of indirect consequences of CVD is of dominant economic importance among working age individuals. After including the CVD-related costs among the elderly, the proportion of direct costs climbs steeply. Among women in particular, retired persons included, the cost of hospital inpatient care rises almost ten-fold to become the most significant item in the total costs.

The percentage changes in CVD-related costs from 1972 to 1992 are presented in Table 6. Setting 1972 as base year for the comparison is quite problematic, since the only disease-specific direct cost item available was the cost of hospitalization. However, in order to facilitate a robust comparison of costs in 1972 and in 1992, an approximation of CVD-related drug costs in 1972 was produced. This was achieved simply by adjusting the 1978 figure for CVD drug costs by the change in total medicine expenditure from 1972 to 1978 (Kansaneläkelaitos Laskenta- ja tilasto-osasto 1993).

Furthermore, the significant reform of municipal health care which accompanied the introduction of The Primary Health Care Act in 1972, and the consequent foundation of state-supported health centres, enhanced the supply of health services (Häkkinen 1988, Kalimo 1982), and may thus have reduced the comparability of health service usage in the early 70s to the corresponding figures of 20 years later. On the other hand, as noted above, the relative magnitude of direct costs is quite modest, and therefore the change in total costs over two decades is not very sensitive to possible error in direct costs.

Table 5. Main items of social costs generated by CVD in Finland in 1992

Year 1992	Person aged 35 to 64						Person aged 35 or more					
	USD million		USD per capita		%		USD million		USD per capita		%	
	North Kare-lia	All Finland	North Kare-lia	All Fin-land	North Kare-lia	All Fin-land	North Kare-lia	All Finland	North Kare-lia	All Fin-land	North Kare-lia	All Fin-land
Men												
-Hospitaliza-tion *	3.4	81.3	94	83	5.3	5.6	9.6	266.2	212	219	13.1	15.6
-Outpatient care **	1.5	31.7	42	32	2.3	2.2	2.8	61.2	62	50	3.8	3.6
-Medicines	1.9	39.1	52	40	2.9	2.7	3.5	75.6	76	62	4.7	4.5
Total direct	6.8	152.1	188	155	10.5	10.5	15.9	403.0	350	331	21.6	23.7
-Sickness absence	5.8	159.4	162	163	9.0	11.0	5.8	159.4	129	131	7.9	9.4
-Disability pensions	30.9	605.6	863	620	48.0	41.9	30.9	605.6	683	497	42.0	35.7
-Mortality	21.0	529.0	585	541	32.5	36.6	21.0	529.0	463	434	28.5	31.2
Total indirect	57.7	1 294.0	1 610	1 324	89.5	89.5	57.7	1 294.0	1 275	1 062	78.4	76.3
TOTAL	64.4	1446.1	1 798	1 479	100.0	100.0	73.5	1 697.0	1 625	1 393	100.0	100.0
Women												
-Hospitaliza-tion *	1.7	41.2	48	42	9.4	10.1	15.3	406.6	309	288	41.7	44.0
-Outpatient care **	1.1	26.6	34	27	6.5	6.5	3.6	84.7	73	60	9.9	9.4
-Medicines	1.4	32.9	42	34	8.0	8.0	4.5	104.4	90	74	12.3	11.5
Total direct	4.2	100.7	124	103	23.9	24.6	23.4	595.7	472	422	63.9	65.9
-Sickness absence	2.5	57.5	75	59	14.4	14.1	2.5	57.5	50	41	6.8	6.4
-Disability pensions	7.2	172.0	215	175	41.4	41.9	7.2	172.0	145	121	19.7	19.0'
-Mortality	3.5	79.3	105	81	20.3	19.4	3.5	79.3	71	56	9.6	8.7
Total indirect	13.2	308.8	395	315	76.1	75.4	13.2	308.8	266	218	36.1	34.1
TOTAL	17.4	409.5	519	418	100.0	100.0	36.6	904.5	738	640	100.0	100.0

*Based on 1990 utilization rates
**Based on 1991 utilization rates

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Table 6. The change in CVD-related social costs from 1972 to 1992 by gender and by the type of costs

Gender/ type of cost	Persons aged 35 to 64				Persons aged 35 or more			
	North Karelia		All Finland		North Karelia		All Finland	
	USD mill.		USD mill.		USD mill.		USD mill.	
Men Change in:								
- Direct costs	4.0	144%	83.8	123%	10.7	207%	258.2	178%
- Indirect costs	-51.4	-47%	-541.6	-30%	-51.4	-47%	-541.6	-30%
Total costs	-47.4	-42%	-457.8	-24%	-40.7	-36%	-283.4	-14%
Women Change in:								
- Direct costs	-0.2	-4%	22.2	28%	14.5	162%	367.7	161 %
- Indirect costs	-17.9	-58%	-192.8	-38%	-17.9	-58 %	-192.7	-38%
Total costs	-18.1	-51%	-170.6	-29%	-3.4	-9 %	175.0	24%
Both sexes Change in:								
- Direct costs	3.8	54%	106.0	72%	25.2	179%	625.9	168%
- Indirect costs	-69.3	-49%	-734.4	-31%	-69.3	-49%	-734.3	-31%
Total costs	-65.5	-45%	-628.4	-25%	-44.1	-29%	-108.4	-4%

A typical development pattern in the costs of CVD over the past 20 years is rising direct costs, i.e. medical expenditure, resulting from the expanding quantity and quality of resources devoted to CVD-patients. On the other hand, the decrease in indirect cost, resulting from the favourable development in CVD mortality and morbidity, has been big enough to outweigh the rise in direct costs. The proportional decrease in CVD-related total costs ranged from about 5 to 50 % and was clearly greater in North Karelia than all Finland on average. Despite this, Table 5 indicates that the costs per capita are still somewhat higher in North Karelia.

Table 1 shows that hospital costs have more than doubled among the working age male population. This is quite a surprising outcome, because simultaneously both the mortality and incidence rates for heart attack and stroke have fallen drastically. There is a two-stage possible explanation. Firstly, the unit cost of hospital treatment has increased at a faster rate than the cost of living in general. The real cost per bed-day has more than doubled in university and other general hospitals over the study period, while the respective increase in health centre wards has been 40%. Apparently, the vast majority of CVD episodes experienced by working age citizens have been treated in university or other general hospitals.

Secondly, the declining incidence of acute myocardial infarction (AMI) and stroke has not necessarily been mirrored by a decline in other CVD events, and hence the resources previously tied up in the treatment of AMI and stroke have been freed for the less severe CVD cases. The recent findings of Pyörälä et al. (1994) support this explanation. Their study found that the number of hospital treatment days due to an AMI diagnosis (ICD code 410) among Finns younger than 65 decreased between 1981 and 1990, but that the number of treatment days associated with other coronary heart disease diagnoses (ICD codes 411-414) increased (Pyörälä et al 1994) . Furthermore, the fall in the number of lost working years reported in Table 3 is a strong indicator of a decrease in either the prevalence or severity of CVD, or both.

It should also be kept in mind that the overall expenditure on general hospitals and medicines has risen by around 150 % over the 20 years (Kansaneläkelaitos Laskenta- ja tilasto-osasto 1993). This is somewhat more than the increase in direct health care costs related to CVD among persons aged 35 to 64, but slightly less than the corresponding figures when the elderly are also taken into account (Table 6).

The cost of CVD-related outpatient care was estimated accurately only for 1992. In order to allow for its influence in total cost calculations, it was assumed to have changed at the same rate as the sum of CVD costs due to hospital care and drug therapy. In fact, the cost of outpatient care was not of crucial importance in the cost calculation and the assumption made above was not expected to cause any major bias to the results reported in Table 6. However, to support that conclusion, sensitivity analysis was performed assuming the cost of outpatient care in 1992 to be as presented in Table 5, and the corresponding figures in 1972 to be zero. The effect on the total cost was generally from one to three percentage points and none of the signs were reversed. It was also noted that allowing for population changes would lead to an even greater decrease in costs, and would also narrow the difference between change rates in North Karelia and the whole country.

On the basis of the facts presented above, it can be concluded that the social costs generated by CVD are likely to have declined since 1972, especially in terms of cost per capita. According to the change rates presented in Table 6, the decreases in annual costs in all Finland have been about 100 and 600 million US dollars for persons over 35 and 35-64 years of age respectively, and in North Karelia 40 and 60 million US dollars, respectively. It can also be seen that the estimated proportional reduction in costs was greater in North Karelia than in all Finland. This could translate as a 35 million US dollar saving in 1992 alone for the province of North Karelia, although this must necessarily be regarded as a crude estimate, as explained above.

REFERENCES

Aro S (1991). *VPK väestövastuisen perusterveydenhuollon kokeilut väliraportti lääkäreiden ja terveydenhoitajien työstä, työterveyshuollosta sekä sosiaali- ja terveydenhuollon yhteistyöstä*. Sosiaali- ja terveyshallitus Helsinki.

Hartunian NS, Smart CN, Thompson MS (1981). *The incidence and economic costs of major health impairments : a comparative analysis of cancer, motor vehicle injuries, coronary heart disease, and stroke*. LexingtonBooks: Lexington, Mass.

Hodgson TA, Meiners MR (1982). Cost-of-illness methodology: a guide to current practices and procedures. *Milbank Mem Fund Q Health Soc* **60:** 429-462.

Häkkinen U (1988). *Terveyspalvelujen kustannukset, rahoitus ja hinnat Suomessa vuosina 1960-1985*. Kansaneläkelaitos: Helsinki.

Kalimo E (1982). *Terveyspalvelusten tarve, käyttö ja kustannukset 1964-1976. Need, use and expenses of health services in Finland, 1946-1976*. Kansaneläkelaitos: Helsinki.

Kansaneläkelaitos (1993). *Unpublished data on disability pensions for years 1971-1992 provided by Social Insurance Institution*. Kansaneläkelaitos: Helsinki.

Kansaneläkelaitos Laskenta- ja tilasto-osasto (1993). *Terveyspalvelujen kustannukset ja rahoitus Suomessa 1960-92*. Kansaneläkelaitos: Helsinki.

Lääkelaitos, Kansaneläkelaitos (1993). *Suomen lääketilasto 1992*. Lääkelaitos Kansaneläkelaitos: Helsinki.

Max W, Rice DP, MacKenzie EJ (1990). The lifetime cost of injury. *Inquiry* **27:** 332-343.

Nordic Council on Medicines, Nordiska läkemedelsnämnden (1993). *Nordic statistics on medicines 1990-1992*. Nordic Council on Medicines: Uppsala.

Pekurinen M (1992). *Economic aspects of smoking is there a case for government intervention in Finland?* National Agency for Welfare and Health: Helsinki.

Pyörälä K, Palomäki P, Miettinen H, Mustaniemi H, Salomaa V, Valkonen T (1994). Decline in coronary heart disease mortality in Finland: Effect on age and gender distribution of the disease. *Am J Geriatr Cardiol* **3:** 20-32.

Sairaalaliitto (1991). *Suomen sairaalatilasto. Finnish hospital statistics*. Sairaalaliitto: Helsinki.

Stakes (1993). *Unpublished hospital discharge register data provided by National Agency for Welfare and Health*. National Agency for Welfare and Health: Helsinki.

Suomen kaupunkiliitto, Suomen kuntaliitto, Finlands svenska kommunförbund (1992). *Statistics on health centres' economy 1982 and 1991*. Suomen kaupunkiliitto: Helsinki.

Suomen kuntaliitto (1993). *Suomen sairaalatilasto. Finnish hospital statistics*. Suomen kuntaliitto: Helsinki.

Tilastokeskus (1992). *Labour force statistics 1991*. Tilastokeskus. Statistics Finland: Helsinki.

Tilastokeskus (1993a). *Tulonjakotilasto. Income distribution statistics 1977-1990*. Tialstokeskus. Statistics Finland: Helsinki.

Tilastokeskus (1993b). *Index of wage and salary earnings*. Tilastokeskus. Statistics Finland: Helsinki.

Tilastokeskus (1993c). *National accounts 1960-1992*. Tilastokeskus. Statistics Finland: Helsinki.

Tilastokeskus (1993d). *Life tables 1971-1990*. Tilastokeskus. Statistics Finland: Helsinki.

Tilastokeskus (1993e). *Causes of death*. Tilastokeskus. Statistics Finland: Helsinki.

19. TOWARDS THE PREVENTION OF TYPE 2 DIABETES

Markku Peltonen, Jaana Lindström and Jaakko Tuomilehto

INTRODUCTION

Despite the decrease in classical cardiovascular risk factors, as well as in cardiovascular morbidity and mortality in recent decades, the prevalence of type 2 diabetes has continued to increase in Finland. It has been estimated that in the year 2008, over half a million Finnish people have type 2 diabetes (Puska et al 2008); however, this figure is an approximation based on several data sources, as there currently is no national diabetes registry in Finland. Based on anti-diabetic drug purchases in the prescription registry of Social Insurance Institution, the number of diabetes patients, of whom about 80% had type 2 diabetes, was 109,919 in the year 1994 and 218,062 in 2006 (Reunanen et al 2008). The largest relative increase in type 2 diabetes over this 12-year period was seen in the youngest age-groups: among 15-29 year olds the increase in prevalence was 9.5-fold; among 30-44 year olds it was 3.3-fold; for 45-74 year olds the increase was 85%; and for those over 75 years it was 48%.

Nevertheless, drug-treated diabetes represents only half of the truth regarding the prevalence of the condition. Based on population-based health surveys, approximately one-third of type 2 diabetes patients are treated by diet only, and thus are not included in the calculations based on diabetes drug use (Reunanen and Kattainen 2002). Furthermore, the number of previously undiagnosed diabetes cases detected during health surveys has generally been equal to the number of known diabetes cases (Peltonen et al 2006, Ylihärsilä et al 2005). Finally, when analysing diabetes trends one should keep in mind that the awareness of the disease, diagnostic methods, and the criteria for type 2 diabetes, have all changed during the past decades, which complicates the comparisons and interpretation of the findings.

The bottom-line, however, is that there has been a steady increase in the prevalence of type 2 diabetes which does not seem to level off. A study completed on young adults (age 15-39 years) utilising four data sources revealed alarming results: although absolute incidence and thus also prevalence of type 2 diabetes among young adults was still low between 1992 and 1996 (11,8 cases per 100 000 / year) the incidence increased on average by 7.9% per year (Lammi et al 2007).

The most important risk factors for type 2 diabetes are (abdominal) obesity, sedentary lifestyle, and dietary pattern with high saturated fat, refined carbohydrate and energy, and low natural fibre content (Hu et al 2003, Hu et al 2004, Montonen et al 2003, World Health Organization 2003). Even though beneficial changes in dietary composition, especially related to intake of saturated fat, have occurred, the increasing trend in obesity prevalence has persisted. In the year 2007, altogether 70% of men and 57% of women were overweight or obese (Vartiainen et al 2008). Leisure time physical activity has increased; however, physical activity at work and walking or bicycling to work have decreased gradually which indicates that total physical activity may not have increased (Helakorpi et al 2008). Changes in these risk factors may be contributing to the observed increased diabetes risk.

Type 2 diabetes is a serious illness complicated by micro- and macrovascular diseases such as renal failure, retinopathy, cardiovascular diseases, and lower limb amputations (Gerstein 1997). Diabetes without any prior evidence of coronary heart disease indicates a comparable or higher myocardial infarction and mortality risk than prior coronary heart disease in non-diabetic subjects, especially in women (Hu et al 2005, Juutilainen et al 2005, Pajunen et al 2005). Furthermore, risk of cardiovascular complications has been shown to increase linearly by increasing blood glucose across the intermediate stage (impaired glucose tolerance IGT) between "normal" and "diabetic" glucose values (The DECODE Study Group 2003).

PREVENTION OF TYPE 2 DIABETES: CLINICAL EVIDENCE

The first controlled, individually randomized trial to test the possibility of type 2 diabetes prevention by lifestyle intervention was the Finnish Diabetes Prevention Study (DPS) (Tuomilehto et al 2001). The DPS was a multicenter study started in 1993, co-ordinated by the National Public Health Institute, and completed in 5 centers (Helsinki, Kuopio, Turku, Tampere, Oulu) in Finland. Altogether 522 middle-aged, overweight men and women with high diabetes risk (defined as IGT detected during two consecutive 75g oral glucose tolerance tests) were recruited and randomly allocated into a "standard care" control group or intensive lifestyle intervention group (Eriksson et al 1999, Lindström et al 2003).

The lifestyle intervention was delivered primarily by study nutritionists during individual counselling sessions and highlighted by study physicians at annual clinical visits (Lindström et al 2003). The intervention goals were to reduce body weight (5% or more reduction from baseline weight), limit dietary fat (< 30% of total energy consumed) and saturated fat (< 10% of total energy consumed), and to increase both

dietary fibre intake (15 g / 1000 kcal or more) and physical activity (≥ 30 minutes/day). Diabetes status was assessed annually by a repeated 75 g oral glucose tolerance testing.

The intervention group showed significantly greater improvement in each intervention goal. After 1 and 3 years, mean weight reductions were 4.5 and 3.5 kg in the intervention group, and 1.0 kg and 0.9 kg in the control group. Cardiovascular risk factors improved more in the intervention group (Ilanne-Parikka et al 2008, Lindström et al 2003). After a mean follow-up of 3.2 years, the risk of diabetes was reduced by 58% in the intervention group compared with the control group (Tuomilehto et al 2001). The reduction in the incidence of diabetes was directly associated with the number of achieved lifestyle goals. Increasing physical activity was shown to be an independent predictor of diabetes risk reduction (Laaksonen et al 2005). Furthermore, those who consumed a moderate-fat, high-fibre diet achieved the largest weight reduction and, even after adjustment for weight reduction, had the lowest diabetes risk during the intervention period (Lindström et al 2006b). After discontinuation of the counselling, the differences in lifestyle variables between the groups still remained favourable for the intervention group. During the post-intervention follow-up period of 3 years, the risk of diabetes was still 36% lower among the former intervention group participants, compared with the former control group participants (Lindström et al 2006a). The effect was seen in both men and women (Figure 1).
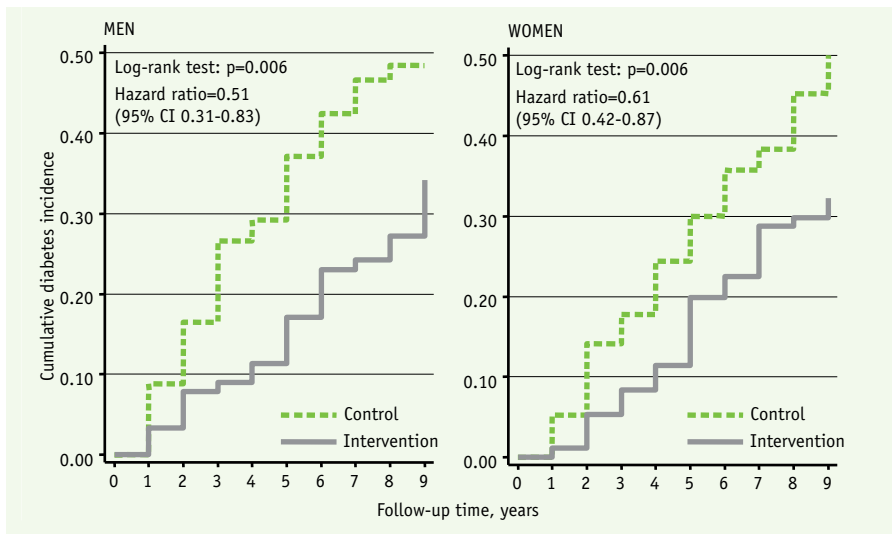

Figure 1. Type 2 diabetes incidence by gender and treatment group during the extended follow-up of the Finnish Diabetes Prevention Study (DPS).

