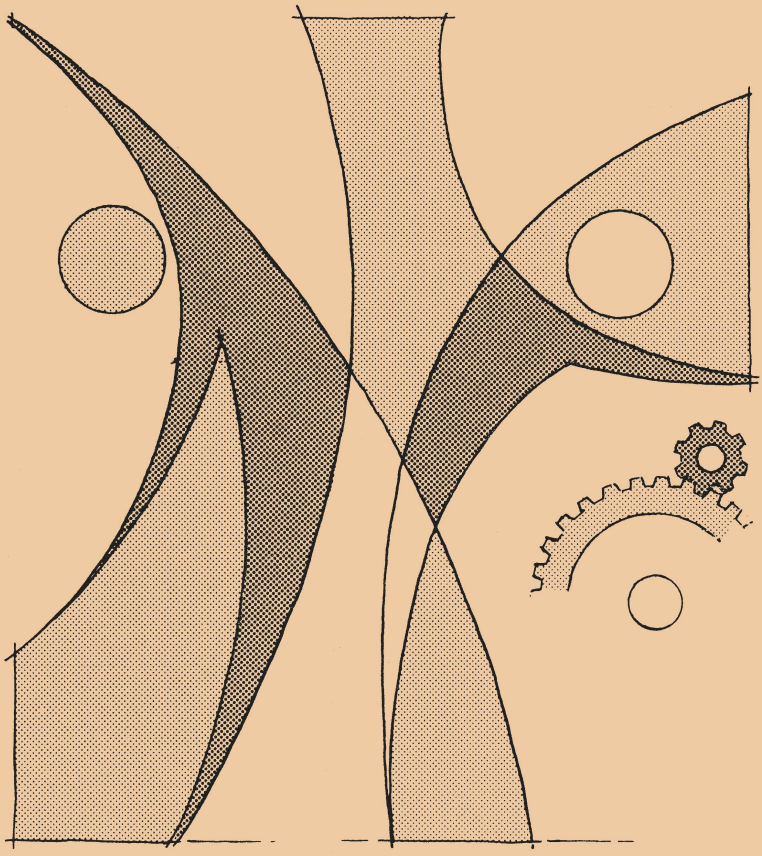
THE IMPORTANCE OF EXERCISE FOR SICK LEAVE AND PERCEIVED HEALTH



BY GUNNAR ANDERSSON

Linköping University Medical Dissertations
No. 245

Linköping University Medical Dissertations
No. 245

THE IMPORTANCE OF EXERCISE FOR SICK LEAVE AND PERCEIVED HEALTH

Gunnar Andersson

Akademisk avhandling

som för avläggande av doktorsexamen i medicinsk vetenskap kommer att offentligt försvaras i Aulan, Vårdhögskolan i Östergötland, Klostergatan 49, Linköping, fredagen 15 maj 1987, kl. 09.00.

ABSTRACT

This dissertation deals with the relationship between exercise, cardiorespiratory endurance (CRE) and some health effects in the form of sick leave, exercise injuries, perceived health and perceived symptoms. It also deals with exercise and CRE as important components in the Health Profile Assessment (HPB) used as a screening instrument.

The study is based on the following materials: A: all employees at Saab-Scania, Linköping in the age group 50—59 years (N = 1 313), B: a total study of persistent participants in a 1-year newspaper health information campaign in Linköping (N = 1 568), C: a random sample of the population of the city of Linköping (N = 248), D: employees at Saab-Scania, Linköping, in the age group 40 years (N = 162).

In material A only slightly more than half had an estimated maximal aerobic power higher than 2 lit 0_2/min, based on submaximal work tests on the bicycle ergometer. This means that relatively low levels of occupational work could become overtaxing and stressful for those with maximal aerobic power of less than 2 lit 0_2/min since it has been shown that nonexercisers can work at a sustained level (for 8 hours or more) at no more than 20—25% of their maximal CRE. In occupational medicine the evaluation of CRE seems to be of great importance in finding those who have low CRE and providing them with appropriate individualized counseling in regard to exercise. Of the risk factors high blood pressure, smoking, over- or underweight, no regular exercise, and low CRE, only "no exercise", as compared to regular exercise, showed a significantly higher rate of absenteeism in salaried employees.

In material B, one fourth of the participants who, prior to the campaign, suffered from headaches, back pain, stomach problems or sleeping trouble, thought their symtoms had decreased during the campaign, primarily due to changed exercise habits. The greater part of those who perceived less trouble had earlier suffered very often or quite often. Half of the participants reported that their general well-being was better and 42% felt they were healthier as a result of changed health habits in connection with the campaign.

In material B sixty-three persons (6.7%) reported that they had injured themselves in connection with exercising in such a way that they had to interrupt their exercise. There were significantly more regular exercisers who had been highly active before the campaign among those who had been injured compared with those who were not injured. However, there was no significant difference in those who felt somewhat or much healthier between the persons who were injured when exercising compared with those who were not injured.

In the HPB an estimation of maximal aerobic power is combined with self assessment of important health habits and health experiences to screen those who are considered to constitute individuals at risk, and who therefore ought to have a motive for revising their way of living. 15% of those in material D comprised a high risk group, who should most often undergo medical examination before joining various health education programs emphasizing regular physical activity.

Department of Preventive and Social Medicine
Linköping University, S-581 85 Linköping, Sweden
Linköping 1987

ISBN 91-7870-028-0 ISSN 0345-0082

Linköping University Medical Dissertations
No. 245

THE IMPORTANCE OF EXERCISE FOR SICK LEAVE AND PERCEIVED HEALTH

Gunnar Andersson

Department of Preventive and Social Medicine
Linköping University, S-581 85 Linköping, Sweden

Linköping 1987

This dissertation is based on the following papers

I. Andersson G, Malmgren S. Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59. Scand J Soc Med 1986; 14: 25–30.

II. Malmgren S, Andersson G. Who were reached by and participated in a one year newspaper health information campaign? Scand J Soc Med 1986; 14: 133–140.

III. Andersson G, Malmgren S. Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a one year extensive newspaper exercise campaign. Scand J Soc Med 1986; 14: 141–146.

IV. Andersson G, Malmgren S, Ekstrand J. Occurrence of athletic injuries in voluntary participants in a 1-year extensive newspaper exercise campaign. Int J Sports Med 1986; 7: 222–225.

V. Andersson G, Malmgren S. Health Profile Assessment as a screening instrument. Submitted for publication.

The articles will be referred to by their Roman numerals.

ISBN 91-7870-028-0
ISSN 0345-0082
Printed in Sweden by VTT-Grafiska, Vimmerby 1987

CONTENTS

ABBREVIATIONS AND DEFINITIONS 6

INTRODUCTION 7

Exercise — health effects 7

Importance of high cardirespiratory endurance (CRE) 8

The scope of the dissertation 8

AIMS OF THE INVESTIGATIONS 9

MATERIALS AND METHODS 10

A total study of employees at Saab-Scania, Linköping, in the age group 50-59 years (paper I) 10

A study of persistent participants in a 1-year newspaper health information campaign (papers II, III, IV) 11

A random sample of the population of the city of Linköping (paper II) 13

Health Profile Assessment, HPB, and the employees at Saab-Scania, Linköping, in the age group 40 years (paper V) 15

STATISTICAL METHODS 16

RESULTS 17

Risk factors and reported sick leave among employees of Saab-Scania Linköping, Sweden, between the ages of 50 and 59 with special emphasis on low physical activity (paper I) 17

Who were reached by and participated in a one year newspaper health information campaign? With special regard to exercise (paper II) 19

Changes in self-reported perceived health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign (paper III) 21

Occurrence of exercise injuries in voluntary participants in a 1-year extensive newspaper exercise campaign (paper IV) 22

Health Profile Assessment as a screening instrument (paper V) 23

DISCUSSION 26

The concept of health 26

Measurements of perceived health in the campaign participants (papers II, III, IV) 27

Dropouts in the risk factor study for sick leave (paper I) 27

Questions related to design and questionnaire responses (papers II, III, IV) 27

The external validity of the random sample from the city of Linköping (paper II) 28

Non-participation in the HPB-study (paper V) 28

Low physical activity as a risk factor (paper I) 28

The relation between physical activity and health is complex (paper I) 29

Beneficial effects of exercise (paper III) 29

Exercise as a risk factor for exercise injuries (paper IV) 30

Assessment of CRE - an important component in the HPB (papers I, V) 31

SUMMARY AND GENERAL CONCLUSIONS 33

ACKNOWLEDGEMENTS 34

REFERENCES 36

PAPERS

I. Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59 47

II. Who were reached by and participated in a one year newspaper health information campaign 55

III. Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign 65

IV. Occurrence of athletic injuries in voluntary participants in a 1-year extensive newspaper exercise campaign 73

V. Health Profile Assessment as a screening instrument 79

ABBREVIATIONS AND DEFINITIONS

Anthropometric measurements	Measurements of body height and skeletal diameters of the wrists (radio-ulnar) and the knees (at the condyle level of the femur) which are included in the determination of lean body mass.
CRE	Cardiorespiratory endurance based on a submaximal work test on the bicycle ergometer. CRE is extrapolated from the heart rate in circulatory steady state at a submaximal work load and is expressed in estimated maximal aerobic power, corrected for age (lit O_2/min).
Exercise	Physical activity that is planned, structured, repetitive and purposeful in the sense that improvement in or maintenance of one or more components of physical fitness is an objective.
External validity	The degree to which the obtained results can be generalized to the target population.
HPB	"Hälsoprofilbedömning", Health Profile Assessment.
LBM	Lean body mass.
Perceived exertion	An individual's assessment during the submaximal work test as to how strenuous he thinks the test is based on Borg's RPE-scale, 6–20.
Perceived general well-being	Self-reported, global affective experience rated on a positive-negative 5-point ordinal scale.
Perceived health	Self-reported health status.
Physical conditioning index	A figure for cardiorespiratory endurance expressed in % of an ideal value based on LBM and the submaximal work test on the bicycle ergometer.
Physical fitness	There are health-related and skill-related components of physical fitness. The health-related fitness components are cardiorespiratory endurance, muscular endurance, muscular strength, body composition and flexibility.

INTRODUCTION

Today's highly industrialized society, with its constantly developing technology and its improved standard of living, has created an environment and a way of life which have not always resulted in better health. In our attempt to optimize the health of the Swedish public, we are beginning to put more and more emphasis on the importance of good health habits (Carlsson et al 1979).

Exercise — health effects

An important health habit seems to be regular physical activity or exercise.

Exercise during leisure time has positive effects on man. These positive effects are well documented, especially within the fields of physiology and medicine (Fentem et al 1981, Strömme et al 1982, Pollock et al 1984, Powell et al 1985). Physiological effects of exercise are improved cardiorespiratory endurance, muscular strength and coordination, and energy balance. Exercise is also regarded as a beneficial factor in the treatment and rehabilitation of patient groups (Kottke et al 1984) with, for example, disorders in the locomotor apparatus (Staff 1982), coronary artery disease (Ehsani et al 1982), bronchial asthma (Oseid 1982), hypertension (Siscovick et al 1985), osteoporosis (Smith et al 1981, Siscovick et al 1985) and peripheral vascular disease (Soerli et al 1978).

Individuals engaged in vigorous exercise have a reduced mortality in regard to cardiovascular disease (Morris et al 1980, Paffenbarger et al 1984) and their total mortality is reduced (Breslow et al 1980, Salonen et al 1982). People who exercise also have better health (Belloc et al 1972, Morris 1973, WHO 1978) and less sick leave, on the average, than others (Cox et al 1981, Shephard et al 1982).

Well-designed studies of the experienced positive effects of exercise do exist, but they are few in number (Hughes 1984, Taylor et al 1985). Exercise can increase life satisfaction and animation (Shephard 1983), improve self-esteem (Taylor et al 1985) and body image (Eide 1982), and relieve anxiety (Mobily 1982, Taylor et al 1985), stress (Blumenthal et al 1980) and depression (Greist et al 1979). Exercise is also correlated with fewer mental health problems (Lundahl 1971, Pilz 1976, Haglund 1984).

However, few studies have been undertaken for the purpose of measuring the influence of exercise on psychosomatic symptoms (Fasting 1982, Haglund 1984) and perceived health in connection with extensive exercise campaigns.

Exercise offers many positive physiological and medical effects, but also involves risks for injuries. Of those who arrive at emergency departments with injuries, 6–15% have been injured while exercising (Skau et al 1979, Axelsson et al 1980, Lorentzon et al 1984).

There have been more studies of injuries due to competitive sports than of injuries due to exercise. Different studies of injuries among exercisers report varying frequencies of injuries (Kilbom et al 1969, Glick et al 1970, Lutter 1980, Maughan et al 1983, Raskin et al 1983). This can be due to differences in

age, types of exercise, and intensity of exercising and also to the length of the period of the study and the way in which injuries are defined and documented. However, there are few studies dealing with the extent of injuries sustained by exercisers in connection with mass media exercise campaigns. It is important that such studies be carried out, since extensive health campaigns have been in progress in Sweden for the last 15 years, and their goal has often been to make people start exercising. Research on the effects of exercising has been focused primarily on the positive benefits. We think it is also important to elucidate the negative effects of exercising in connection with extensive exercise campaigns.

Importance of high cardiorespiratory endurance (CRE)

An important health related component of physical fitness is cardiorespiratory endurance (CRE). A high level of CRE is related to fewer coronary risk factors (Cooper et al 1976, Brown et al 1983, Poole 1984). A low level of CRE has been shown to be related to a higher incidence of coronary heart disease (Gyntelberg et al 1980, Poole 1984).

There are both submaximal and maximal methods which can be used to measure CRE. In a population study it is important not to expose the participants to any risks in regard to the work tests. We have therefore chosen to use submaximal work tests for our material. An estimation of CRE can also be combined with other types of assessments to screen those who are considered to constitute individuals at risk and who therefore ought to have a motive for revising their way of living.

Over a period of 18 years we have developed a special method designated as "Hälsoprofilbedömning", HPB, (Health Profile Assessment) for this purpose. Important components in the HPB are an assessment of the person's health habits with emphasis on physical activity, how the person experiences his own health to be, and cardiorespiratory endurance. There is a high degree of readiness in the general public to utilize some type of regular health check-ups coupled with health counseling (Bygren et al 1983).

The scope of the dissertation

This dissertation deals with the relationship in several studies between exercise, cardiorespiratory endurance (CRE) and some health effects in the form of sick leave, injuries, perceived health and perceived symptoms. It also deals with exercise and CRE as important components in the Health Profile Assessment as a screening instrument.

AIMS OF THE INVESTIGATIONS

To study the connection between exercise and reported sick leave in a group of older industrial employees (paper I).

To determine in a comparative analysis of two investigations how many individuals were reached by and participated in a 1-year newspaper health information campaign and who these individuals were, as well as to report and discuss the dropouts and the questionnaire responses (paper II).

To shed light on self-reported general well-being and experienced psychosomatic symptoms and health in voluntary participants in the exercise part of a 1-year mass media campaign in Linköping (paper III).

To study the extent of self-reported athletic injuries in voluntary participants who showed persistent interest in a 1-year extensive newspaper campaign (paper IV).

To describe "Hälsoprofilbedömning", HPB, (Health Profile Assessment) and its theoretical background and to exemplify its use as a screening instrument for a group of 40-year-old employees at Saab-Scania in Linköping (paper V).

MATERIALS AND METHODS

This study is based on the following four materials:

- All employees at Saab-Scania, Linköping, in the age group 50–59 years (paper I).
- A total population study of persistent participants in a 1-year newspaper health information campaign (papers II, III, IV).
- A random sample of the population of the city of Linköping (paper II).
- Employees at Saab-Scania, Linköping, in the age group 40 years (paper V).

A total study of employees at Saab-Scania, Linköping, in the age group 50–59 years (paper I)

The study group included all 1 313 employees of Saab Aircraft Division, Saab-Scania, Linköping, in the age group 50–59 years. The entire study group is presented in Table I.

Table I. *All employees of Saab Aircraft Division, Saab-Scania, Linköping, Sweden, in the age group 50–59 years.*

	Men		Women		Total	
Workers	512	(94%)	33	(6%)	545	(42%)
Salaried employees	691	(90%)	77	(10%)	768	(58%)
Total	1 203	(91%)	110	(9%)	1 313	(100%)

In 1975 everyone in the study group was called during their working hours to the company's Physical Fitness Centre to be interviewed, weighed, measured and have several other physical measurements taken. The interview covered physical exertion at work, mode of travelling to work, smoking habits, physical training before age 20 and current exercise habits. The measurements taken included systolic blood pressure, height, weight and skeletal diameters of the wrists (radio-ulnar) and the knees (at the condyle level of the femur) (von Döbeln 1959). The blood pressure was taken after about 10 minutes in a sitting position. Submaximal work test were performed on mechanically braked bicycle ergometers (Åstrand 1977). A nomogram was used to estimate maximal aerobic power from the working pulse and the load, corrected for age (Åstrand 1960). Physical conditioning indices were calculated using skeletal weight and working pulse (von Döbeln 1965, 1966).

Information was also obtained from personnel records about sex, age and type of employment. For the workers the number of days reported sick in 1974 and 1975 was included. For the salaried employees the number of days reported sick between 1970 and 1975, as well as the educational level (low=elementary school, medium= secondary school, high=university) and level of responsibility

at work were taken into consideration. When rating the level of responsibility, the two main criteria used were work function and degree of difficulty (SAF 1975). A worker's sick leave included only the number of working days which he/she reported being sick (max 269 days/year). Salaried employees had a maximum of 334 days, including all the days of the year except holidays.

Those in the study group who failed to appear at the Physical Fitness Centre, despite personal contact, are categorized in Table II.

Table II. *Dropouts – reasons for not participating.*

	Workers		Salaried employees		Total
	Men	Women	Men	Women	
Declined because of physical handicap	53	2	30	3	88
Declined for other reasons	62	2	35	4	103
Reported sick	24	0	20	2	46
Deceased	0	0	1	0	1
Total dropouts	139	4	86	9	238
Percent dropouts	27%	12%	12%	12%	18.1%

A study of persistent participants in a 1-year newspaper health information campaign (papers II, III, IV)

In 1977–1978 the newspaper Östgötacorrespondenten (Corren) ran a 1-year campaign for better health in Linköping and Motala (Malmgren et al 1981). The campaign was called "Piggare med Corren" (Get Fit with the Corren) and included exercise, dietary and antismoking components. It was given a great deal of publicity in the newspaper with special supplements every week. Approximately ten informative meetings were arranged in Linköping with specialists from the University Hospital, the Saab-Scania Physical Fitness Centre and Linköping University, and readers' questions were answered in the newspaper. Cooperation was established with the local indoor and outdoor sports organizations which resulted in the formation of about twenty new exercise groups in Linköping. Company teams were formed and competitions were held between different places of work. There has probably never been a more intensive newspaper campaign in Sweden to increase people's awareness of their health.

The campaign started in April 1977 and ended in March 1978. Participants in the campaign registered voluntarily. Information on the participants was collected from registration forms, monthly reports, fitness tests and questionnaires. 2 887 persons registered for the campaign. The mean age of the registered participants was 40.4 years. 67% were women and 33% men. During the campaign the registrants sent monthly reports during the campaign to the newspaper with information about their exercise, weight and smoking changes. 1 622 (56%) of the 2 887 persons who registered for the campaign sent in monthly reports at

least once. 199 (7%) sent in all monthly reports. 1 212 of the 2 887 registrants expressed an interest in participating in a fitness test at the Saab-Scania Physical Fitness Centre in Linköping. All 1 212 were called, with 844 persons (70%) participating in the first test which took place between March and May, 1977. These 844 persons were called again one year later for follow-up. 255 persons participated in the second test in April 1978. The fitness test included interviews, measurements and a submaximal work test on the bicycle ergometer. The interview covered exercise and smoking habits. The measurements taken included systolic blood pressure, height, weight and the same anthropometric measurements as described earlier (von Döbeln 1959).

After the campaign a questionnaire was sent out in April 1978 to (Fig. 1):

A. All participants who had taken part in the first fitness test (844 persons).

B. All participants who had taken part in the "quit smoking" part of the campaign (418 persons).

C. All participants who had sent at least ten monthly reports to the newspaper (433 persons).

D. All participants who had sent in one or more of the last 3 monthly reports and who did not fit into one of the other categories (220 persons).

Of 1 568 participants who received the questionnaire, 935 persons (60%) returned it. The lowest response rate was among the participants in group B (39%), and the highest was in groups C (84%) and D (70%), i.e., those who sent in most of their monthly reports. The combination of categories containing the greatest number of persons who answered the questionnaire was comprised of those who took part in the first fitness test and who sent in 10–12 monthly reports.

The questions in the questionnaire pertained to exercise habits before the campaign and number of different exercise activities before and during the campaign. There were also questions about exercise injuries which had posed an obstacle to continued exercise and had also resulted in calls to a doctor and sick leave. The questionnaire included questions about diseases before the campaign, perceived symptoms before and after the campaign, and experiences of feeling more or less healthy/ill in connection with the campaign.

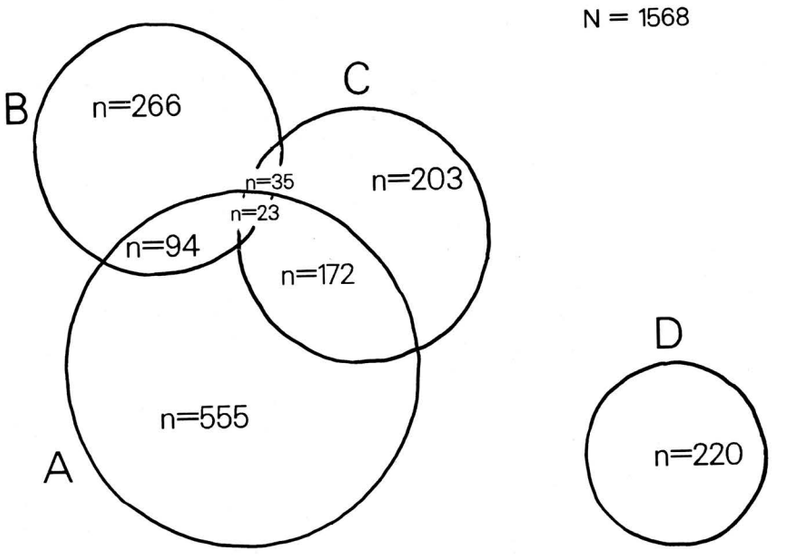


Figure 1. *Target group for questionnaire to registrants in the campaign (A) who participated in the fitness test (n=844), (B) who participated in the "quit smoking" part of the campaign (n=418), (C) who sent in 10–12 monthly reports (n=433), (D) who sent in at least one of the last three monthly reports and who do not fit into categories A, B, or C.*

A random sample of the population of the city of Linköping (paper II)

The sampling was carried out by the County Administration Data Section. The population is defined as inhabitants of the city of Linköping over the age of 17 years. There are 65 735 persons in the population and a random sample of 248 persons was used for this study (Fig. 2). A questionnaire was sent to this sample one year after the campaign ended. Of the 248 questionnaires sent out, 204 (82%) were returned or answered by telephone. The returned questionnaires were representative for the age distribution of the population, but men were slightly underrepresented. Of the 44 persons who did not return the questionnaire, 35 could not be reached,6 refused to answer, 2 were sick and 1 was deceased.