After the DPS, several clinical studies have confirmed the finding, most importantly the US Diabetes Prevention Program. In 2002, it reported exactly the same risk reduction of 58% (The Diabetes Prevention Program Research Group 2002). It has also reported that lifestyle intervention is both more effective and cost-efficient than prevention using glucose lowering medication (Herman et al 2005).

SCREENING FOR HIGH DIABETES RISK

A practical problem in "real-world" diabetes prevention is how to identify individuals with increased diabetes risk, and discern who would benefit from intensified actions to prevent development of diabetes. In the prevention trials the oral glucose tolerance test was used to identify individuals with impaired glucose tolerance, based on the fact that impaired glucose tolerance is known to strongly predict future diabetes. Oral glucose tolerance testing, which is mandatory for diagnosing impaired glucose tolerance however is too expensive and time-consuming to perform in primary health care as a first-line screening strategy on a large scale. Therefore, a Finnish type 2 diabetes risk score (FINDRISC), was developed using the longitudinal follow-up data of the FINRISKI 1987 and 1992 cohorts with new cases of drug-treated diabetes as the end-point, ascertained using the Social Insurance Institution's Drug register (Lindström and Tuomilehto 2003). The aim was to have a simple, self-administered screening tool which did not require blood testing or measurements by trained personnel, yet which could satisfactorily categorize individuals according to their risk of developing type 2 diabetes in the future.

Baseline age, body mass index, waist circumference, history of antihypertensive drug treatment and high blood glucose, physical activity and daily consumption of fruits, berries or vegetables were selected into the risk score as categorical variables. In the 1987 cohort the optimal cut-off point of the risk score identified 78% of those who developed diabetes during the follow-up (= sensitivity of the test) and 77% of those who remained free of diabetes (= specificity of the test). In the 1992 cohort, which was used as an external validation cohort, the risk score performed equally well. The final FINDRISC form includes, in addition to the predictors of the model, a question about family history of diabetes, and the age category of over 64 years (Figure 2).

TYPE 2 DIABETES RISK ASSESSMENT FORM

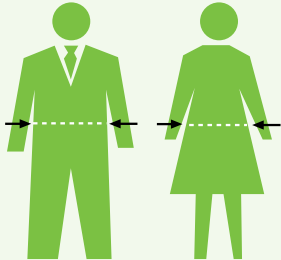Circle the right alternative and add up your points.

1. Age
0 p.   Under 45 years
2 p.   45–54 years
3 p.   55–64 years
4 p.   Over 64 years

2. Body-mass index

0 p.   Lower than 25 kg/m^2
1 p.   25–30 kg/m^2
3 p.   Higher than 30 kg/m^2

3. Waist circumference measured below the ribs
(usually at the level of the navel)
          MEN   WOMEN
0 p.   Less than 94 cm   Less than 80 cm
3 p.   94–102 cm   80–88 cm
4 p.   More than 102 cm   More than 88 cm

4. Do you usually have daily at least 30 minutes
of physical activity at work and/or during leisure
time (including normal daily activity)?
0 p.   Yes
2 p.   No

5. How often do you eat vegetables, fruit or
berries?
0 p.   Every day
1 p.   Not every day

6. Have you ever taken medication for high
blood pressure on regular basis?

0 p.   No
2 p.   Yes

7. Have you ever been found to have high blood
glucose (eg in a health examination, during an
illness, during pregnancy)?

0 p.   No
5 p.   Yes

8. Have any of the members of your immediate
family or other relatives been diagnosed with
diabetes (type 1 or type 2)?

0 p.   No
3 p.   Yes: grandparent, aunt, uncle or first
          cousin (but no own parent, brother, sister
          or child)
5 p.   Yes: parent, brother, sister or own child

Total Risk Score

The risk of developing
type 2 diabetes within 10 years is

Lower than 7   Low: estimated 1 in 100
                   will develop disease

7–11   Slightly elevated:
                   estimated 1 in 25
                   will develop disease

12–14   Moderate: estimated 1 in 6
                   will develop disease

15–20   High: estimated 1 in 3
                   will develop disease

Higher   Very high:
than 20   estimated 1 in 2
                   will develop disease

Test designed by Professor Jaakko Tuomilehto, Department of Public Health, University of Helsinki,
and Jaana Lindström, MFS, National Public Health Institute.

Figure 2. Finnish Type 2 Diabetes Risk Score FINDRISC (Finnish Diabetes Association).

When applied to the DPS study cohort, the intervention proved to be most effective among the individuals with a high baseline FINDRISC, indicating that the FINDRISC is useful in identifying individuals for intensified lifestyle intervention

even among individuals with impaired glucose tolerance, and that lifestyle intervention is beneficial especially in these high-risk individuals (Lindström et al 2008).

Even though the FINDRISC was originally aimed at identifying people with a high risk of developing diabetes in the future, it can also be used to screen for prevalent diabetes and other categories of glucose intolerance (Saaristo et al 2005). Although the oral glucose tolerance testing is usually mandatory to diagnose type 2 diabetes, screening first with FINDRISC can reduce significantly the number of necessary diagnostic tests. In addition, a high FINDRISC value also predicts the incidence of myocardial infarction and stroke (Silventoinen et al 2005).

PRACTICAL IMPLEMENTATION OF PREVENTION

Finland was one of the first countries in the world to set up a national programme for the prevention and better care of type 2 diabetes, called DEHKO (Suomen Diabetesliitto 2000). Related to one of the three aims of DEHKO, the Programme for the Prevention of Type 2 Diabetes in Finland was launched in 2003, to deal with the emerging diabetes epidemic. The programme comprises three concurrent strategies: 1) the population strategy covering the general population, 2) the high-risk strategy which is based on individual-oriented measures targeted at those at particularly high risk of developing type 2 diabetes, and 3) the strategy of early diagnosis and management of type 2 diabetes. As a part of the nationwide promotion of these programme components, an implementation project, FIN-D2D, was carried out in 5 of the 21 hospital districts in Finland during 2003-2007 (Suomen Diabetesliitto 2004). The main objective of the implementation project was to organise and develop prevention models that would be feasible within the regular primary and occupational health care system. These prevention models are largely based on findings and experiences from the DPS study. Furthermore, an additional aim of the implementation programme was to evaluate the effectiveness of these activities at population level; these analyses are now underway.

The FIN-D2D project was carried out by seven partners; the five participating hospital districts, the Finnish Diabetes Association and the National Public Health Institute. The hospital district's role was to organize the practical prevention work in the local health centres, and in the occupational health centres in its area. The Finnish Diabetes Association coordinated the programme. The role of the National Public Health Institute was to provide expertise on primary prevention of type 2 diabetes, and to evaluate the effectiveness of the project. Furthermore, a close cooperation between the partners of the FIN-D2D, the Finnish Heart Association, the Association

of Finnish Pharmacies, and other non-governmental organizations, was established to provide support for the practical intervention work in the primary and occupational health care.

In addition to the national FIN-D2D programme, several other implementation projects in the field of diabetes prevention are currently ongoing in Finland (Uutela et al 2004). Furthermore, the DE-PLAN project (Diabetes in Europe: Prevention using Lifestyle, Physical Activity and Nutritional Intervention) is the European continuum to the prevention activities started in Finland (Schwarz et al 2008). Initiated by the University of Helsinki and National Public Health Institute of Finland, the project aims at developing and testing models of efficient identification of and intervention with individuals at high risk of type 2 diabetes across various countries in the EU. In total, 25 centres from 17 EU member-states are involved in the project. Many of the ongoing prevention programmes in Europe have adopted the FINDRISC score as a tool to detect asymptomatic high risk individuals. In addition, it is used together with the oral glucose tolerance test for early detection of prevalent type 2 diabetes.

DISCUSSION

The current situation in regard to type 2 diabetes can well be compared with the epidemic of coronary heart disease in the late 1960's in Finland. Primary prevention measures at the population level targeted to control the known modifiable risk factors of coronary heart disease have been shown to be very successful (Vartiainen et al 1991). For type 2 diabetes, the effects of lifestyle intervention to prevent type 2 diabetes in high-risk individuals have been firmly demonstrated in clinical trials. Furthermore, the extension of the DPS study demonstrated that life-style intervention lasting for a limited duration can lead to sustained lifestyle modification and prevention of the development of diabetes also in the long-term (Lindström et al 2006a). These experiences indicate that there is great potential in using lifestyle intervention to reduce the burden of type 2 diabetes among high-risk individuals.

However, there are still some unanswered questions concerning prevention of type 2 diabetes by lifestyle intervention. First, it is not clear whether prevention of diabetes also prevents diabetes-related comorbidities, i.e. cardiovascular disease. In the Malmö Preventive Trial with a 12-year follow-up of individuals with impaired glucose tolerance, both the over-all and ischaemic heart disease mortality were lower among subjects who were participating in the diet and exercise intervention group, as compared to the routine treatment group (Eriksson and Lindgarde 1998). However, as the group allocation was based on personal preference and thus was not random,

it is not clear whether the intervention itself explains the observed risk difference. In the extended follow-up of the cluster-randomised Chinese Da Qing IGT and Diabetes Study with men and women with impaired glucose tolerance, there was a tendency towards lower mortality from cardiovascular disease in the diet and/or physical activity intervention groups compared with the control group during a 20-year follow-up, but this did not reach statistical significance (Li et al 2008). Further, there were no differences in cardiovascular disease incidence nor all-cause mortality, despite the fact that the diabetes risk remained lower in the intervention group compared with the control group.

Second, how the implementation of effective diabetes prevention programmes in general healthcare should be practically organized is still unclear. To be more widely accepted, the feasibility, effects and cost-effectiveness of the applied intervention strategies need to be assessed. At the moment, some evidence suggests that the preventive effect of lifestyle interventions achieved in a clinical trial setting is attenuated when prevention is pursued within health-care settings, with less-selected patient groups (Absetz et al 2007). Evaluation of the currently ongoing national and regional diabetes prevention programmes, both in Finland and abroad, will help us to identify methods that will enable us to prevent type 2 diabetes more successfully at population level.

The currently available evidence strongly indicates that prevention of type 2 diabetes among high-risk individuals is effective. However, it is clear that the diabetes epidemic cannot be solved by concentrating on high-risk strategies and preventive actions carried out by health care system. We need to develop and implement primary prevention programmes targeting the population as a whole. In particular, the importance of co-operation and of a multisectorial approach should be emphasized. A large number of stakeholders and sectors should be involved at all levels of society. Citizens' awareness of the importance of a healthy lifestyle has to be increased, and there is a need to address social inequalities in diet, physical activity and obesity. Healthy lifestyle choices have to be made available, affordable, and enjoyable. We have to influence and work together with the educational system, food industry, media, urban planning and non-governmental organizations to make healthy choices easier and more appealing. We need to support local communities and workplaces in their efforts to promote healthier lifestyles.

Nevertheless, we also need to have targeted action to reach risk groups. Moreover, newly diagnosed diabetes should be managed effectively. Therefore, we need also secondary prevention programmes and intensive lifestyle management strategies to prevent the development of complications.

REFERENCES

Absetz P, Valve R, Oldenburg B, Heinonen H, Nissinen A, Fogelholm M *et al* (2007). Type 2 Diabetes Prevention in the "Real World": One-year results of the GOAL Implementation Trial. *Diabetes Care* **30:** 2465-2470.

Eriksson J, Lindstrom J, Valle T, Aunola S, Hämäläinen H, Ilanne-Parikka P *et al* (1999). Prevention of Type II diabetes in subjects with impaired glucose tolerance: the Diabetes Prevention Study (DPS) in Finland. Study design and 1-year interim report on the feasibility of the lifestyle intervention programme. *Diabetologia* **42:** 793-801.

Eriksson KF, Lindgärde F (1998). No excess 12-year mortality in men with impaired glucose tolerance who participated in the Malmo Preventive Trial with diet and exercise. *Diabetologia* **41:** 1010-1016.

Gerstein HC (1997). Glucose: a continuous risk factor for cardiovascular disease. *Diabet Med* **14 Suppl 3:** S25-31.

Helakorpi S, Prättälä R, Uutela A. Suomalaisen aikuisväestön terveyskäyttäytyminen ja terveys, kevät 2007: Kansanterveyslaitoksen julkaisuja B. Helsinki, Kansanterveyslaitos, 2008.

Herman WH, Hoerger TJ, Brandle M, Hicks K, Sorensen S, Zhang P *et al* (2005). The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. *Ann Intern Med* **142:** 323-332.

Hu G, Qiao Q, Silventoinen K, Eriksson JG, Jousilahti P, Lindström J *et al* (2003). Occupational, commuting, and leisure-time physical activity in relation to risk for Type 2 diabetes in middle-aged Finnish men and women. *Diabetologia* **46:** 322-329.

Hu G, Lindström J, Valle TT, Eriksson JG, Jousilahti P, Silventoinen K *et al* (2004). Physical activity, body mass index, and risk of type 2 diabetes in patients with normal or impaired glucose regulation. *Arch Intern Med* **164:** 892-896.

Hu G, Jousilahti P, Qiao Q, Peltonen M, Katoh S, Tuomilehto J (2005). The gender-specific impact of diabetes and myocardial infarction at baseline and during follow-up on mortality from all causes and coronary heart disease. *J Am Coll Cardiol* **45:** 1413-1418.

Ilanne-Parikka P, Eriksson JG, Lindstrom J, Peltonen M, Aunola S, Hämäläinen H *et al* (2008). Effect of Lifestyle Intervention on the Occurrence of Metabolic Syndrome and its Components in the Finnish Diabetes Prevention Study. *Diabetes Care* **31:** 805-807.

Juutilainen A, Lehto S, Rönnemaa T, Pyorälä K, Laakso M (2005). Type 2 Diabetes as a "Coronary Heart Disease Equivalent": An 18-year prospective population-based study in Finnish subjects.. *Diabetes Care* **28:** 2901-2907.

Laaksonen DE, Lindström J, Lakka TA, Eriksson JG, Niskanen L, Wikström K *et al* (2005). Physical activity in the prevention of type 2 diabetes: the Finnish Diabetes Prevention Study. *Diabetes* **54:** 158-165.

Lammi N, Taskinen O, Moltchanova E, Notkola IL, Eriksson JG, Tuomilehto J *et al* (2007). A high incidence of type 1 diabetes and an alarming increase in the incidence of type 2 diabetes among young adults in Finland between 1992 and 1996. *Diabetologia* **50:** 1393-1400.

Li G, Zhang P, Wang J, Gregg EW, Yang W, Gong Q *et al* (2008). The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study. *Lancet* **371:** 1783-1789.

Lindström J, Louheranta A, Mannelin M, Rastas M, Salminen V, Eriksson J *et al* (2003). The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity. *Diabetes Care* **26:** 3230-3236.

Lindström J, Tuomilehto J (2003). The Diabetes Risk Score: A practical tool to predict type 2 diabetes risk. *Diabetes Care* **26:** 725-731.

Lindström J, Ilanne-Parikka P, Peltonen M, Aunola S, Eriksson J, G. , Hemiö K *et al* (2006a). Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: The follow-up results of the Finnish Diabetes Prevention Study. *Lancet* **368:** 1673-1679.

Lindström J, Peltonen M, Eriksson JG, Louheranta A, Fogelholm M, Uusitupa M *et al* (2006b). High-fibre, low-fat diet predicts long-term weight loss and decreased type 2 diabetes risk: the Finnish Diabetes Prevention Study. *Diabetologia* **49:** 912-920.

Lindström J, Peltonen M, Eriksson J, Aunola S, Hämäläinen H, Ilanne-Parikka P *et al* (2008). Determinants for the effectiveness of lifestyle intervention in the Finnish Diabetes Prevention Study. *Diabetes Care* **31:** 857-862.

Montonen J, Knekt P, Järvinen R, Aromaa A, Reunanen A (2003). Whole-grain and fiber intake and the incidence of type 2 diabetes. *Am J Clin Nutr* **77:** 622-629.

Pajunen P, Koukkunen H, Ketonen M, Jerkkola T, Immonen-Räihä P, Karja-Koskenkari P *et al* (2005). Myocardial infarction in diabetic and non-diabetic persons with and without prior myocardial infarction: the FINAMI Study. *Diabetologia* **48:** 2519-2524.

Peltonen M, Korpi-Hyövälti E, Oksa H, Puolijoki H, Saltevo J, Vanhala M *et al* (2006). Lihavuuden, diabeteksen ja muiden glukoosiaineenvaihdunnan häiriöiden esiintyvyys suomalaissessa aikuisväestössä. Dehkon 2D-hanke (D2D). *Suom Lääkäril* **61:** 163-170.

Puska P, Peltonen M, Reunanen A (2008). Kakkostyypin diabetes - ajankohtainen kansanterveysuhkamme. *Yleislääkärilehti***:** 11-13.

Reunanen A, Kattainen A. Verenkiertoelinten sairaudet ja diabetes. In: Aromaa A, Koskinen S (eds): Terveys ja toimintakyky Suomessa. Terveys 2000 -tutkimuksen perustulokset. Kansanterveyslaitoksen julkaisuja B3/2002. Helsinki, Kansanterveyslaitos, 2002.

Reunanen A, Virta L, Klaukka T (2008). Tyypin 2 diabeetikkoja on jo yli puoli miljoonaa. *Suom Lääkäril* **63:** 1952-1955.

Saaristo T, Peltonen M, Lindström J, Saarikoski L, Sundvall J, Eriksson JG *et al* (2005). Cross-sectional evaluation of the Finnish Diabetes Risk Score: a tool to identify undetected type 2 diabetes, abnormal glucose tolerance and metabolic syndrome. *Diab Vasc Dis Res* **2:** 67-72.

Schwarz P, Lindström J, Kissimova-Skarbek K, Szybinski Z, Barengo N, Peltonen M *et al* (2008). The European Perspective of Type 2 Diabetes Prevention: Diabetes in Europe - Prevention using Lifestyle, physical Activity and Nutritional intervention (DE-PLAN) project. *Exp Clin Endocrinol Diabetes* **116:** 167-172.

Silventoinen K, Pankow J, Lindström J, Jousilahti P, Hu G, Tuomilehto J (2005). The validity of the Finnish Diabetes Risk Score for the prediction of the incidence of coronary heart disease and stroke, and total mortality. *Eur J Cardiovasc Prev Rehabil* **12:** 451-458.

Suomen Diabetesliitto. Diabeteksen ehkäisyn ja hoidon kehittämisohjelma 2000-2010. Tampere, Suomen Diabetesliitto ry, 2000.

Suomen Diabetesliitto. Suunnitelma tyypin 2 diabeteksen ehkäisyohjelman toteuttamiseksi. Projektisuunnitelma 2003-2007. Dehkon 2D-hanke (D2D). Tampere, Suomen Diabetesliitto ry, 2004.

The DECODE Study Group (2003). Is the current definition for diabetes relevant to mortality risk from all causes and cardiovascular and noncardiovascular diseases? *Diabetes Care* **26:** 688-696.

The Diabetes Prevention Program Research Group (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* **346:** 393-403.

Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P *et al* (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* **344:** 1343-1350.

Uutela A, Absetz P, Nissinen A, Valve R, Talja M, Fogelholm M (2004). Health psychological theory in promoting population health in Päijät-Häme, Finland: first steps toward a type 2 diabetes prevention study. *J Health Psychol* **9:** 73-84.

Vartiainen E, Korhonen HJ, Pietinen P, Tuomilehto J, Kartovaara L, Nissinen A *et al* (1991). Fifteen-year trends in coronary risk factors in Finland, with special reference to North Karelia. *Int J Epidemiol* **20:** 651-662.

Vartiainen E, Peltonen M, Laatikainen T, Sundvall J, Salomaa V, Jousilahti P *et al* (2008). FINRISKI-tutkimus: Sekä miesten että naisten sydän- ja verisuonisairauksien kokonaisriski pieneni viime vuosina. *Suom Lääkäril* **63:** 1375-1381.

World Health Organization. Diet, nutrition and the prevenion of chronic diseases. Report of a joint FAO/WHO consultation. Geneva, World Health Organization, 2003.

Ylihärsilä H, Lindström J, Eriksson JG, Jousilahti P, Valle TT, Sundvall J *et al* (2005). Prevalence of diabetes and impaired glucose regulation in 45- to 64-year-old individuals in three areas of Finland. *Diabet Med* **22:** 88-91.

20. INTERNATIONAL EXPERIENCES WITH COMMUNITY BASED CVD PREVENTION PROGRAMMES AND THEIR EVALUATION

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After World War II, with the emergence of cardiovascular and some other chronic disease epidemics and with increasing medical evidence on their risk factors, preventive efforts in many industrialized countries included community-based preventive programmes, projects and studies. An important background was the notion that the strong risk factors relate closely to behaviours and lifestyles – especially to diet and smoking. It was also realized that in order to reduce the disease rates in the population, merely working with individuals with "clinically high risk" is insufficient. Instead, to reduce the disease rates, a population-based approach is needed, i.e. changes in general lifestyle and reduction of general risk factor levels in the population.

The first major community-based project was the North Karelia Project in Finland, which was started in 1972 to plan, implement and evaluate a comprehensive preventive cardiovascular preventive programme in this population with a very high mortality from cardiovascular diseases. Based on similar concepts, and later with the encouraging experiences from the North Karelia Project, many other community-based projects were started, with somewhat different background and approaches. In the 1980s the focus of the programmes expanded from cardiovascular diseases to noncommunicable diseases, mainly because of common risk factors. Attention turned to promoting this approach also in developing countries, where the prevalence of chronic diseases was growing.

Today, many evaluation results and experiences are available about numerous community-based intervention studies in high-income countries, as well as from some developing countries. However, the results of the specific studies have not matched with the initial optimism. On the other hand, the results of the North Karelia Project and other community-based studies show the great potential of long-term, sustained and comprehensive interventions.

The chapter describes some of the major community-based studies. It discusses further the many challenges of the design of such intervention studies and their

evaluation. Despite many constraints, modern public health is very dependent on interventions on the main, well-established chronic disease risk factors in the community and in the national population. Community-based programmes have also helped to develop national policies and activities. At the same time further development in both our concepts, methods and measurements with community-based interventions will be important to better serve public health.

BACKGROUND

Community based intervention studies have mostly been used to assess the possibility and extent of chronic disease prevention in the population. Historically, community-based trials have been a logical follow-up from case-control and prospective studies that have identified likely causal risk factors, and from individual randomized trials. As early as the 1950s and 1960s, early cohort studies on cardiovascular diseases (Anderson *et al*, 1991) showed how three main risk factors (blood pressure, blood cholesterol and smoking) were strongly associated with cardiovascular diseases both within and between populations.

To prove causality, randomized trials are generally needed. But very soon the many limitations of individual randomized trials in assessing the effectiveness of community-based interventions for cardiovascular diseases were realized. The proposed interventions should deal with a large number of people to introduce lifestyles changes that are, to a great extent, features of the community rather than individuals *per se*.

Epidemiological considerations further spurred the movement towards community-based intervention approaches. The risk of cardiovascular diseases increases continuously as the level of a risk factor increases, without any natural threshold limit. Most of the cardiovascular disease cases come individuals in the population with an average risk level, because they constitute the largest proportion of the population at risk. Although a very high risk factor level leads to a high disease risk for an individual, the number of cases from this risk group is relatively low because of the relatively low proportion of people in this population segment.

Following this, the discussion on prevention has focused on two major prevention strategies: the high-risk strategy and the population strategy. In the high-risk strategy people are screened for their risk factors (like high blood pressure, high LDL cholesterol), and preventive activities are directed to those at high risk. In the population strategy, preventive activities, such as health promotion and policy measures, are directed to all the people in the community, i.e. to the whole population.

The community-based approach is thus based on the observation that effective reduction of chronic disease rates in the population usually calls for changes in general risk-related behaviours or reduction in mean risk factor levels. Hence, the intervention predominantly involves general lifestyle changes. Another important feature of the community-based approach is that the intervention targets the community, aiming at modifying social and environmental determinants.

The relative merits of the two strategies in influencing blood cholesterol levels are illustrated by Finnish data derived from five independent risk factor surveys conducted between 1972 and 1992 at five-year intervals (Jousilahti *et al*, 1998). About 30% of the coronary heart disease (CHD) deaths came from the population group whose serum cholesterol level was ≥ 8 mmol/l. It was estimated that 20% of the mortality could be prevented by reducing the cholesterol levels in the entire population by 10%. In contrast, a 25% reduction in cholesterol levels ≥ 8 mmol/l could reduce CHD mortality by only 5%. (Figure 1).
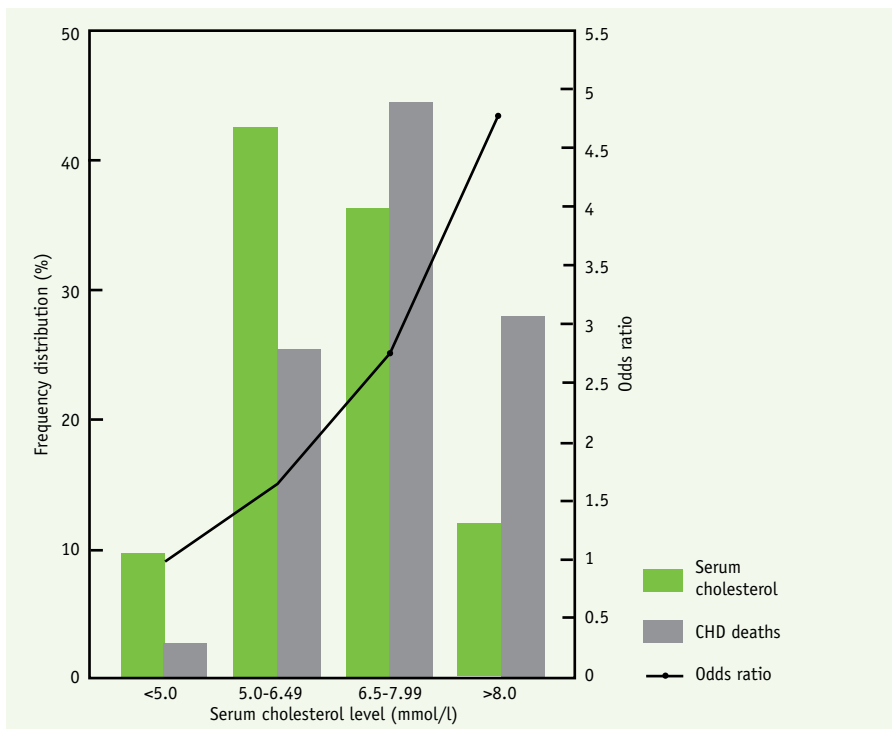
Figure 1. Distribution of serum cholesterol and coronary heart disease (CHD) deaths of men aged 30 to 59 years (1972, 1977, and 1982 cohorts combined) and odds ratios of CHD mortality associated with serum cholesterol. Source: Jousilahti et al. 1998

As early as the 1950s it was observed that blood cholesterol level could be greatly influenced by a few dietary factors: saturated fats increase blood cholesterol level; polyunsaturated fats decrease it. Also dietary cholesterol was found to increase blood cholesterol level (Keys *et al*, 1959). Since then, numerous studies have been carried out to further assess the role of diet on blood cholesterol level. Even in the most recent reviews the original findings have not changed very much. Only the effect of trans fatty acids on blood cholesterol in the 1980s is a new finding. Also, pectin, certain veg on. etables and plant sterols and stanols were found to have favourable effects on blood cholesterol. Blood pressure could be reduced by limiting sodium intake and obesity, in addition to the use of drugs (Lichtenstein *et al*, 2006). Based on these findings it became obvious that dietary habits of people pois ic are key areas for intervention.

At the same time numerous studies had shown smoking to be a strong risk factor, both for cardiovascular diseases and for cancer. In addition, some other behavioural factors, especially physical inactivity and excess alcohol use, were shown to be important risk factors.. These researches strengthened the evidence that most major chronic, noncommunicable diseases (NCD) are indeed strongly related to certain lifestyles, with individual, psychosocial and environmental determinants. Thus the World Health Organization (WHO) and others often refer to these diseases as "lifestyle diseases". The Global Strategy for NCD Prevention and Control targets smoking, unhealthy diet and physical inactivity (WHO, 1999).

Community-based programmes and studies were introduced to assess two questions: (1) Can the mean risk factor level be reduced in an entire population, primarily through general lifestyle change; and (2) does such reduction lead to a decline in mortality and morbidity?

The first three cardiovascular prevention community programmes were started in the 1970s: the North Karelia Project in Finland (Puska *et al*, 1983), the Stanford Three Communities Study in the USA (Farquhar *et al*, 1977), and the CHAD (Community syndrome of *H*ypertension, *A*therosclerosis, and *D*iabetes) programme in Israel (Abramson *et al*, 1981). In 1974 the European Office of WHO initiated the Comprehensive Cardiovascular Community Control Programme to help countries develop community-based cardiovascular disease prevention programmes and to facilitate learning from other experiences. Nine European countries participated in this programme (Puska *et al*, 1988).

In the 1980s this programme evolved into the Countrywide Integrated Noncommunicable Disease Prevention Program (CINDI), with the aim of enlarging the community programme to other chronic diseases sharing the same risk factors. These experiences were used in developing the WHO European strategy to prevent and control noncommunicable diseases (WHO 2006).

In the United States three major demonstration programmes were started in the 1980s: the Stanford Five-City Project (Farquhar *et al*, 1990), the Minnesota Heart Health Program (Luepker *et al*, 1994), and the Pawtucket Heart Health Program (Carleton *et al*, 1995). In the USA, the latest development has been to use these experiences to carry out cardiovascular programmes with fewer resources (Goodman *et al*, 1995) and in hard-to-reach populations (Shea *et al*, 1992), and to develop the US national strategy to prevent coronary heart disease and stroke Following positive experiences in the CINDI programme the WHO Regional Office for the Americas started a similar network called CARMEN in the 1990s.

Even if most of the integrated community programmes have been carried out in the developed countries, the great increase in the NCD burden in many developing countries has led to similar activities in these places also. Many of them were carried out in conjunction with the WHO Interhealth Programme (Interhealth Steering Committee, 1991), which was started in 1986. The aim was to demonstrate how an integrated programme could be implemented in populations in all regions of the world, at every stage of the demographic and epidemiological transition. The programme was based on the recommendations contained in the core protocol: a quasi-experimental design was used in selecting intervention and reference populations to assess the effect of the intervention activities. Altogether 10 out of 12 countries provided risk factor data (measured by the MONICA methodology), based on random samples of middle-aged populations. Chile, China (Beijing and Tianjin), Mauritius, and the United Republic of Tanzania represented the developing countries; and Finland, Cyprus, Lithuania, Malta, the Russian Federation, and the USA represented the developed ones. In the framework of the Programme, special activities were undertaken among schoolchildren in Chile, and the United Republic of Tanzania (Kiangi, 1995). Large scale community programmes were launched in Mauritius (Dowse et al, 1995; Uusitalo et al, 1996) and China (Sun et al, 2000; Tian et al, 1995).

With the regional development (CINDI, CARMEN) the Interhealth Programme ended, and WHO's Africa and Eastern Mediterranean Regional Offices have taken steps to launch similar networks.

It should be noted that this chapter deals with studies where the "community" has been defined in terms of geographical areas. A number of studies have used other type of "communities", such as schools, work sites, or communities defined by profession. In the 1970s WHO coordinated a work site-based cardiovascular study, initially in England and Belgium, and later in Poland and Italy (WHO 1989).

SELECTED COMMUNITY-BASED INTERVENTION PROJECTS TO REDUCE CARDIOVASCULAR MORTALITY

The North Karelia Project was initiated in 1972 to reduce the extremely high cardiovascular mortality in the area, as described in this book and numerous publications (Puska *et al*, 1983).

In the Stanford Three Community Study (Farquhar *et al*, 1977), three semi-rural communities with populations between 13,000 and 15,000 were chosen for the study. In two of these communities there were extensive mass media campaigns over a 2-year period, and in one of these, face-to face counselling was also provided to a small subset of high-risk individuals. A random sample of the same individuals was studied before and after the campaign over two years. In the control community the risk of cardiovascular disease increased over the two-year study period, but in the treatment communities there was a substantial and sustained decrease in risk, specifically a greater reduction in plasma cholesterol, blood pressure and smoking in the programme communities.

The CHAD programme was initiated in 1970, and the second screening was carried out in 1975 (Abramson *et al*, 1981). The CHAD programme serves adult residents aged 25 years and older in a housing project in Jerusalem. In the beginning 648 people were studied in the programme area, and 1,995 served as the control neighbourhood. In 1975, 524 members from the same cohort in the intervention population and 1,512 in the control population were examined. The programme depended primarily on face-to-face counselling of individuals and married couples in a local health centre providing primary health care services. Reductions in blood pressure, obesity and smoking were greater in the programme area than in the control neighbourhood. No significant effect was observed on blood cholesterol levels.

The National Research Programme on Primary Prevention of Cardiovascular Diseases in Switzerland was conducted from 1977–1980 (Gutzwiller *et al*, 1985). Two towns (12,000 inhabitants each) in the French-speaking areas and two towns (16,000 inhabitants each) in the German-speaking part of the country were selected either for the intervention or the comparison group. The intervention involved different kinds of health education with various community involvements. In the intervention towns 26.2% of the regular smokers quit during the study period, compared to 18.1% in the reference towns. A significant net increase in the proportion of hypertensive patients under effective control was observed in the intervention towns. The decline in serum cholesterol was similar in the intervention and comparator towns.

As a Mediterranean country Italy has had traditionally low coronary mortality rates, but during the 1970s the rates began to increase. The Martignacco community cardiovascular control project was started in 1977. The intervention community had 5,259 inhabitants. A community of 7,651 residents was selected as the control community (Feruglio, 1983a). The programme included mass communication, and group and individual counselling. The mean serum cholesterol level decreased in the intervention community and increased in the control community over a three-year follow-up of the same cohorts.

In the Stanford Five-City Project, two treatment cities (N=122,800) received a 5-year low-cost comprehensive programme that used a communication-behaviour change model, community organization principles, and social marketing methods. Two cities (N=197,500) served as controls. Risk factors were assessed both by cohort and independent cross-sectional surveys. After 30–64 months of education, significant net reductions in the intervention cities compared to the control cities were seen in plasma cholesterol (2%), blood pressure (4%), and smoking rate (13%). Significant reductions were observed also in the cross-sectional surveys in cholesterol and blood pressure but not in smoking (Farquhar *et al*, 1990)

In the Minnesota Heart Health Program, three pairs of communities were matched in size and type. Each pair had one education site and one comparison site (Luepker *et al*, 1994). After a baseline survey, a 5- to 6-year programme involving mass media, community organization, and direct education for risk reduction was begun in the education communities. Against a background of strong secular trends with increasing health promotion and declining risk factors, the overall programme effect was modest in size and duration.

In the Pawtucket Heart Health Program, a random sample of residents aged 18-64 year-old were studied using cross-sectional and cohort surveys (Carleton *et al*, 1995). Pawtucket citizens of all ages participated in multi-level education, screening, and counselling programs. The downward trend in smoking was slightly greater in the comparison city. The decline in blood pressure and cholesterol was similar in both cities. Achieving cardiovascular risk reduction at the community level was feasible, but maintaining statistically significant difference between the cities was not.

The Kilkenny Health Project was a community research and demonstration programme that aimed to reduce the risk of cardiovascular diseases in a county in the southeast of Ireland with total population of 70,000 (Shelley *et al*, 1995). Independent random samples were used to evaluate the effects of the programme from the intervention and reference counties. The health promotion programme was carried out in Kilkenny from 1985 to 1992. Blood pressure and cholesterol levels declined both in the intervention and reference area.

In former West Germany a community-oriented cardiovascular disease prevention programme was conducted in six regions over a seven-year period, starting in 1988 (Hoffmeister *et al*, 1996). The six intervention regions, comprising a total population of over one million, were scattered throughout the country. The national trend was used as reference. The prevention activities were aimed to promote healthy nutrition, increase physical activity, and reduce smoking, hypertension and hypercholesterolemia. In the pooled intervention area, the net reduction in mean systolic and diastolic blood pressure was 2 %, total serum cholesterol 1.8% and in smoking 6.7%, as compared with the national trend.

The Hartslag Limburg community-based intervention project was started in 1998 in a general population of Maastricht region (population 185,000) in The Netherlands (Schuit *et al*, 2006). In the intervention area, two strategies were integrated: a population- wide strategy aimed at all inhabitants to change lifestyle to reduce risk factors, and a subgroup strategy focused on individuals with diagnosed cardiovascular disease or multiple physical risk factors. A random sample of 3,000 individuals in the intervention area, and 758 in the reference area were studied in the beginning of the programme and after five years. Risk factors changed unfavourably in the reference group, whereas changes were less pronounced or absent in the intervention group. The programme had a significant effect on body mass index, waist circumference, systolic blood pressure; in women, the mean serum cholesterol and glucose level also decreased.

Tianjin Project in China is one of the few examples from developing countries which has reported the results of intervention against major cardiovascular diseases, stroke, coronary heart disease, cancer and hypertension. The Project was launched in 1984 in the urban Tianjin district (9 million inhabitants). The Project area consisted of both intervention and reference area randomly selected from within the district. The aim was to reduce high sodium intake among the entire population, decrease smoking especially among men, and provide hypertension care by reorganizing the existing primary health care services. Both the feasibility and the effects of the project were evaluated. The results show a significant reduction in sodium intake in men after three years of intervention, with a similar reduction in all socioeconomic groups (Tian et al, 1995; Yu et al, 1999); and after five years, the prevalence rates of both hypertension and obesity decreased among 45-65 year- olds, but increased in younger age groups (Yu et al, 1999). Smoking rates also showed an increase among men, especially those with higher education (Yu et al, 2000). During the same period, physical activity resulting from going to and from work was found to have decreased in the population (Hu, 2001).

Another example from the developing countries is the Mirame Project in Chile. A 3-year health education programme on the principles of social learning theory (Bandura, 1977) was conceived among schoolchildren and their families in the Metropolitan Region. The objectives were firstly to develop skills to resist social, environmental and peer pressure and learn how to say "No" to such pressures, and secondly to inform the children and their families about the most common health risk behaviours and biological risk factors. After three years of intervention there had been a significant positive impact on alcohol consumption and smoking, the net change being from 8% to 11% in favour of the intervention population when comparing with the reference population (Berrios, 1997; Nissinen et al, 2001). In Iran an integrated comprehensive community-based national programme entitled "Isfahan Healthy Heart Program" was launched in 1999. The NCD programme use both population and high risk approaches (Sarrafzadegan et al, 2003). Annual evaluation shows improvements in diet and physical activity in two intervention areas compared to reference area (Mohamadifard et al, 2006) . Among children and adolescents, the consumption of salty/fat snacks, fast foods and fried foods decreased significantly in the intervention areas, but increased in the reference area (Kelishadi et al, 2004).