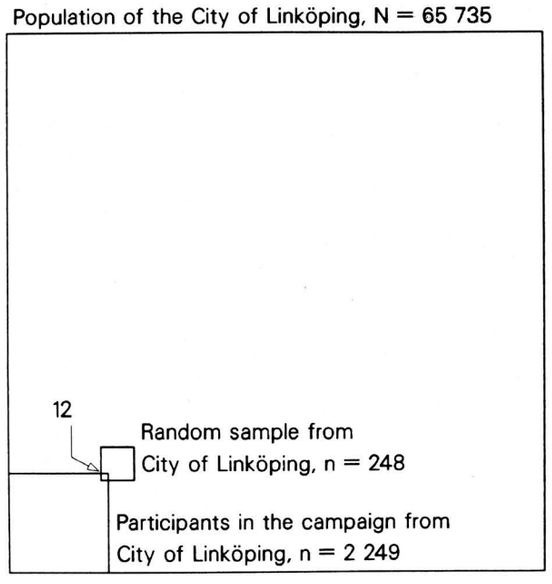


Figure 2. *The population, the registrants in the campaign and the random sample from the city of Linköping.*

The questions asked in the questionnaire were in reference to awareness of the "Piggare med Corren" campaign, exercise, dietary and smoking habits after the campaign, and attitudes toward exercise, diet and smoking after the campaign.

The percentages obtained in the random sample can be generalized to the population of the city of Linköping with a 95% confidence interval so that these lie within the following limits:

Percentage in the random sample	Percentage interval in the population
10%	6.5–15%
20%	15–26%
30%	24–36.5%
40%	33.5–47%
50%	43–57%
60%	53–66.5%
70%	63–76%
80%	74–85%
90%	85–93%

Health Profile Assessment, HPB, and the employees at Saab-Scania, Linköping, in the age group 40 years (paper V)

Since 1982 "Hälsoprofilbedömning", HPB, (Health Profile Assessment) has been carried out on employees at Saab-Scania in Linköping when they become 40 years old. The HPB has replaced the general medical check-up carried out on company employees in this age group. In 1982 there were 50 workers and 112 salaried employees who were 40 years old. 38 persons (23%) declined participation in the HPB. Of the 124 participating 40-year-olds, 10 (8%) were women.

The HPB comprises three components: self assessment of important health habits, self assessment of some health experiences, and some medical and physiological measurements. The HPB is begun with a conversation based on a questionnaire, which is followed by measurements of blood pressure, anthropometric measurements, and a submaximal work test on the bicycle ergometer, and it is completed with a discussion. The dialogue is begun with questions about physical activity prior to the age of 20 years and the person's current job situation.

The questionnaire consists of eleven questions on a 5-point ordinal scale the answers to which shed light on some important health habits and what the participant considers his state of health to be. Only one of the five given response alternatives can be chosen. The questions are based on having the participant make a self assessment which reflects his awareness and conceptions that are associated with the respective questions.

All questions refer to the past month and the first five questions in the questionnaire concern: *mode of transportation to work*, *leisure-time activities*, *exercise* (in sweat suit or appropriate training clothes for the purpose of maintaining or improving one's physical condition or health), *diet*, and *tobacco use*. The person conducting the dialogue and test transfers the answers from the questionnaire to a new form and by means of supplementary questions tries to help the person undergoing the HPB to determine whether he has correctly understood the questions and answered them accurately. He then has a chance to revise his assessment. The next two questions concern *alcohol intake* and *drug consumption* (tranquilizers, stimulants, or drugs for sleep and/or pain relief). The final questions concern the individual's perception of psychosomatic *symptoms*, *stress*, *loneliness* and *health*.

The measurements are begun with systolic and diastolic blood pressure. Overweight and underweight are assessed by the same anthropometric measurements as described earlier (von Döbeln 1959). The measurements are followed by a submaximal work test on the bicycle ergometer in which the individual also makes an assessment as to how strenous he thinks the test is based on the so-called RPE-scale, 6-20 (Borg 1970, 1982).

STATISTICAL METHODS

The information was computer processed (papers I, II, III, IV). The material was processed with standard statistical packages SPSS (papers I, II, III, IV) and OSIRIS (paper I). The statistical methods used were AID analysis (paper I), paired t-tests (papers I, II), Fisher's exact test (paper II) and the chi-square test (papers II, III, IV).

AID-analysis is a "stepwise analysis" in which the material to be analysed is successively divided into two mutually exclusive parts in such a way that they differ as significantly as possible from each other with respect to the dependent variable. After the first division, the two groups obtained are divided, and these groups are in turn divided into two groups, still with respect to those predictors giving the strongest possible contrast regarding the dependent variable.

RESULTS

Risk factors and reported sick leave among employees of Saab-Scania between the ages of 50 and 59 with special emphasis on low physical activity (paper I)

Earlier drop-outs in the 50–59 year old salaried employees and workers 1964–1975

In order to gain some idea as to the systematic error caused by earlier drop-outs due to death, early retirement and disability retirement, a retrospective comparison was undertaken between salaried employees and workers between the ages of 50–59 for the years 1964–1975. This comparison showed that more workers (5%) than salaried employees (3%) had died, and that a considerably greater number of individuals had been awarded disability pensions or had gone into early retirement among the workers (5%) than among the salaried employees (1%) ($p<0.01$).

Groups with high vs. low rates of sick leave

AID-analysis was used to analyse the number of sick leave days in 1974–1975 for the workers and in 1970–1975 for the salaried employees. As predictors we used sex, age, blood pressure, physical conditioning index, smoking, exercise, weight, estimated maximal aerobic power, overweight, participation in the interview/measurements and the completion of the work test. Educational level and level of responsibility were also used as predictors for the salaried employees.

With regard to days absent for the workers, further breakdown into smaller groups as unlike each other as possible could only be done via the predictor "participant in interview/measurements". Those who had not participated in the interview and measurements were defined as the group with the highest rate of absenteeism, a mean of 82 days as compared with a mean of 27 days absent for the participants. The other predictors were not strong enough to warrant further subdivision.

Of the 759 salaried employees, 166 did not participate at all in the investigation, or else they only participated in the interview, during which they said that they did not exercise. These formed a high-risk group whose mean absence was almost three times that of the others.

Risk factors and sick leave

The five risk factors that we have included are *smoking* (more than 0 cig/day), *weight* (more than: *LBM* + 20% (men), *LBM* + 35% (women) or less than *LBM* as calculated anthropometrically), *systolic blood pressure* (> 160), *exercise* (occasional or not at all), and *physical conditioning index* (lower than mean, men: < 87, women: < 73).

When risk factors and sick leave are correlated, little or no exercise among the salaried employees yielded a significantly higher rate of absence.

Both workers and salaried employees who did not exercise regularly and were either over- or underweight had more absenteeism. If the salaried employees who had all three risk factors, i.e. weight, physical inactivity and low physical conditioning index, are compared with those salaried employees who lacked all three, the rate of absence of those with the risk factors is three times that of those without them.

Workers who had a physical conditioning index higher than the mean, but who did not exercise and whose weight was in the risk zone, had 30 absence days as compared with 8 absence days for workers whose physical conditioning index was lower than the mean but who lacked the risk factors of weight and exercise.

A physical conditioning index lower than the mean among the salaried employees yielded an increased rate of absence, whereas a similar low physical conditioning index for workers was related to a high (not significant) rate of sick leave only when combined with all the other risk factors.

When we combine the risk factors smoking and weight, smoking and exercise, and weight and exercise, we find that the combinations in which a low amount of exercise is included show increased sick leave among both salaried employees and workers.

Cardiorespiratory endurance (CRE)

Of the 1 313 50–59-year-olds, 238 (18%) did not participate. An additional 154 persons (12%) either were unable to complete the work test on the bicycle ergometer, despite the lowest load (50 W), or else they were taking antihypertensive medication (beta-blockers) which also affect the working pulse, thereby making an estimation of maximal aerobic power impossible. Besides these individuals, 16% of the target group had an estimated maximal aerobic power below 2 lit O_2/min, a CRE corresponding to stair climbing, which is equivalent in this age group to a "somewhat low" level of CRE for men and an "average" level for women (Andersson et al 1984). Accordingly, only slightly more than half the target group had an estimated maximal aerobic power higher than 2 lit O_2/min.

Follow-up 1985

In 1985 an additional follow-up was done of the employees in the study group in question. By that time 408 salaried employees and 308 workers had retired. Of those salaried employees who should still have been part of the group based on their ages (n=360), 10.2% (n=37) had died, retired early or been forced to retire early due to disability during the period 1975–1985.

Of the workers who should still have been in the group (n=237), 14.3% (n=34) had died, retired early, or been forced to retire early due to disability during the period 1975–1985. This was a significantly greater number as compared with the salaried employees ($p<0.05$).

Of the 34 workers who died, retired early or were forced to take a disability pension during the period 1975–1985, 47% (n=16) did not take part in the study in 1975, 18% (n=6) were part of the "incomplete work test" group, and an additional 18% (n=6) had an estimated aerobic power of less than 2 lit O_2/min. None of the participating 18 individuals did any exercising in 1975. Of the 37 salaried employees who died, retired early or were forced to take a disability pension during the same period of time, 16% (n=6) did not participate in the study in 1975, 19% (n=7) belonged to the "incomplete work test" group, and an additional 16% (n=6) had an estimated maximal aerobic power of less than 2 lit O_2/min.

Who were reached by and participated in a one year newspaper health information campaign? With special regard to exercise (paper II)

The registrants in the campaign

Slightly more than half of the registrants who did not answer the questionnaire (52%) participated in the first fitness test. This makes it possible to study the non-response and dropout problems by an analysis of the results from both fitness tests. A model of this analysis is presented in Fig. 3. In the following comparisons, questionnaire response (comparisons 1, 2 and 3), dropout (comparison 4) and participation (comparison 5) are studied.

	Analysis of results from fitness **test one**		Analysis of results from fitness **test two** in group participating in both tests
	Participated **only** in **test one**	Participated in **both** test one and test two	
Answered the questionnaire	A n=303	B n=214	E n=214
Did not answer questionnaire	C n=286	D n=41	F n=41

N=844

Figure 3. *Model for analysis of the results of the fitness tests.*

1. In comparing A + B to C + D, differences in starting values in fitness test one for those who answered and those who did not answer the questionnaire can be seen. The comparison shows that the group that did not answer the questionnaire contains more non-exercisers ($p<0.01$) and more smokers ($p<0.01$), compared with those who answered the questionnaire.

2. In the comparison between B and D, the initial values in fitness test one are analysed for those who were motivated enough to come back for the second test. Even in this motivated group we find that the group that did not answer the questionnaire contained more smokers ($p<0.05$) and a tendency to more non-exercisers, which was not significant, however, compared with those who answered the questionnaire.

3. The changes from B to E are compared with the changes from D to F. This analysis shows whether there is any difference from test one to test two between the groups which had answered and those which had not answered the questionnaire. The results show that very few of the persons who returned for the second test did not answer the questionnaire, and also show that both groups had positive changes with regard to exercise and smoking habits. Non-exercisers decreased from 19% to 4% and smokers from 19% to 10% in the group answering the questionnaire. The corresponding figures for those who did not answer the questionnaire are 27% to 17% for non-exercisers and 34% to 22% for smokers. The differences in improvement in these two groups, however, are not significant. When these groups are compared, we also find a significant decrease in weight ($p<0.01$) and a significant increase in estimated maximal aerobic power ($p<0.05$) in the group that answered the questionnaire, whereas no improvements were found among those who did not answer the questionnaire.

4. A comparison is made between those who came for just the first test (A + C) and those who came for both tests (B + D), and this illustrates the problem of dropout. When the starting points in fitness test one of these two groups are compared, we can see that the group which did not come back a second time contained more non-exercisers ($p<0.01$) and more smokers ($p<0.05$), and that the mean age was lower ($p<0.01$) compared with those who came for both tests (B + D). The estimated maximal aerobic power was also significantly higher in B + D compared with A + C ($p<0.05$).

5. The comparison between B and C illustrates the difference in the starting values in fitness test one for those who participated the most (group B) and the least (group C), respectively, with the regard to both tests and questionnaires. The analysis shows that the group which participated least (group C) consisted of more non-exercisers ($p<0.01$) and smokers ($p<0.001$) compared with group B. The average age was also lower ($p<0.01$) in group C compared with group B.

Random sample from the city of Linköping

Six percent of the sample reported that they participated in and followed the campaign regularly. There are no significant differences between the sexes, in spite of the fact that women said that they paid more attention to the campaign than men. Clearly, awareness of the campaign in the city was high, as only 3% said they had not heard of it and the majority had read about it.

Changes in self-reported perceived health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign (paper III)

Exercise habits

Most of the campaign participants registered for the campaign in the first place in order to get in better physical condition (62%) and in order to feel better (57%). Half of them said, in connection with their registrations, that they already exercised before the start of the campaign. Of the 935 persons answering the questionnaire, only 50 persons said that they never exercised before the start of the campaign.

The mean number of different exercise activities before the campaign was 2.0 compared to 2.5 during the campaign, which indicates a mean increase of 0.5 activities per participant.

Only 62 persons (6.5%) had a smaller number of different exercise activities (mean= −1.1) during the campaign as compared with before the campaign. These persons had more than the mean number of exercise activities before the campaign. 375 persons (40%) had more different exercise activities (mean= +1.5) during than before the campaign, and before the campaign they had fewer than the mean number of activities.

Symptoms before the campaign

In the group answering the questionnaire, there were many participants who reported that they suffered from problems, and these problems often or quite often, consisted of backpain (37%), headache (31%), sleeping trouble (26%) and stomach problems (25%). Most of the participants with sleeping trouble or stomach problems also had one or several other kinds of symptoms. 101 persons were not completely free from any of these four kinds of symptoms.

Symptoms after the campaign

One fourth of those with symptoms before the campaign experienced that their headache, backpain, stomach problems or sleeping trouble had decreased after the campaign. 2-4% felt that their symptoms had increased. Most of them were of the opinion that the change in their symptoms was the result of changed exercise (n=127), diet (n=63) and smoking (n=33) habits. The majority of

those with less headache (68%), backpain (64%), stomach problems (63%) or sleeping trouble (54%), respectively, previously suffered very often or quite often ($p<0,01$).

Half of the participants reported that their general well-being was much better or somewhat better, and 42% perceived themselves as much healthier or somewhat healthier due to changed health habits in connection with the campaign.

Exercise habits — general well-being and perceived health

Most of the persons whose general well-being was much better were in the group with more different exercise activities during the campaign than before. Those who increased their exercising most and those who had the highest total mean number of exercise activities (3.6) were also found in this group ($p<0,01$).

Those who decreased their exercising most, i.e. a mean of 1.2 exercise activities fewer than before the campaign were in the group whose general well-being was neither better nor worse.

There is a corresponding relationship ($p<0,01$) between changed exercise habits and the experience of feeling healthier/more ill due to the campaign. Almost double as many individuals, 62% as compared to 34%, increased their exercising in the group which felt much healthier as compared with those who felt neither healthier nor sicker. The largest increase in the mean number of exercise activities (+1.8) as well as the largest total number of exercise activities (3.5) during the campaign were also found in the group that felt much healthier.

Occurrence of exercise injuries in voluntary participants in a 1-year extensive newspaper exercise campaign (paper IV)

Exercise habits

Only 50 persons (5%) said that they did not exercise before the campaign, 44% exercised at least 1–2 times a week, and the rest exercised occasionally. In this respect there was no difference between men and women, but there was a difference regarding change of exercise habits, which was indicative of whether or not the exercisers had begun new and different exercise activities. 43% of the women and 35% of the men ($p<0.05$) participated in a greater number of different exercise activities during the campaign than before it. 6% of the women and 8% of the men participated in fewer different exercise activities.

Exercise injuries

Of those who answered the questionnaire, 63 persons (6.7%) reported that they had been injured in connection with exercising during the campaign so that they could not continue exercising; 18 persons had to discontinue exercise for more than 1 month. Of the 63 injured persons, 26 were men (8.3% of the men who answered the questionnaire) with a mean age of 34.6 years, and 37 were women (5.9%) with a mean age of 39.4 years.

As a result of the exercise injuries, 37 persons consulted a doctor an average of two times. One person said he was hospitalized for one week due to the injury. A total of 19 persons were reported sick for an average of 1 month because of exercise injuries and three of these were reported sick for more than 1 month.

Regarding the part of the body injured most frequently, injuries to the the lower legs predominated and comprised 64% of all injuries. Only five persons reported that the injuries resulted from bodily contact.

Exercise injuries — exercise habits

15% of the individuals in the group which exercised 3–5 times a week before the campaign were injured as compared with 6.5–8% of those who did not exercise regularly before the campaign ($p<0.05$).

The mean number of different exercise activities/participant before the campaign was 2.5 for the injured persons and 2.0 for the others ($p<0.01$). The increase in the mean number of activities/participant was not significantly greater for the injured individuals: 0.6 compared with 0.5 activities for the noninjured participants.

Exercise injuries — perceived health

The injured persons were compared with the other participants who answered the questionnaire as to whether the campaign had influenced their habits of living so that they felt healthier/sicker. Among the persons who felt somewhat or much healthier, there was no significant difference between those who were injured when exercising, as compared with those who were not injured. 44% of the injured participants felt somewhat or much healthier as a result of the campaign. None of the injured participants felt sicker because of the campaign.

Health Profile Assessment as a screening instrument (paper V)

Presentation of the results from the Health Profile Assessments of the 124 participating 40-year-old employees is based on the extent to which negative components were found in the examinations of each person. The components are comprised of the individual's health habits, perceived health and physiological/medical test measurements. The following limits have been chosen: (Table III)

Table III. *Limits and frequency distribution of negative components originating from "Hälsoprofilbedömning", (Health Profile Assessments) carried out on 124 40-year-old employees at Saab-Scania in Linköping.*

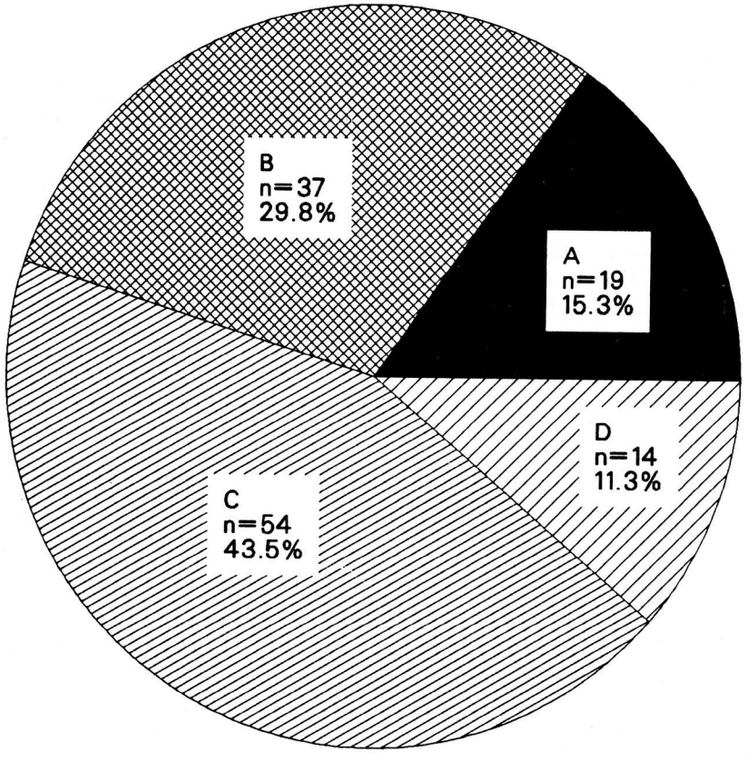
	Limits	Number of persons (n)
Exercise	1–2	61 (49%)
Diet	1–2	68 (55%)
Tobacco use	1–4	39 (31%)
Alcolhol intake	1–2	1 (1%)
Drug consumption	1–2	5 (4%)
Symptoms	1–2	26 (21%)
Perceived stress	1–2	25 (20%)
Perceived loneliness*	1–2	—
Perceived health*	1–2	—
Blood pressure	Too high	8 (6%)
Cardiovasc. Medic.	Yes	1 (1%)
Diabetes	Yes	0 (0%)
Weight	Overweight or underweight	14 (11%)
Cardiorespiratory endurance (CRE)	1–2	17 (14%)

* Questions not included in this study

49% of the 124 40-year-old employees participating in the HPB did not exercise regularly and 14% had low cardiorespiratory endurance.

The participants' low CRE, perceived stress, troublesome symptoms, high blood pressure according to (Andrén et al 1983), and overweight or underweight go along with poor health habits. Only 8 of the 44 participants with burdensome stress and symptoms had these problems without having them coupled with low CRE, poor health habits, high blood pressure, overweight or underweight.

The majority of the 40-year-old employees (55%) had only 0-2 negative components according to the definitions in Table III. 15% had high blood pressure, took cardiac medication, were stressed very often, had very poor CRE (Fig. 4) or had a total of at least four negative components.



A. High blood pressure, cardiac medication, very often stressed, experiences some symptom very often, very low cardiorespiratory endurance or a total of >3 negative components.

B. 3 negative components or totally inactive physically.

C. 1–2 negative components.

D. 0 negative components.

Figure 4. *Presence of negative health components in 124 40-year-old employees participating in "Hälsoprofilbedömning", HPB, (Health Profile Assessment).*

DISCUSSION

The concept of health

The concept of health is complex and no clear definition exists. Among the definitions of and the different theories about the concept of health which are found in the literature today, a development toward a totally holistic concept can be clearly perceived, and more and more importance has been attached to subjective health. This can be illustrated by an increasing number of studies within this field. It has been shown that perceived health is a strong predictor of mortality (Singer et al 1976, Kaplan et al 1983), independent of physical health status. It is also apparent that the connection between perceived health and mortality is not entirely a function of their mutual relationship with objective health status (Mossey et al 1982, Goldstein et al 1984, Hunt et al 1984).

This is in line with the WHO definition which is that health is a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity. The presence or absence of functional disorders in the individual are found in the more objective dimensions of the concept of health. A traditional measure of poor health is sick leave. Short periods of sick leave decrease with increasing age, while long periods increase (Eriksen 1980). In a total population study of 50–59-year-old individuals, we used sick leave as a measure of poor health (paper I). In 1975 more than 30% of both the salaried employees and the workers took no sick leave at all, and 5% accounted for 50% of the sick leave (Malmgren et al 1984). The number of sick days appears to be fairly constant when viewed over longer periods. However, the uneven distribution is not as pronounced as the one year statistics show, but it is still considerable (Malmgren et al 1984). The reported sick leave in this age group is mainly a matter of the long-term absence of a minority of employees as well as increasing absenteeism among this same minority (Malmgren et al 1984).

Sick leave provides a limited understanding of health, and it is difficult to evaluate health and well-being by using absolute and measurable criteria. Many people have psychosomatic symptoms; more than 15% suffered from recurrent headache, closer to 20% had sleeping trouble, more than 35% had back pain (SOS, SCB 1985), often without any provable somatic changes. In spite of this, the symptoms must be taken seriously. Many of them require medical treatment notwithstanding the absence of provable somatic changes. There is often no correspondence between provable somatic changes and symptoms with reference to stomach problems, backpain, headache and sleeping difficulties. Thus medical treatment for these kinds of symptoms consequently is often based on subjective experiences of the patient. It is being noticed more and more frequently that too high a consumption of sedatives and tranquilizers can lead to addiction and injurious effects. It is therefore of great importance, both from the point of view of the individual and society, to find alternative methods of treatment.

Measurements of perceived health in the campaign participants (papers II, III, IV)

Using a questionnaire, we retrospectively asked the most persistent campaign participants about their experiences of changed health and symptoms after the campaign as compared to before it began (papers II, III, IV). There were structured questions and the answer alternatives were standardized along a five-point ordinal scale with a neutral point in the middle. If verbal descriptions of quantitative data are used, numerical differences can be obtained between indviduals or groups despite the fact that there are no actual differences (Langlet et al 1983). In order to decrease the problem of interindividual differences, we put the emphasis on the account of intraindividual experiences of *changes* in symptoms and in health.