COMMUNITY-BASED INTERVENTION PROJECTS FOR OTHER MAJOR HEALTH PROBLEMS

As stated earlier, in the field of prevention of chronic, noncommunicable diseases and health problems, much of the research activity and methodological discussions has concerned prevention of cardiovascular diseases. There have been many other activities and programmes to try to influence other health problems, like traffic and other accidents or just health related lifestyles without any specific diseases and targets. Most of these have been programmes with varying degree of evaluation. Much less has there been systematic community-based intervention studies.

In the field of cancer a major limitation is that the rates for specific outcomes, i.e., cancer rates, are usually smaller than cardiovascular rates and the time lag between the risk factor and disease changes are likely to be longer. In the 1990s, the COMMIT study (Community Intervention Trial for Smoking) was undertaken to reduce smoking rates in the intervention communities, with reduction in cancer as a goal. The results were modest and demonstrated the difficulties in assessing the effectiveness of multiple interventions with a larger number of intervention communities vs. comparator communities (COMMIT Research Group, 1995).

In the North Karelia Project, where there was a significant net reduction in smoking in the study areas, there was a significantly greater reduction in incidence and mortality from tobacco-related cancers in North Karelia compared to the rest of the country (Luostarinen *et al*, 1995) (Puska *et al*, 1998) .

With current international concern on the increasing problem of obesity and diabetes rates, many programmes and policy measures have been launched to help prevent diabetes. Although many of these have a community basis, there are few rigorous community-based studies. In Finland a community-based preventive programme for diabetes, FIN-DCD-project, was launched in 2003. It involves community-based prevention in five hospital districts, with baseline surveys in 2002/2003 and follow-up surveys in 2007 in the intervention areas and three reference areas (Saaristo *et al*, 2007).

In the field of injury prevention, Duperrex e*t al.* (2002) conducted a study on safety education of pedestrians for injury prevention. In the field of environmental health, where communities are natural targets for health interventions, examples of community-based studies relate to water and sewage systems, traffic arrangements, and city planning. The introduction of congestion traffic charges has been studied as 'natural experiments' in London and Stockholm (Beevers & Carslaw, 2005) (Hugosson *et al*, 2006) .

IMPORTANT METHODOLOGICAL ASPECTS OF COMMUNITY STUDIES

Study design

Most community-based studies have used a quasi-experimental design in which one or several communities are allocated to receive the experimental intensified intervention programme and one or several communities are selected to serve as reference areas which represent the development in the country. In the intervention community an innovative programme is implemented to apply the best possible approaches to change the population level of one or more risk factors in the whole community.

The reference community is not deprived of any new health developments that might occur other than those represented by the experimental programme. In fact the comparison between the communities is not a comparison of programme and no programme but is, in most cases, a comparison of two programmes. This is exemplified clearly in the US studies. In the Stanford Three Community Study there was a clear effect on risk factors and some effect was seen in the Stanford Five-City Program but the effects in the Minnesota and Pawtucket Heart Health

Programs were minimal or did not exist because of strong changes in risk factors at the national level. This secular trend is often thought to happen by itself, but this is unlikely to be correct. The more likely explanation is that strong national and local policies and activities were carried out at the same time.

The observation unit in community trials is a community. In cluster randomized trials, several communities should be used to allow use of the community as a unit in the statistical analyses. Communities can be matched by size and other characteristics of the population and randomly allocated to intervention and control conditions. However, in real life it is usually not feasible to include a sufficient number of communities to use the community as a unit of statistical analysis. It is also difficult to run several community programmes at the same time. In addition, the use of the two or more communities creates interpretational complications in the event of a positive result in one community and a negative one in another.

In a truly experimental design with a sufficient number of communities randomly allocated into intervention and control communities, one other issue raised is how much this would comply with the basic idea of community interventions, that is, broad community participation and comprehensive community organization that benefit from a bottom-up approach.

In all quasi-experimental designs, where the assignment into experimental and control units is not random, there is the possibility of both biased selection of experimental and reference units and of biased sampling in the selection of study units. In the case of the North Karelia Project the experimental unit was already selected before sampling. The only choice for the evaluation was in the selection of a suitable reference unit. Another county in Eastern Finland was chosen as the reference area. Similarly, in the Israel CHAD programme the intervention area was first decided and the reference community was selected later.

Two designs in the evaluation of community programmes have been used. The main design for the assessment of the effect of an intervention on risk-factor levels is the `separate-sampling pretest-post-test control group' design. Separate independent cross-sectional samples are drawn from the same populations, one in the intervention and another in the reference area, before and after the study period. The net reduction in disease and risk-factor levels in the intervention community (i.e., the reduction in the intervention area minus the reduction in the reference area) is considered to be the effect of the intervention. This design was used in the studies in North Karelia and Germany and in the three major cardiovascular risk studies in the US, and is regarded to give the best estimates of the intervention effects from quasi-experimental studies.

A cohort design was used to evaluate the programmes in Israel, Italy and the Netherlands. The same subjects were studied before and after the intervention. This was the only option in Italy and Israel because all the people were studied in the intervention and control areas. In the US studies where both designs were used, the results from the cohort design seemed to show more positive effects than those from the independent cross-sectional samples. This can be explained partly by the higher statistical power of the cohort studies or by the influence of the initial survey on those individuals, as explained in the subsection below on survey samples.

Whether cross-sectional, independent population samples or a cohort design should be used in the assessment depends on the aims of the study. Independent samples are more likely to better assess the magnitude of changes in the population as a whole compared to follow-up of a single cohort. Thus this is the preferred method in assessing changes in the community. The cohort approach can give more information on the types of changes that have actually taken place at the individual level, and can thus give useful additional information.

SELECTION OF INTERVENTION AND REFERENCE COMMUNITIES

Ideally, the intervention community should be typical of the larger area to which the results are to be applied. Often, however, this choice is guided by historical or practical factors, as was the case in the decision to make North Karelia the setting for an intervention trial. In selecting a community it is particularly important that the area chosen does not have exceptionally good resources or other characteristics that will render the programme experience non-replicable in other parts of the country. North Karelia, for example, had the lowest level of service resources and was the least developed in socioeconomic terms among all the counties of Finland. If the intervention is successful in a community of average or below average resources, it is reasonable to conclude that the introduction of similar programmes would be feasible in other parts of the country.

Establishing an intervention programme in a small community is usually easier and makes the evaluation of the intervention process and risk factors simpler. Increasing the community size usually provides a setting more typical of the region or nation for which the intervention programme is ultimately to be applied. If the evaluation aims to assess the effects on disease rates, a large population is usually needed. Where it is only feasible to compare one intervention community against one reference community, each community should be large enough to provide a sufficient number of disease events of interest and to enable the

use of relatively independent samples at subsequent time points and of sufficient size, so that the statistical significance of the net differences in the disease rates in the two communities can be tested. Depending on the disease rates and the length of follow-up, a community of 250,000 to 500,000 would be necessary for a community intervention study on CHD.

A reference community is essential because changes may occur `spontaneously' as societies change their lifestyle, for example through increased popular awareness of the risk factors, technological or fashion changes, or increased or improved treatment of risk factors by health professionals. In order to separate the effect of the intervention from general trends of change, the intervention must be compared with a reference community. If risk-factor levels are decreasing nationally, then the 'net' reduction in the intervention community, i.e., the impact of the intervention programme, will be lowered.

Where the national trend is for risk-factor levels to increase, then there may not be sufficient time to reverse that trend although even a deceleration of the increase would suggest that the programme has some positive effect on lifestyles. If a cohort design is used, the ageing of the study subjects can increase some of the risk factors such as on blood pressure, cholesterol levels, body mass index. This was observed in the Hartslag Limburg study (*Schuit et al*, 2006) and during long-term follow-up of participants in the Martignacco study (Feruglio, 1983b).

Changes in an intervention area can be compared with national trends. This, however, may be misleading since often there is considerable within-country variation and the secular trends occurring in an area in the absence of intervention might not coincide with the national pattern. Thus it is preferable to select a reference community that is similar in all respects to the intervention community. In North Karelia, the decline in risk factors was faster during the first 5 and 10 years of the intervention than in the reference area, but subsequently the development was very similar to other areas of Finland (Vartiainen *et al*, 2000). It is difficult to determine whether these changes represent national trends independent of the intervention, whether the intervention programme contributed to national interest and lifestyle changes and risk-factor control, or whether there was direct `spill-over' or contamination from North Karelia to the neighbouring county. In the 10-year follow-up of the CHAD programme in Israel the smoking prevalence continued to decline in the intervention population while the national survey did not show any decline in the age group studied (Gofin *et al*, 1986).

STUDY PERIOD

The length of time over which the intervention study continues is very important since a short study period may not provide sufficient time for permanent changes to occur, while a long study period may result in a levelling-off in the differences between areas. Furthermore, different end-points may have different optimum time periods. Changes in health behaviour, for example, can be detected quite quickly, changes in levels of risk factors somewhat later, while changes in disease incidence and finally mortality will be detected only after a considerably longer time period.

In first five years of the North Karelia Project, for example, most of the reduction in cigarette smoking took place in the first year of the programme; most hypertensive individuals who brought their blood pressure under control achieved this by the end of the third year; dietary changes took place gradually over a five-year period; and, as noted earlier, at the end of five years, a net reduction in risk-factor levels was observed. Concerning mortality, CHD incidence and mortality rates started to decline surprisingly quickly after the start of the intervention in North Karelia. In the rest of the country, a similar decline started several years later. Thus a significant net change in favour of North Karelia was observed, especially in 1974 to 1979 (Salonen *et al*, 1983). Thereafter, although the decline in North Karelia continued, the net decline was gradually reduced. Thus maximal difference in favour of the intervention area was observed some 5-8 years after its start (Puska *et al*, 1995). For cancer mortality, a net reduction in favour of North Karelia could be observed much later, i.e., 5 to10 years after the intervention commenced.

SURVEY SAMPLES

The aim of an intervention programme is to introduce changes in risk factors that will in turn lead to changes in disease rates. The success of a programme in achieving such changes is assessed by comparing risk-factor levels and disease rates in a cross-sectional sample at baseline with the findings from an independent cross-sectional sample at the end of the intervention.

Independent cross-sectional samples are used in preference to a longitudinal follow-up of a cohort because the latter severely limits its ability to estimate the impact of an intervention. Involvement in a survey may in itself affect the behaviour of the subjects, and those who participate in the survey preceding implementation of an intervention programme subsequently may be more sensitive to the programme activities. In this group, any observed change may be due in part to

participation in the pre-test survey and not to the intervention. Thus the true magnitude of the effect in the intervention programme can be measured only by examining a new random sample of the population at the end of the trial period.

For these reasons, the main assessment of the impact of intervention is based on repeat cross-sectional samples. However, longitudinal follow-up of baseline survey samples can provide useful supplementary information, for example, about the characteristics of individuals who change their behaviour and lifestyles compared with those who do not. The cohort design also has certain analytical advantages such as higher statistical power, possibility for adjustment of differences in baseline levels of risk factors, and more efficient testing procedures.

The sample size usually depends on the magnitude of changes to be detected, the required level of confidence, and the cross-sectional intra- and interpersonal variation. Changes in the reference area must also be taken into consideration. The detection of risk factors does not usually need a very large sample size. However, detection of small net changes are important if these are in the same direction for all risk factors and will require a larger sample size. If several subgroups are to be analysed separately, a larger sample size is also needed.

The sample's age range is also an important issue. Obviously the whole population is the target of the intervention but often, as in North Karelia, the intervention programme, although comprehensive, emphasizes persons of certain ages because of the nature of the problem. Emphasis on lifestyle changes directs the age range towards younger age groups, while emphasis on disease end-points would be towards older age groups. With increased interest in "healthy ageing" the tendency has been to include older age groups. On the other hand, children and youth are targeted in many studies that are not discussed here.

At the end of the intervention period either a second independent sample of the same age-groups is examined, or an independent cross-section of the same birth cohort. Use of the same birth cohort increases the comparability of the baseline and terminal measurements because it avoids any possible unrecognized birth cohort effects (e.g., due to wars or famines). However, this means that the sample at the end is, for example, five years older, which may bias the observed absolute changes (i.e., intervention-related changes in risk factors are countered by increases due to ageing). This effect is controlled for when the change in the intervention area is compared with the change in the reference area to describe the net change. Obviously, the analyses can, if necessary, be restricted to the same age-group at both time points.

SURVEY IMPLEMENTATION

The pre-and post-test survey conducted in intervention and reference areas should be strictly comparable. The measurements should be well standardized and tested. Self-administered and pre-coded questionnaires are often used. The measurements are carried out by personnel (often nurses) who are carefully instructed and trained before the surveys to use standardized and often internationally accepted measurement techniques. Strenuous efforts must be made to use identical procedures in the study areas and in the two surveys. The time of the year should also be considered because of possible seasonal variation.

High participation rates are of vital importance to avoid bias in the results. In the North Karelia Project, the data quality was strengthened by the high participation rates of both areas in the two surveys. The participation rate did vary between the two areas, although the variation was small. At the outset the participation was higher in the intervention area, presumably because people were interested in participating in the programme. At the end, however, the response rate was smaller in the intervention area, probably due to a waning of interest following exposure to the numerous intervention activities organized over the life of the programme.

Good laboratory standardization and standardization of survey measurements are important if results are to be comparable. Ideally samples should be sent to a central laboratory for analysis by technicians who do not know whether samples originated from the intervention or reference areas.

DISEASE AND MORTALITY SURVEILLANCE

Monitoring disease and mortality rates at the community level has many problems. Examinations of cross-sectional representative samples do not give much information about the incidence of new cases.

A register, even with the most complete coverage and rigorous criteria, is dependent on individuals seeking health services or being identified in other ways. It is possible and even likely that an intensive community intervention stimulates people to seek medical aid more actively and with milder symptoms, which would tend to increase the incidence rates spuriously. In the North Karelia register it was found that incidence of `definite' acute myocardial infarction decreased more than `possible' acute myocardial infarction during the intervention. This might have been because, in response to the intervention, persons with milder symptoms were more eager to seek medical help. The actual decrease in the acute myocardial

infarction incidence rate in North Karelia may thus have been greater than indicated by the register.

A further problem encountered with a community-based disease register is the maintenance of the same diagnostic criteria and coverage. A blind reclassification of cases may be done after the study period to confirm the consistency of the diagnostic criteria. To ensure the completeness of coverage, death certificates, hospital records, and other available sources of notification should be checked continuously.

The launching of a new permanent disease register in the reference area can represent a substantial intervention that may minimize the impact of the programme in the intervention area. And because a better health information system (including registers) can be part of the comprehensive intervention programme, its contribution cannot be assessed if a register is also established in the reference area. To avoid contamination due to the introduction of an *ad hoc* register, the ideal solution would be to monitor disease and mortality rates based on national routine statistics. This is adequate when a comprehensive centralized hospital data system is available. In some countries hospital discharge data achieve complete coverage although the reliability of the diagnostic data is less satisfactory. In other countries, where hospital discharge data are less complete and reliable, it is necessary to establish disease registers in both the intervention and reference areas.

The ultimate end-point is mortality, although there are limitations with regard to cause-specific mortality, especially in areas where autopsy rates are relatively low. The observed rates are dependent on physicians' practices in completing the death certificates and these may change over the course of the programme. Age- and sex-specific total mortality rates are, the more reliable indices; however, they lack sensitivity because mortality is the ultimate end-point in the course of the disease and, for example, only a portion of the total mortality is due to cardiovascular disease.

For most community intervention programmes, changes in risk factors are preferred as outcome measures instead of mortality or morbidity (Lindholm & Rosen, 2000). This is only partly because of the abovementioned difficulties in assessing the disease end-points. There are also other arguments: the medical evidence on effects of reduction of, for example, smoking rates, low-density lipoprotein cholesterol levels and blood pressure levels on disease rates is overwhelming. Thus if we can convincingly show an effect on these indicators, we can be assured that useful prevention has been served. Obviously the use of surrogate end-points such as reduction of risk factors are acceptable only if there is shown to be a strong, independent, consistent association

between the surrogate end-point and the "hard end-points" such as morbidity or mortality reduction, particularly from prospective studies and randomized controlled trials. With a smaller community it is unrealistic to expect statistically significant effects on disease rates despite effective intervention.

ASSESSMENT OF THE INTERVENTION

A crucial but difficult question is how to actually evaluate the intervention. Obviously, the assessment of possible effects is meaningful only if we can be sure that a proper intervention has taken place. This relates both to appropriate theoretical frameworks and the intensity of the intervention. A common problem of most community programmes is the application of small 'doses' of these interventions, in contrast to their generally ambitious aims (Mittelmark *et al*, 1993a).

The issue on the proper assessment of the input of intervention programmes is extremely important to understand public health implications. Negative or meager results from some community-based interventions are often interpreted as proof that population-based interventions are not effective, while the actual reason may be that very little happened in the community.

In addition to the intensity or dose of the intervention, even more difficult is to assess the quality or type of the intervention. A population-based community intervention typically uses a whole range of intervention modalities ranging from media campaigns and health service interventions to community organization and environmental and policy changes. Some work has been done to assess factors like exposure to media or to preventive services (Flora *et al*, 1993), but assessment of factors such as community organization or environmental changes is even more difficult. Despite many efforts, there has been little progress concerning assessment of these complex interventions.

DISCUSSION ON RESULTS

A number of publications have tried to summarize the results of major community-based preventive projects, particularly those concerning cardiovascular diseases prevention (Ebrahim & Smith, 1997; Fortmann *et al*, 1995; Lindholm & Rosen, 2000; Mittelmark *et al*, 1993b; Sellers *et al*, 1997). So far practically all such studies have been carried out in high-income countries. Only during the last few years, with emergence of chronic diseases in low- and middle-income countries, have such studies been started in such countrieswith varying study designs and levels of evaluation.

A summary of the evaluaton of the early European community-based cardio-vascular preventive studies, linked to the WHO programme on Comprehensive Cardiovascular Community Control Programmes, showed that most of the nine European studies analyzed showed a reduction in the risk factor levels in the intervention community, but a statistically significant net reduction was shown in three programmes for smoking, four for serum cholesterol and five for blood pressure (Puska *et al*, 1988).

Winkleby *et al.* (1997) made a review of the results of the Stanford Five City Project, Minnesota HHP and the Pawtucket HHP. They showed that the joint estimates of intervention effect were in the expected direction in 9 of 12 gender-specific comparisons but were not statistically significant. It was concluded that the results illustrate the analytic challenges of evaluating community-based intervention trials and indicate smaller than expected net differences. Rigid evaluations of the projects showed only modest or no "hard" effects on targeted risk factors or CVD rates in most of the projects. They also discussed the difficulties in assessing the true overall impact. This is because of the comprehensive nature of the intervention, caused by diffusion to other areas and linkage with national trends. A British review dealt with both community intervention trials and community studies and arrived at rather similar conclusions (Ebrahim & Smith, 1997). It stated that for pooled effects on mortality, a small but potentially significant (about 10% reduction) may have been missed.

Expectations for community-level interventions are often unrealistic, that is, based on overly high estimates of effect size and insufficient sample sizes to detect smaller effects. Commercial advertising campaigns, which generally have substantially more resources than community prevention trials, are typically satisfied with modest increases in market share. Mittelmark et al, (1993b) called for 'realistic outcomes' in their review.

A very important aspect is thus the dose of the intervention, as discussed earlier. Because most of the projects in larger communities over a number of years have had only very limited resources, the dose of the intervention is small. Another important aspect is the nature of the intervention. Most of the projects carried out so far have, in spite of many efforts, been limited to educational and health service-based interventions. Among the projects, the North Karelia Project was perhaps the most "community-based", i.e., influencing broadly the physical and social environment of the community.

It should also be noted that many community-based preventive projects have served as sites of training, advocacy raising and demonstration for national programmes and policies. They have thus contributed to national preventive work in a way that has been very difficult to evaluate.

Perhaps the best example to illustrate the long-term experience and potential of sustained community- based and national heart health work is the experience in Finland. After the early success in the 1970s, and with significant net reductions in both risk factors and CHD mortality, intensive national work was started, to which the project actively contributed. During this latter period the decline in risk factors and disease rates accelerated in parallel between North Karelia and the whole of Finland. Associated with the risk factor changes, a dramatic reduction was, indeed, seen in the cardiovascular mortality and a huge improvement in public health. This success has generally been attributed to a sustained, theory-based and comprehensive intervention that was broadly integrated in the community of North Karelia and later on involved national policy and health promotion measures, all influencing the social and physical environments of the population.

CONCLUSIONS

Numerous community-based programmes have been implemented to change lifestyles for pilot, demonstration and research purposes. Their evaluation and experiences have contributed greatly to national policy decisions and actions. Further development in our concepts, methods and measurement with community-based interventions will be important to better serve public health. Despite many critical constraints, modern public health is very dependent on changes in the major, well-established risk factors in the community and in the national population.

Successful community-based programmes should do the right things and enough of them, that is, use sound theoretical frameworks and implement the interventions in the communities with a sufficient 'dose'. Usually environmental and policy decisions are key, but often they can be achieved only in conjunction with health promotion activities that influence the public agenda and people's intentions. At the same time, the human factor is crucial: persistent and dedicated work is needed, combining enthusiastic and credible leadership with close involvement of, and ownership by, the population.

In summary, the key messages from the chapter are:
- Chronic disease risk factors are closely related with lifestyles that are strongly enrooted in community features.
- The greatest potential in reducing cardiovascular and other chronic disease rates in the population are population-based strategies that reduce general risk factor levels in the community.

- Since the 1970s many community-based studies in high-income countries have assessed the possibilities and effects of community-based prevention.
- While the direct effects of many studies have been less than expected, the great potential of long-term, sustained and comprehensive population-based intervention is demonstrated by the long-term results of the North Karelia Project in Finland.
- Many community-based projects have greatly contributed to national activities and policies. At the same time, further work on concepts, methods and evaluation measurements is needed.

REFERENCES

Abramson JH, Gofin R, Hopp C, Gofin J, Donchin M, Habib J (1981) Evaluation of a community program for the control of cardiovascular risk factors: the CHAD program in Jerusalem. *Israel journal of medical sciences* **17:** 201-12

Anderson KM, Wilson PW, Odell PM, Kannel WB (1991) An updated coronary risk profile. A statement for health professionals. *Circulation* **83:** 356-62

Bandura A (1977) *Social learning theory*. Englewood Cliffs, N.J.: Prentice-Hall

Beevers SD, Carslaw DC (2005) The impact of congestion charging on vehicle emissions in London. *Atmos Environ* **39:** 1-5

Berrios X (1997) Time trends in risk factors for chronic diseases: is a new epidemic coming? *Rev Med Chil* **125:** 1405-7

Carleton RA, Lasater TM, Assaf AR, Feldman HA, McKinlay S (1995) The Pawtucket Heart Health Program: community changes in cardiovascular risk factors and projected disease risk. *Am J Public Health* **85:** 777-85

COMMIT Research Group (1995) Community Intervention Trial for Smoking Cessation (COMMIT): I. cohort results from a four-year community intervention. *Am J Public Health* **85:** 183-92

Dowse GK, Gareeboo H, Alberti KG, Zimmet P, Tuomilehto J, Purran A, Fareed D, Chitson P, Collins VR (1995) Changes in population cholesterol concentrations and other cardiovascular risk factor levels after five years of the non-communicable disease intervention programme in Mauritius. Mauritius Non-communicable Disease Study Group. *BMJ* **311:** 1255-9

Duperrex O, Bunn F, Roberts I (2002) Safety education of pedestrians for injury prevention: a systematic review of randomised controlled trials. *BMJ* **324:** 1129

Ebrahim S, Smith GD (1997) Systematic review of randomised controlled trials of multiple risk factor interventions for preventing coronary heart disease. *BMJ* **314:** 1666-74

Farquhar JW, Fortmann SP, Flora JA, Taylor CB, Haskell WL, Williams PT, Maccoby N, Wood PD (1990) Effects of communitywide education on cardiovascular disease risk factors. The Stanford Five-City Project. *JAMA* **264:** 359-65

Farquhar JW, Maccoby N, Wood PD, Alexander JK, Breitrose H, Brown BW, Jr., Haskell WL, McAlister AL, Meyer AJ, Nash JD, Stern MP (1977) Community education for cardiovascular health. *Lancet* **1:** 1192-5

Feruglio GA, Vanuzzo, D., Di Muro, G et al. (1983a) The Mertignacco project: A community stydy. Outlines and preliminary results after four years. *Giornale di Arteriosclerosis* **2:** 207-17

Feruglio GA, Vanuzzo, D., Di Muro, G et al. (1983b) The Mertignacco project: A community stydy. Outlines and preliminary results after four years. *Giornale di Arteriosclerosis* **2:** 207-17

Flora JA, Lefebvre RC, Murray DM, Stone EJ, Assaf A, Mittelmark MB, Finnegan JR, Jr. (1993) A community education monitoring system: methods from the Stanford Five-City Project, the Minnesota Heart Health Program and the Pawtucket Heart Health Program. *Health Educ Res* **8:** 81-95

Fortmann SP, Flora JA, Winkleby MA, Schooler C, Taylor CB, Farquhar JW (1995) Community intervention trials: reflections on the Stanford Five-City Project Experience. *Am J Epidemiol* **142:** 576-86

Gofin J, Gofin R, Abramson JH, Ban R (1986) Ten-year evaluation of hypertension, overweight, cholesterol, and smoking control: the CHAD program in Jerusalem. Community Syndrome of Hypertension, Atherosclerosis and Diabetes. *Prev Med* **15:** 304-12

Goodman RM, Wheeler FC, Lee PR (1995) Evaluation of the Heart To Heart Project: lessons from a community-based chronic disease prevention project. *Am J Health Promot* **9:** 443-55

Gutzwiller F, Nater B, Martin J (1985) Community-based primary prevention of cardiovascular disease in Switzerland: methods and results of the National Research Program (NRP 1A). *Prev Med* **14:** 482-91

Hoffmeister H, Mensink GB, Stolzenberg H, Hoeltz J, Kreuter H, Laaser U, Nussel E, Hullemann KD, Troschke JV (1996) Reduction of coronary heart disease risk factors in the German cardiovascular prevention study. *Prev Med* **25:** 135-45

Hu G (2001) *Physical activity during commuting and recreation associated with cardiovascular risk factors in China, with reference to Finland.* Kuopio: Kuopion yliopisto

Hugosson MB, Sjöberg A, Byström C (2006) *Facts and results from the Stockholm Trials. Stockholm, Congestion charge secretariat.* Stockholm: City of Stockholm

Interhealth Steering Committee (1991) Demonstration projects for intergated prevention and control of noncommunicable diseases. Interhealth Programme. *World Health Stat Q* **44:** 48-54

Jousilahti P, Vartiainen E, Pekkanen J, Tuomilehto J, Sundvall J, Puska P (1998) Serum cholesterol distribution and coronary heart disease risk: observations and predictions among middle-aged population in eastern Finland. *Circulation* **97:** 1087-94

Kelishadi R, Pour MH, Zadegan NS, Kahbazi M, Sadry G, Amani A, Ansari R, Alikhassy H, Bashardoust N (2004) Dietary fat intake and lipid profiles of Iranian adolescents: Isfahan Healthy Heart Program--Heart Health Promotion from Childhood. *Prev Med* **39:** 760-6

Keys A, Anderson JT, Grande F (1959) Serum cholesterol in man: diet fat and intrinsic responsiveness. *Circulation* **19:** 201-14

Kiangi G (1995) *Drinking and smoking among adolescents in Tanzania A needs assessment for health promotion*. Kuopio: Kuopion yliopisto

Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, Franklin B, Kris-Etherton P, Harris WS, Howard B, Karanja N, Lefevre M, Rudel L, Sacks F, Van Horn L, Winston M, Wylie-Rosett J (2006) Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee. *Circulation* **114:** 82-96

Lindholm L, Rosen M (2000) What is the "golden standard" for assessing population-based interventions?--problems of dilution bias. *J Epidemiol Community Health* **54:** 617-22

Luepker RV, Murray DM, Jacobs DR, Jr., Mittelmark MB, Bracht N, Carlaw R, Crow R, Elmer P, Finnegan J, Folsom AR, et al. (1994) Community education for cardiovascular disease prevention: risk factor changes in the Minnesota Heart Health Program. *Am J Public Health* **84:** 1383-93

Luostarinen T, Hakulinen T, Pukkala E (1995) Cancer risk following a community-based programme to prevent cardiovascular diseases. *Int J Epidemiol* **24:** 1094-9

Mittelmark MB, Hunt MK, Heath GW, Schmid TL (1993a) Realistic outcomes: lessons from community-based research and demonstration programs for the prevention of cardiovascular diseases. *J Public Health Policy* **14:** 437-62

Mittelmark MB, Hunt MK, Heath GW, Schmid TL (1993b) Realistic outcomes: lessons from community-based research and demonstration programs for the prevention of cardiovascular diseases. *J Public Health Policy* **14:** 437-62

Mohamadifard N, ., Ashtiani R, Sajadi F (2006) "Isfahan Healthy Heart Program: Comparison of the nutrition knowledge, attitude & practice in adults of Isfahan & Central provinces" Results of Phase I. *Iran J Nutrh (MATA)* **2:** 75-83

Nissinen A, Berrios X, Puska P (2001) Community-based noncommunicable disease interventions: lessons from developed countries for developing ones. *Bull World Health Organ* **79:** 963-70

Puska P, Kansanterveyslaitos, Maailman terveysjärjestö Euroopan aluetoimisto, Pohjois-Karjala-projektin tutkimussäätiö, Pohjois-Karjala-projekti (1995) *The North Karelia Project 20 year results and experiences*. Helsinki: National Public Health Institute

Puska P, Leparski E, World Health Organization Regional Office for Europe (1988) *Comprehensive cardiovascular community control programmes in Europe*. Copenhagen: World Health Organization

Puska P, Salonen JT, Nissinen A, Tuomilehto J, Vartiainen E, Korhonen H, Tanskanen A, Ronnqvist P, Koskela K, Huttunen J (1983) Change in risk factors for coronary heart disease during 10 years of a community intervention programme (North Karelia project). *Br Med J (Clin Res Ed)* **287:** 1840-4

Puska P, Vartiainen E, Tuomilehto J, Salomaa V, Nissinen A (1998) Changes in premature deaths in Finland: successful long-term prevention of cardiovascular diseases. *Bull World Health Organ* **76:** 419-25

Saaristo T, Peltonen M, Keinänen-Kiukaanniemi S, Vanhala M, Saltevo J, Niskanen L, Oksa H, Korpi-Hyövälti E, Tuomilehto J (2007) National type 2 diabetes prevention programme in Finland: FIN-D2D. *Int J Circumpolar Health* **66:** 101-112

Salonen JT, Puska P, Kottke TE, Tuomilehto J, Nissinen A (1983) Decline in mortality from coronary heart disease in Finland from 1969 to 1979. *Br Med J (Clin Res Ed)* **286:** 1857-60

Sarrafzadegan N, Sadri GH, Malek Afzali H (2003) Isfahan Healthy Heart Programme: a comprehensive integrated community-based programme for cardiovascular disease prevention and control. *Acta Cardiologice* **58:** 309-320

Schuit AJ, Wendel-Vos GC, Verschuren WM, Ronckers ET, Ament A, Van Assema P, Van Ree J, Ruland EC (2006) Effect of 5-year community intervention Hartslag Limburg on cardiovascular risk factors. *Am J Prev Med* **30:** 237-42

Sellers DE, Crawford SL, Bullock K, McKinlay JB (1997) Understanding the variability in the effectiveness of community heart health programs: a meta-analysis. *Soc Sci Med* **44:** 1325-39

Shea S, Basch CE, Lantigua R, Wechsler H (1992) The Washington Heights-Inwood Healthy Heart Program: a third generation community-based cardiovascular disease prevention program in a disadvantaged urban setting. *Prev Med* **21:** 203-17

Shelley E, Daly L, Collins C, Christie M, Conroy R, Gibney M, Hickey N, Kelleher C, Kilcoyne D, Lee P, et al. (1995) Cardiovascular risk factor changes in the Kilkenny Health Project. A community health promotion programme. *Eur Heart J* **16:** 752-60

Sun S, Korhonen T, Uutela A, Korhonen HJ, Puska P, Jun Y, Chonghua Y, Zeyu G, Yonghao W, Wenqing X (2000) International Quit and Win 1996: comparative evaluation study in China and Finland. *Tob Control* **9:** 303-9

Tian HG, Guo ZY, Hu G, Yu SJ, Sun W, Pietinen P, Nissinen A (1995) Changes in sodium intake and blood pressure in a community-based intervention project in China. *J Hum Hypertens* **9:** 959-68

Uusitalo U, Feskens EJ, Tuomilehto J, Dowse G, Haw U, Fareed D, Hemraj F, Gareeboo H, Alberti KG, Zimmet P (1996) Fall in total cholesterol concentration over five years in association with changes in fatty acid composition of cooking oil in Mauritius: cross sectional survey. *BMJ* **313:** 1044-6

Vartiainen E, Jousilahti P, Alfthan G, Sundvall J, Pietinen P, Puska P (2000) Cardiovascular risk factor changes in Finland, 1972-1997. *Int J Epidemiol* **29:** 49-56

WHO (1999) *Global strategy for the prevention and control of noncommunicable diseases : report by the Director-General*. Geneva: World Health Organization

Winkleby MA, Feldman HA, Murray DM (1997) Joint analysis of three U.S. community intervention trials for reduction of cardiovascular disease risk. *J Clin Epidemiol* **50:** 645-58

Yu Z, Nissinen A, Vartiainen E, Song G, Guo Z, Tian H (2000) Changes in cardiovascular risk factors in different socioeconomic groups: seven year trends in a Chinese urban population. *J Epidemiol Community Health* **54:** 692-6

Yu Z, Song G, Guo Z, Zheng G, Tian H, Vartiainen E, Puska P, Nissinen A (1999) Changes in blood pressure, body mass index, and salt consumption in a Chinese population. *Prev Med* **29:** 165-72

21. WHO'S WORK ON CHRONIC DISEASES PREVENTION IN RELATION TO NORTH KARELIA PROJECT AND FINLAND

Pekka Puska

In previous decades, major chronic diseases were mainly considered to be diseases of Western lifestyles in the industrialised countries. The term "executive's disease" was used in Finland after the World War II to refer to such illnesses. The Finnish Institute of Occupational Health started in the 1950s a study concerning the health of business leaders.

When the North Karelia Project was started in 1972, there was obvious interest and involvement from the WHO, as described earlier. However, as the diseases were seen as "diseases of affluence" there was no wider interest from the WHO.

As the diseases became more widespread especially in North America and Europe, several countries began extensive scientific research into the epidemiology, etiology and prevention of chronic diseases. WHO's European office also launched several new programmes addressing these issues. The Regional Director was Dr. Leo Kaprio from Finland. He had an obvious relevant interest in the new project, but also had broad public health visions and saw the potential of the project.

An important step was starting and coordinating the acute myocardial infarction (AMI) register in the 1960s. Such a register was also used in Helsinki for evaluating heart ambulance operations. The initiation of the North Karelia project led to the creation of AMI registers in Finland: in Tampere, North Karelia and Turku, and later also in Kuopio.

Based on the model of the AMI register, WHO's Geneva headquarters started similar stroke register cooperation in 1970s. This was done as a headquarters operation because strokes were a big problem also in other countries across the globe, such as Japan, for example. Japan became an active participant in these activities. In Finland, a stroke register was started in the Kauniainen region that existed in addition to the stroke registers of North Karelia and Turku which had been started in connection with the North Karelia Project that participated in this cooperation.

Elevated blood pressure is closely linked to strokes. Already for a long time, elevated blood pressure has been identified as a globally widespread and serious risk

factor for chronic diseases. In addition to the stroke register, WHO headquarters commenced a programme in the 1970s for the community control of hypertension. The North Karelia Project became the largest participant in this project, generating much background information and helping establish guidelines for the extensive hypertension programme in the 1970's. This programme was coordinated in Geneva by Doctor T. Strasser, who later became the President of the World Hypertension League.

WHO's European office also implemented several other programmes concerning chronic diseases, especially cardiovascular diseases. The work to develop and assess heart attack rehabilitation and secondary prevention was especially significant. Finland participated in this work too; Professor Veikko Kallio, in particular, was strongly involved in it. The programme also affected the North Karelia Project and its work to promote secondary prevention. This work took the form of an outpatient rehabilitation group at the central hospital's heart attack polyclinic, on the one hand, and of health centres and heart associations, on the other. The Finnish Heart Association's current "Tulppa" programme still largely utilises this model.

PREVENTION BECOMES PARAMOUNT

When WHO's mortality statistics, among other data, brought to light Finland's incredibly high mortality from cardiovascular diseases, the North Karelia project was started in Finland in 1972 as described in other chapters. Based on what was then fairly new medical information, the project aimed at implementing an efficient community-level project in order to decrease the particularly grim mortality figures for cardiovascular diseases in the province of North Karelia, as well as evaluating the project in as scientific a manner as possible.

As the central figure in the planning of the project, Professor Martti J. Karvonen, was closely linked to WHO, the organization supported the project right from the beginning. Early cooperation involved in particular the European regional office of WHO, whose director, Professor Leo Kaprio, naturally gave the project strong support. In the early stages, WHO's support consisted of various types of expert help, training trips for key project staff, as well as participation in the aforementioned programmes.

As the principles of the North Karelia Project and the positive experiences from the first stage started to spread throughout Europe, some countries started similar, albeit smaller, projects. WHO/EURO began coordinating these projects in the mid-1970s in the CCCCP programme (Comprehensive Cardiovascular Community

Control Programme). WHO/EURO later reported the results of this cooperation (Puska et al 1988).

NEW TRENDS IN THE 1980s

National differences in mortality from cardiovascular diseases had been studied in previous years, but in the 1980s the focus shifted towards the differences in trends. Why were there different trends in different countries? MONICA has been one of the most extensive field research programmes WHO has ever carried out. It included 32 centres in Europe, the United States and Asia, which implemented standardized disease registration as well as evaluations of risk factors and treatments for 10 years.

Finland, represented by the North Karelia Project team at the National Public Health Institute (KTL), participated to a great extent n the planning, and later in the implementation, of the MONICA Project. In fact, the methods (risk factor surveys, CVD registers) were fairly similar to those used in the North Karelia Project. The International Data Centre for this extensive MONICA project was also located at the National Public Health Institute.

Another new trend observed in the international discussions occurring at WHO was that many risk factors appeared to be linked simultaneously to several chronic diseases. It was concluded that instead of vertical, disease-specific prevention programmes, integrated prevention was needed with interventions aimed at reducing the risk factors common to several chronic noncommunicable diseases. Many of the new programmes focused especially on nutrition, smoking and physical exercise.

After the CCCCP project, there was strong demand in Europe for such a programme, which was finally launched in the early 1980s under the name CINDI (Countrywide Integrated Noncommunicable Disease Intervention). The North Karelia project, once again, and also the National Public Health Institute, held central positions within the programme.