Dropouts in the risk factor study for sick leave (paper I)

The material in paper I, consisting of the 50–59-year-old employees at Saab-Scania in Linköping, was used for a complete investigation of employees in a special industrial field survey, and the observed differences between the subgroups are factual. The cross-sectional design of this investigation limits its use to the assessment of the current degree of relationship between different risk factors and absenteeism. The total number of dropouts was 238, or 18%. The dropout rate was clearly greatest among the workers. It is important to note that in the retrospective comparison between salaried employees and workers between the ages of 50–59 for the years 1964–1975, 5% of the workers had been awarded a disability or early retirement pension, whereas only 1% of the salaried group fell into this category ($p<0.01$). The comparison of the present situation between workers and salaried employees does not, therefore, give a complete picture of the reported sick leave.

The number of sick leave days was three times as high in the dropout group. Some of these individuals were on the sick list during the time we carried out the investigation and were therefore not available. Others could not be convinced to participate. This makes it more difficult to analyse accurately the importance of individual risk factors as related to absenteeism. In this case, the relationship could be underestimated.

Questions related to design and questionnaire responses (papers II, III, IV)

We wanted to illustrate the perceived health effects in those who had changed their dietary, exercise and smoking habits as a result of the campaign. Therefore we looked for a group of individuals who persistently participated in the campaign.

79 % of the group who returned at least 10 monthly reports responded to the questionnaire. We probably received responses from those who had been

the most successful in improving their habits. This is reinforced by our analysis of the group of campaign registrants who took the fitness test. Those who took the fitness test comprise slightly more than half of the individuals who did not answer the questionnaire. The analysis showed that those who answered the questionnaire improved their estimated maximal aerobic power to a greater extent than those who did not answer the questionnaire. The analysis showed that the group who answered the questionnaire contained fewer smokers and non-exercisers before the campaign began than the group which did not answer the questionnaire.

We find the same pattern in a comparison between those who took one or both fitness tests. Those who came back at the end of the campaign for the second fitness test initially had better exercise and smoking habits as compared with those who took only the first fitness test.

The most persistent participants apparently already had better health habits than the rest of the registrants at the beginning of the campaign. For obvious reasons they were also the most willing to discuss their results.

This dropout analysis shows that those in our total population study who answered the questionnaire were also the most persistent participants in the campaign.

The external validity of the random sample from the city of Linköping (paper II)

The random sample from the city of Linköping is small (paper II). A 95% confidence interval in this sample yields such uncertainty that generalization to the population is limited. Those generalizations which are made to the population of Linköping have to be interpreted very cautiously.

Non-participation in the HPB-study (paper V)

The material in paper V is only used to exemplify the HPB as a screening instrument. A study of sick leave showed that those who did not show up for a HPB were those with the highest rate of sick leave. They are probably the individuals with the greatest need for rehabilitation and retraining to sounder health habits.

Low physical activity as a risk factor (paper I)

Low physical activity could be a risk factor for poorer future health status (Wiley et al 1980). In the risk factor study (paper I), a low degree of exercise during leisure time was the only sole risk factor correlated to a significant increase in absenteeism among salaried employees. If this risk factor is combined with the weight risk factor (over-or underweight) or the smoking risk factor, the rate of absenteeism also increases for the workers.

The relation between physical activity and health is complex (paper I)

The risk factor low physical conditioning index has a different relationship to sick leave for workers as compared to salaried employees (paper I). Salaried employees who had a physical conditioning index lower than the mean had increased rates of absenteeism, whereas workers who had a similarly low physical conditioning index had high (not significant) rates of absenteeism only when the risk factor was combined with all the other risk factors. A greater number of workers than salaried employees had active or physically strenous jobs, but considerably fewer exercised during their leisure time. This suggests that physical conditioning indices for workers are influenced to a greater degree by the physical demand of their work than is the case for salaried employees. This indicates that there is a complex relationship between physical activity and health. Whether the relationship is dependent on physiological or other effects from exercise is not obvious. The motivation to exercise might be a part of other good health habits. However, there are studies which have demonstrated direct effects of exercise on health indicators (Seals et al 1984, Haskell 1986).

Beneficial effects of exercise (paper III)

Of the participants in the campaign who answered the questionnaire, one fourth felt that their headache, backpain, stomach problems or sleeping trouble had decreased mainly as a result of changed exercise habits in connection with the campaign. The majority of those who had fewer symptoms had previously had symptoms often or quite often. Headache, backpain, stomach problems and sleeping trouble are often classified among psychosomatic symptoms (Fasting 1982, Haglund 1984). A relationship between unfavourable stress and psychosomatic symptoms is very likely. In our study most of the participants with sleeping or stomach problems also had one or more other kinds of symptoms. Since exercise has a positive effect on unfavourable stress (Blumenthal et al 1980), an increase in different exercise activities constitutes a possible explanation for the reported decrease in symptoms. The fact that all symptoms decreased to about the same extent provides positive evidence for such a general explanation.

Explanations for recovery from psychosomatic symptoms can also be sought in the positive physiological effects of exercise (Fentem et al 1981, Strömme et al 1982). This can also apply to reported improvements in general well-being and the health experience by almost half of the participants. 42% experienced that they felt healthier and 50% experienced an improved sense of well-being as a result of changed health habits in connection with the campaign. The results also showed greater improvement in general well-being and perceived health changes in the group that was most physically active during the campaign.

Recent studies have demonstrated that concentrations of circulatory beta-endorphin increase in response to exercise (Allen et al 1983). It has been sug-

gested that this increase in the endogenous opioid peptide secretion may be responsible for an increase in the pain tolerance level associated with exercise (von Knorring et al 1978).

The improvements could also be regarded as "placebo effects" (Haas et al 1963). By placebo effect we mean both the spontaneous course of the symptom and the influence of suggestion (Lindahl 1983). This does not make the improvements any less valuable.

The fact that positive results have been obtained without either therapeutic or pharmacological treatment shows that one way in which to improve the feeling of well-being and to alleviate psychosomatic symptoms for people in general is to improve their habits of living, in particular their exercise habits. The study shows that this can in fact be accomplished via an extensive mass media campaign.

Exercise as a risk factor for exercise injuries (paper IV)

Other risks with exercise, such as sudden cardiac death, are not included in the study.

The campaign did not succeed in activating nonexercisers. Only 5% of those who answered the questionnaire reported that they did not exercise before the campaign (paper IV).

A comparison with other studies showed that the campaign "Piggare med Corren" resulted in a definitely lower rate of injuries: 6.7% as compared with 37–90%. Possible explanations may be:

— The rate of injury in our study was based only on the participants' reports in the ensuing questionnaire. There was no medical follow-up as was done in some other studies (Kilbom et al 1969, Lutter 1980, Raskin et al 1983).

— Our questions only referred to injuries that required cessation of training. Consequently, there may well have been milder injuries sustained (Glick et al 1970).

— Those who were injured at the beginning of the campaign and were then afraid to continue exercising (Glick et al 1970, Maughan et al 1983) were not included, since we only studied those who diligently took part in the campaign.

— Our study comprised persistent participants in an extensive exercise campaign who exercised with varying degrees of intensity and varying numbers of exercise forms. Most other studies comprise smaller, more homogeneous groups with a high degree of exercise intensity (Lutter 1980, Maughan et al 1983).

In our study we have not calculated the total risk for injury at the start of an exercise campaign, since we have chosen to record only those injuries which were serious enough to result in a cessation in exercise. There is reason to

believe that the total injury risk was actually higher than what was reported. Consequently, it is important to understand the seriousness of our results. More than one-half of the injured persons went to see a doctor, which has also been observed in other studies (Maughan et al 1983). Almost every third injured person was absent from work due to illness for an average of 1 month.

It is also important to note that persons with low levels of activity who start exercising are not the ones who run the greatest risk of sustaining injury. The rate of injuries seems to depend on the number of different activities, whether or not they have recently been initiated. There was no significant difference in injuries between the group which had increased its mean number of activities from 1.8 to 3.2 and the group which maintained the same 3.2 activities. However, exercise frequency seemed to be of great importance. The rate of injuries was about double in the group who had exercised 3–5 times a week before the campaign as compared with beginners and less active exercisers. Consequently, too high a level of exercise seemed to increase the risk for injuries. This is in line with other studies (Allman 1971, Lutter 1980, Orava 1980, Piterman 1982, Renström et al 1985). Therefore, before launching extensive mass media exercise campaigns, it would seem important to research whether, from the point of view of good health, there is an optimal amount and intensity of exercise and, if possible, to define it in numbers of occasions and types of activities with an individually graded successive increase. This is important since exercise campaigns primarily reach those who are already physically active.

The lower extremities are most prone to injuries (Glick et al 1970, Lutter 1980, Maughan et al 1983, Temple 1983). Strain on the legs while exercising can be reduced with good sports shoes of the right construction. A suitable warm-up program which increases joint flexibility and strengthens the muscles prevents injuries (Ekstrand et al 1983, Möller et al 1985) and should be emphasized in mass media campaigns.

It is also important that "minor injuries" and pain signals not be neglected. Much can be done to minimize the risks of injury when exercising (Allman 1971, Piterman 1982, Ekstrand et al 1983). Health information designed to increase the number of regular exercisers in Sweden should be supplemented by measures to be used for the prevention of injuries.

Assessment of CRE — an important component in the HPB (papers I, V)

Many people have a low cardiorespiratory endurance (Jonsson et al 1979). In our study (paper I) almost half of the material probably had an estimated maximal aerobic power of less than than 2 lit O_2/min. It has been observed that non-exercisers can work at sustained levels (for 8 hours or more) at no more than 20–25% of their maximal CRE (Serfass et al 1984). It has also been shown that many individuals overestimate their CRE (Optenberg 1984). This means that very low levels of occupational work could become overtaxing and stressful for those with maximal aerobic power of less than 2 lit O_2/min.

In occupational medicine the evaluation of CRE seems to be of great importance in finding those who have a low CRE and providing them with appropriate individualized counseling in regard to exercise. Methods for assessment of CRE which measure the consumption of oxygen at maximal dynamic effort have the smallest amount of error (Hammond et al 1984). There are, however, risks present with exercise stress tests (Atterhög et al 1979), even if they are minimal in normal materials. In papers I, II and V, a submaximal work test on the bicycle ergometer is used for estimation of maximal aerobic power. During the final minute on the bicycle, the participant is asked to assess his perceived exertion according to the so-called RPE-scale (Borg 1982). In a comparison of this value with an assessment of working pulse on a 7-point scale and the previously reported exercise habits, an estimate is also made of possible deviations from the average maximal pulse frequency for the age in question.

In the HPB an estimation of maximal aerobic power is combined with other assessments to screen those who are considered to constitute individuals at risk and who therefore ought to have a motive for revising their way of living. Participants in a HPB are given the opportunity to discover the significance of a high level of cardiorespiratory endurance (CRE) and exercise as an important health habit.

SUMMARY AND GENERAL CONCLUSIONS

An important component of physical fitness is cardiorespiratory endurance (CRE). In a group comprised of all 1 313 employees aged 50–59 years at Saab-Scania, Linköping, only slightly more than half had an estimated maximal aerobic power higher than 2 lit O_2/min. This means that relatively low levels of occupational work could become overtaxing and stressful for those with maximal aerobic power of less than 2 lit O_2/min, since it has been shown that non-exercisers can work at a sustained level (for 8 hours or more) at no more than 20–25% of their maximal CRE (Serfass et al 1984).

Of the risk factors high blood pressure, smoking, over- or underweight, no regular exercise, and low CRE only "no regular exercise", as compared to regular exercise, showed a significantly higher rate of absenteeism in the group 50–59-year-old salaried employees.

One fourth of the participants in a one year newspaper health information campaign who had suffered from headaches, back pain, stomach problems or sleeping trouble, prior to the campaign, felt that their symptoms had decreased during the campaign, primarily due to changed exercise habits. The majority of those who felt that their symptoms were decreased had previously suffered from them very often or quite often.

50% of the participants reported that their general well-being was improved and 42% felt that they were healthier as a result of changed health habits in connection with the campaign.

Sixty-three persons (6.7%) reported that they had injured themselves while exercising during the campaign so that they were forced to stop exercising. Thirty-seven persons consulted a doctor and 19 persons were absent from work for in average of 1 month because of exercise injuries.

There were significantly more regular exercisers who had been highly active before the campaign among those who were injured as compared with those who were not injured. When launching a mass media exercise campaign, measures for preventing injuries should be included.

Among those who felt healthier, there was no significant difference between the persons who were injured while exercising and those who were not injured. 44% of the injured participants felt somewhat or much healthier as a result of the campaign.

In the HPB an estimation of maximal aerobic power is combined with self assessment of important health habits and health experiences to screen those who are considered to constitute individuals at risk, and who therefore ought to have a motive for revising their way of living. 15% of a group of 40-year-old employees comprised a high risk group who should almost without exeption undergo a medical examination before joining various health education programs emphasizing regular physical activity.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to:

Professor Per Bjurulf, head of the Department of Preventive and Social Medicine, Linköping, for his tutorship. His guidance in critical scientific thinking, arguing and writing has been of invaluable help.

Professor Per Gunnar Svensson, WHO, Copenhagen, who was my assistant tutor at the beginning of the research project.

Professor Nils-Holger Areskog, for his constructive criticism and support.

Sture Malmgren, manager of Saab-Scania Physical Fitness Centre, Linköping, for our long, unwavering, very positive and rewarding collaboration throughout the entire project.

Jan Ekstrand, head of the Sports Clinic, Department of Orthopaedics, Linköping, for our fruitful collaboration on one of the papers.

Cajsa (Eva-Karin) Andersson, Linköping University Computer Centre, LIDAC, for invaluable assistance with the computer analysis of the results, for producing the figures, doing the layout and phototype setting. Also for the never failing support and encouragement my wonderful wife Cajsa has given me.

The staff at Linköping University, Computer Centre, LIDAC. Lars Lindwall for statistical advice and computer analysis of the results in paper I. Lars Sjöström for phototype setting. Eila Back and Gun Jonsson for punching the data.

My fantastic colleagues at the Saab-Scania Physical Fitness Centre, Linköping, for assistance with parts of the research and for their support.

The personnel at the Medical Library for kind and skilled assistance.

The staff at the Department of Preventive and Social Medicine, Linköping, for their support.

Jane Wigertz, Marcia Hill, Marcia Skogh, Ingrid Norbäck and Ulla Wiklander for translation and language revision of the manuscripts.

My employer Saab-Scania, Linköping, for allowing me to take a leave of absence during the time required to do the studies. Also for economic support for the statistical analysis of the material in paper I.

The Medical Faculty at Linköping University which supported me economically by means of an educational grant to doctoral candidates from 1980–1987.

The staff at the newspaper Östgötacorrespondenten, Linköping. Manager Arne Argus who made it possible to carry out the "Piggare med Corren" campaign; Allan Hall, who was responsible for the campaign; Marianne Sylwan and Ragnhild Persson who did an extensive job of sorting all the information obtained from the campaign participants. The Östgötacorrespondenten newspaper which also paid for part of the statistical analysis of the data.

Drawer Gunnar Jansson, who designed the cover of this dissertation.

My wonderful children Linnea and Gabriel, who allowed me to sit at home and write in peace and quiet numerous times each day.

REFERENCES

Allen M. *Activity-generated endorphins: A review of their role in sports science.* Can J Appl Sports Science **1983**; 8: 115–133.

Allman F. *The prevention and treatment of orthopedic problems related to an adult exercise program.* J Occup Med **1971**; 12: 573–76.

Almroth V, Fjellström Å. *Utvärdering av kampanjen "Motionera med MoDo".* Ped Inst, Umeå Universitet, **1976**.

Andersen K L, Masironi R, Rutenfranz J, Seliger V. *Habitual physical activity and health.* WHO Regional Publications. European Series **1978**; 6.

Andersson G, Malmgren S. *Testledarutbildning.* Malmö: Utbildningsproduktion AB, **1984**.

Andrén L, Dahlöf B, Eggertsen R et al. *Läkartidningens behandlingsschema: Högt blodtryck.* Läkartidningen **1983**; 80.

Atterhög J-H, Jonsson B P E, Samuelsson R. *Exercise testing: a prospective study of complication rates.* Am Heart J **1979**; 98: 572–579.

Axelsson R, Renström P, Svensson H-O. *Akuta idrottsskador på ett centrallasarett.* Läkartidningen **1980**; 77: 3615–7.

Bell R. *Over-the-Counter drugs: Factors in adult use of sedatives, tranquilizers, and stimulants.* Publ Health Rep **1984**; 99: 319–323.

Belloc N B, Breslow L. *Relationship of physical health status and health practices.* Prev Med **1972**; 1: 409–421.

Belloc N B. *Relationship of health practices and mortality.* Prev Med **1973**; 2: 67–81.

Bjurö T, Wilhelmsen L. *Attityder och orsaker till fysisk inaktivitet hos medelålders män.* Svenska Läkartidningen **1975**; 72: 347–349.

Blumenthal J, Williams R, Wallace A. *Effects of exercise on type A behaviour pattern.* Psychosom Med **1980**; 42: 289–96.

Borg G A V. *Perceived exertion as an indicator of somatic stress.* Scand J Rehab Med **1970**; 2: 92–98.

Borg G A V. *Psychophysical bases of perceived exertion.* Med Science Sports Exercise **1982**; 14: 377–381.

Breslow L, Enstrom J E. *Persistance of health habits and their relationship to mortality.* Prev Med **1980**; 9: 469–483.

Brown T E, Myles W S, Allen C L. *The relationship between aerobic fitness and certain cardiovascular risk factors.* Aviation, Space, and Environmental Med **1983**; June: 543–547.

Bygren L O, Nyström S. *Allmänhetens syn på hälsofrämjande åtgärder.* Soc Med Tidskrift **1983**; 1: 17–21.

Carlsson G. *En summering.* In: Carlsson G, Arvidsson O, Bygren L O, Werkö L, eds. Liv och hälsa — en kartläggning av hälsoutveckling i Sverige. Liber Förlag, Stockholm **1979**; 206.

Caspersen C J, Powell K E, Christenson G M. *Physical activity, exercise and physical fitness: Definitions and distinctions for health-related research.* Publ Health Reports **1985**; 100: 126–131.

Chesney A P, Gentry W D. *Psychosocial factors mediating health risk: A balanced perspective.* Prev Med **1982**; 11: 612–617.

Cooper K H, Pollock M L, Martin R P, White S R, Linnerud A C, Jackson A. *Physical fitness levels vs selected coronary risk factors — a cross-sectional study.* JAMA **1976**; 236: 166–169.

Cox M, Shephard R J, Corey P. *Influence of an employee fitness programme upon fitness, productivity and absenteeism.* Ergonomics **1981**; 24:795–806.

Dishman R K. *Prediction of adherence to habitual physical activity.* In: Exercise in health and disease. Eds. Nagle F J, Montoye H J. Springfield III: CC Thomas **1981**; 259.

Drenick E J, Bale G S, Seltzer F, Johnson D G. *Exessive mortality and causes of death in morbidly obese men.* JAMA **1980**; 243: 443–445.

von Döbeln W. *Anthropometric determination of fat-free body weight.* Acta Med Scand **1959**; 165: 37.

von Döbeln W. *Fysisk profil.* Läkartidningen **1965**; 62: 210–213.

von Döbeln W *Kroppsstorlek, energimätning och kondition.* In: Handbok i ergonomi (eds Luthman G, Åberg U, Lundgren N). Stockholm: Almqvist & Wiksell, **1966**; 245–253.

Ehsani A, Martin W, Heath G, Coyle E. *Cardiac effects of prolonged and intense exercise training in patients with coronary artery disease.* Amer J Cardiol **1982**; 50: 246–254.

Eide R. *The relationship between body image, self-image and physical activity.* Scand J Soc Med **1982**; Suppl 29: 109–112.

Ekstrand J, Gillquist J. *The avoidability of soccer injuries.* Int J Sports Med **1983**; 4: 124–128.

Eriksen T E. *Den ökade sjukfrånvaron — en statistisk analys.* Delegationen för Social Forskning, Stockholm, Rapport **1980**: 1.

Fasting K. *Leisure time, physical activity and some indices of mental health.* Scand J Soc Med **1982**; 29: 113–119.

Fentem P H, Bassey E J. *The case for exercise.* Sports Council Research working papers no 8. The Sports Council, 70 Brompton Road, London SW3 IEX, **1981**.

Furu M, Engström L M, Lindänge F. *Kost, motion, hälsa — en undersökning bland medelålders män i Malmö.* Forskningsgruppen för idrottspedagogik, Högskolan för lärarutbildning, Stockholm **1978**.

Glick J, Katch V. *Musculoskeletal injuries in jogging.* Arch Phys Med Rehabil **1970**; 51: 123–126.

Goldman E, Najman J M. *Lifetime absteiners, current absteiners and imbibers: a methodological note.* Br J Addiction **1984**, 7: 309–314.

Goldstein M S, Siegel J M, Boyer R. *Predicting changes in perceived health status.* Am J Publ Health **1984**; 74: 611–614.

Goldwater B C, Collis M L. *Psychologic effects of cardiovascular conditioning: a controlled experiment.* Psychosom Med **1985**; 47: 174–181.

Gordon T, Kannel W B. *Drinking and mortality.* The Framingham study. Am J Epidemiol **1984**; 120: 97–107.

Gottlieb N H, Green L W. *Life events, social network, life-style, and health: an analysis of the 1979 national survey of personal health practices and consequences.* Health Educ Quarterly **1984**; 11: 91–105.

Greist J H, Klein M H, Eischens R R, Faris J, Gurman A S, Morgan W P. *Running as treatment for depression.* Comp Psychiatry **1979**; 20: 41–54.

Gyntelberg F, Lauridsen L, Schubell K. *Physical fitness and risk of myocardial infarction in Copenhagen males aged 40-59.* Scand J Work Environ Health **1980**; 6: 170-178.

Haas H, Fink H, Härtfelder G. *The placebo problem.* Psychopharmacology Service Centre Bull **1963**; 8:1–65.

Haglund B. *Geographical and socioeconomic distribution of physical activity at work and leisure time and its relation to morbidity in a Swedish rural county.* Scand J Soc Med **1984**; 12: 155–64.

Hammond H K, Froelicher V F. *Exercise testing for cardiorespiratory fitness.* Sports Med **1984**; 1: 234–239.

Hannay D R. *Factors associated with formal symptom referral.* Soc Sci Med **1979**; 13A: 101–104.

Haskell W L. *The influence of exercise training on plasma lipids and lipoproteins in health and disease.* Acta Med Scand **1986**; suppl 711: 25–37.

Haskell W L, Camargo Jr C, Williams P T, Vranizan K M, Krauss R M, Lindgren F T, Wood P D. *The effect of cessation and resumption of moderate alcohol intake on serum high-density-lipoprotein subfractions.* N Engl J Med **1984**; 310: 805–810.

Henrysson S, Wedman I. *Regelbundna motionsvanor — Umeåexperimentet.* In Ed Arvidsson D. Att förändra levnadssätt — rapport från ett symposium om metoder att förbättra folkhälsan. Riksbankens jubileumsfond **1982**; 3: 126–137.

Hjermann I, Ryre K V, Holme I, Leren P. *Effect of diet and smoking intervention on the incidence of coronary heart disease.* Lancet **1981**; 2: 1303–1310.

Hughes J. *Psychological effects of habitual aerobic exercise.* A critical review. Prev Med **1984**; 13: 66–78.

Hunt S M, McKenna S P, McEwen J, Williams J, Papp E. *The Nottingham Health Profile: subjective health status and medical consultations.* Soc Sci Med **1981**; 15A: 221–229.

Hunt S M, McEwen J, McKenna S P. *Perceived health: age and sex comparisons in a community.* J Epidemiol Community Health **1984**; 38: 156–160.

Hunt S M, McKenna S P, McEwen J, Backett E M, Williams J, Papp E. *A quantitative approach to perceived health status: a validation study.* J Epidemiol Community Health **1980**; 34: 281–286.

Hörnquist J O, Elton M A. *A prospective longitudinal study of abusers of alcohol granted disability pension.* Scand J Soc Med **1983**; 11: 91–96.

Jonsson B G, Åstrand I. *Physical work capacity in men and women aged 18 to 65.* Scand J Soc Med **1979**; 7: 131–142.

Kannel W B, Gordon T, Schwartz M J. *Systolic versus diastolic blood pressure and risk of coronary disease: The Framingham study.* Amer J Cardiol **1971**; 21: 335–346.

Kaplan G A, Camacho T. *Perceived health and mortality: a nine-year follow up of the Human Population Laboratory Cohort.* Am J Epidemiol **1983**; 117: 291–304.

Keir S, Lauzon R. *Physical activity in a healthy lifestyle.* In eds Davidsson P O, Davidsson S M. Behavioural medicine — changing health lifestyles. New York, Bruner/Mazel **1980**; 334–350.

Keys A B. *Overweight, obesity, coronary heart disease, and mortality.* Nutrition Today **1980**; 15: 16–22.

Kilbom Å, Hartley L H, Saltin B, Bjure J, Grimby G, Åstrand I. *Physical training in sedentary middle-aged and older men.* I. Medical evaluation. Scand J Clin Lab Invest **1969**; 24: 315–322.

Klapper J T. *The effects of mass communication.* Glencoe III, Free Press, **1960**.

von Knorring L, Almay B G L, Johansson F, Terenius L. *Pain perception and endorphin levels in cerebrospinal fluid.* Pain **1978**; 5: 359–365.

Kottke T E, Caspersen C J, Hill C S. *Exercise in the management and rehabilitation of selected chronic diseases.* Prev Med **1984**; 13: 47–65.

Langlet P, Wärneryd B. *Att fråga. Om frågekonstruktion vid intervju- och enkätundersökningar.* Statistiska Centralbyrån. Stockholm, Liber Förlag **1983**; 40-50.

Larsson B, Björntorp P, Tibblin G. *The health consequences of moderate obesity.* Int J Obes **1981**; 5: 97–116.

Laszlo C A, Varga L E. *A computorized Health Hazard Appraisal System (CHAMP).* Meth Inform Med **1981**; 20: 147–156.

Lindahl O. *Placebo-bot eller vetenskaplig realbot — ingen kan skilja de två...* Läkartidningen **1983**; 80: 783–784.

Lorentzon R, Johansson C, Björnstig U. *Fotbollen orsakar flest skador men badmintonskador är dyrast.* Läkartidningen **1984**; 81: 340-43.

Lundahl A. *Fritid och rekreation.* Utkast till kap II i betänkandet om svenska folkets levnadsförhållanden. Allmänna Förlaget, Stockholm, **1971**.

Lutter L. *Injuries in the runner and jogger.* Minn Med **1980**; 1: 45–51.

Malmgren S, Andersson G. *Corporate reported sick leave and its relationship with education, responsibility and blood pressure.* Scand J Soc Med **1984**; 12: 171–176.

Malmgren S, Andersson G. *Health Profile Assessment as an instrument for revelatory communication.* Dep of Prev and Soc Med, Linköping University. (submitted).

Malmgren S, Andersson G. *På jakt efter hälsoprofilen.* Tre- och fyrabetygsuppsats. Linköping University, **1976**.

Malmgren S, Andersson G. *Utvärdering av Piggare med Corren.* Dep of Prev and Soc Med, Linköping University **1981**.

Maughan R J, Miller J D B. *Incidence of training-related injuries among marathon runners.* Br J Sports Med **1983**; 3: 162–165.

Mc Guire W J. *Public communication as a strategy for inducing health-promoting behavioural change.* Prev Med **1984**; 13: 299–319.

Mobily K. *Using physical activity and recreation to cope with stress and anxiety.* A review. Amer Correct J **1982**; 3: 77–8.

Morris J N, Pollard R, Everitt M G. *Vigorous exercise in leisure time, protection against coronary heart disease.* Lancet **1980**; 2: 1207–1210.

Morris J N. *Vigorous exercise in leisure time and the incidence of coronary heart disease.* Lancet **1973**; 1: 333–339.

Mossey J M, Shapiro E. *Self-rated health: a predictor of mortality among the elderly.* Am J Public Health **1982**; 72: 800-808.

Möller M, Öberg B, Ekstrand J, Gillquist J. *Duration of stretching effect on range of motion in lower extremities.* Arch Phys Med Rehabil **1985**; 3: 171–73.

Nie N, Hull H, Jenkins J, Steinbrenner K, Bengt D. *SPSS — stastistical package for the social sciences.* Mc Graw-Hill, New York **1975**.

Nilsson T, Rydberg U. *The impact of alcohol on health.* In: Health and Society IV. The use of tobacco and alcohol and its influence on health. A report from the resaerch survey "Changing health conditions and individual health" **1979**; 60–80.

Optenberg S A, Lairson D R, Slater C H, Russell M L. *Agreement of self-reported and physiologically estimated fitness status in a symtom-free population.* Prev Med **1984**; 13: 349–354.

Orava S. *Exertion injuries due to sports and physical exercise.* A clinical and statistical study of non-traumatic overuse injuries of the musculoskeletal system of athletes and keep-fit athletes, dissertation. Department of Surgery, University Hospital, Uleåborg, Finland, **1980**.

Oseid S. *Asthma and physical activity.* Scand J Soc Med **1982**; suppl 29: 227–234.

Paffenbarger R S, Hyde R T, Wing A L, Hsieh C. *Physical activity, all-cause mortality, and longevity of college alumni.* N Engl J Med **1986**; 314: 605–613.

Paffenbarger R S, Hyde R, Steinmetz C. *A natural history of athleticism and cardiovascular health.* JAMA **1984**; 4: 491–495.

Peterson B, Trell E, Kristensson H. *Alcohol abstention and premature mortality in middle-aged men.* Brit Med J **1982**; 285: 1457–1459.

Pilz G. *Kritische Gedanken zur Fitness-welle und zu den Volkslaufen aus sozial-psychologischen Sicht.* Sportartzt Sportmedizin **1976**; 1: 24–27.

Piterman L. *The hazards of jogging and running.* Aust Fam Physician **1982**; 12: 943–48.

Pollock M L, Wilmore J H, Fox S M. *Exercise in health and disease.* Evaluation and prescription for prevention and rehabilitation. Philadephia: W B Saunders, **1984**: 14–28.

Poole G W. *Exercise, coronary heart disease and risk factors.* A brief report. Sports Med **1984**; 1: 341–349.

Powell K E, Paffenbarger R S. *Workshop on epidemiologic and public health aspects of physical activity and exercise: a summary.* Publ Health Rep **1985**; 100: 118–125.

Puska P, Tuomilehto J, Salonen J et al. *Changes in coronary risk factors during comprehensive five-year community programme to control cardiovascular diseases (North Karelia project).* Br Med J **1979**; 10: 1173–1178.

Raskin R J, Rebecca G S. *Posttraumatic sports-related musculoskeletal abnormalities: Prevalence in a normal population.* Am J Sports Med **1983**; 5: 336–39.

Renström P, Johnson R J. *Overuse injuries in sports.* A review. Sports Med **1985**; 2: 316–333.

Russell R P, Blair S N. *Physical fitness programming for health promotion at the worksite.* Prev Med **1983**; 12: 632–643.

SAF, SIF, SALF, HTF. *Befattningsnomenklatur, tjänstemän.* SAF:s förlagssektion, Katrineholm, **1975**.

SIFO. *Några förändringar i kost- och motionsvanor under 1970-talet.* Svenska Institutet för opinionsundersökningar AB, Vällingby, **1978**.

SOS, SCB. *Living conditions, report no 42, ill health and medical care.* Official Statistics of Sweden, Statistics Sweden, Stockholm **1985**.

Salonen J T, Puska P, Tuomilehto J. *Physical activity and risk of myocardial infarction, cerebral stroke and death.* A longitudinal study in Eastern Finland. Am J Epidemiol **1982**; 115: 526–537.

Seals D R, Hagberg J M, Hurley B F, Ehsani A A, Holloszy J O. *Effects of endurance training on glucose tolerance and plasma lipid levels in older men and women.* JAMA **1984**; 252: 645–649.

Serfass R C, Gerberich S G. *Exercise for optimal health, strategies and motivational considerations.* Prev Med **1984**; 13: 79–99.

Shephard R J, Morgan P, Finncane R, Schimmelfing L. *Factors influencing recruitment to an occupational fitness program.* J Occup Med **1980**; 22: 389–398.

Shephard R J, Corey P, Renzland P, Cox M. *The influence of an employee fitness and lifestyle modification program upon medical care costs.* Can J Publ Health **1982**; 73: 259–263.

Shephard R J. *Physical activity and the healthy mind.* Can Med Assoc J **1983**; 128: 525–530.

Singer E, Garfinkel R, Cohen S M. *Mortality and mental health evidence from the Midtown Manhattan Restudy.* Soc Sci Med **1976**; 10: 517–525.

Siscovick D S, Laporte R E, Newman J M. *The disease-specific benefits and risks of physical activity and exercise.* Publ Health Rep **1985**; 100: 180-188.

Skau T, Bröte L, Nettelblad H. *Traumatologi vid ett länsdelssjukhus* Läkartidningen **1979**; 79: 1576–80.

Smith E, Reddan W, Smith P. *Physical activity and calcium modalities for bone mineral increase an aged women.* Med Sci Sports Exer **1981**; 13: 60-64.

Smoking and health — a report of the Surgeon General. U.S. Dep of Health, Education and Wellfare, Washington **1979**.

Soerlie D, Myhre K. *Effects of physical training in intermittent claudication.* Scand J Clin Lab Invest **1978**; 38: 217–222.

Sonqvist J, Baker E, Morgan J. *Searching for structure.* Inst for Social Research, Ann Arbor **1973**.

Staff P H. *The effects of physical activity on joints, cartilage, tendons and ligaments.* Scand J Soc Med **1982**; suppl 29: 59–63.

Strömme S B, Frey H, Harlem O K, et al. *Physical activity and health.* Scand J Soc Med **1982**; Suppl 29.

Stubbe I, Hansson P, Gustafsson A, Nilsson-Ehle P. *Plasma lipoproteins and lipolytic enzyme activities during endurance training in sedentary men: changes in HDL subfractions and composition.* Metabolism **1983**; 12: 1120-1128.

Taylor C B, Sallis J F, Needle R. *The relation of physical activity and exercise to mental health.* Publ Health Rep **1985**; 100: 195–202.

Temple C. *Hazards of jogging and marathon running.* Br J Hosp Med **1983**; 3: 237–39.

Thorarinsson A A. *Mortality among men alcoholics in Iceland, 1951–1974.* J Stud Alcohol **1979**; 40: 704–718.

Tibblin G, Wilhelmsen L. *Fysisk aktivitet och risk för hjärtinfarkt.* Läkartidningen **1975**; 72: 343–345.

Tones B K. *The use and abuse of mass media in health promotion.* In: Leathar DS, Hastings GB, Davies JK, eds. Health education and the media. London: Pergamon Press, **1981**: 97–114.

Vogt T M. *Risk assessment and health hazard appraisal.* Ann Rev Public Health **1981**; 2: 32–47.

Wiley J A, Camacho T C. *Life-style and future health: evidence from the Alameda County Study.* Prev Med **1980**; 9: 1–21.

Åstrand I. *Aerobic work capacity in men and women with special reference to age.* Acta Physiol Scand **1960**; 49: suppl 169.

Åstrand P-O, Rodahl K. *Textbook of work physiology.* New York: McGraw-Hill, **1977**; 343–372.

Åstrand P-O. *Work tests with the bicycle ergometer.* Monark-Crescent AB, Varberg, Sweden.

I

Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59

Gunnar Andersson and Sture Malmgren

Scand J Soc Med 14: 25–30, 1986

Risk Factors and Reported Sick Leave among Employees of Saab-Scania, Linköping, Sweden, between the Ages of 50 and 59

Gunnar Andersson and Sture Malmgren

From the Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden

Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59. Andersson, G. and Malmgren, S. (Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden).

Scand J Soc Med 1986, 1 (25–30).

An investigation group, consisting of all 1 313 employees in the age range 50–59 years, in 1975 was called during working time to the Company's Physical Training Centre to have certain risk factors assessed. The evaluation included an interview which covered risk factors such as smoking and exercise habits and measurements such as systolic blood pressure, height, weight and certain anthropometric measurements. Information was also obtained from the personnel records regarding sex, age, form of employment, education code and reported sick leave in 1974 and 1975 for the workers, and between 1970 and 1975 for the salaried employees. The total number of dropouts was 238, or 18%. Absenteeism among those who did not participate in the interview and measurements was markedly higher than for those who did. The fact that this group dropped out of the investigation implies a high risk and a need for preventive programmes. The single risk factor that showed the strongest connection with absenteeism was a low degree of physical activity during leisure hours. The design of this study as a cross-section investigation limits its use to assessing the current degree of correlation between different risk factors and absenteeism. We cannot, then, predict future illness on the basis of these findings.

BACKGROUND

A new law has been passed in Sweden with regard to public health and medical care, whereby preventive public health work is accorded greater priority than before. During the past decade, several County Councils (*landsting*) have approved special plans for public health. Company health services whose main task is to prevent ill health are growing at a rapid rate.

However, there is still a great deal of uncertainty as to how we can optimize the health of the Swedish public. Improvements have been made in working environments, and we are beginning to put more emphasis on the importance of good health habits (2).

The purpose of our investigation was to study the connection between health habits and absence due to illness of a group of older industrial employees.

MATERIALS AND METHODS

This is a complete investigation of employees in a special industrial field survey (6). The group investigated is presented in Table I. In 1975 all individuals in the investigation group were called during their working time to the Company's Physical Training Movement Centre to be evaluated. Information was obtained from the personnel records about sex and age. For the workers, the number of days reported sick in 1974 and 1975 were recorded. For the salaried employees the number of days reported sick between 1970 and 1975, as well as the education code and level of responsibility (9) were taken into consideration. Workers' sick days included only the number of working days on which he/she could be reported sick (max. 269 days/year). Salaried employees had a maximum of 334 days, including all the days of the year except holidays.

The interview covered physical exertion at work, way

Table I. *All employees of the Aerospace Division of Saab-Scania AB, Linköping, Sweden, in the age group 50–59 years*

	Men	Women	
Workers	94%	6%	42%
	512	33	545
Salaried employees	90%	10%	58%
	691	77	768
	91%	9%	100%
	1 203	110	n=1 313

Table II. *Drop-out reasons because of not participating*

	Workers		Salaried employees		
	Men	Women	Men	Women	Total
Declined because of physical handicap	53	2	30	3	88
Declined for other reasons	62	2	35	4	103
Reported sick	24	–	20	2	46
Deceased	–	–	1	–	1
Total drop-outs	139	4	86	9	238
Percent drop-outs	27	12	12	12	18.1

of travelling to work, smoking habits, physical training before age 20 and current exercise habits.

The measurements taken included systolic blood pressure, length, weight and certain anthropometric measurements. The blood pressure was taken after about 10 minutes in a sitting position. The exercise tests were performed on mechanically braked bicycle ergometers (12, 13, 14).

A nomogram was used to determine the maximum capacity for absorbing oxygen from the working pulse and the load. Physical condition figures were calculated using skeletal weight and working pulse (4). Body composition was determined anthropometrically (5).

Drop-outs

The members of the investigation group who, despite personal contact, failed to appear, are categorized in Table II. The material has been computerized with the program package SPSS (7) and OSIRIS (10).

RESULTS

Groups with high vs. low rates of sick leave

AID analysis (7) was used to analyse the number of sick leave days in 1974–75. As predictors we used sex, age, blood pressure, test value, physical condition figures, smoking, physical training, weight, oxygen absorbing capacity, overweight, participation in interview/measurements and the completion work test. Education and level of responsibility were also used as predictors for the salaried employees.

With regard to the workers' absence days any further breakdown into smaller groups as unlike each other as possible could only take place via the predictor "participant of interview/measurement" (Fig. 1). Those who had not participated in interviews and measurements were defined as the group with the highest rate of absence days. The strength of the other predictors was not sufficient to indicate further subdivision.

Persons in the "incomplete work test" category include those who have participated neither in the interview nor in the work test on the bicycle ergometer, have participated in the interview without being able to carry out the work test for medical

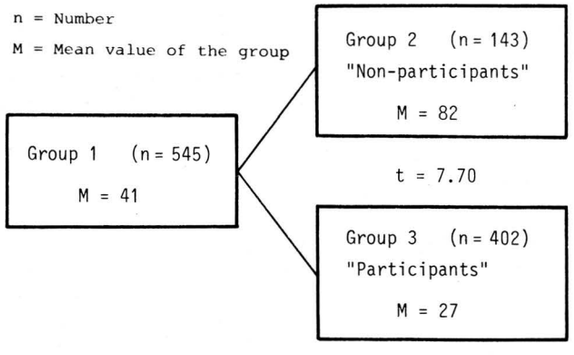


Fig. 1. AID analysis of total number of absence days reported sick, for 1974–75, workers. *n* = number, M = mean value of the group.

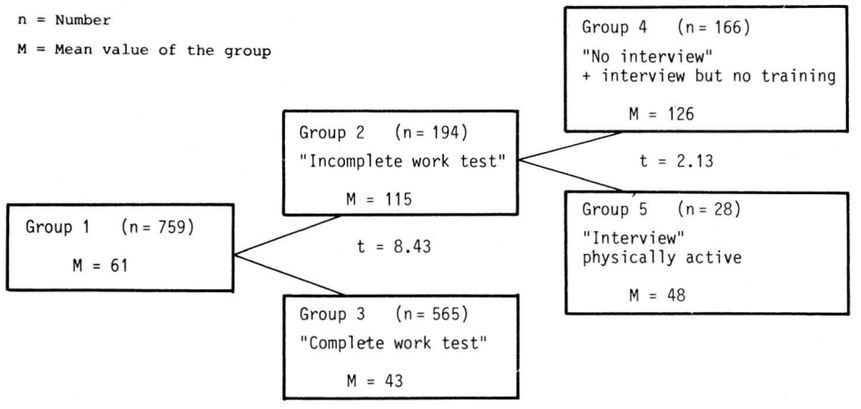


Fig. 2. AID analysis of the total number of absence days reported sick, for 1970–75, salaried employees. *n* = number, M = mean value of the group.

reasons, or participated in the interview and carried out the work test but were taking medication that affected heart rate.

Of the 759 salaried employees, 166 did not participate at all in the investigation, or only participated in the interview, during which they said that they did not indulge in any physical exercise. These formed a high-risk group whose mean absence was almost three times that of the others (Fig. 2).

Risk factors and absence days reported sick

The five risk factors that we have included are presented and defined in Table III. Paired *t*-tests are shown in Tables IV–VII.

It is evident in Table IV, where risk factors and absences are correlated, that little or complete absence of physical activity among salaried employees yielded a significantly higher rate of absence. In most cases, however, the workers were not as susceptible to individual risk factors as were the salaried employees, and in one case, workers and salaried employees showed opposite tendencies. Workers with low figures for physical condition had fewer absences than had workers with high figures, whereas the contrary was found among salaried employees. The salaried employees with high blood pressure had fewer absences, but no difference was found among the workers.

To obtain a better basis for analysis, certain combinations of risk factors were correlated with sick days. Table V shows the two risk factors that, in combination with physical condition, affect absenteeism.

Both workers and salaried employees who do not train regularly and are either over- or underweight, are more often absent. If, among the salaried em-

Table III. *Definitions of risk factors*

Designation	Variables	Definition
F1	Smoking	Smokes more than 0 cig/day
F2	Weight	More than: LBM + 20% (men), LBM + 35% (women) or less than LBM as calculated anthropometrically
F3	Blood pressure	Systolic blood pressure >160
F4	Physical training	Occasional or not at all
F5	Physical condition figures	Men: <87 (mean) Women: <73 (mean)

Table IV. *Average number of absence days reported sick for 1974–75, divided among groups with individual risk factors*

	F 1		F 2		F 3		F 4		F 5		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Workers	26	24	26	24	25	25	25	25	22	29	Days absent (mean)
	40	35	37	38	33	39	38	33	33	41	Standard deviation
	154	198	199	153	111	241	317	35	197	155	Number of individuals
Salaried employees	20	16	19	16	14	19	19*	11	20	15	Days absent (mean)
	31	33	37	25	22	35	34	19	32	32	Standard deviation
	215	358	314	259	142	431	459	114	284	289	Number of individuals

* $p<0.02$.

ployees, those who have all three risk factors are compared with those who lack all three, the rate of absence of those with the risk factors is three times that of those without. When the same comparison is made with the workers, this difference is not found. The risk factor of the physical condition figures in Table V seems to have the same effect as in Table IV for the workers, where it appeared as an individual risk factor. Those who have "acceptable" condition figures but do not train and whose weight is in the risk zone have 30 absence days compared with the 8 days of those whose condition figures were not acceptable but who lack the risk factors of weight and training.

When the breakdown is continued as shown in Table VI with regard to all five risk factors, it becomes too difficult to interpret the results accurately. The condition figures affect the two working categories in different ways (Table VI). Poor physical condition among the salaried employees yielded an increased rate of absence, whereas similar low condition figures for workers show high absenteeism only when combined with all the other risk factors.

The next risk factors examined included smoking (F1), weight (F2) and physical training (F4).

The risk factor blood pressure is discussed in a separate article. When assessing risk factors individually, as shown in Table IV, smoking, weight, blood pressure and physical training had little effect upon the workers. For the salaried employees, the differences were more noticeable between those with and those without the risk factors. Physical training gave the greatest effect, with a 73% higher rate of absence in the encumbered group. When we combine the risk factors with each other according to Table VII, we find that the combinations where physical training is included show the greatest effect among both salaried employees and workers.

All the combinations given in Table VII show a definitely increased rate of absence for subjects with risk factors, where the combinations in Table VI, including blood pressure and physical condition figures, do not have this consistency.

Table V. *Average number of absence days reported sick for 1974–75, divided among groups encumbered with different combinations of risk factors*

	Have F2+F4		Do not have F2+F4		
	Have F5	Do not have F5	Have F5	Do not have F5	
Workers	21	30	8	17	Days absent (mean)
	29	43	8	34	Standard deviation
	96	86	5	13	Number of individuals
Salaried employees	22	18	13	7	Days absent (mean)
	38	41	13	9	Standard deviation
	141	117	15	43	Number of individuals

Table VI. *Average number of absence days reported sick for 1974–75 divided among groups encumbered with different combinations of risk factors*

	F1+F2+F4+F5				F1+F2+F3+F4				
	Yes		No		Yes		No		
	Not F3	F3	Not F3	F3	Not F5	F5	Not F5	F5	
Workers	18	32	24	6	18	32	23	10	Days absent (mean)
	20	48	42	8	28	48	42	7	Standard deviation
	33	12	8	3	7	12	8	4	No. of individuals
Salaried employees	35	14	6	3	4*	14	6*	15	Days absent (mean)
	47	14	7	5	3	14	7	14	Standard deviation
	40	13	24	8	12	13	24	7	No. of individuals

* $p<0.05$.