Besides further developing the North Karelia Project, the CINDI programme had a concrete effect on many other European countries, including the Soviet Union. After the disintegration of the Soviet Union, many newly independent Eastern European countries joined CINDI, which thereby experienced a second expansion. The operation of CINDI has only started to slow down in recent years as WHO/EURO's more general programmes, and the European NCD strategy approved in 2006, have largely come to replace CINDI (WHO and Regional Office for Europe 2006).

When the disease situation in Latin America started to change quickly in the 1990s, WHO's American regional office, PAHO, started the CARMEN programme,

based largely on the principles of CINDI as applicable in Latin America. The North Karelia Project experts and experiences were much used in the work of both CINDI and CARMEN.

Already at the beginning of the 1980s the North Karelia Project started an International Visitors' Week programme. In the almost 30 years that have followed, over 50 such programmes have been organized with over two thousand participants from over one hundred countries. The participants have included experts, health officials and media representatives, and many of them have greatly helped to build similar levels of work in their respective countries.

FROM HEALTH EDUCATION TO THE PROMOTION OF HEALTH

WHO's work on chronic diseases has been closely linked to the development of health education and health promotion as well as to efforts to strengthen the basic health care system. The Alma Ata conference in 1978 issued a declaration concerning the development of basic health care. This declaration also had a positive on the prevention strategies of chronic diseases.

Around the same time, a conference was held in Ottawa, Canada, the Charter of which (1986) became the basis for the development of health promotion principles. The Ottawa conference was followed by conferences in Adelaide, Sundsvall, Jakarta, Mexico City and Bangkok (*Bangkok charter for health promotion in a globalized world* 2005). The Charters of each of these conferences have, for their part, set goals for health promotion – most recently in Bangkok. The work of these conferences, and the health care developments following the Alma Ata conference, provided the basis for WHO's Health for All Charter which had a major effect on the health policies, as well as the prevention of chronic diseases, in various countries in the 1990s.

Finland was an active supporter of both the Alma Ata and Ottawa principles. In fact, the principles strongly echoed the findings of the Finnish experiences, in the North Karelia Project and elsewhere. With regard to primary health care, the North Karelia Project had effectively taken advantage and developed the work of the municipal health centres which had been established in response to the new Public Health Act in 1972.

PREVENTION OF CHRONIC DISEASES ADDED TO THE GLOBAL AGENDA OF WHO

By the beginning of the 21st century, chronic noncommunicable diseases were, for the first time, becoming a major issue on WHO's global agenda. An essential background factor to this, in addition to what is discussed above, was the extensive Global Burden of Disease study that showed the change in the global health situation (Murray et al 1996). Chronic diseases were no longer just a problem of the industrialised countries, but a global problem and a leading cause of death across the world, including most developing countries. Such diseases were even spreading to poorer countries and, within countries to the lower social classes.

WHO's Global Strategy for Prevention and Control of Noncommunicable Diseases (WHO 1999) was finalised in this context. It stated, for the first time, that chronic diseases are one of WHO's priorities; that integrated prevention is a central strategy; and that smoking, nutrition and physical exercise are globally important issues. The expert groups in Geneva in the late 1990s was chaired by the director of the North Karelia Project.

After finalisation of the strategy, and in line with WHO's year 2000 general assembly charter, the work concerning chronic noncommunicable diseases advanced rapidly at the headquarters of WHO. Support from the Director General, Doctor Gro Harlem Brundtland, played an important role. Organisational changes were made by merging the prevention of noncommunicable diseases and health promotion into one department. Another department was formed for treatment programmes especially for cardiovascular diseases, cancer and diabetes. WHO has a specialised cancer research centre, IARC, in Lyon. Similarly, Kobe houses a centre for health promotion supported by the Japanese government.

The greater focus on chronic diseases at WHO is also reflected in the work in the WHO Regions. WHO's CINDI programme had already suggested that the headquarters' InterHealth programme be stopped and replaced by a global forum combining the corresponding programmes of the various regions. This led to the establishment of the Global Forum for NCD Prevention and Control, the planning meeting of which took place in North Karelia (Ilomantsi), Finland. The main regional programmes were Europe's CINDI and the Pan-American Health Organization's CARMEN. Other regions started similar networks for preventing chronic diseases.

COMMUNITY-BASED DEMONSTRATION PROJECTS

During the 1970s several community-based demonstration projects had already been started for the prevention of cardiovascular diseases. This was the case especially in the USA where three major projects were commenced in Stanford, Minnesota and Rhode Island. The projects in Europe collaborated with the WHO/EURO CCCCP programme described earlier.

With the start of the WHO/EURO's CINDI programme new demonstration programmes were started in Europe. Gradually such programmes were initiated also in other parts of the world, eg. in China, Chile, Iran and South Africa. Many of them were related to WHO's regional networks, like CARMEN.

Over the years the concepts of such projects, both concerning intervention and evaluation principles, have been developed. Moreover, other areas than cardiovascular diseases have been included. The close links between CVD and diabetes prevention have been given particular emphasis.

These projects have been discussed in greater detail in several articles, eg. by Nissinen and others (Nissinen et al 2001) concerning developing countries, and Puska & Vartiainen (Puska and Vartiainen 2009) concerning developed countries. Many of these projects have undoubtedly contributed to the national prevention work in their respective countries and also to the international developments in the area.

ADVANCES IN RISK FACTOR SPECIFIC WORK

The work to combat smoking had already gained significant global strength in the 1990s. This development was, in part, accelerated by the World Bank's report on the economical implications of damage caused by smoking (World Bank 1999). There arose the idea of drafting a specific framework convention on the issue, as allowed by the WHO's Charter.

This historical agreement, FCTC (Framework Convention on Tobacco Control), was finally accepted unanimously by the WHO General Assembly in 2003 (WHO 2003a). For the first time, a convention that was binding on governments was achieved in healthcare. At the time of writing in 2008 it has been ratified by more than 160 countries. The International Health Regulations aimed at the prevention of infectious diseases are, however, somewhat comparable.

The negotiations for the tobacco convention, the convention itself, as well as the related supporting work and financing (from the Bloomberg foundation, among others), have together significantly promoted the prevention of smoking worldwide in just the past couple of years. Countries are reforming and tightening their tobacco

legislation. Nonetheless, smoking continues to increase in developing countries. It is estimated that by the end of the next decade, smoking will cause approximately 10 million deaths a year globally, or approximately one out of six deaths in the world (WHO 2002).

As nutrition and physical exercise were the two other central targets of WHO's global strategy, global measures were examined to help achieve these too. It was clear that although there were many global characteristics, just as for smoking, these issues were complex and somewhat different. The connection between nutrition and chronic diseases is complex, and physical exercise is not a product at all.

In order to strengthen the scientific basis of the operations, WHO and FAO (World Food and Agriculture Organization) set up a joint team of experts. Their unanimous report on the effects of nutrition on the prevention of chronic diseases was published in 2002 (WHO 2003b). Although the report is unanimous, considerable commercial lobbying took place against its contents and publication, especially with regard to sugar, palm oil and salt.

After the scientific basis had been established , negotiations towards a global strategy were started. This extensive round of consultations included negotiations with the member countries, other international organisations, industry and commerce, as well as other relevant organisations. After some wrangling, WHO's Global Strategy on Diet, Physical Activity and Health was approved unanimously by the WHO General Assembly in 2004 (WHO 2004).

Global strategy on diet and physical activity embodies the general principles and recommendations to change the dietary and physical activity habits of populations, in order to prevent chronic diseases and to promote health, as the Finnish experiences have testified. The WHO strategy was published in Finnish in 2005 by the National Nutrition Council. The strategy has been useful in giving direction to both Finnish and European work. The Commission of the EU, among others, has relied on it when launching its European Platform on Diet and Physical Activity.

This work with both smoking, and diet and physical activity, matched well with the interest and experiences in Finland, both in the North Karelia Project and otherwise. Finnish tobacco legislation had already earlier adopted most of the principles of the FCTC.

CURRENT SITUATION AT WHO

The work carried out in the past years, described above, has given the WHO a strong basis for implementing effective measures in order to globally prevent chronic diseases.

The rapid changes in the global health situation emphasize the importance of this work: approximately 60% of all deaths in the world are caused by chronic, noncommunicable diseases, approximately half of which are cardiovascular diseases (WHO and WHO Regional Office for Europe 2006). These diseases have quickly become more common in developing countries, where change has been brought about, in addition to demographic factors, by urbanisation, industrialisation, successful prevention of infectious diseases, and by the import of Western habits due to cross-border communications, sales and marketing. This phenomenon has often been connected with the socially detrimental effects of globalization, discussed extensively in the ILO commission report (ILO 2004).

In recent years a great deal of attention has been paid to the health differences between various population groups in Finland and elsewhere. As the effect of chronic diseases on public health is so significant, it is understandable that they are also an important factor in health differences (Marmot 1999). As known, the risk factors of chronic diseases tend to pile up in the lower socioeconomic groups. Therefore, it is noteworthy that WHO has set up a high commission led by Professor Sir Michael Marmot to evaluate the measures needed. The report of the commission was published in 2008 and is influencing current international health work. In Finland parallel work had been started with a national TEROKA Project.

It is clear that the prevention of chronic diseases will not receive similar financial or political support to that accorded to the prevention of epidemics of infectious diseases, which receives tenfold the resources, for example, in the WHO. Important basic information on the prevention of chronic diseases, as well as the myths preventing effective decisions, are thoroughly discussed in the WHO publication, "Prevention of Chronic Diseases. A Vital Investment" (WHO and Public Health Agency of Canada 2005). As regards chronic disease prevention, the UN Millennium Development Goals, have, for example, been criticized for having forgotten about the world's worst health problems. Such criticism has been voiced in particular by the World Heart Federation (WHF), International Union Against Cancer (UICC), the World Tobacco or Health Congress, as well as by the International Diabetes Federation (IDF)(WHO and Public Health Agency of Canada 2005). Recently there has been political pressure especially to tackle the rapid increase in obesity and diabetes.

In recent years, WHO's General Assembly has demanded stronger measures in order to implement the strategy concerning chronic diseases. A more concrete action programme was prepared and endorsed by the World Health Assembly in 2008, consisting of, on the one hand, strong support to the Member States in the prevention of chronic diseases, and, on the other, the enforcement of global actions. With regard

to the latter objective, a particularly heated issue has been the advertising of unhealthy foods aimed at children and adolescents, and its more effective regulation.

Until recently, WHO has done but little work related to alcohol. It has mainly focused on analysing the underlying situation; but not many concrete policies for dealing with alcohol have been drafted. There have been many reasons for this: in Arab countries, this matter cannot be discussed officially. In Western countries, strong commercial and economical interests play a role, and in many countries generally, wine is an essential part of agricultural policy. The General Assembly has been more forthright in raising the issue in recent years. The Nordic countries, in particular, have been placing important alcohol policy measures on WHO's agenda.

ACTIVE EUROPEAN REGION, NEW DEVELOPMENTS IN HEADQUARTERS

While the situation within the WHO headquarters somewhat slowed down after 2004 as regards the prevention of chronic diseases, the European region has been active. The European regional committee approved a rather thorough strategy for the prevention of chronic diseases in 2006 (ILO 2004). In November 2006, a European ministerial conference on the prevention of obesity was held in Istanbul, and a document was approved on the subject (WHO 2003b). These general strategy documents were supported by more detailed action plans for nutrition, physical exercise, smoking and alcohol, for example.

The European region has also actively drawn attention to the grim health situation in Eastern Europe, and to the fact that its basic causes are noncommunicable diseases and accidents (Poole-Wilson 2007). The most important risk factors in the population are alcohol, smoking , unhealthy nutrition and lack of exercise.

As the prevention of chronic diseases is also linked to the health differences between and within populations, the report by WHO's commission on the social determinants of health published in 2008 will have an effect on the strategies aimed at preventing chronic diseases.

FINAL COMMENTS

As the importance of chronic noncommunicable diseases for global health will continue to increase, and as this will certainly also apply to poor developing countries, the necessity of preventing chronic diseases will come to be highlighted both on the WHO agenda and in other international health work. Western support for health

development policies and the public's interest are currently clearly focused on a few infectious diseases. They are naturally major problems and make good showcases, but the focus is probably very much a matter of Western countries wanting to prevent the entry of serious infectious diseases into their territories.

The prevention of chronic diseases and infectious diseases must not be pitted against each other, however. Both require professional and balanced efforts to promote national health. In the future, the focus is sure to be rather on chronic diseases because they are vital to public health and to social and economical development. Furthermore, as the Finnish experience shows, there is strong evidence that they can be prevented.

The North Karelia Project and the Finnish experience in general has provided strong evidence and support for WHO's work in the prevention and control of noncommunicable diseases. These diseases are to a great extent, and until late in life, preventable diseases. Population based prevention, influencing lifestyles, broad collaboration and sound policies are the most cost effective ways forward – a great lesson for WHO's work in low and middle income countries. The North Karelia Project – that has received much attention from WHO – has been happy to have had the possibility to contribute to this important global health work.

REFERENCES

Bangkok charter for health promotion in a globalized world (2005). Bangkok.

ILO (2004). *A fair globalization : Creating Opportunities for all. World commission on the social dimension of globalization*. International Labour Office: Geneva.

Marmot M (1999). Acting on the evidence to reduce inequalities in health. *Health Aff (Millwood)* **18:** 42-44.

Murray CJL, Lopez AD, Harvard School of Public Health., World Health Organization., World Bank. (1996). *The global burden of disease : a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Published by the Harvard School of Public Health on behalf of the World Health Organization and the World Bank Cambridge, Mass.

Nissinen A, Berrios X, Puska P (2001). Community-based noncommunicable disease interventions: lessons from developed countries for developing ones. *Bull World Health Organ* **79:** 963-970.

Ottawa Charter (1986). *Ottawa charter for health promotion*. WHO, Health Welfare Canada, Canadian Public Health Association: Canada.

Poole-Wilson PA (2007). Millennium development goals: an unbalanced approach to global health. *Nat Clin Pract Cardiovasc Med* **4:** 289.

Puska P, Leparski E, World Health Organization Regional Office for Europe (1988). *Comprehensive cardiovascular community control programmes in Europe*. World Health Organization: Copenhagen.

Puska P, Vartiainen E (2009). Community based studies in high income countries. In: Detels R, Beaglehole R, Lansang MA, Gulliford M (eds). *Oxford Textbook of Public Health*, 5th edn. Oxford University Press: Oxford.

WHO (1999). *Global strategy for the prevention and control of noncommunicable diseases : report by the Director-General*. World Health Organization: Geneva.

WHO (2002). *Tobacco Atlas*. World Health Organization: Geneva.

WHO (2003a). *WHO Framework Convention on Tobacco Control*. World Health Organization: Geneva.

WHO (2003b). *Diet, nutrition and the prevenion of chronic diseases. Report of a joint FAO/WHO consultation*. World Health Organization: Geneva.

WHO (2004). *Global strategy on diet, physical activity, and health*. World Health Organization: Geneva.

WHO, Public Health Agency of Canada (2005). *Preventing chronic diseases : a vital investment*. World Health Organization: Geneva.

WHO, Regional Office for Europe (2006). *The European strategy for the prevention and control of non-communicable diseases*. Word Health Organization. Regional Office for Europe: Copenhagen.

WHO, WHO Regional Office for Europe (2006). *European charter on counteracting obesity*. World Health Organization: Copenhagen.

World Bank (1999). *Curbling the epidemic: Governments and the economics of tobacco control*. Wirld Bank: Geneva.

22. GENERAL DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

Pekka Puska

The following are examples from the numerous letters we received from people in North Karelia at the beginning of the project:

"I want to tell you more about heart disease in my family. My mother died suddenly of heart disease at 65 years of age. My father had several heart attacks, but with regular treatment he managed to survive to nearly 80. My brother died of a heart attack at 52 years. My eldest sister has had two heart attacks, and my younger sister also has heart problems. I hope this information helps you in your research."

"With great sorrow and grief I want to inform you that my husband died on ... of a heart attack. So everything is too late for him. Many thanks to you. With regards."

"This project is a matter of the heart to me, because my husband died of a heart attack. He had one five years ago, followed by two more; the third one took him. He was a heavy smoker, which certainly contributed to it and damaged his heart. I hope that this project can bring understanding and help to many, so that people do not have to lose their health at their best age. With heart-felt wishes."

"Honourable doctors. This disease has been our family curse for 13 years. My husband was then 32 years and I was 30. We had three daughters. Now I feel that it is hundred years since then ... People always ask how my husband is, but nobody asks how I manage. I have to carry on, be happy and take good care of everything. All this sorrow, worry, lack of money, many other things I cannot tell about - I often wonder why this life was given to me. There are certainly many of us in the same boat, but that does not comfort me... With respect."

"Your letter arrived at a place where the father of the family died recently of heart infarction. Four of his brothers are known to have died of the same disease. My husband was 44 years. Myself, I suffer from high blood pressure. I have had it for about 4-6 years. Nowadays I already have chest pain attacks, although the nitro tablets help. I have three young children. What else can I do for them than to teach them good nutrition, encourage physical activity, etc. Please advise me if you can, because I also come from a family with much heart disease. I could at least build my children's lives on healthier grounds. How to do it, I don't know. I would be grateful for your advice."

The whole thing could have happened elsewhere - just the names of the sufferers and their diseases would have been different. So what made North Karelia unique?

Information, for a start. As certain statistics and study findings were published it began to dawn on people in the area that there was an unusual problem in Finland in general, and particularly in North Karelia. The very large number of heart attacks and deaths among even relatively young men was not normal. It was not a normal part of the aging process to develop chest pain during effort reaching 50 years of age, and to have to use nitro tablets. The idea began to grow that there might be something that could be done about it.

The actions which took place with the petition and subsequent planning were in many ways fortunate. Some strong personalities were in the right place to get the ball rolling. The role of Professor Martti J. Karvonen with his close relationship with Ancel Keys and WHO was clearly a major one; so was the part played by Mr. Esa Timonen, the strong Governor of North Karelia. In addition, two other important names must be mentioned: Dr. Leo Noro, the Director General of the National Board of Health, and Dr. Leo Kaprio, the Director of the Regional Office for Europe of WHO. It was these individuals who started the early planning, involved WHO, and outlined the project organization.

Professor Martti J. Karvonen has since remarked that he realized the long term perspective of the Project, and thus wanted to have a young director to implement it. Dr. Puska, for his part, gathered a group of young, dedicated and enthusiastic professionals to build up the project team, and to take on the challenge of changing the public health situation of North Karelia.

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The activities that were subsequently set in motion in North Karelia were not totally unique in Finland's history. In the early decades following Finnish independence - the 1920s and 30s - Finland was faced with severe public health problems due to infectious diseases, which were in turn related to poverty, bad housing conditions, poor hygiene, and the lack of health services. The great tuberculosis epidemic of the time was a major killer, much feared by the public.

A major initiative was launched to fight tuberculosis. The mass epidemic called for mass action, including general educational messages, a variety of lay activities, work by public health nurses in the local villages, mass screenings, setting up treatment and rehabilitation centres, etc. Community awareness and involvement, and the participation of the people themselves were crucial dimensions in the success achieved.

These decades were followed by the hardships of World War II, and then by years of severe post-war difficulties. Only during the 1950s and 60s did the national economy really pick up speed and the standard of living start to rise. The public health problems related to infectious diseases receded, as clinical medicine developed apace and health services expanded. There was a widespread perception of greatly improved public health ; chronic diseases were seen as a consequence of aging, with the provision of curative and rehabilitative services the appropriate response of a welfare state.