DISCUSSION

The number of absence days reported sick was three times as high in the drop-out group. This makes it more difficult to analyse accurately the importance of individual risk factors as related to absenteeism. In this case, this relationship could be underestimated. The fact that so many of the people with the highest rate of absence did not participate in the interview and the work test shows how difficult it is to reach these people in attempt to educate them about health habits.

Some of them were on the sick list during the time we carried out the investigation and were therefore not available. Others could not be convinced to participate. This shows the importance of special visiting activities regarding the chronically ill, and the significance of an effective program to help those who need help, but may not seek it. If they have sought help, they are motivated and should be encouraged to learn better health habits. It is reasonable to believe that in the long run this will yield an improved state of health and a lower rate of absence (1, 2, 3, 8). It is interesting to note that the drop-out rate is clearly greatest among male workers.

In this study a low degree of physical training is the sole risk factor which showed a significant difference in the absence among salaried employees. If this risk factor is combined with the weight risk factor, the rate of absence also increases for the workers. A look at some combinations shows that it is the combinations of other factors with the physical training risk factor that have the greatest effects.

The risk factor physical condition figures (physical ability to work) have different effects on workers and salaried employees. More workers than salaried employees have active or physically strenuous jobs, but considerably fewer undertake regular physical activities during their spare time. This suggests that physical condition figures for workers are influenced to a greater degree than for salaried employees by the physical demand of their work. This tendency regarding the workers

Table VII. *Average number of absence days reported sick 1974–75, divided among groups encumbered with different combinations of risk factors*

	F1+F2		F1+F4		F2+F4		
	Yes	No	Yes	No	Yes	No	
Workers	25	21	30	19	25	19	Days absent (mean)
	40	35	44	34	34	34	Standard deviation
	79	78	60	12	61	12	No. of individuals
Salaried employees	21	14	20*	8	20	8	Days absent (mean)
	33	22	30	10	48	10	Standard deviation
	107	151	76	31	108	31	No. of individuals

* $p<0.05$.

could possibly indicate that it is the physical training during their leisure time and not the physical condition that is most important from a health point of view (11).

The relationship between the different risk factors and the absence days reported sick shows that the only factor which individually correlates with an increased rate of absence is "low degree of physical training during spare time". The combinations that show the same connection for both workers and salaried employees are: over/underweight with low degree of physical training and smoking with low degree of physical training.

CONCLUSIONS

This was a complete investigation of employees in a special industrial field survey, and the observed differences between the sub-groups are factual. The design of this study as a cross-section investigation limits its use to assessing the current degree of correlation between different risk factors and absenteeism. We cannot, then, predict future illness on the basis of these findings.

The results lead us to the following conclusions:

- The number of absence days reported sick for the group who did not participate in the interview and measurement part of the investigation is markedly larger than for the participants. The fact that this group dropped out of the investigation implies high risk and a need for preventive programs.
- The specific risk factor that shows the strongest connection with a high rate of absence days reported sick is a low degree of physical activity during leisure time.

REFERENCES

1. Belloc, N. & Breslow, L.: Relationship of physical health status and health practices. Preventive Medicine 1: 409–421, 1972.
2. Carlsson, G., Arvidsson, O., Bygren, L.-O. & Werkö, L.: Liv och hälsa—en kartläggning av hälsoutvecklingen i Sverige. Liber Förlag, Stockholm, 1979.
3. Cox, M., Shepard, R. & Corey, P.: Influence of an employee fitness programme upon fitness, productivity and absenteeism. Ergonomics no. 10: 795–806, 1981.
4. Von Döbeln, W.: Kroppstorlek, energiomsättning och kondition. In: Handbok i ergonomi (ed. G. Luthman, U. Åberg, N. Lundgren), pp. 245–253. Almqvist & Wiksell, Stockholm, 1966.
5. Von Döbeln, W.: Mätmetoder och nomenklatur. Läkartidningen no. 36, 1960.
6. Malmgren, S. & Andersson, G.: På jakt efter hälsoprofilen, C1 och D1 uppsats i sociologi. Universitetet i Linköping, 1976.
7. Nie, N., Hull, H., Jenkins, J., Steinbrenner, K. & Bengt, D.: SPSS—statistical package for the social sciences. McGraw-Hill, New York, 1975.
8. Puska, P., Tuomilehto, J., Salonen, J., Neittaanmäki, L., Maki, J., Virtamo, J., Nissinen, A., Koskela, K. & Takalo, T.: Changes in coronary risk factors during comprehensive five-year community programme to control cardiovascular disease (North Karelia project). Br Med J ii: 1173–1178, 1979.
9. SAF, SIF, SALF, HTF: Befattningsnomenklatur, tjänstemän. SAF:s förslagssektion, Katrineholm, 1975.
10. Sonqvist, J., Baker, E. & Morgan, J.: Searching for structure. Institute for Social research, Ann Arbor, 1973.
11. Tibblin, G. & Wilhelmsen, L.: Fysisk aktivitet och risk för hjärtinfarkt. Läkartidningen no. 5, 1975.
12. Åstrand, I.: Aerobic work capacity in men and women with special reference to age. Acta Physiol Scand 49: Suppl. 169, 1960.
13. Åstrand, P.-O. & Rodahl, K.: Text book of work physiology, 2nd ed., pp. 343–352. McGraw-Hill, New York, 1977.
14. Åstrand, P.-O.: Work tests with the bicycle ergometer. Monark-Crescent AB, Varberg, Sweden.

Address for offprints:

Gunnar Andersson
Dept. of Preventive and Social Medicine
University Hospital
S-581 85 Linköping
Sweden

II

Who were reached by and participated in a one year newspaper health information campaign

Sture Malmgren and Gunnar Andersson

Scand J Soc Med 14: 133–140, 1986

Who Were Reached by and Participated in a One Year Newspaper Health Information Campaign?

Sture Malmgren and Gunnar Andersson

From the Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden

Who were reached by and participated in a one year newspaper health information campaign? Malmgren, S. and Andersson, G. (Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden).
Scand J Soc Med 1986, 3 (133–140).

In 1977–1978 the newspaper Östgöta Correspondenten (Corren) had a one year campaign for better health. The campaign was called "Piggare med Corren" (Get fit with the Corren) and included anti-smoking, dietary and exercise components. It was given great publicity in the newspaper. The purposes of this investigation were to examine the changes in dietary, exercise and smoking habits of the registered participants, the effects on well-being related to those changes, and to determine the effects of the campaign on the whole population of the city of Linköping. This article focuses upon questionnaire response, dropout and participation. Information on the registrants was collected by registration forms, monthly reports, fitness tests and questionnaires. 62% answered the questionnaire. Those who did not return the questionnaire were also studied. Most of the people in Linköping knew of the campaign, but only a small number registered (2.5%). There was greater response among women between the ages of 30–49; and less among those who had poor dietary, exercise or smoking habits. Most inclined to answer the questionnaires were those who had comparatively better exercise and smoking habits before the campaign. This group also improved their exercise habits and capacities for absorbing oxygen (VO_2 max).

BACKGROUND

Within the last 15 years health information has been made available in Sweden, with hopes of improving dietary, exercise and smoking habits among the inhabitants. The majority of middle-aged men (90%) believe that exercise is important for their health and well-being, but only about 15% practise some kind of physical training (2). There has not been an increase in the number of people exercising, but a change in the level at which they train (13). It seems as though the extensive efforts have initiated few behavioral changes even though the main content of the health message seems to have been accepted.

In 1977 the newspaper Östgöta Correspondenten (Corren) initiated a one year campaign to improve dietary, smoking and exercise habits of the people in Linköping and Motala (8). The campaign, "Piggare med Corren" was given very large space in the newspaper with special supplements every week. Among other things about ten informational meetings were arranged in Linköping with specialists from the regional hospital, the Saab-Scania Physical Fitness Centre and Linköping University and readers' questions were answered in the newspaper. Cooperation was established locally with the sports and outdoor organisations for forming about twenty new exercise groups in Linköping. Company teams were formed, and competitions between different places of work.

There has probably never been a more intensive newspaper campaign to increase people's awareness of their health in Sweden.

We have chosen to study Östgöta Correspondenten's campaign for improving dietary, exercise and smoking habits of the inhabitants of Linköping and surrounding communities in two separate investigations.

The first investigation will examine the changes in the registrants' habits, and the effects those changes had on well being.

The second investigation focuses upon the entire population of Linköping; attention given to the campaign, the changes in people's attitudes, knowledge gained and behavioral changes.

PURPOSE

The purpose with the article is to study, in a comparative analysis of the two investigations, partly how many and who were reached by and persistent-

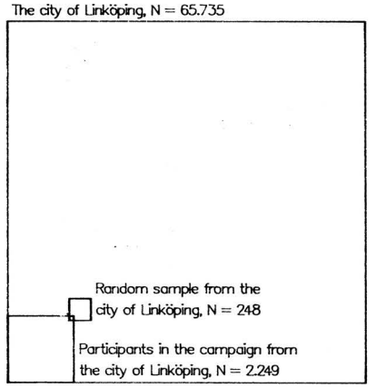


Fig. 1. The population, the registrants in the campaign and the random sample from the city of Linköping.

ly participated in the campaign, partly report and discuss drop-outs and questionnaire responses.

INVESTIGATION 1: PARTICIPANTS IN THE CAMPAIGN

Method

The campaign started in April 1977 and ended in March 1978. Participants in the campaign registered voluntarily. Information on the participants was collected from: registration forms, monthly reports, fitness evaluations, and questionnaires.

Registration forms

2887 persons registered voluntarily from Jan. to April 1977 for the campaign. The mean age of the registered participants was 40.4 years. 67% of the registered persons were women and 33% men. The registration forms included age, sex and profession.

Monthly reports

The registrants sent monthly reports during the campaign to the newspaper with information about their exercise, weight and smoking changes. 1622 persons (56%) of the 2887 registered for the campaign sent in monthly reports at least once. 199 (7%) sent in all 12 monthly reports.

Fitness test

1212 of the 2887 registrants expressed an interest in participating in the fitness test at the Saab-Scania Physical Fitness Centre in Linköping. All 1212 were called, with 844 persons (70%) participating in the first test in March to May 1977. These 844 persons were called again in one year as a follow-up. 255 persons participated in the second test in April 1978.

The fitness test included interviews, measurements and work tests on the bicycle ergometer. The interview covered some risk factors such as work situation, smoking and exercise habits. The measurements taken included systolic blood pressure, height, weight and certain skeletal measurements. The exercise tests were performed on mechanically braked bicycle ergometers (16). The maximum capacity for absorbing oxygen (VO_2 max) was estimated from the working pulse and the load using a nomogram (15).

Questionnaire

The questionnaire was sent in April 1978 to:

A) all registrants participating in the first fitness test, 844 persons;

B) all registrants participating in the quit smoking part of the campaign, 418 persons;

C) all registrants who have sent at least 10 monthly reports, 433 persons;

D) all registrants who sent in one or more of the last three months' reports, and do not fit in one of the categories A, B or C, 220 persons.

935 persons (60%) of 1568 registrants who received the questionnaire returned it.

All the information obtained was data processed. Significance was determined using Fisher's test and *t*-tests.

Drop-outs

The highest drop-out rate (61%) was among the registrants participating in the anti-smoking part of the campaign. The group who sent in most of their monthly reports tended to have higher response to the questionnaire.

The drop-out for combinations of the different groups of registrants is shown in Fig. 3.

The combination that contains the greatest number of persons who answered the questionnaire were those who took part in the fitness test and sent 10–12 monthly reports.

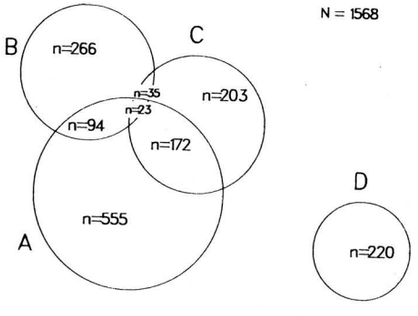


Fig. 2. Target group for questionnaire to registrants in the campaign. (*A*) participating in fitness test (n=844), (*B*) participating in quit smoking (n=418), (*C*) who sent in 10–12 monthly reports (n=433), (*D*) who sent their monthly reports at least one of the last three months of the campaign and do not fit in one of the categories *A*, *B* or *C* (n=220).

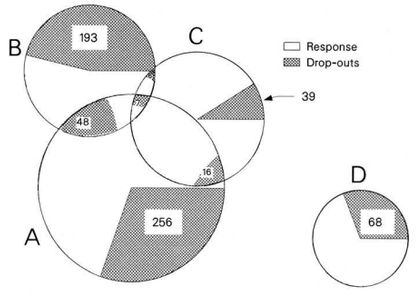


Fig. 3. Questionnaire response arranged by group (N=1568). (*A*) participating in fitness test (n=844), (*B*) participating in quit smoking (n=418), (*C*) who sent in 10–12 monthly reports (n=433), (*D*) who sent their monthly reports at least one of the last three months of the campaign and do not fit in one of the categories *A*, *B* or *C* (n=220).

Result

The registrants in the campaign

There were 2887 participants registered in the campaign. 2249 of those persons were living in Linköping (78%). The distribution of the *Östgöta Correspondenten* is the largest in Linköping. 2.5% of those readers registered for "Piggare med Corren". 4.8% of the newspaper's readers in Norrköping registered for the campaign. This, however was only 57 participants.

In Mjölby-Skänninge we find the greatest number of persons who sent 10 monthly reports or more. 149 of the 269 registered participants from Motala–Vadstena (55%) did not send in any reports.

Clearly more women registered than men, and registration was greater in the 30–39 and 40–49 year old groups. This misrepresentation is shown in Fig. 4. 131 registrants did not report their sex or age.

Questionnaire response, dropout and participation

Slightly more than half of the registrants who did not answer the questionnaire (52%) participated in the first fitness test. This makes it possible to study the non-response and drop-out problems by an analysis of the results from both the tests. A model of this analysis is presented in Fig. 5 and the results of the tests in Tables I–V.

In the following comparisons, questionnaire response (comparisons 1, 2 and 3), dropout (comparison 4) and participation (comparison 5) are studied.

Significance was determined using Fisher's test, *t*-tests between groups with two-tailed probability and *t*-tests between variables using paired samples.

1. In comparing A + B to C + D differences in starting values for those who answered and those who did not answer the questionnaire can be seen. The comparison shows that the group that did not answer the questionnaire contains more non-exercisers (p<0.01) and more smokers (p<0.01).

2. In the comparison between B and D the initial values are analysed for those who were motivated enough to come back for the second test. Even in this highly motivated group we find that the group

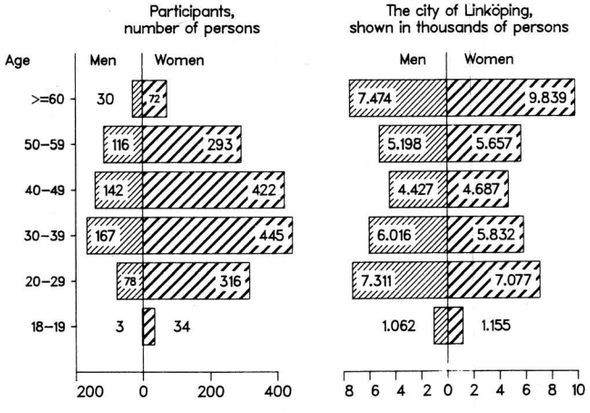


Fig. 4. The distribution of sex and age of the registered participants in Linköping (N=2249). The city of Linköping (N=65735). Missing values = 131.

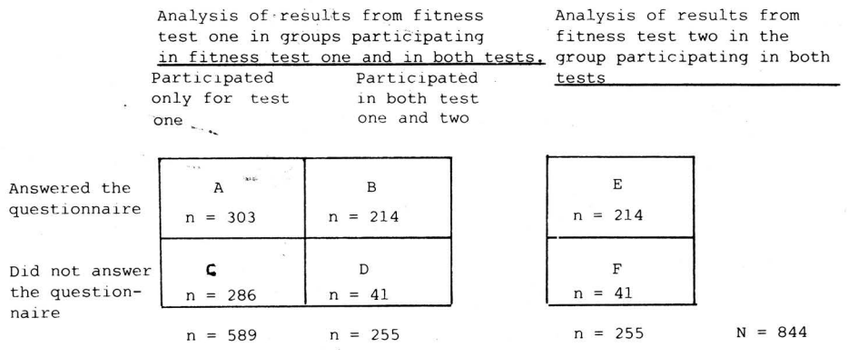


Fig. 5. Model for analysis of the results of the fitness tests.

that did not answer the questionnaire contained more smokers ($p<0.05$) and non-exercisers (not sign).

3. The changes from B to E are compared to the changes from D to F. This analysis shows if there is any difference from test one to test two between the groups who had answered respectively had not answered the questionnaire. The results show that very few of the persons returning to the second test did not answer the questionnaire, and also show that both groups had positive changes, with regard to exercise and smoking habits. Non-exercisers decreased from 19% to 4% and smokers from 19% to 10% in the group answering the questionnaire. The corresponding figures among those who did not answer the questionnaire are 27% to 17% for non-exercisers and 34% to 22% for smokers. The difference in improvement in these two groups however is not singificant. While comparing these groups we also find a significant decrease in weight ($p<0.01$) and a significant increase in predicted VO_2 max ($p<0.05$) in the group that answered the questionnaire; whereas no improvements were found among those who did not answer the questionnaire.

4. Those who came for just the first test (A + C), is compared to those who came for both tests (B + D), and illustrates the problem of dropout. When the starting points of these two groups are compared, we can see that those who did not come back a second time contained more non-exercisers ($p<0.01$), more smokers ($p<0.05$) and the mean age was lower ($p<0.01$). Predicted VO_2 max was also significantly higher in B + D ($p<0.05$).

5. The comparison between B and C illustrates

Table I. *Results of fitness test one for participants in test one who answered and who did not answer the questionnaire (comparison 1)*

Medicine consumption = medicine affecting the cardiovascular system, No exercise = never does any physical activity, Smoker = smokes more than 0 cigarettes per dag, Stressed = feels stressed often or very often, VO_2 max = predicted maximal oxygen absorbing capacity calculated from a submaximal work test on an ergocycle

	Women (%)	Birth year (mean)	Weight (mean)	Medicine consumption (%)	No exercise (%)	Smoker (%)	Stressed (%)	VO_2 max (mean)	Number of persons
All participants in test one, and answering the questionnaire (A + B)	No inform.	1934	70	8	25	21	24	2.5	517
All participants in test one, but did not answer the questionnaire (C + D)	No inform.	1935	72	8	38	33	24	2.5	327

Table II. *Results of fitness test one for participants in both test one and two who answered and did not answer the questionnaire (comparison 2)*

	Women (%)	Birth year (mean)	Weight (mean)	Medicine consumption (%)	No exercise (%)	Smoker (%)	Stressed (%)	VO_2 max (mean)	Number of persons
Both test one and two and answering the questionnaire (B)	62	1931	70	8	19	19	21	2.6	214
Both test one and two but did not answer the questionnaire (D)	47	1934	69	7	27	34	27	2.7	41

Table III. *Results of fitness test one and two for participants in both test one and two who answered and did not answer the questionnaire (comparison 3)*

	Women (%)	Birth year (mean)	Weight (mean)	Medicine consumption (%)	No exercise (%)	Smoker (%)	Stressed (%)	VO_2 max (mean)	Number of persons
Results of test one									
Both test one and two and answering the questionnaire (B)	62	1931	70	8	19	19	21	2.6	214
Both test one and two but did not answer the questionnaire (D)	47	1934	69	7	27	34	27	2.7	41
Results of test two									
Both test one and two and answering the questionnaire (E)	62	1931	69	7	4	10	19	2.7	214
Both test one and two but did not answer the questionnaire (F)	47	1934	69	7	17	22	24	2.7	41

Table IV. *Results of test one for all participants in test one and participants in both test one and two (comparison 4)*

	Women (%)	Birth year (mean)	Weight (mean)	Medicine consumption (%)	No exercise (%)	Smoker (%)	Stressed (%)	VO_2 max (mean)	Number of persons
Only test one (A + C)	73	1936	71	8	34	28	27	2.5	589
Both test one and two (B + D)	60	1932	70	8	20	21	22	2.6	255

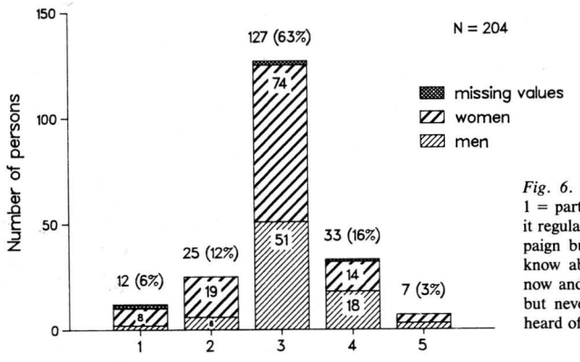


Fig. 6. Distribution of campaign awareness. 1 = participated in the campaign and followed it regularly, 2 = never participated in the campaign but followed it regularly anyway, 3 = know about the campaign and read about it now and then, 4 = know about the campaign but never read anything about it, 5 = never heard of the campaign.

the difference in the starting values for those who participated to the greatest respectively least extent with regard to both tests and questionnaires. The analysis shows that the group who participated least consisted of more non-exercisers ($p<0.01$) and smokers ($p<0.001$). The average age was also lower ($p<0.01$).

INVESTIGATION 2: RANDOM SAMPLE

Method

Sample. The sampling has been carried out by the County Administration Data Section. The population is defined as inhabitants of the city of Linköping over the age of 17. There are 65735 persons in this group, and a random sample of 248 was used for this study (Fig. 1).

Questionnaire. Information about this sample was obtained through a questionnaire. Of the 248 questionnaires distributed, 204 (82%) were returned or answered on the telephone. The information obtained from the questionnaires was computerized. Significance tests of the distributions were carried out using chi-square.

Non-responses. The 44 persons (18%) who did not return the questionnaires are distributed in Table VI with regard to reasons for non-response. The returned questionnaires were representative of the age of the population, but there was a slight underrepresentation of men.

Result

Fig. 6 represents the awareness of the participants regarding the campaign. The question asked was: "How much do you know about the campaign 'Piggare med Corren'?" Six percent of the sample participated in and followed the campaign regularly. There are no significant differences between the sexes, in spite of the fact that women said that they payed more attention to the campaign than the men. Clearly, awareness in the city was high, as only 3% said they had not heard of it. The majority only read about the campaign and 6% participated fully.

DISCUSSION

It was natural for us to choose the city of Linköping for our study since 83% of the household subscribed to the newspaper and 78% of the registrations came from there.

Table V. *Results of test one for participants in both test one and two who also answered the questionnaire and participants only in test one who did not answer the questionnaire (comparison 5)*

	Women (%)	Birth year (mean)	Weight (mean)	Medicine consumption (%)	No exercise (%)	Smoker (%)	Stressed (%)	VO_2 max (mean)	Number of persons
Both test one and two and answering the questionnaire (B)	62	1931	70	8	19	19	21	2.6	214
Only test one but did not answer the questionnaire (C)	No inform.	1936	72	8	40	33	28	2.5	286

Table VI. *Distributions of reasons for not returning the questionnaire*

Non-response reason	Number of persons
Not available	35
Refusal	6
Sick	2
Deceased	1
Total	44

Methodologically, we combined a total study of those who appeared most interested and persistent as registrants in the campaign with a study of a random sample from the city of Linköping. This gave us the opportunity to examine in depth the health changes felt by the most actively engaged persons, and to investigate how many persons might have participated without showing it openly.

From the random study it can be seen that at least three quarters of the Linköping inhabitants above the age of 17 had read about the campaign, and that only a very small percentage did not know about it. In spite of this awareness only 6% said that they had participated. A 95% confidence interval in random sample yields such uncertainty that it is only possible to say that the number of participants can be as low as 2.6 percent, but it could be somewhat higher. Both studies thus show that the campaign reached the majority of the inhabitants of Linköping but that only a small part participated in and followed it regularly.

The group of participants contained more women than men and the age group 30–49 years was overrepresented. One explanation of this distribution of sex and age could be that the sports organizations in Sweden mainly involve men in younger age groups and the campaign have reached some of the groups that were least engaged in organized sports. Another possible explanation of the success among these target groups can also be that women in these ages are more frequently responsible for the household and are therefore more susceptible to food and diet propaganda.

The aim of the total study was to illustrate the experienced effects on those who had changed their dietary, exercise and smoking habits in a positive way as a result of the campaign. Therefore we looked for a group who had shown a permanent interest in health improvement. Smoking was an exception. We chose all the registered smokers. 61% of this group did not answer the questionnaire, the lowest response of any group. Closer examination of the smokers shows that 67% of those who did not send in 10–12 reports did not answer the questionnaire, while only 22% of those who did send in 10–12 reports did not answer the questionnaire. This poor questionnaire response is probably due to the fact that the majority of those who did not complete the monthly reports were not successful in their attempt to quit and did not wish to reveil this in a questionnaire. The lack of response from this group does not negatively affect the study since we want to study those who have succeeded in changing their behaviour.

79% of the group who returned at least 10 monthly reports responded to the questionnaire. We feel that throughout the study we have probably received responses from those who have been the most successful in improving their habits. This is reinforced by our analysis of the group of campaign registrants who went through the fitness test. The analysis comprises slightly more than half of those who did not answer the questionnaire. The results show that those who answered the questionnaire improved their capacity for absorbing oxygen (VO_2 max) to a greater extent than those who did not answer the questionnaire. The analysis also showed that this group contained fewer smokers and non-exercisers before the campaign began.

We find the same pattern in a comparison between those who went through one or both tests. Those who came back at the end of the campaign to complete a work test and discuss their success toward their goal of behavior modification initially had better exercise and smoking habits.

The most dedicated participants apparently had better health habits than the rest of the registrants. For obvious reasons they were also the most willing to discuss the results.

Thus with this drop-out analysis we have been able to show that those in our total study who answered the questionnaire are persistent participants in the campaign.

The process of behaviour change involves two distinct steps, initiation of the behaviour and adherence to the newly adopted behaviour (10).

Also this campaign seems to have followed an expected pattern for mass communication (6). The health information reached most of the population

but only a small segment registered and even fewer participated.

The fact that the initiation step did not function better might be that the campaign was a pure mass media campaign. The elements of lectures, group work and face to face interaction were of limited proportions and based on self-selection (9, 12, 14).

In spite of all the efforts to maintain the registrants' interest there were many who did not participate throughout the length of the campaign. Among those who initially had poor habits, fewer were successful in carrying through, with drop-out a difficult problem to master (1, 3, 4, 5, 7, 11).

CONCLUSIONS

The majority of the population of Linköping knew of and had read about the campaign but only a small minority registered and followed it regularly.

The campaign received the best response among women in the age group 30 to 49 years.

The most willing to tell about their participation in the campaign were those who had better smoking and exercising habits before it began. Most of this group started exercising more frequently and had improved their capacities for absorbing oxygen.

Many persons did not participate for the duration of the campaign. The largest number of drop-outs was among those with poorer exercise and smoking habits.

REFERENCES

1. Almroth V, Fjellström Å. Utvärdering av kampanjen "Motionera med Modo". Pedagogiska institutionen, Umeå Universitetet, 1976.
2. Bjurö T, Wilhelmsen L. Attityder och orsaker till fysisk inaktivitet hos medelålders män. Läkartidningen 1975; 5: 347–49.
3. Dishman RK. Prediction of adherence to habitual physical activity. In: Nagle FJ, Montoye HJ, eds. Exercise in health and disease. Springfield Ill: CC Thomas 1981: 259.
4. Henrysson S, Wedman I. Regelbundna motionsvanor—Umeå-experimentet. In: Arvidsson D, ed. Att förändra levnadssätt—rapport från ett symposium om metoder att förbättra folkhälsan. Riksbankens Jubileumsfond, 1982; 3: 126–137.
5. Keir S, Lauzon R. Physical activity in a healthy lifestyle. In: Davidsson PO, Davidsson SM, ed. Behavioral medicine—changing health lifestyles. New York: Bruner/Mazel, 1980: 334–350.
6. Klapper JT. The effects of mass communication. Glencoe, Ill: Free Press, 1960.
7. Malmgren S, Andersson G. På jakt efter hälsoprofilen. C1 och D1 uppsats i sociologi. Samhällsvetenskapliga institutionen, Universitetet i Linköping, 1976.
8. Malmgren S, Andersson G. Utvärdering av Piggare med Corren. Dep. of Prev. and Soc. Med., University Hospital, Linköping, 1981.
9. McGuire WJ. Public communication as a strategy for inducing health-promoting behavioral change. Prev Med 1984; 3: 299–319.
10. Russell RP, Blair SN. Physical fitness programming for health promotion at the worksite. Prev Med 1983; 12: 632–643.
11. Serfass RC, Gerberich SG. Exercise for optimal health. Strategies and motivational considerations. Prev Med 1984; 13: 79–99.
12. Shepard RJ, Morgan P, Finncane R, Schimmelfing L. Factors influencing recruitment to an occupational fitness program. J Occup Med 1980; 22: 389–398.
13. SIFO: Några förändringar i kost- och motionsvanor under 1970-talet. Svenska Institutet för Opinionsundersökningar AB, Vällingby, 1978.
14. Tones BK. The use and abuse of Mass Media in health promotion. In: Leathar DS, Hastings GB, Davies JK, eds. Health education and the media. Oxford: Pergamon Press, 1981: 97–114.
15. Åstrand I. Aerobic work capacity in men and women with special reference to age. Acta Physiol Scand 1960; 49: Suppl 169.
16. Åstrand P-O, Rodahl K. Text book of work physiology, 2nd ed. New York: McGraw–Hill Book Company, 1977: 343–352.

Address for offprints

Dr. G. Andersson
Motionscentralen
Saab-Scania AB
S-581 88 Linköping
Sweden

III

Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign

Gunnar Andersson and Sture Malmgren

Scand J Soc Med 14: 141–146, 1986.

Changes in Self-reported Experienced Health and Psychosomatic Symptoms in Voluntary Participants in a 1-Year Extensive Newspaper Exercise Campaign

Gunnar Andersson and Sture Malmgren

From the Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden

Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign. Andersson, G. and Malmgren, S. (Department of Preventive and Social Medicine, University Hospital, Linköping, Sweden).
Scand J Soc Med 1986, 3 (141–146).

Starting in 1977 the newspaper Östgötacorrespondenten carried through a 1-year health information campaign in Linköping. The campaign included exercise, dietary and anti-smoking components. It was given a great deal of space in the paper with special supplements almost every week. The purpose of the study is to throw light upon self-reported changed general well-being and experienced psychosomatic symptoms and health of the participants in this campaign. 2 887 persons registered voluntarily for the campaign. After the campaign a questionnaire was sent to the 1 568 participants who had been the most active in the campaign. 935 persons (60 %) answered the questionnaire. One fourth of the participants with headache, back pain, stomach problems or sleeping trouble before the campaign experienced that their symptoms had decreased during the campaign, primarily due to changed exercise habits. Half of the participants reported that their general well-being was better and 42 % experienced themselves healthier as a result of changed health habits in connection with the campaign. In the group that felt healthier, almost twice as many, 62 % compared with 34 %, had increased their exercising compared with those who experienced themselves as neither healthier nor less healthy.

Physical activity during leisure time has positive effects on man. These positive effects are well documented primarily within the physiological and medical field (9, 30). Physiological effects of physical activity are, e.g., improved physical work capacity, muscular tone and strength, efficiency of cardiorespiratory system, locomotor system, and energy balance. Physical activity is also regarded as a beneficial factor in treatment and rehabilitation of patient groups with for example disorders in the locomotor apparatus (29), coronary artery disease (6), bronchial asthma (21), osteoporosis (27) and peripheral vascular disease (28).

Self-reports of physical activity are associated with reduced mortality from cardiovascular disease (19, 22) and total mortality (4, 24). People who are physically active also have better health (2, 18, 31) and lower sick leave on the average than others (1, 5).

Controlled studies of the experienced positive effects of physical activity exist but are rather sparse (13). Physical activity can increase life satisfaction and arousal (25), improve self-esteem and body image (7), relieve anxiety (17), stress (3) and depression (10). More physical activity during leisure time is also correlated with fewer mental health problems (12, 15, 23).

However, few studies have been undertaken to measure the influence of physical activity on psychosomatic symptoms (8, 12) and experienced health in connection with extensive exercise campaigns.

The purpose of the study is to throw light upon self-reported changed general well-being and experienced psychosomatic symptoms and health of voluntary participants in a one-year extensive exercise campaign in Linköping.

MATERIAL AND METHODS

From April 1977 to and including March 1978 the newspaper Östgötacorrespondenten carried through a 1-year exercise campaign in Linköping. The campaign was given a lot of space in the paper with special supplements every week. In addition, large informative meetings were arranged every month with assistance of experts who also answered questions from the readers in the paper regularly. Participants in the campaign registered voluntarily.

The participants of the campaign accounted for their exercise habits, continuously via monthly reports to the paper as well as via a questionnaire that was sent to the

Table I. *Occurrence of diseases and consumption of medicine before the campaign (N=935)*

– =values missing

Disease	No. of persons	%	Also took medicine for the disease
Hypertension	55	6	33
Angina pectoris	13	1	5
Diabetes mellitus	13	1	5
Allergy, asthma	13	1	5
Lung disease	13	1	2
Other heart disease	12	1	3
Myocardial infarction	10	1	3
Low blood pressure	9	1	–
Back pain, ischias	8	1	–
Joint trouble, rheumatism	5	0.5	–
Migraine	4	0.5	–
Other disease	35	4	–

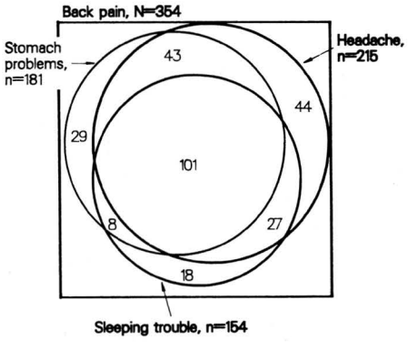


Fig. 1. Pattern of psychosomatic symptoms before the campaign among those with back pain.

participants after the end of the campaign. Of the 2887 campaign registrants 1622 persons (56%) sent their monthly reports to the paper at least once. The questionnaire was sent to the registrants who most persistently participated in the campaign (1568 persons). After two reminders, 935 persons (60%) had answered the questionnaire. An analysis of the dropouts shows that the registrants who had not answered the questionnaire had not started to exercise to the same extent as the others (16).

The questions asked in the questionnaire pertained to diseases before the campaign, symptoms before the campaign and changes of symptoms after the campaign and experience of feeling more or less healthy/ill in connection with the campaign. There were also questions about exercise habits before the campaign and number of different exercise activities before and during the campaign.

All the information obtained was data processed. Significance was determined using the chi-square test.

RESULTS

Exercise habits

Most of the campaign participants registered for the campaign in the first place in order to obtain better physical condition (62%) and in order to feel better (57%). Half of them said, in connection with their registrations, that they exercised already before the start of the campaign. 1554 persons (54%) accounted for exercise points via their monthly reports to the paper. 816 (28%) of them accounted for more than 50 exercise points, corresponding to at least one exercise occasion per week. Of the 935 persons answering the questionnaire, only 50 persons said that they never exercised before the start of the campaign.

The mean number of different exercise activities before the campaign was 2.0 compared to 2.5 during the campaign which means a mean increase of 0.5 activities per participant.

Only 62 persons (6.5%) practised a smaller number of exercise activities (mean=−1.1) during the campaign compared with before. These persons practised more exercise activities before the campaign than the mean. 375 persons (40%) practised more exercise activities (mean=+1.5) during than before the campaign at the same time as they before

Table II. *Occurrence of participants' psychosomatic symptoms before the campaign*

Symptom	Number of persons	Number of persons with only one of the symptoms
Headache	409	92
Back pain	354	84
Sleeping trouble	273	31
Stomach problems	269	23

Table III. *Decreased psychosomatic symptoms after the campaign*

Symptom	Number of persons
Headache	99 (24%)
Back pain	90 (25%)
Sleeping trouble	68 (25%)
Stomach problems	67 (25%)

Table IV. *Changed exercise habits distributed on change of general well-being (p<0.01)*

Mean number of different exercise activities before/during the campaign

	General well-being							
	Much better		Somewhat better		Neither better nor worse		Total	Missing values
Exercise activities								
Increased	1.8/3.6	80 (57%)	1.7/3.2	164 (50%)	1.6/3.0	109 (31%)	353 (43%)	22
Unchanged	2.3/2.3	47 (34%)	2.3/2.3	146 (45%)	2.4/2.4	221 (62%)	414 (50%)	82
Decreased	2.9/1.0	12 (9%)	3.1/2.0	18 (5%)	2.6/1.4	25 (7%)	55 (7%)	6
Total		139 (17%)		328 (40%)		355 (43%)	822 (100%)	110

the campaign practised fewer exercise activities than mean.

741 persons (80%) found it pleasant and stimulating to exercise. 26 persons (3%) answered that exercising is boring. 775 persons (83%) also said that they intended to continue exercising, four persons (0.4%) did not intend to continue.

Diseases and symptoms before the campaign

In the group answering the questionnaire there were participants who reported that they had medical trouble and diseases (Table I). Several persons also took medicine for these diseases. Many of them also suffered from headache, back pain, sleeping trouble or stomach problems which is shown in Table II. Of those having problems, the problems consisted often or quite often, of back pain (37%), headache (31%), sleeping trouble (26%) and stomach problems (25%). Most of the participants with sleeping trouble or stomach problems also had trouble in combination with one or some other kinds of symptoms (Fig. 1). 101 persons were not completely free from any of these four kinds of symptoms.

Diseases and symptoms after the campaign

26 persons reported that they had decreased their consumption of medicines after the campaign and that this in the first place was due to changed food and exercise habits. Only four persons reported that their consumption of medicine had increased.

One fourth of those having psychosomatic symptoms before the campaign experienced that their headache, back pain, stomach problems or sleeping trouble had decreased after the campaign (Table III). 2% to 4% experienced that their symptoms had increased. Most of them were of the opinion that the changes in their symptoms were the result of changed exercise (n=127), food (n=63) and smoking (n=33) habits. The greater part of those who reported a decrease in headaches (68%), backpains (64%), stomach problems (63%) and sleeping troubles (54%) had earlier suffered very or quite often. (p<0.01).

Half of the participants reported that their general well-being was much or somewhat better, and 42% experienced themselves as much or somewhat healthier due to changed health habits in connection with the campaign.

Exercise habits—well-being and experienced health

Table IV shows the changes in the general well-being in relation to changed exercise habits. The three persons who answered that their general well-being was worse have been omitted. Most of the persons whose general well-being was much better can be found in the group with more exercise activities during the campaign than previously. Here you can also find those who most increased their exercise level and those who on average had a higher number of exercise activities (3.6). In the group whose general well-being was neither better nor worse are also those who had decreased their exercising most, i.e. mean 1.2 exercise activities fewer compared with before the campaign.

As can be seen from Table V there is a corresponding relation (p<0.01) between changed exercise habits and the experience of being healthier/less healthy due to the campaign. In the group who feel much healthier almost double as many, 62%

Table V. *Changed exercise habits distributed on experience of healthier/more ill ($p<0.01$)*

Mean number of different exercise activities before/during the campaign

	Healthier/more ill							
	Much healthier		Somewhat healthier		No difference		Total	Missing values
Exercise activities								
Increased	1.7/3.5	72 (62%)	1.8/3.3	129 (47%)	1.7/3.1	149 (34%)	350 (42%)	25
Unchanged	2.5/2.5	33 (29%)	2.3/2.3	126 (46%)	2.3/2.3	258 (60%)	417 (51%)	79
Decreased	3.0/2.0	10 (9%)	3.0/2.0	21 (7%)	2.6/1.3	24 (6%)	55 (7%)	7
Total		115 (14%)		276 (34%)		431 (52%)	822 (100%)	111

compared with 34%, have increased their exercising in comparison with those feeling neither healthier nor less healthy. The largest increase of the mean number of exercise activities (+1.8) as well as the largest number of exercise activities totally (3.5) during the campaign are also found in the group that feels much healthier. The two persons who answered that the campaign had affected their habits of living so that they felt less healthy have been omitted in the table.

DISCUSSION

The concept of health is complicated and there is no clear definition. Anyhow more and more importance has been attached to the subjective health. This can be illustrated by an increasing number of studies within this fiels. It is shown that experienced health is a strong predictor of mortality (14, 26), independent of physical health status. It is also apparent that the relation between health and mortality is not entirely a function of their mutual relationship with objective health status (20).

It is therefore difficult to evaluate health and well-being in absolute and measurable criteria. Many people have psychosomatic symptoms without any provable somatic changes. In spite of this, the symptoms must be taken seriously. Many of them require medical treatment notwithstanding the absence of provable somatic changes. There is often a non-correspondence between provable somatic changes and symptoms with reference to stomach problems and backpain. Medical treatment, for these kinds of symptoms, is thus often based on subjective experiences of the patient. More and more it is noticed that a too high consumption of sedatives and tranquillizers can create addiction and injurious effects. Therefore, it is of great value, both from the individual's and society's points of view to find alternative methods of treatment.

We have studied an extensive exercise campaign. Retrospectively, via questionnaires, we have registered persistent participants' experiences of changes partly as to psychosomatic symptoms, partly as to general well-being and experienced health. Our dropout study (16) shows that among those who answered the questionnaire there were more persons who had increased their physical activity than among those who did not answer the questionnaire.

In this study one fourth experienced that their headache, back pain, stomach problems or sleeping trouble, respectively, had decreased as a result of changed health habits in connection with the campaign. The greater part of those who had decreased symptoms had earlier had symptoms, often or quite often. Headache, back pain, stomach problems and sleeping trouble are often classified among psychosomatic symptoms (8, 12). Very much talks in favour of a relation between stress and psychosomatic problems. In our study most of the participants with sleeping trouble or stomach problems also had trouble in combination with one or some other kinds of symptoms. Since physical activity has a positive effect on stress (3), the increase in exercise activities is a possible explanation of the reported decreases of symptoms. Since all symptoms decreased to about the same extent there is much that speaks in favour of such a general explanation.

Explanations of the recoveries of psychosomatic

symptoms can also be searched for in physiological positive effects from regular exercise (9, 30). This can also apply to the reported improvements of the general well-being and the health experienced by almost half of the participants. 42% experienced that they felt healthier and 50% experienced that their well-being was better as a result of changed health habits in connection with the campaign. The results also show greater improvement as to general well-being and experienced changed health in the group that was most physically active during the campaign (Tables IV, V).

The improvements accounted for can also be seen as placebo effects (11) which do not make the improvements less valuable.

The fact that the results are obtained without either therapeutical or pharmacological treatment shows that one way to improve the feeling of well-being and some psychosomatic symptoms for people in general is to improve their habits of living and in particular their exercise habits. The study shows that this could be effected also in an extensive massmedia campaign, which is given as extra information above the ongoing information within these areas to the population.

CONCLUSIONS

One fourth of the participants who, prior to the campaign, suffered from headaches, back pain, stomach problems or sleeping trouble, experienced that their symptoms had decreased during the campaign, primarily due to changed exercise habits. The greater part of those who experienced less trouble had suffered very often or quite often.

Half of the participants reported that their general well-being was better and 42% experience themselves healthier as a result of changed health habits in connection with the campaign.

In the group that felt healthier, almost twice as many, 62% compared with 34%, had increased their exercising compared with those who experience themselves as neither healthier nor less healthy.

REFERENCES

1. Andersson G, Malmgren S. Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59. Department of Preventive and Social Medicine, University Hospital, Linköping, accepted for publication, Scand J Soc Med. 1986; 14: 25–30.
2. Belloc NB, Breslow L. Relationship of physical health status and health practices. Preventive Medicine 1972; 1: 409–21.
3. Blumenthal J, Williams R, Wallace A. Effects of exercise on type A behaviour pattern. Psychosom Med 1980; 42: 289–96.
4. Breslow L, Enstrom JE. Persistence of health habits and their relationship to mortality. Preventive Medicine 1980; 9: 469–83.
5. Cox M, Shephard RJ, Corey P. Influence of an employee fitness programme upon fitness, productivity and absenteeism. Ergonomics 1981; 24: 795–806.
6. Ehsani A, Martin W, Heath G, Coyle E. Cardiac effects of prolonged and intense exercise training in patients with coronary artery disease. Am J Cardiol 1982; 50: 246–54.
7. Eide R. The relationship between body image, self-image and physical activity. Scand J Soc Med 1982; Suppl 29: 109–12.
8. Fasting K. Leisure time, physical activity and some indices of mental health. Scand J Soc Med 1982; Suppl 29: 113–19.
9. Fentem PH, Bassey EJ. The case for exercise. Sports Council Research Working Papers No. 8. London, 1981.
10. Greist JH, Klein MH, Eischens RR, Faris J, Gurman AS, Morgan WP. Running as treatment for depression. Comp Psychiatry 1979; 20: 41–54.
11. Haas H, Fink H, Hartfelder G. The placebo problem. Psychopharmacology Service Centre Bull 1963: 1–65.
12. Haglund B. Geographical and socioeconomic distribution of physical activity at work and leisure time and its relation to morbidity in a Swedish rural county. Scand J Soc Med 1984; 12: 155–64.
13. Hughes J. Psychological effects of habitual aerobic exercise. A critical review. Prev Med 1984; 13: 66–78.
14. Kaplan GA, Camacho T. Perceived health and mortality: a nine-year follow up of the Human Population Laboratory Cohort. Am J Epidemiol 1983;117: 291–304.
15. Lundahl A. Fritid och rekreation. Utkast till kap. II i betänkandet om svenska folkets levnadsförhållanden. Stockholm: Allmänna Förlaget, 1971.
16. Malmgren S, Andersson G. Who was reached by an extensive one year health information campaign? Department of Perventive and Social Medicine, Linköping University, accepted for publication, Scand J Soc Med.
17. Mobily K. Using physical activity and recreation to cope with stress and anxiety. A review. Am Correct J 1982; 36: 77–81.
18. Morris JN. Vigorous exercise in leisure time and the incidence of coronary heart disease. Lancet 1973; 1: 333–339.
19. Morris JN, Pollard R, Everitt MG. Vigorous exercise in leisure time, protection against coronary heart disease. Lancet 1980; 2: 1207–1210.
20. Mossey JM, Shapiro E. Self-rated health: a predictor of mortality among the elderly. Am J Public Health 1982; 72: 800–808.
21. Oseid S. Asthma and physical activity. Scand J Soc Med 1982; Suppl 29: 227–234.