Today, chronic noncommunicable disorders, notably cardiovascular diseases and cancer, are responsible for most of the cases of early mortality and disability in the population. But at the same time we are understanding much more about their causes. These diseases are not the natural consequences of aging, but the result of pathological processes induced by our lifestyles and environments. We already possess sufficient information to vastly reduce the burden of chronic disease.

In spite of the obvious differences between the infectious communicable and the chronic noncommunicable diseases, epidemics of both kinds of disease are deeply rooted in the prevailing cultural, social, and physical environments. So whilst the old public health maxim of dealing not only with the agent but also with host and environment' evolved for infectious diseases, it also holds for today's noncommunicable health problems.

Notwithstanding the remaining uncertainties surrounding the etiology of our major chronic diseases, a number of obvious causal and strong risk factors are identifiable, and many of them are common to several diseases. As most people are at some risk of noncommunicable diseases, successful prevention necessarily involves large segments of the population. The majority of the measures needed relate to lifestyles that are safe and that promote health in general. The fact that risk-related lifestyles are a part of general day-to-day living means that broad integrated strategies are needed, both in the community and on national levels.

These were the important issues which were considered by the young project team when the project was formulated and their work started. The role of some "risk factors", prevalent in North Karelia, was obvious and provided a firm basis for action. Even more important was the realization that these factors are closely linked to behaviours and lifestyles – diet and smoking seemed to be of crucial importance. At that time most men had high physical activity at work and obesity was not common.

Perhaps the greatest innovation was the notion that the lifestyles are moulded by the social features of the community – thus the target aimed for, and the slogan used, was to change North Karelia, as a physical and social entity. The principle of community-based prevention was developed. Thus the overriding incentive behind

both the inception of the North Karelia Project and its successful outcome was an absolute determination at the community level – and later, at the broader level of national action – to effectively tackle this cardiovascular disease problem which had attained literally epidemic proportions.

The approaches used and the experiences gained have been described in the earlier chapters. The overall outcome of the project has certainly been very positive: a dramatic change in public health has taken place in North Karelia, and subsequently in all of Finland. The experience has also been an inspiring example to the international community, by showcasing the potential of prevention. At the same time, the work needs to continue. Premature mortality and morbidity of CVD and other noncommunicable diseases is still far too high. Great new progress can be achieved with continued and persistent work. So although our successes so far have saved countless lives, human suffering and money, the problem is far from solved. Moreover, the burden worldwide is large and steadily growing. The good results encourage us that the basic approach adopted has been the right one. Therefore it is important for the work to continue, not only for the benefit of Finnish people, but also as part of Finland's contribution to global health.

EVALUATION QUESTIONS

The evaluation principles applied in the North Karelia Project have been described earlier. High-quality, comprehensive evaluation was of central importance from the start of the project. It was regarded as vital to help gain experience that could be applied nationally and internationally, as well as broadening our knowledge about the possibilities of preventing chronic diseases in real life. In addition, high-level evaluative research was considered important for the credibility and continued support of the project.

When the North Karelia Project was planned and launched, efforts at prevention in the field of CVD were relatively new. Developments had just reached the stage of proceeding from prospective epidemiology to the start of multifactorial trials.

Launching a community-based "trial" or "intervention programme" was quite a new idea and a pioneering task. Many of the intended approaches had still to be developed, not least in the area of evaluation.

The use of the formal "matched" reference area was problematic, even during the initial five-year period, for the reasons mentioned earlier. The project later became actively involved with developments on a national scale, and there can be little doubt that it has contributed significantly to the remarkable decline in CVD rates across

Finland. From the opposite perspective, the national 'readiness' to deal with the problem, social pressure and supportive policies have helped the project to achieve its successes.

Thus developments in North Karelia and Finland as a whole have been intertwined in complex ways. This is one reason why in recent years the main monitoring activity has been largely focused on the whole of Finland, but with a continuous emphasis on North Karelia. It has also been justified by the overall aim of the project to contribute to nationwide developments . The evaluation and monitoring systems designed at the outset for the North Karelia Project have evolved into a national monitoring system for chronic diseases, their risk factors and determinants.

During the past decades much has been written on the evaluation principles, with methods of evaluation being discussed frequently by the project team and others (see also Chapter 20). There are clearly two distinct types of emphasis or perspective.

One is to see and develop these projects as "community intervention trials". Here the emphasis is on rigorous effect evaluation. Ideally this would involve random allocation of services to a number of communities. The other perspective puts more stress on genuine community organization and on the process-related issues involved in the intervention and evaluation. While a study applying random allocation to several large communities is seldom feasible anyway, it may also contradict the true nature of community organization.

In the case of the North Karelia Project a quasi-experimental study design was applied, with the intention of creating a balanced mix of the two approaches. The aim was to describe, monitor, and analyze developments in the most reliable ways available, and from many different perspectives, including strict epidemiological approaches and various quantitative and qualitative aspects of the process. More recently the evaluation has been particularly concerned with following trends in mortality, incidence, risk factors, lifestyles and nutrition, and in analyzing the contribution that risk factors and other changes have had on the disease trends. At the same time various kinds of process evaluation have taken place.

Rigorous methods have been applied to gain a broad and accurate picture of the changes - those related to the objectives and others - that have occurred over the years in North Karelia and in all of Finland. After the original project period (1972-77), and especially following the official determination of the Project (in 1997), the emphasis has clearly been on monitoring and analyzing national change. Thus the preventive work and evaluation, coordinated by the National Public Health Institute (KTL), has been an important part of national public health work, whilst, North Karelia has still received some special attention.

Over the years numerous indicators of target changes and process factors have been monitored to better understand the change process. The process evaluation has additionally provided some insight into the determinants of change, and how to attribute such changes to the various intervention activities. Analyses are presented in this book that also assess the extent to which CHD mortality changes can be attributed to the alterations in the observed population risk factor profile.

WHY SUCCESS?

With the success in Finland and evident international interest, the North Karelia Project team has often been asked to describe the main reasons for its success. While the Project team may be biased, it is, netheretheless, useful to outline below some factors that they have felt to be of great importance.

Appropriate theory base

A fundamental reason for the success of the North Karelia Project is the adoption of a correct and appropriate theory-base. Within the Project, a phrase that is often used is "nothing is so practical as a good theory". At the outset of the Project much advice and assistance was received from WHO and its experts. This concerned, in particular, the information available at that time on the most important risk factors and the nature of those "classical risk factors". The epidemiological considerations led, as described earlier in the book, to the adoption of a community-based approach to changing the risk factor profile in the population – i.e. shifting the risk factor distribution of the population - through comprehensive activities, particularly targeting changes in lifestyles (especially diet and smoking).

Very soon, moreover, the behavioural and social sciences theory-base was developed for the Project, as outlined earlier. It was realized that changing lifestyles is within the framework of behavioural and social sciences. The problem, of course, was the lack of a unifying theory. Instead, a number of relevant frameworks were considered (Puska et al. 1985). These concerned steps towards behaviour change, communication-behaviour change, innovation diffusion, and community organization. Furthermore, after moving to the national level, the theoretical bases of policy issues also became relevant.

Flexible intervention

At the same time as the intervention in the North Karelia Project had the above mentioned strong theory-base, it was important that the actual intervention was

flexible. The intervention had to respond to the naturally occurring social variations in the community. This was linked with the fact that the representatives of the Project worked in close collaboration with the local population. The Project was very visible in the community and interacted closely with different organizations. Acting in this way was not only a question of communicating the Project message, but also very much of listening to the views, suggestions and issues raised by the people and the various organizations who were involved.

Intensive intervention

Results of the Project did not depend only on correct theoretical frameworks, but on much practical work. It was not enough to "do the right thing", but also "to do enough of it". A commonly used phrase within the Project was to work with "boots deep in the mud". Over the years the Project team initiated and organized a very great amount of practical activities.

Although the core budget of the Project was never "huge", the Project was able to mobilize much action that did, indeed, reach people in the context of their everyday lives. It can, for example, be mentioned that within the first five years of the Project, some 20,000 hypertensives were registered, and followed up with advice and treatment. Numerous specific campaigns, like those of the Martta Housewife Association "Parties for Long Life", numerous Heart evenings, cholesterol lowering competitions between villages, work site programmes, distribution of "smoke-free signs", and so on, did reach a large number of people.

The great awareness of the Project and the involvement of large sections of the population in various ways were also witnessed in the several surveys that served the evaluation.
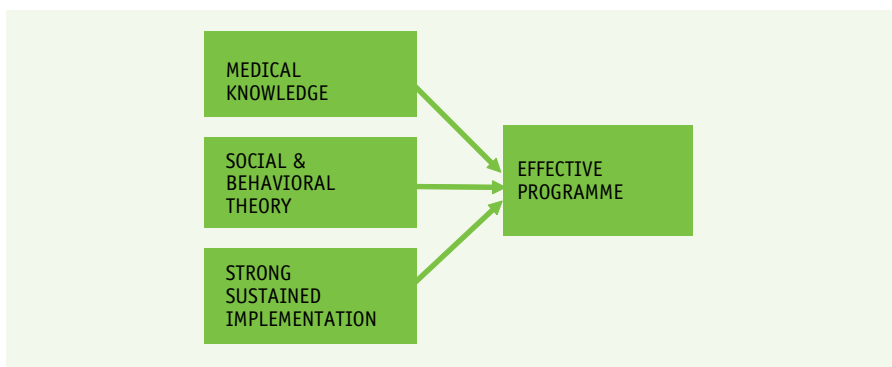

Figure 1. Key elements of an effective programme

Working with the people

From the very beginning of the Project it was felt important to work closely with the community. The ownership of the Project by the population was considered crucial. The Project was launched after a petition of the representatives of the people. This was much emphasized by the Project personnel when launching the Project activities. These activities had to be seen as response to the petition: "The Project message is the best scientific way to respond to the wish of your petition: reduction of cardiovascular rates."

It was clearly seen that, in the end, health behaviour changes must be achieved by people themselves. The role of the Project was to help and to make such changes as easy as possible in North Karelia.

The ownership of the people was also stressed. A common phrase was "I am in the Project". Even the name of the Project- "North Karelia Project" - indicates the ownership of the Project by the Province.

In the organization and work of the Project numerous local people were involved. These people concerned themselves with the formal Project working groups and the implementation of the Project itself. The role of the Project was not seen primarily as carrying out the activities, but to plan, catalyze, coordinate and evaluate.

Community organization

"Community-based prevention" was the new, innovative approach to fight CVD in the early 1970's. Thus from the very beginning the basic idea was to change North Karelia as social and physical environment. Individual behaviours tend to follow the general lifestyle patterns in the community.

Chapter 3 describes the theoretical principles used. In practice, the Project team, living in close interaction with the community took every opportunity to discuss with various organizations about how they could contribute to the practical objectives of the Project. This organization included official service structures (in addition to health services, schools, social services, sports administrations etc.), NGOs (both health related and non-health related, the private sector (industry, retail), local political decision making (municipal bodies), the media etc.

In these persuasive contacts two principles were important. First, much of the influence was based on personal, and often opportunistic, contacts. Second, the aim was to find win-win situations. This means that the suggested activities had to benefit the targets of the Project, as well as at the same time benefiting the other partner. There was therefore often media publicity on the work and mission of the partners, public pressure or financial incentives.

Work with health services

The intervention in North Karelia was broad and all possible areas of life were considered. At the same time it was clearly realized that health services must form the backbone of the intervention. When the North Karelia Project was started the new national law on public health/primary health care came into force. This legislation introduced the health centre system as a functional unit to provide comprehensive primary health care to all citizens of the municipalities. Within health centres public health nurses and physicians were in an especially key position. Thus the Project established special and close contacts with them through training seminars, written materials, personal contacts etc.

Public health nurses have traditionally been working closely to people and doing important public health work – earlier in Finnish history to fight tuberculosis and childhood mortality. Their enthusiasm and commitment was also crucial, especially during the early years of the project. Medical doctors, on the other hand, were seen as local authorities and experts in the medical issues. Thus their support and cooperation was very important. Since much of the treatment of severe cardiovascular attacks takes place at the Central Hospital of North Karelia, the specialists there (esp. in cardiology, internal medicine and neurology) were also in an important position as opinion leaders and as experts in medical cardiovascular issues. Thus the leaders of those experts were closely involved with the Project. Also, some key activities were hosted and coordinated at the hospital (myocardial infarction and stroke registers, local secondary prevention/rehabilitation groups).

Official authority

Very much of the Project work was based on voluntary collaboration, persuasion, training, communication, etc. At the same time, the Project work was also linked with official administrative structures and health authorities. During the original years of the Project, the Project office in North Karelia was part of the Department of Health and Social Issues of the Provincial Administration. The Director of the Department and the County Medical Officer were also centrally involved in the Project organization. This emphasized the point that the new Project activities in health services were not just some voluntary work, but an important part of official daily duties. In this way the Project used a tactic of wearing "two hats": an official and unofficial one.

The Project activities were also linked as much as possible with national official guidelines and programmes. The aim was to take advantage of these national authoritative guidelines, and to implement them as well as possible in North Karelia. In the original Project period the contacts with the National Board of Health were

important. Moving the coordinating centre of the Project from University of Kuopio to the National Public Health Institute (KTL) at the end of the 1970s was very significant. Since KTL is directly under the Ministry of Health and has the task to promote public health through many means, this was extremely important for the sustained continuation and for the transfer of the Project activities to national level.

Limited targets – outcome orientation

It is felt that one reason for the success of the Project was the careful analysis of the critical targets and the choice of limited number of these targets. "Less is more" is a phrase that was sometimes used. The intervention was oriented by all feasible means towards the reduction in population levels of the three now "classical" risk factors: blood cholesterol, blood pressure and smoking. Since it was seen that population blood cholesterol level was very strongly a result of dietary habits (too much saturated fat, too little unsaturated fat, and little vegetable intake) and also blood pressure to a certain extent (due to excessive salt consumption, etc.), some critical changes in diet and a reduction in the smoking rates were chosen as the direct targets. For blood pressure, in addition, detection, treatment and follow-up was targeted.

It was also important that in the practical intervention these limited set targets were defined in terms of very practical behaviours. As to diet, the main sources of dietary saturated fat were heavily emphasized. Thus the key targets were switch from butter to soft margarines, choice of non fat (or low fat) milk, preference of lean meat, and increased consumption of vegetables in multiple ways. In addition, reduction of salt intake (also with replacement by low sodium salts) was emphasized. Stopping smoking was another clear message and target.

These limited and practical targets were pushed in all possible ways feasible to the Project. As the theoretical section explains, information was given to people but that was not the main part of the intervention. The main emphasis was to use persuasive messages, to involve local opinion leaders, to teach practical skills and to take every practical opportunity to push and facilitate these outcomes.

Changes in knowledge or even attitudes was not seen as a primary objective. The idea, rather, was that new behaviours would lead to changes in attitudes and even in increased attention to information. The Project also had naturally broader visions for good health and well being. But it was felt that rather than trying to persuade people about these broad aims directly, the practical activities, changes and positive experiences would be the "spearhead" and lead to changes in broader values.

Positive messages

Although the initial message of the Project was a dramatic and negative one – that North Karelia had the highest CVD mortality in the world – the Project messages that emanated after this were as positive as possible. Essentially, it was that Heart disease can be prevented by practical, positive action.

Concerning tobacco the attention was soon shifted from "Don't smoke" to "smoke-free", to smoking cessation issues – i.e. helping smokers to quit, to the benefits of clean air, smokefree lifestyle etc. Concerning diet, the message was soon shifted from avoiding fat to "Heart Healthy diets", healthy foods, (Finnish rapeseed) vegetable oil, fat free milk, berries & vegetables, etc.

In all messages attention was also paid to emotional issues close to the local culture: Karelia features, local agriculture, national and international example of the Project etc. Many local opinion leaders were effective at communicating the messages in a positive way, adopting them to the local culture.

Furthermore, part of the strategy was to give feedback to people about the positive changes seen in the monitoring: about changes in dietary habits, risk factors and in the disease rates themselves.

From North Karelia to national

The original aim of the North Karelia Project was to carry out the comprehensive preventive intervention in North Karelia for a five year period (1972-77). In this way North Karelia was seen as a pilot study for all of Finland. After this period, many positive changes were already observed, but obviously there was much more to be achieved. Thus the decision was made, encouraged by national authorities, to start to apply the Project experiences nationally, but at the same time to continue carrying out the project in North Karelia as a national "demonstration" or "model". Thus in this way it was seen that both North Karelia and all of Finland would benefit from this. National interest helped continuation in North Karelia, and the visible example of North Karelia helped the national work.

Working with the media

Innovative work and partnership with the media were key in communicating with the public. Very little of the media activities were related to the provision of health information. The main work in this area was reporting to people about activities and results. Attention was paid to the theory that said that mass media activities should be linked as much as possible with ongoing interpersonal activities and activities in the field.

The Project team had close personal relationships with the media people. The aim was to work together and to help serve the media in their needs. Health and the Project work were of great interest to the people; thus the media, of course, wanted to cover these issues. The Project did not avoid debates or confrontation; on the contrary, it was seen that patiently responding to the questions and criticism with good facts and arguments was very important to establish progress.

After the original Project period had ended the coverage of the Project issues much increased in the national media. Of great significance were the popular TV courses from 1978 up until 1991, as described earlier. Again it was felt that there was a mutual advantage to be had: in other parts of Finland the North Karelian example was seen as both interesting and encouraging. At the same time it helped the work in North Karelia, when local people saw other experiences being featured and praised nationally.

Bottom-up – top-down

In health promotion the discussion is often about whether to use a bottom-up or a top-down approach. In the North Karelia Project clearly a blended model was used. The Project started in a bottom-up way, with the petition to experts and national authorities: do something. This was heavily used and it was continuously emphasized that "this is your Project". "Only you can change North Karelia."

Also, throughout the Project the ownership and innovative work of the public was an important principle. The Project work was done with the people and many of the activities were their own ideas.

At the same time international and national expertise identified from a "top-down" perspective the objectives of the Project, and much professional expertise was used to outline the theoretical frameworks, the many innovative interventions (often with ideas borrowed from abroad), and to carry out the evaluation.

Although the population felt very proud of the Project and the Project was very popular, the practical messages were not tempting: to stop smoking, to change from butter to margarine, to start eating vegetables, etc. Smoking was seen as a pleasure and of small harm to health by the hard working men. In the local culture butter, fatty milk, etc., were held very dear to people, both culturally and economically. So the Project clearly had to act as a vigorous "change agent" to persuade early adopters and gradually get the new innovations through.

Leadership – collaboration

The North Karelia Project was clearly a major societal undertaking – first in North Karelia and then nationally. This called for visible, strong, dedicated, persistent and long-term leadership. This meant that the Project leader and the core team also received a fair amount of personal publicity as leaders of the movement. This was seen as inevitable.

The Project team and the office also did an enormous amount of work, with "boots deep in the mud", as noted. It was seen that "committees do not do the real work" and there must be a strong visible focal point and leadership.

But as important as this was broad collaboration. It was clearly realized that good results can only be achieved if many other organizations and stakeholders collaborate. The Project tried also to give them visible merits. During the years of the Project an enormous amount of various organizations and individuals were active in the Project work in their specific circumstances.

Monitoring and feedback

The evaluation system and principles were defined at the outset. Over the years the health monitoring was further developed and became the basis for national health monitoring for chronic, noncommunicable diseases and their health prevention.

Very soon it was also realized that the monitoring does not serve only the evaluation. Monitoring of trends with feedback to people through the media was discovered to be one of the strongest intervention modalities. The Project started a simple twice yearly health behaviour monitoring programme that gave feedback about the practical changes. After the original Project period had ended this was transferred to the national level as the national health behaviour monitoring system. The surveys used for the monitoring also collected simple information on some key process and performance indicators that were extremely useful for practical planning.

The media was very interested in the feedback and in the trends. This information greatly helped to set the public agenda. "What gets measured, gets talked about" was the lesson. Thus this information gathered was used as persuasive messages to people, as mentioned earlier.

Gradually the monitoring and survey data was increasingly used also to push for healthy public decisions and policies. When many people responded that they would like to buy fat free milk, this information was used in the discussion with the dairies. People's responses on smokefree policies were constantly used to support new amendments in the tobacco control legislation.

Social change as the basic issue

In North Karelia the ultimate aim was to prevent the cardiovascular rates increasing based on the medical knowledge, through changing the lifestyles of the population to heart healthy ones. Thus the big question is, how this is possible? The previous chapters discuss the various theory-based intervention strategies that obviously worked and brought about the great positive changes.

Since the main aim was to change the community – and later the nation – so that the desired lifestyles would be easy and normal, attention was towards questions of how to ultimately influence policies and the private sector.

Already in North Karelia it had been realized how the local politicians were inspired by the support of the people. The Project often had local decision makers at the various Project meetings and gave them personal visibility. While the Project's representatives spoke directly with politicians and private sector representatives, it became apparent that the strong way to influence them was through personal contact.

This was even more the case on the national level. It can clearly be argued that the numerous changes in Finnish nutritional policy, agricultural and industrial production and marketing, are much the result of the fact that the population became interested in healthier diets and started to make such changes. The changes in policies, in turn, helped further the change process to ensure it was a sustainable and growing one, and helped lead to the very large changes that have taken place in the Finnish diet.
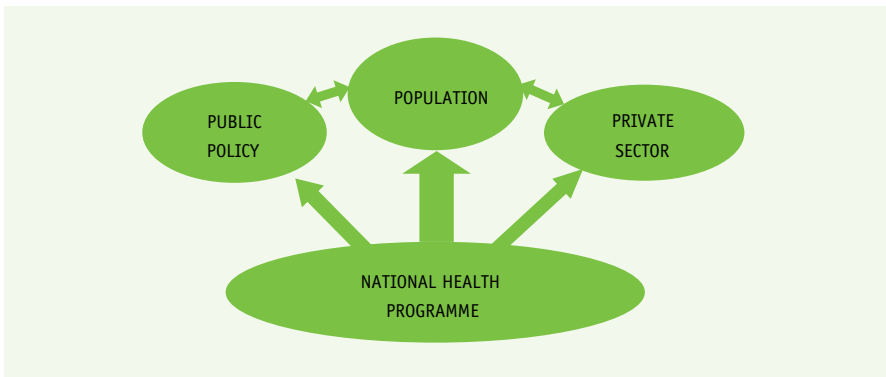

Figure 2. How to promote public changes?

FROM NORTH KARELIA TO NATIONAL AND INTERNATIONAL LEVEL – FROM PRACTICAL INTERVENTIONS TO POLICIES

The original petition in North Karelia called for "urgent and major assistance in reducing the record high burden of cardiovascular diseases in the area". Following this petition the Project was formulated and launched as described earlier. At that time the medical knowledge and experience to help aid prevention was much more scarce than is the case nowadays, and many of the plans and ideas of the Project were quite new.

Thus the original idea of the Project was to carry out the intensive community-based intervention only in North Karelia. This was both to serve the Province in response to the petition, and also to act as a "pilot" for the country. With the positive results and experiences that occurred already during 1972-77, and with the growing awareness of the national problem, it was decided to start to apply the Project experiences nationally. At the same time the work in North Karelia continued to act as a "demonstration" programme for national action.

Figure 3 shows how the demonstration programme was formed and how it serves national action. The Project team has often been asked how it achieved the transition from the demonstration programme to national level. Did it gradually take in other provinces? The Finnish experience has clearly been moving from North Karelia to national level largely through gradual diffusion. The North Karelia experience has been used in national health policy planning whenever feasible and needed. The greatest impact has probably been through informal diffusion. Reference to the North Karelian experience and results has been made in numerous connections and it is very well known on the national agenda.

In the national preventive work multiple actions by multiple organizations have contributed together. These contributions included Finnish research, health services, schools, numerous NGOs, and the media. The Project itself organized visible national TV health programmes from 1978 to 1991.

The increased interest coming from the population helped cause the private sector to become much more involved. In particular the food industry saw new business opportunities. "Low fat", "light", "cholesterol lowering", "heart healthy", "low salt", etc., became frequent sales arguments. These new products and slogans helped people to comply with the message, and also communicated the new healthier fashion.

Over the years policy decisions in support of these changes also increased. These decisions especially concerned tobacco legislation. Already the original tobacco control law of 1977 was quite comprehensive, but it was amended further during

MEDICAL INFORMATION

NATIONAL HEALTH PROBLEM

PUBLIC NEED FOR CHANGE

NATIONAL DEMONSTRATION PROGRAMME

VISIBLE EXPERIENCE, RESULTS

NATIONAL POLICY

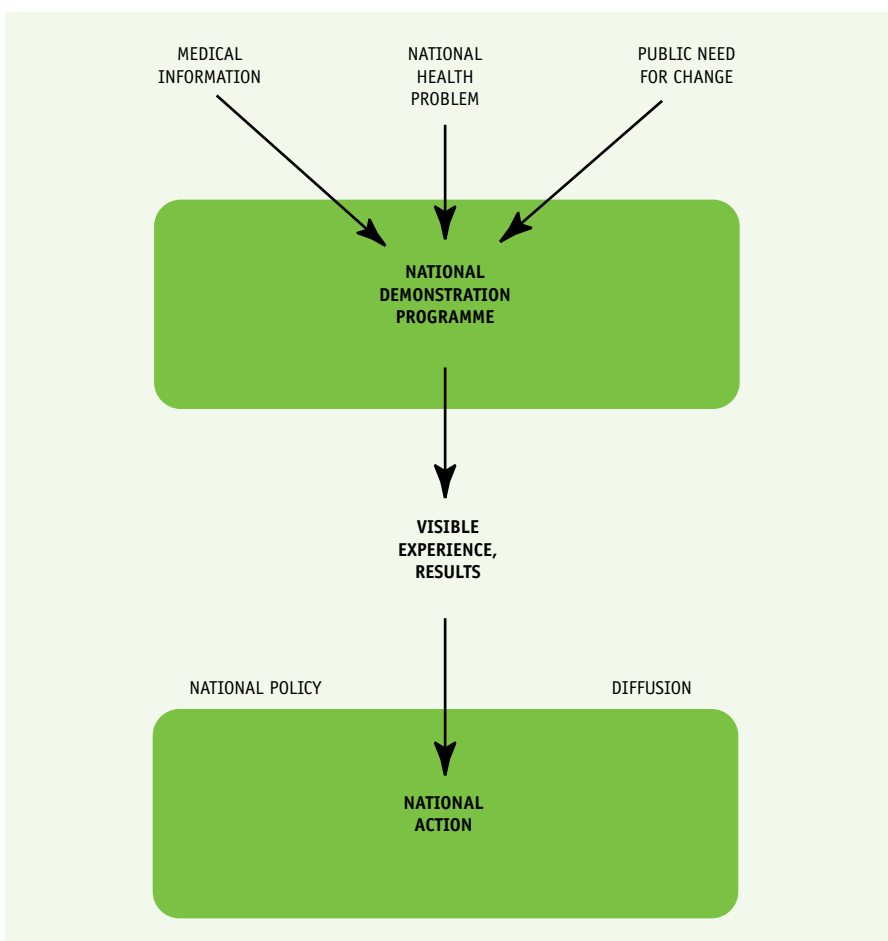DIFFUSION

NATIONAL ACTION

Figure 3. Overall use of national demonstration programme

these years. Several policy decisions also helped encourage the dietary changes. These policies concerned also, for example, agricultural subsidy policies.

While the original Project work targeted very much the population to encourage them to change lifestyles, it was gradually realized, particularly at the national level, how decisions by policy makers and the private sector – i.e. structural interventions to modify environments – are of key importance for effective and sustained changes.

Thus the real question was not a switch from "blame the patients" to "blame the politicians", but how to influence policies and the private sector (Puska 2009). It was realized that in addition to many direct contacts with important people, the ultimate and most effective way to achieve success is through pressure from the public – activities and intentions by people, as voters and as customers.

Thus it was realized that preventive action in the country is actually a question of social change. In this the actions and intentions of people are interrelated with policy and the behaviour of the private sector in a complex way. With health being higher and higher on the public agenda it became possible to introduce the concept of "Health in All Policies" which was the health theme of Finnish EU Presidency in 2006 (Puska 2007b).

* * * * *

When the North Karelia Project was started, cardiovascular diseases were seen as "diseases of affluence", as they mainly concerned industrialized countries. However, over the years global health has much changed as results of rapid health transition. Noncommunicable diseases have moved to poorer and poorer countries, and within populations these diseases and their risk factors are increasingly accumulating in lower socioeconomic segments of the population. Thus NCDs are now in crucial position regarding global health and are great contributors to inequality in health.

In this situation the majority of the NCDs nowadays occur in the low and middle income countries, adding greatly to the burden on the health services and economies of these countries. Thus we see in these countries what we saw in the early 1970s in North Karelia: people are poor and sick. Links with many social determinants of health are obvious, as the recent WHO Commission points out (WHO Commission 2008). And the development relates also in many ways to the harmful social consequences of globalization as highlighted by the ILO Commission (ILO 2004).

WHO has realized this new global health challenge, and it adopted, in 2000, a Global Strategy on NCD Prevention and Control. This strategy acknowledges that NCD prevention and control is now a priority of the organization, and that integrated prevention, targeting the population levels of the main lifestyle related risk factors, has the greatest potential.

Thus the WHO strategy greatly follows the lines successfully applied in the North Karelia Project. In fact, representatives of the Project have worked extensively with WHO to develop this base, both on the WHO level and in many particular Member States. The Finnish results from the North Karelia Project are frequently cited as an encouraging example of the potential of prevention.

Particularly for the low and middle income countries the message of the North Karelia Project is very relevant. In those countries, the possibilities for expensive clinical services are very limited; but the North Karelia Project has shown how in principle simple and inexpensive lifestyle changes, achieved through broad health

promotion and policy measures, is the most cost effective, sustainable and affordable way for public health improvements to occur.

WHO has indeed in 2008 intensified its work in the form of a special implementation plan of the global strategy. This is greatly supported by the recent risk factor specific global instruments: the WHO Framework Convention on Tobacco Control (2003) and the WHO Global Strategy on Diet, Physical Activity and Health (2004). Finland and the National Public Health Institute are actively supporting and contributing to this work in many ways. The Institute, as the WHO Collaborating Centre in this field, continues to run international training seminars and other related activities.

RECOMMENDATIONS AND CONCLUSIONS

The following recommendations are made, based on the theoretical consideration presented, and on the results and experiences in North Karelia:

- Integrated community-based chronic disease prevention and health promotion programmes should adhere to the well-established principles and rules of general programme planning, implementation and evaluation.
- Community-based preventive programmes should utilize the appropriate medical/epidemiological frameworks in selecting the intermediate objectives, and the relevant behavioural/social theories for designing the actual intervention programme.
- The essential elements of a successful community intervention programme are a sound and comprehensive understanding of the community ("community diagnosis"), close collaboration with various community organizations, and full participation by the local people themselves.
- Community-based intervention programmes need to combine well planned media and other messages with broad-ranging community activities involving sectors such as primary health care, voluntary organizations, food manufacturers and supermarkets, worksites and schools, the local media, etc.
- Community-based preventive programmes should cultivate the collaboration and support of both formal community decision makers and informal opinion leaders.
- Successful community-based intervention programmes need to amalgamate sound theoretical frameworks with dedicated persistence and hard work, and with close day-to-day interactions with the community.
- An essential component of all community programmes, and especially of national demonstration projects, is a system of reliable and first-rate monitoring

and evaluation, both for continuous follow-up of the change process and for more comprehensive summative evaluations.

- The major emphasis and resources of a community intervention programme should be directed at modifying social and physical environments in the community to help them become more conducive to health and healthy lifestyles.
- Major community intervention programmes can be beneficial not only for the target community, but also in the broader context by serving as national demonstration programmes. This requires close cooperation with the national authorities for the dissemination of experiences and evaluation findings, etc.
- Strong dedicated leadership should be combined with the broad collaboration of various stakeholders.
- Sustained national progress calls for broad activities by different sectors and policy changes for maintenance of new lifestyles.
- Strong involvement of policy decisions and positive changes by the private sector are of great importance, but such need frequent pressure and support by people, usually reflected in the media.
- It should be understood that ultimately it is a question of social change where policy decisions, actions by different organizations, and people's own activities and intentions are interrelated in a complex way.

The three main conclusions have already long been obvious from the experience with the North Karelia Project:

1. A comprehensive, determined and theory-based community programme can have a substantially positive effect on risk factors and lifestyles.
2. Such developments are associated with correspondingly favourable changes in chronic disease rates and population health.
3. A major national demonstration programme can be a powerful tool for generating favourable nationwide developments in chronic disease prevention and health promotion.

It is further felt that the Finnish experience has shown:

1. Prevention of major chronic diseases is possible and pays off.
2. Population based prevention is the most cost effective and sustainable public health approach to chronic disease control.
3. Prevention calls for simple changes in some lifestyles (individual, family, community, national and global level action).
4. Influencing lifestyles of the population is of key importance.

5. Many results of prevention occur surprisingly quickly (CVD, diabetes) and also at a relatively late age.

6. Comprehensive action, broad collaboration with dedicated leadership, and strong government policy support are key for success.

The North Karelia Project clearly achieved beyond all expectations its original goal in North Karelia. It has greatly contributed to major similar changes on a national level, resulting in enormous public health improvements. This in turn is a very encouraging example internationally in a situation where chronic noncommunicable diseases have become the leading cause of mortality in the world: prevention is possible and can result in great improvements in public health.

REFERENCES

ILO. (2004) *A Fair Globalization, Creating Opportunities for all. World commission on the social dimension of globalization*. ILO, Geneva.

Puska P. (2007a) Blame the patients or blame the politicians? Editorial. *Int J Public Health* **52**:331-332.

Puska P.(2007b). Health in all policies. Editorial. *Eur J Public Health* **17**:328.

Puska P, Nissinen A, Tuomilehto J, Salonen JT, Koskela K, McAlister A *et al* (1985). The community-based strategy to prevent coronary heart disease: conclusions from the ten years of the North Karelia project. *Annu Rev Public Health* **6:** 147-193.

WHO. (2003) *WHO Framework Convention on Tobacco Control*. Geneva: WHO.

WHO. (2004). *Global strategy on diet, physical activity, and health*. World Health Organization: Geneva.

WHO, Public Health Agency of Canada (2005). *Preventing chronic diseases : a vital investment*. World Health Organization: Geneva.

WHO, Commission on social determinants of health (2008). *Closing the gap in a generation: Health equity through action on the social determinants of health*. World Health Organization: Geneva.

Opening of Health Fair in Joensuu in 1990: Mr. Dhillon from WHO, Riitta Väisänen, Pekka Puska

Draw for winners in the national Quit and Win competition in 1986: Pekka Puska, Seija Nurmi and constable Reijo Muuri

Population health examination in North Karelia

Professor Kerttu Tossavainen from the North Karelia Youth Project

Associate Professor Tiina Laatikainen

Vesa Korpelainen, Executive Manager of the North Karelia Project field office

Project worker Stig Björkqvist discussing with lumberjacks in the 1970's

Presentation of the new Project poster in 1991: Vesa Korpelainen, Jussi Huttunen, Pekka Puska, Heikki J. Korhonen

Secondary prevention activities of the Project in the 1980's: Professot Jukka T. Salonen

Health education material of the North Karelia Project

Press meeting for the launch of the North Karelia Project in 1972 in Joensuu: Matti Rimpelä, Väinö Soininen, Pekka Puska, Esa Timonen, Peter Rhomberg, Leo Noro, Martti J. Karvonen, Kai Sievers

Director General of WHO, Dr. Halfdan Mahler, visiting Ilomantsi health cente in 1973: Leo Noro, Halfdan Mahler, Kari Puro, Pekka Puska

Professor Aulikki Nissinen and Associate Professor Antti Uutela

Awarding key persons of the North Karelia Project in 1987: Martti J. Karvonen, Esa Timonen, Pekka Puska, Väinö Soininen, Helge Honkapohja

Doctors Harri Mustaniemi and Matti Ketonen, cardiologists of the North Karelia central hospital

Launching youth prevention activities in the late 1970's: Martti J. Kokko, Anna-Liisa Asikainen, Stig Björkqvist, Pekka Puska and Väinö Soininen

"Quit smoking" TV programme studio group with Pekka Puska and Kaj Koskela, promotional picture taken in Joensuu in 1989
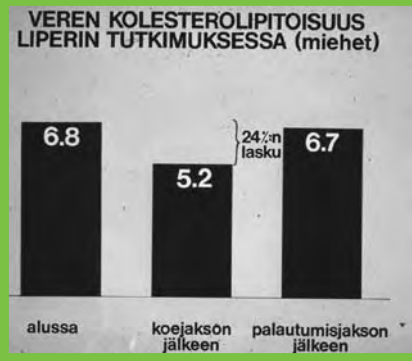
Harri Mustaniemi in 1992 awarding professionals from different fields distinguished in the Project

Pekka Puska giving a seminar talk in Joensuu in the 1970's

Cholesterol reduction in the Finnish – Italian diet study during the intervention "Italian" period, early 1980's

VEREN KOLESTEROLIPITOISUUS
LIPERIN TUTKIMUKSESSA (miehet)

6.8   5.2   24%:n lasku   6.7

alussa   koejakson jälkeen   palautumisjakson jälkeen

Presenting early reports of the North Karelia Project: Jaakko Tuomilehto, Pekka Puska, Ismo Helenius, Hilkka Pakarinen, Kaj Koskela

Start of production of low fat sausage by Halonen sausage factory in 1976: Mr. Halonen, Jaakko Tuomilehto, Hilkka Pakarinen, Pekka Puska

Production of low fat milk by North Karelian co-operative dairy

Arja Hukkanen (later Puska), worksite project in North Karelia

North Karelia Project salt project team in early 1980's: Antti Tanskanen, Pirjo Ruotsalainen, Jaakko Tuomilehto, Pekka Puska, Heikki Karppanen, Pirjo Pietinen, Aulikki Nissinen

Presenting the 20 year anniversary poster to the Governor Esa Timonen in 1992: Vesa Korpelainen, Pertti Puhakka, Pekka Puska, Arja Muuttoranta, Esa Timonen

Returning the 24-hour urinary collection sample in the 1980's

"Keys to health", TV health promotion programme series by the North Karelia Project in 1984: Pekka Puska, Pirjo Pietinen, Kaj Koskela

Health meeting in Russian Karelia in 1994: Mihail Uhanov, Pekka Puska, Anatoli Artemjev, Rafael Oganov

Signing the agreement on CINDI between Finland and WHO/EURO in 1982: Pekka Puska, Jussi Huttunen, Leo Kaprio, Aulikki Nissinen

Professor Jaakko Tuomilehto giving a speech at a Project event in Ilomantsi

Simo Moisio from the North Karelia Berry Project

Eeva-Liisa Urjanheimo from the North Karelia Youth Project

Health Fair in Joensuu in 1990: Martti J. Karvonen, Pirjo Pietinen, Pekka Puska

Dr. Pertti Puhakka, county Medical Officer of North Karelia 1978-1997

Tiina Vlasoff from the North Karelia Project field office

Professor Erkki Vartiainen