22. Paffenbarger RS, Hyde R, Steinmetz C. A natural history of athleticism and cardiovascular health. JAMA 1984; 4: 491–495.
23. Pilz G. Kritische Gedanken zur Fitness-Welle und zu den Volkslaufen aus sozialpsychologischen Sicht. Sportartzt Sportmedizin 1976; 1: 24–27.
24. Salonen JT, Puska P, Tuomilehto J. Physical activity and risk of myocardial infarction, cerebral stroke and death. A longitudinal study in Eastern Finland. Am J Epidemiol 1982; 115: 526–537.
25. Shephard RJ. Physical activity and the healthy mind. Can Med Assoc J 1983; 128: 525–530.
26. Singer E, Garfinkel R, Cohen SM. Mortality and mental health evidence from the Midtown Manhattan Restudy. Soc Sci Med 1976; 10: 517–525.
27. Smith E, Reddan W, Smith P. Physical activity and calcium modalities for bone mineral increase in aged women. Med Sci Sports Exer 1981; 13: 60–64.
28. Soerlie D, Myhre K. Effects of physical training in intermittent claudication. Scand J Clin Lab Invest 1978; 38: 217–222.
29. Staff PH. The effects of physical activity on joints, cartilage, tendons and ligaments. Scand J Soc Med 1982; Suppl 29: 59–63.
30. Strömme SB, Frey H, Harlem OK. Physical activity and health. Scand J Soc Med 1982; Suppl 29.
31. WHO Regional Publications. European Series no. 6. Andersen KL. Habitual physical activity and health. 1978.

Address for offprints:

Dr G. Andersson
Motionscentralen
Saab-Scania AB
S-581 88 Linköping
Sweden

IV

Occurrence of athletic injuries in voluntary participants in a 1-year extensive newspaper exercise campaign

Gunnar Andersson, Sture Malmgren and Jan Ekstrand

Int. J. Sports Med. 7 (1986) 222–225

Occurrence of Athletic Injuries in Voluntary Participants in a 1-Year Extensive Newspaper Exercise Campaign

G. Andersson, S. Malmgren, and J. Ekstrand*

Department of Preventive and Social Medicine, University Hospital, and *Sports Clinic, Department of Orthopedics, University Hospital, Linköping, Sweden

Abstract

G. Andersson, S. Malmgren, and J. Ekstrand, Occurrence of Athletic Injuries in Voluntary Participants in a 1-Year Extensive Newspaper Exercise Campaign. Int J Sports Med, Vol 7, No 4, pp 222–225, 1986.

In 1977 the newspaper *Östgötacorrespondenten* (Corren) started a 1-year campaign for better health. The campaign was called "Piggare med Corren" (get fit with the Corren) and included antismoking, dietary, and exercise components. It was given widespread publicity in the newspaper.

The purpose of the study was to examine the extent of self-reported exercise injuries in volunteers who diligently participated in a newspaper campaign.

Information was collected from questionnaires sent to the most persistent participants after the campaign; 60% answered the questionnaire. An analysis of the dropouts showed that they had not started to exercise to the same extent as the others.

Only 5% said that they had not exercised before the campaign; 6.7% reported that they were injured in connection with their exercising during the campaign in such a way that they had to interrupt their exercise. Thirty-seven persons had called a doctor and 19 persons were reported sick during for an average of 1 month because of the exercise injuries.

There were significantly more regular exercisers who had been highly active before the campaign among those who had been injured compared with those who were not injured.

Key words: physical activity, athletic injuries, exercise campaign

Introduction

People of different ages, with different types of possibilities and talents, are participating in sports in the form of competition or exercise. More and more people are exercising in an organized and qualified way in sports clubs (17). Many people also have a positive attitude toward the importance of exercise for health and well-being (4).

Exercise offers many positive physiologic and medical effects, but also involves great risks for injuries. Of those who come to casualty wards with injuries, 6%–15% have been injured in connection with exercising (3, 9, 18).

There have been more studies of injuries due to competitive sports than of injuries due to exercise. Different studies of injuries among exercisers show varying frequencies of injuries (7, 8, 10, 12, 16). This can be due to differences in age, exercise forms, and intensity of exercising; also, the length of the period of the study and the way of defining and registering the injuries may show some differences. However, there are few studies on the extent of injuries of exercisers in connection with extensive newspaper exercise campaigns. It is important that studies of this kind are carried through since there have been extensive health campaigns going on in Sweden during the last 15 years, often in the form of campaigns with the aim of making people start exercising. The research on the effects of exercising has mainly been focused on the positive benefits. We think it is important also to throw light upon the negative effects of exercising in connection with extensive exercise campaigns. The purpose of the study was to examine the extent of self-reported exercise injuries in voluntary participants with persistent interest in a 1-year exercise campaign.

Material and Methods

In 1977–1978 the newspaper *Östgötacorrespondenten* (Corren) ran a 1-year campaign in Linköping for better health. The compaign was called "Piggare med Corren" (get fit with the Corren) and included exercise, dietary, and antismoking components. It was given great publicity in the newspaper with special supplements every week. Informative meetings were arranged monthly with specialists from the regional hospital, the Saab-Scania Physical Fitness Center, and Linköping University, and readers' questions were answered in the newspaper. Company teams were formed and competitions held between different places of work.

The participants sent in monthly reports during the campaign to the newspaper about the number of days of physical activity.

Questionnaires sent to the participants after the campaign made it possible to register the number of self-reported injuries in connection with exercising. It was important that the questionnaire reached the persons who participated in the campaign most diligently.

After the campaign the questionnaire was sent out in April 1978 to:

A. All participants in a fitness test (844 persons)
B. All participants in the "quit-smoking" part of the campaign (418 persons)
C. All participants who had sent a least ten monthly reports to the newspaper (433 persons)

D. All participants who had sent in one or more of the last 3 months' reports and did not fit into one of the other categories (220 persons)

Of 1568 participants who received the questionnaire, 935 persons (60%) returned it. The lowest response was among the participants in group B (39%) and the highest in groups C (84%) and D (70%), i.e., those who sent in most of their monthly reports and by doing so showed improvements in their health habits. The mean age of the participants was 40.4 years; 67% were women and 33% men.

An analysis of the dropouts showed that the registrants who had not answered the questionnaire had not started to exercise to the same extent as the others (11).

The questions in the questionnaire pertained to exercise habits before the campaign and number of different exercise activities before and during the campaign. There were also questions about exercise injuries which had posed an obstacle to continued exercise and had also resulted in calls to a doctor and sick leave. All the information obtained was data processed. Significance was determined using the chi-square test and t tests with two-tailed probability.

Results

Exercise Habits

Only 50 persons (5%) said that they had not exercised before the campaign; 44% exercised at least 1–2 times a week and the rest exercised occasionally. In this respect there was no difference between men and women, as was the case regarding change of exercise habits, which shows if the exercisers have started new different exercise activities or not: 43% of the women and 35% of the men ($P < 0.05$) had participated in more different exercise activities during the campaign than before; 6% of the women and 8% of the men had participated in less different exercise activities.

Exercise Injuries

Of those who answered the questionnaire, 63 persons (6.7%) reported that they had been injured in connection with their exercising during the campaign in such a way that they could not go on exercising; 18 persons had to discontinue exercise for more than 1 month. Of the 63 injured persons, 26 were men (8.3% of the men who answered the questionnaire) with a mean age of 34.6 years and 37 women (5.9%) with a mean age of 39.4 years.

As a result of the exercise injuries, 37 persons had consulted a doctor with for an average of two calls. One person said that due to the injury he had to stay in a hospital for 1 week. In all, 19 persons were reported sick during for an average of 1 month because of exercise injuries, three of whom were reported sick for more than 1 month.

Regarding the part of the body injured the most, injuries to the lower legs predominated, namely, 64% of all injuries (Table 1). Only five persons answered that the injuries resulted from body contact.

Exercise Injuries – Exercise Habits

In Table 2 the exercise habits are compared before the start of the campaign for the 63 injured persons with those who had not been injured. Table 2 shows that the greatest difference between the groups is to be found among those who exercised 3–5 times a week before the campaign where 15% were injured compared with 6.5%–8% among those who had not exercised regularly before the campaign ($P < 0.05$).

The mean number of different exercise activities/participant before the campaign was 2.5 for the injured and 2.0 for the rest ($P < 0.01$). The increase in the mean number of activities/participant was not significantly greater for the injured: 0.6 compared with 0.5 activities for the non-injured.

Table 3 illustrates the relationship between recently initiated exercise activities and exercise injuries. It shows that there was no difference between the injured persons

Table 1 Distribution of exercise injuries according to parts of the body affected

Part of the body	Number of answers
Lower leg	46 (64%)
Back	10 (14%)
Arm	6 (8%)
Shoulder	2 (3%)
Eye	2 (3%)
Other parts	1 (1%)
Missing Values	5 (7%)

Table 2 Exercise habits before starting the campaign for those injured and not injured ($P < 0.05$)

	Never exercised	Exercised now and then	Exercised 1–2 times a week	Exercised 3–5 times a week	Elite training	Missing values	
Injured	4 (8%)	24 (6.5%)	21 (6.5%)	14 (15%)	0 (0%)	0 (0%)	63 (6.7%)
Not injured	46 (92%)	345 (93.5%)	299 (93.5%)	81 (85%)	0 (0%)	101 (11.5%)	872 (93.3%)
	50 (5.3%)	369 (39.5%)	320 (34.2%)	95 (10.2%)	0 (0%)	101 (10.8%)	935 (100%)

Table 3 Participants in the campaign exercise who were injured distributed according to changed exercise habits.

	Mean number of different exercise activities before/ during the campaign	Injured persons forced to interrupt their exercising	Injured persons who called a doctor	Injured persons who reported sick
Increased exercise (n= 375)	1.8/3.2	31 (8.3%)	15 (4.0%)	10 (2.7%)
Unchanged exercise (n= 498)	3.2/3.2	28 (5.6%)	20 (4.0%)	9 (1.8%)
Decreased exercise (n= 62)	3.3/2.3	4 (6.5%)	2 (3.2%)	0 (0%)
N = 935		63	37	19

who had participated in more compared with those who had participated in fewer different exercise activities during the campaign.

Discussion

The campaign did not succeed in activating nonexercisers. Only 5% of those who answered the questionnaire reported that they had not exercised before the campaign.

The dropout of the response rate when it comes to the questionnaire is of less importance in this study since the purpose was to reach those who diligently participated in the 1-year campaign. An analysis of the dropouts showed that the registrants who had not answered the questionnaire had not started to exercise to the same extent as the others (11). The highest response was in groups C (84%) and D (70%), i.e., those who sent in most of their monthly reports and thus showed improvements in their health habits.

A comparison with other studies showed that the campaign "Piggare med Corren" had a definitely lower rate of injuries: 6.7% compared with 37%–90%. Some explanations could be:

1. The rate of injury in our study was based only on the reports from the participants contained in the ensuing questionnaire. No medical follow-up was made compared with other studies (8, 10, 16).
2. Our questions only referred to injuries that required cessation of training. Consequently, slight injuries could well have been sustained (7).
3. Those who were injured at the beginning of the campaign and then were frightened to go on exercising (7, 12) were not included since we only studied those who diligently took part in the campaign.
4. Our study comprised assiduous participants in an extensive exercise campaign who exercised with varying degrees of intensity and varying numbers of exercise forms. Most other studies comprise less more homogeneous groups with a high exercise intensity (10, 12).

Our study does not give the total injury risk at the start of an exercise campaign because we chose to register only the injuries that were so serious that they led to a halt in training. There are reasons to believe that the total injury risk was higher than those reported. Consequently, it is important to realize the seriousness of our results. More than one-half of the injured persons went to see a doctor, which was also observed in other studies (12). Almost every third injured person reported sick for an average of 1 month.

It is also important to note that it is not the persons with low levels of activity who, when they start exercising, run the greatest risk of sustaining injury. The rate of injuries seems to depend on the number of different activities, whether recently started or not. There was no significant difference in injuries between the group which had increased its mean activity per week from 1.8 to 3.2 activities and the group that remained unchanged with 3.2 activities (Table 3). Furthermore, the number of opportunities for activities seemed to be of great importance. The rate of injuries was about double in the group who had exercised 3–5 times a week before the campaign compared with beginners and less active exercisers (Table 2). Consequently, a high level of training that had been going on before the exercise campaign seemed to increase the risk for injuries (1, 10, 14, 15). Therefore, it appears to be an important research project, before launching extensive mass media exercise campaigns, to clarify whether, from a health point of view, there is an optimal amount of exercise and, if possible, to define it in numbers of occasions and activities. This is important since exercise campaigns principally reach those who are already physically active.

Naturally, it must not be forgotten in this discussion that regular exercise has many positive effects (6, 19), which we also studied in this campaign. One-fourth of the participants who had suffered from headache, back pain, stomach problems, or sleeping disturbances before the campaign experienced that their symptoms had decreased during the campaign, primarily due to changes in exercise habits (2). Much speaks in favor of the positive effects, which are

greater than the negative aspects in the form of injuries. Of course, this does not reduce the importance of taking measures to minimize the risks of injuries. The lower extremities are most prone to injuries (7, 10, 12, 20). The strains on legs when exercising can be reduced by good sports shoes of the right construction. A suitable warm-up and movement program, which increases the flexibility of the joints and strengthens the muscles, prevents injuries (5, 13) and should be emphasized in the mass media campaigns.

It is also important not to neglect "minor injuries" and pain signals. Much can be done to minimize the risks of injury when exercising (1, 5, 15). The information about health provided to increase the number of regular exercisers in Sweden should be supplemented by means for prevention of injuries.

Conclusions

1. Sixty-three persons (6.7%) reported that they were injured in connection with their exercising during the campaign in such a way that they had to interrupt their exercise. Thirty-seven persons consulted a doctor and 19 persons were reported sick for an average of 1 month because of exercise injuries.
2. Injuries to the lower legs accounted for 64% of all injuries.
3. There were significantly more regular exercisers who had been highly active before the campaign among those who had been injured compared with those who were not injured.
4. Measures to prevent accidents should be emphasized when launching extensive mass media exercise campaigns.

References

1. Allman F.: The prevention and treatment of orthopedic problems related to an adult exercise program. *J Occup Med* 12: 573–576, 1971.
2. Andersson G., Malmgren S.: Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a one-year extensive newspaper exercise campaign. Department of Preventive and Social Medicine, Linköping University, accepted in *Scand J Soc Med.*
3. Axelsson R., Renström P., Svensson H.-O.: Akuta idrottsskador på ett centrallasarett. *Lärkartidningen* 77: 3615–3617, 1980.
4. Bjurö T., Vilhelmsen L.: Attityder och orsaker till fysisk inaktivitet hos medelålders män. *Läkartidningen* 5: 347–349, 1975.
5. Ekstrand J., Gillquist J.: The avoidability of soccer injuries. *Int J Sports Med* 4: 124–128, 1983.
6. Fentem P.H., Bassey E.J.: The case for exercise. Sports Council Research Working papers no 8. The Sports Council, 70 Brompton Road, London SW3 IEX, 1981.
7. Glick J., Katch V.: Musculoskeletal injuries in jogging. *Arch Phys Med Rehabil* 51: 123–126, 1970.
8. Kilbom Å., Hartley L.H., Saltin B., Bjure J., Grimby G., Åstrand I.: Physical training in sedentary middle-aged and older men. I. Medical evaluation. *Scand J Clin Lab Invest* 24: 315–322, 1969.
9. Lorentzon R., Johansson C., Björnstig U.: Fotbollen orsakar flest skador men badmintonskador är dyrast. *Läkartidningen* 81: 340–343, 1984.
10. Lutter L.: Injuries in the runner and jogger. *Minn Med* 1: 45–51, 1980.
11. Malmgren S., Andersson G.: Who was reached by an extensive one-year health information campaign? Department of Preventive and Social Medicine, Linköping University, accepted in *Scand J Soc Med*
12. Maughan R.J., Miller J.D.B.: Incidence of training-related injuries among marathon runners. *Br J Sports Med* 3: 162–165, 1983.
13. Möller M., Öberg B., Ekstrand J., Gillquist J.: Duration of stretching effect on range of motion in lower extremities. *Arch Phys Med Rehabil* 3: 171–173, 1985.
14. Orava S.: Exertion injuries due to sports and physical exercise. A clinical and statistical study of non-traumatic overuse injuries of the musculoskeletal system of athletes and keep-fit athletes, dissertation. Department of Surgery, University Hospital, Uleåborg, Finland, 1980.
15. Piterman L.: The hazards of jogging and running. *Aust Fam Physician* 12: 943–948, 1982.
16. Raskin R.J., Rebecca G.S.: Posttraumatic sports-related musculoskeletal abnormalities: Prevalence in a normal population. *Am J Sports Med* 5: 336–339, 1983.
17. SIFO: Några förändringar i kost- och motionsvanor under 1970-talet. Svenska Institutet för opinionsundersökningar AB, Vällingby, 1978.
18. Skau T., Bröte L., Nettelblad H.: Traumatologi vid ett länsdelssjukhus. *Läkartidningen* 79: 1576–1580, 1979.
19. Strömme S., Frey H., Harlem O., Stokke O., Vellar O., Aarö L.E., Johnsen J.E.: Physical activity and health. *Scand J Soc Med* (suppl) 29: 1982.
20. Temple C.: Hazards of jogging and marathon running. *Br J Hosp Med* 3: 237–239, 1983.

G. Andersson, Department of Preventive and Social Medicine, University Hospital, S-581 85 Linköping (Sweden)

V

Health Profile Assessment as a screening instrument

Gunnar Andersson and Sture Malmgren

ABSTRACT

Over a period of 18 years we have developed a special method within the area of revelatory communication the purpose of which is to get the individual himself to take responsibility for his health via positive health habits. This method, which we have designated as "Hälsoprofilbedömning", HPB, (Health Profile Assessment), is also a method for screening those who are considered to constitute individuals at risk and who therefore ought to have a motive for revising their way of living. The HPB is begun with a conversation based on a questionnaire which is then followed up by skeletal measurements, blood pressure determination, a submaximal work test on the bicycle ergometer and, finally, a discussion.

The purpose of the present article is to describe this method and its theoretical background and to exemplify its use as a screening instrument for 124 40-year-old employees at Saab-Scania in Linköping.

The participants' perceived stress, troublesome symptoms, high blood pressure, low cardiorespiratory endurance (CRE), and overweight or underweight go along with poor health habits. The high risk group (15%) have high blood pressure, take cardiac medication, are stressed very often, have a very low CRE or have a total of at least four negative components in the HPB. When forming groups according to treatment programs, particular attention should be paid to future risk of illness and the resources which are available.

BACKGROUND

Over a period of 18 years we have developed a special method within the area of revelatory communication the purpose of which is to get the individual himself to take responsibility for his health via positive health habits. This is important since one's lifestyle not only varies according to the length of one's life, illness and health, but also influences to a large extent one's general sense of well-being, joy of living and productivity. This method, which we have designated as "Hälsoprofilbedömning", HPB, (Health Profile Assessment), is also a method for screening those who are considered to constitute individuals at risk and who therefore ought to have a motive for revising their way of living.

The HPB arises from the philosophy of prospective medicine (1) from which other similar methods have developed such as the Health Hazard Appraisal (2) and the Nottingham Health Profile (3,4). In contrast to the other methods, the HPB places more emphasis on the importance of a two-way communication process. This means that the individual actively takes part in the assessment of negative and positive components in his health profile and their importance in regard to his future state of health, and eventually takes the responsibility and initiative for changes in his health habits.

The purpose of the present article is to describe this method and its theoretical background and to exemplify its use as a screening instrument for a group of 40-year-old employees at Saab-Scania in Linköping.

METHODS

"Hälsoprofilbedömning", HPB — Development and testing

From 1968–1978 the HPB was developed and tested within the evolvement of a comprehensive preventive health care program at Saab-Scania in Linköping. This company currently has approximately 6 000 employees. The HPB has its origins in a submaximal work test on the bicycle ergometer which was used as a complement to other medical tests and measurements in a general health examination. The initial conversation and the final discussion have become more and more important, concurrent with growing medical interest in influences on lifestyle. Parallel to the development of standardized forms, the method has been supplemented with additional measurements.

External training of Health Profile assessors began in 1979. Great importance has been attached to guaranteeing as much as possible, based on special forms, the standardized and uniform application of the HPB. In all, 653 Health Profile assessors have been trained throughout Sweden (Fig. 1). Since 1979 approximately 50 000 Health Profile Assessments have been carried out.

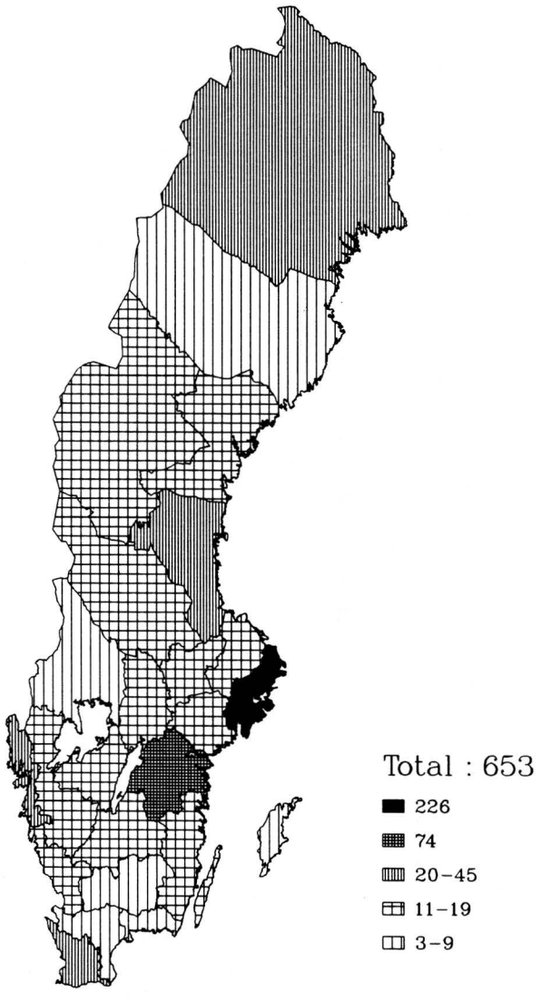


Figure 1. *Participants in the basic course in Health Profile Assessment from 1979–1985. N = 653. 50% of the districts in Sweden are represented.*

Design

The HPB is begun with a conversation based on a questionnaire which is then followed up by skeletal measurements, blood pressure determination, a submaximal work test on the bicycle ergometer and, finally, a discussion.

The HPB — questionnaire

The conversation is begun with questions about physical activity prior to the age of 20 years and the person's current job situation. The questionnaire consists of eleven questions with five fixed alternative answers for each question, one of which is to be chosen (Fig. 2). The answers shed light on some important health habits and what the participant considers his state of health to be. The questions are based on the participant making self assessments which reflect his awareness and conceptions associated with the respective questions. The participant is informed in advance that if there is no answer that is appropriate then the answer farthest to the right and the one farthest to the left are the answers which are most extreme. If the participant does not want to select either of the two most extreme answers perhaps there is a tendency toward one direction or the other. If the individual does not feel that there is a "tendency" toward either direction the alternative in the middle remains.

All questions refer to the past month.

Mode of transportation to work

The questionnaire begins with a question about mode of transportation to work. The answer alternatives indicate whether the person gets to work under his own power or by other means of transportation.

Leisure activities

The second question is subdivided into seven different persuits and is designed to cover leisure activities. The answers are summarized in an index and provide some idea of the person's energy level (4), social contacts and level of activity.

Exercise

The operational concept of exercise is physical activity while wearing a sweat suit or appropriate exercise clothes for the purpose of maintaining or improving one's physical condition or health. Exercise shows a strong positive relationship to better health (5,6,7,8,9), less cardiovascular disease (10,11), less sick leave (12,13), lower mortality rate (14,15,16,17) fewer psychosomatic symptoms (18) and a better sense of general well-being (19,20).

H.O.S.
Sture Malmgren
Gunnar Andersson

Copyright

QUESTIONNAIRE FOR HÄLSOPROFILBEDÖMNING, HPB (HEALTH PROFILE ASSESSMENT)

Name | Department/Address | Telephone

Answer the following questions, which are the basis of your health profile, by placing an "X" in the appropriate box. All questions refer to the past month.

HÄLSOPROFIL

TRANSPORTATION to work

Car, bus or train	Walk less than 2 km	Walk over 2 km	Bicycle less than 5 km	Bicycle over 5 km
1	2	3	4	5

LEISURE ACTIVITIES

	Never	Seldom	Now and then	Often	Very often
Hobbies	1	2	3	4	5
Activities associated with clubs, organizations (religious, political etc)	1	2	3	4	5
Taking courses	1	2	3	4	5
Spectator sports, going to exhibitions, the Theatre, cinema, restaurants	1	2	3	4	5
Dancing, discoteque, folk dancing	1	2	3	4	5
Painting, carpentry, housework, gardening, shoveling snow	1	2	3	4	5
Walk, cycle, hunting, fishing, go berrying, mushroom picking, outdoor life	1	2	3	4	5

EXERCISE

Exercise refers to activities you take part in, while dressed in a sweat suit or exercise clothes, for the purpose of maintaining or improving your physical condition or health

Never	Occasionally	1-2 times a week	3-5 times a week	At least 5 times a week
1	2	3	4	5

DIET

I never think about my diet	I occasionally follow dietary recommendations	I follow dietary recommendations but not regulary	I follow dietary recommendations regularly	I almost always plan and eat a nutritioned diet
1	2	3	4	5

TOBACCO USE

(If you smoke a pipe or other types of tobacco, try to estimate your consumtion in cigarettes per day)

	More than 30 cig/day	21-30 cig/day	11-20 cig/day	1-10 cig/day	O cig/day
Smoking	1	2	3	4	5

	At least 1 tin/day	4-6 tins/week	2-3 tins/week	Not more than 1 tin/week	I do not chew tobacco
Chewing tobacco	1	2	3	4	5

ALCOHOL INTAKE - beer (not non-alcoholic beer), wine, liquor

I drink very often or periodically in large quantities	I drink often	I drink now and then	I seldom drink	I never drink
1	2	3	4	5

DRUG CONSUMPTION

Do you use Do you use tranquilizers, stimulants or drugs for sleep and/or pain relief?

Very often	Often	Now and then	Seldom	Never
1	2	3	4	5

SYMPTOMS

Do you have back pain, neck pain, stomach problems, headaches, sleeping problems or problems with fatigue?

Very often	Often	Now and then	Seldom	Never
1	2	3	4	5

PERCEIVED STRESS (at work and/or during leisure time)

I feel stressed very often	I feel often stressed	I feel stressed now and then	I feel seldom stressed	I feel never stressed
1	2	3	4	5

PERCEIVED LONELINESS

I am very often lonely	I am often lonely	I am lonely now and then	I am seldom lonely	I am never lonely
1	2	3	4	5

PERCEIVED HEALTH (physical and mental)

Very poor	Poor	Fair	Good	Very good
1	2	3	4	5

Figure 2. *Questionnaire for "Hälsoprofilbedömning", HPB, (Health Profile Assessment).*

Diet

The importance of diet in regard to health has been reported in many studies (21). Eating breakfast regularly and refraining from eating between meals shows a significant positive relationship to better health (6). The participant himself is to judge the status of his dietary habits. The answer primarily elucidates the participant's own assessment of how eager he is to practice proper dietary habits.

Tobacco use

The relationship between smoking and illness is well known and well documented (22). The harmful medical effects of snuff are only incompletely known.

Tobacco use can be quantified and smoking is recorded in consumption per day while taking snuff is recorded per day or per week. Even here the questions is summarized in an index which cover the tobacco use.

Alcohol intake

There is a relationship between extensive use of alcohol and a broad spectrum of somatic illnesses (23). Alcohol is socially destructive when missused and is strongly associated with mental problems and increased mortality (24,25). Modest alcohol consumption, however, has a positive relationship to better health (26,27). Nevertheless interpretation of this finding, however, is ambigous (25,28).

Drug consumption

It is being observed more and more frequently that too large a consumption of sedatives, sleeping medicine and stimulants can lead to addiction and injurious effects.

Symptoms

Many people have psychosomatic symptoms, often a number of them at once (29), such as back pain, neck troubles, stomach problems and headache, without any provable somatic changes. In spite of this, the symptoms must be taken seriously. Many of them require medical treatment notwithstanding the absence of provable somatic changes. Perception of symptoms is a very important variable influencing the use of medical services (30). Sleeping trouble and reported symptoms are also predictors of OTC (Over The Counter) drug use (31).

Perceived stress

Stress in the sense of psychosocial strain influences health and well-being. Examples of causes of stress are a discrepancy between requirements and opportunities in the environment and the individual's ability and needs, — that is,

a poor fit between expectations and perceived reality and role conflicts. Life events are also frequently related to decreased levels of physical health and emotional well-being (32).

The way in which the individual experiences stress is essential. The question is intended to elucidate all the psychosocial stresses which the individual experiences both at work and during leisure time.

Perceived loneliness

In the past few years the importance of the social support network as it affects our mental and physical health has been given more and more attention. Social support has also been linked to resistance to illness (32,33).

A common denominator seems to be perceived loneliness, a variable which, in addiction, appears to be an important factor regarding positive changes in self-rated well-being (34).

Perceived health

The rating of perceived health is significantly associated with physician ratings (35) and is a very important variable influencing the use of medical services (30). Aside from sex and age, perceived health can also be a strong predictor of mortality (35,36,37).

The HPB — physiological and medical measurements

Assessment of overweight and underweight

A vast number of methods are used for determination and calculation of the amount of body fat, and they exhibit methodological errors of various sizes. Methods for determining the amount of fat more precisely, such as hydrostatic weighing, are not applicable outside of the laboratory. In the method we use, measurement of body height and skeletal diameters of the wrists (radio-ulnar) and the knees (condyle of the femur) are included in the determination of lean body mass. With precision and standardization of the anthropometrical measurements the error is $\pm 4\%$ when the method is used on young, healthy persons (38).

Low body mass is related, among other things, to increased mortality (39,40), slight or moderate overweight is related to lower mortality (40,41), and extreme obesity shows a relationship to higher mortality (41).

Blood pressure determination

There is little argument that elevated blood pressure is an important risk factor for "all-cause" as well as cardiovascular mortality (42).

Estimation of maximal aerobic power

An important health related component of physical fitness is cardiorespiratory endurance (CRE). A high level of CRE is related to fewer coronary risk factors (43,44,45).

In the HPB a submaximal work test on the bicycle ergometer is included for estimation of maximal aerobic power (46,47), and physical conditioning index expressed in % of an ideal value (48).

One of the reasons the bicycle ergometer work test is submaximal is to avoid the risks present with exercise stress tests (49).

Perceived exertion

During the final minute on the bicycle ergometer the participant is asked what his perceived exertion is according to the so-called RPE-scale (Ratings of Perceived Exertion) (50). The scale consists of numbers varying from 6 to 20, where each odd number is associated with an expression such as "fairly light", "very hard". Coupled with the absolute load on the bicycle ergometer the participant's assessment of his exertion provides information about his CRE. In a comparison of perceived exertion with an assessment of working pulse on a 7-point scale and the previosly reported exercise habits, an estimate is also made of possible deviations from the average maximal pulse frequency for the age in question.

MATERIAL

Since 1982 the HPB has been carried out on employees at Saab-Scania in Linköping when they become 40 years old. The HPB has replaced the general medical check-up carried out on company employees in this age group. In 1982 there were 50 workers and 112 salaried employees who were 40 years old. 38 persons (23%) declined participation in the HPB. Of the 124 participating 40-year-olds, 10 (8%) were women.

RESULTS

Presentation of the results from the HPB of the 124 participating 40-year-old employees is based on the extent to which negative components were found in the examinations of each person. The components are comprised of the individual's health habits, perceived health and physiological/medical test measurements. Limits of negative components are shown in Table I.

Table I. *Limits and frequency distribution of negative components originating from "Hälsoprofilbedömning", (Health Profile Assessments) carried out on 124 40-year-old employees at Saab-Scania in Linköping.*

	Limits	Number of persons (n)
Exercise	1–2	61 (49%)
Diet	1–2	68 (55%)
Tobacco use	1–4	39 (31%)
Alcolhol intake	1–2	1 (1%)
Drug consumption	1–2	5 (4%)
Symptoms	1–2	26 (21%)
Perceived stress	1–2	25 (20%)
Perceived loneliness*	1–2	—
Perceived health*	1–2	—
Blood pressure	Too high	8 (6%)
Cardiovas. medic.	Yes	1 (1%)
Diabetes	Yes	0 (0%)
Weight	Overweight or underweight	14 (11%)
Cardiorespiratory endurance (CRE)	1–2	17 (14%)

* Questions not included in this study

It is evident from Fig. 3 that the participants' perceived stress, troublesome symptoms, high blood pressure, low CRE, and overweight or underweight go along with poor health habits. Only 8 of the 44 participants with burdensome stress and symptoms have these problems without having them coupled with poor health habits, high blood pressure, low CRE, overweight or underweight.

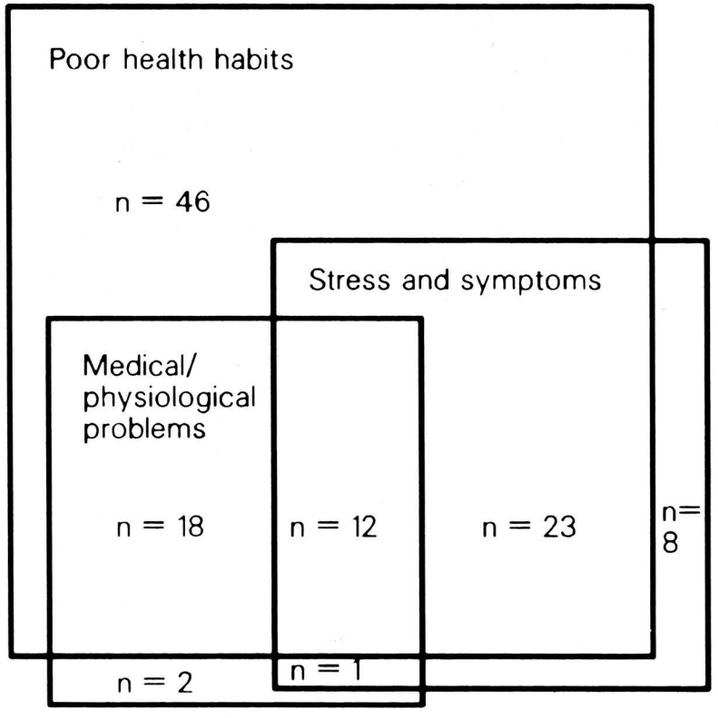
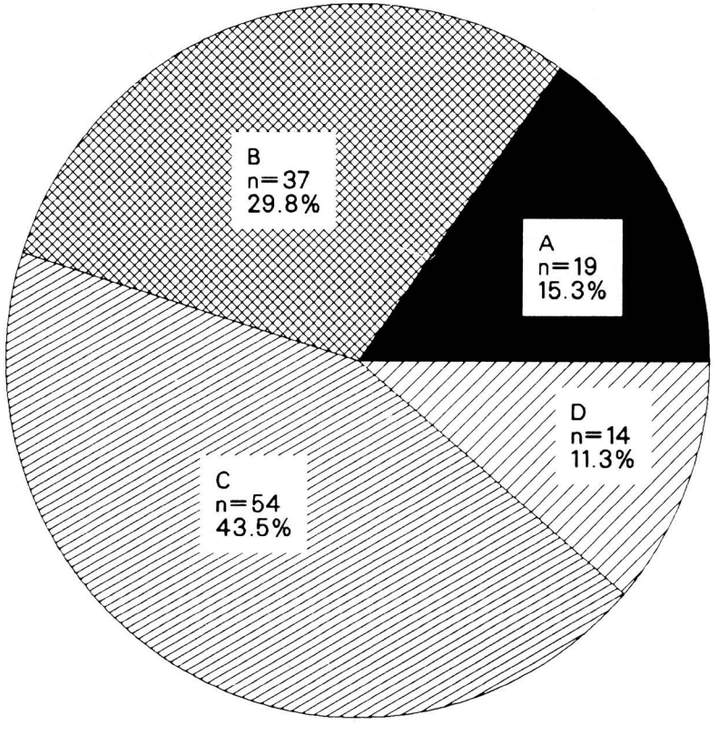


Figure 3. *Patterns of poor health habits (exercise, diet, tobacco use), perceived stress, psychosomatic symptoms and medical/physiological problems in the form of high blood pressure, low cardiorespiratory endurance, overweight or underweight for 124 40-year-old participants in the "Hälsoprofilbedömning", (Health Profile Assessment).*

The majority of the 40-year-old employees (55%) have only 0–2 negative components according to the definitions in Fig. 4 (levels C and D). 15% have high blood pressure (51), take cardiac medication, are stressed very often, have very low cardiorespiratory endurance (CRE) or have a total of at least four negative components (level A).



Negative components in the HPB

A. High blood pressure, cardiac medication, very often stressed, experiences some symptom very often, very low cardiorespiratory endurance or a total of >3 negative components.

B. 3 negative components or totally inactive physically.

C. 1–2 negative components.

D. 0 negative components.

Figure 4. *Presence of negative health components in 124 40-year-old employees participating in "Hälsoprofilbedömning", (Health Profile Assessment).*

DISCUSSION

The HPB is designed primarily with the thought of initiating and motivating a process of change in the individual which will lead in the long run to permanent, sound health habits. The theories and principles which constitute the basis of the development and application of this aspect of the method are described in more detail in a separate article (52). The main idea is that the individual's own assessment of health habits, perceived health, and social ties will obtain feedback when combined both with his own experience of cardiorespiratory endurance and its calculation, plus additional other measurements. This feedback increases the individual's awareness of the degree of truthfulness of the assessment and how important his health habits are for his health. The purpose of most of the questions is to motivate the individual to change his health habits. The intention is not to search for a connection between individual components of his lifestyle and specific illness.

Many different individual-related measurements of health have been developed. One can distinguish between measurements which concern level of function, illness-specific health measurements such as the Health Hazard Appraisal (HHA), the health profiles such as the Nottingham Health Profile, and health indices.

The HPB differs from the HHA, which combines personal health histories and life style factors with computer-based profiles of morbidity and mortality risk, which are often translated into a physical "age" for comparison with true chronological age. An individual can also be given a ten-year estimate of his probability of dying from specific causes and from all causes. From an epidemiological point of view it can be questioned whether the risk factor concept should be given such far-reaching causal significance. Furthermore, we have hesitated to use the risk factor prognostic values in individual prediction. The HHA differs from HPB in some additional respects. Physiological and medical measurements and assessments of perceived health are not included in the HHA.

The Nottingham Health Profile is another method which has some aspects in common with the HPB. It does not have the HPB's association to health habits but is an instrument designed to measure subjective health status in the following areas: physical mobility, pain, sleep, emotional reactions, social isolation and energy.

In summary, The HPB contains certain parts of both the HHA and the Nottingham Health Profile. The HPB has some physiological and medical measurements important for risk level assessment and feedback which are not present in either of the other methods. In addition, the HPB differs from both the HHA and the Nottingham Health Profile in terms of how it is carried out, in that great importance is placed on creating two-way, face-to-face communication.

Information is required to complement the questionnaire so that the HPB will give as complete a picture as possible of the individual's health habits, perceived health and conceptions associated with them. The initial and final two-way discussions with supplementary information are therefore of decisive

importance for both validity and the effectiveness of the motivation. This is dependent on standardized training of those who apply the method so that they can ask supplementary questions and supply commentary and information along with a correct evaluation of the physiological and medical test results in relation to answers in the questionnaire.

A standardized questionnaire, in combination with standardized instructions for answering, constitute the basic prerequisites for good reliability in the psychological part of the HPB. The method also requires at least a week's training in the theoretical background of the method and the practical application of the standardized methods. This is also important for the physiological and medical tests, which require certain basic knowledge. Thus high reliability presupposes good standardized training combined with standardized forms.

The construction of the questionnaire is based on the first two answer alternatives constituting negative components. Smoking is an exeption since there is medical agreement concerning the deleterious effects of tobacco. Reluctance to report troublesome alcohol habits and the fact that alcohol abusers may be more frequent among the dropouts can constitute explanations for the low number of individuals reporting alcohol problems (Table I).

The HPB presupposes that most of the population knows that sound health habits are important for good health and well-being (53,54). Previous research (55) also shows that it is those who already consciously live a more wholesome type of life who, when they come in contact with a broad health promotion effort, are influenced and try to improve their health habits even more. A more deliberate, effective way of influencing the health habits of those who need it most by means of health information therefore requires methods of screening those in whom it is important to take additional interest. In our development of the HPB, resources and routines within preventive health care have been developed simultaneosly. In cooperation with physicians, these can be used to study risk individuals, rehabilitate and recondition them and educate them individually and in groups to more wholesome health habits.

When forming groups according to treatment measures, particular attention should be paid to future risk of illness and available resources. The smaller one makes the high risk group, the greater the relative risk of illness in the defined group at the same time as it comprises a smaller and smaller part of the total expected incidence in the group. One must therefore include the group at medium risk, which results in a greater quantitative effect. We have therefore chosen to distinguish 4 groups with different risk levels. In the high risk group A (15%) there are those who are already ill or experience symptoms, those with high-grade stress or who are in very poor condition, and those who can be considered to have a generally increased risk of poorer health and well-being because of at least four negative components on the health profile (7). Furthermore, two medium-risk groups have been discerned comprising B (30%), C (44%) and one group without negative components. Group B contains individuals with a total of three negative components on the HPB or who are totally inactive physically. The risk level decreases additionally in group C with 1–2 negative components

on the HPB.

The resources needed for these groups are different. Those who belong to the high risk group (A) most often pass through medical examinations, a survey of their place of work, and different health education programs at the Physical Fitness Centre during working hours. In addition to feedback in a comprehensive discussion in the HPB, risk groups B and C also get a form which they take home for comparison between their desired and their current health profiles. From this comparison a contract can be signed for behaviour change and an appointment can be made for follow-up in terms of another HPB. Brochures with information about the significance of different health habits, high blood pressure, stress, and other factors are given out to those who are motivated. And for group D the final discussion in the HPB is often of great importance. In this group there are also those who want to exercise too much and too intensively, which increases their risk of injuring themselves and can decrease the preventive effects of exercise in regard to cardiovascular disease (56).

A study of absence from work due to illness shows that those who do not show up for a HPB despite repeated reminders are those with the highest frequency of absence from work due to illness. We pointed out this problem of reaching those who are perhaps in the greatest need of rehabilitation and retraining to sounder health habits in a study of 50-59-year-old employees at our company in 1975 (12). Those with a high frequency of absence and with varying mental and physical symptoms of illness often go to the company physician for individual advice and are then referred for preventive health care programs. In this way we can help a number of those who are most difficult to motivate to find their own way to sounder health habits.

REFERENCES

1. **Laszlo C A, Varga L E.** *A computorized Health Hazard Appraisal System (CHAMP).* Meth Inform Med **1981**; 20: 147–156.

2. **Vogt T M.** *Risk assessment and health hazard appraisal.* Ann Rev Public Health **1981**; 2: 32–47.

3. **Hunt S M, Mc Kenna S P, Mc Ewen J, Williams J, Papp E.** *The Nottingham health profile: subjective health status and medical consultations.* Soc Sci Med **1981**; 15A: 221–229.

4. **Hunt S M, McKenna S P, Mc Ewen J, Backett E M, Williams J, Papp E.** *A quantitative approach to perceived health status: a validation study.* J Epidemiol Community Health **1980**; 34: 281–286.

5. **Andersen K L, Masironi R, Rutenfranz J, Seliger V.** *Habitual physical activity and health.* WHO Regional Publications. European Series no 6, **1978**.

6. **Belloc N B, Breslow L.** *Relationship of physical health status and health practices.* Preventive Medicine **1972**; 1: 409–421.

7. **Fentem P H, Bassey E J.** *The case for exercise.* Sports Council Research Working Papers no 8. London, **1981**.

8. **Morris J N.** *Vigorous exercise in leisure time and the incidence of coronary heart disease.* Lancet **1973**; 1: 333–339.

9. **Strömme S B, Frey H, Harlem O K.** *Physical activity and health.* Scand J Soc Med **1982**; Suppl 29.

10. **Morris J N, Pollard R, Everitt M G.** *Vigorous exercise in time, protection against coronary heart disease.* Lancet **1980**; 2: 1207–1210.

11. **Paffenbarger R S, Hyde R, Steinmetz C.** *A natural history of athleticism and cardiovascular health.* JAMA **1984**; 4: 491–495.

12. **Andersson G, Malmgren S.** *Risk factors and reported sick leave among employees of Saab-Scania, Linköping, Sweden, between the ages of 50 and 59.* Scand J Soc Med **1986**; 14: 25–30.

13. **Cox M, Shephard R J, Corey P.** *Influence of an employee fitness programme upon fitness, productivity and absenteeism.* Ergonomics **1981**; 24: 795–806.

14. **Belloc N B.** *Relationship of health practices and mortality.* Prev Med **1973**; 2: 67–81.

15. **Breslow L, Enstrom J E.** *Persistance of health habits and their relationship to mortality.* Prev Med **1980**; 9: 469–483.

16. **Paffenbarger R S, Hyde R T, Wing A L, Hsieh C.** *Physical activiy, all-cause mortality, and longevity of college alumni.* N Engl J Med **1986**; 314: 605–613.

17. **Salonen J T, Puska P, Tuomilehto J.** *Physical activity and risk of myocardial infarction, cerebral stroke and death. A longitudinal study in Eastern Finland.* Am J Epidemiol **1982**; 115: 526–537.

18. **Haglund B.** *Geographical and socioeconomic distribution of physical activity at work and leisure time and its relation to morbidity in a Swedish rural county.* Scand J Soc Med **1984**; 12: 155–64.

19. **Goldwater B C, Collis M L.** *Psychologic effects of cardiovascular conditioning: a controlled experiment.* Psychosom Med **1985**; 47: 174–181.

20. **Shephard R J**. *Physical activity and the healthy mind.* Can Med Assoc J **1983**; 128: 525–530.

21. **Hjermann I, Ryre K V, Holme I, Leren P**. *Effect of diet and smoking intervention on the incidence of coronary heart disease.* Lancet **1981**; 2: 1303–1310.

22. *Smoking and health — a report of the surgeon general.* U.S. Department of Health, Education and Wellfare Washington **1979**.

23. **Nilsson T, Rydberg U**. *The impact of alcohol on health. In: Health and Society IV. The use of tobacco and alcohol and its influence on health.* A report from the resaerch survey "Changing health conditions and individual health" **1979**; 60–80.

24. **Thorarinsson A A**. *Mortality among men alcoholics in Iceland, 1951–1974.* J Stud Alcohol **1979**; 40: 704–718.

25. **Peterson B, Trell E, Kristensson H**. *Alcohol abstention and premature mortality in middle-aged men.* Brit Med J **1982**; 285: 1457–1459.

26. **Gordon T, Kannel W B**. *Drinking and mortality.* The Framingham study. Am J Epidemiol **1984**; 120: 97–107.

27. **Haskell W L, Camargo Jr C, Williams P T, Vranizan K M, Krauss R M, Lindgren F T, Wood P D**. *The effect of cessation and resumption of moderate alcohol intake on serum high-density-lipoprotein subfractions.* N Engl J Med **1984**; 310: 805–810.

28. **Goldman E, Najman J M**. *Lifetime absteiners, current absteiners and imbibers: a methodological note.* Br J Addiction **1984**; 7: 309–314.

29. **Andersson G, Malmgren S**. *Changes in self-reported experienced health and psychosomatic symptoms in voluntary participants in a 1-year extensive newspaper exercise campaign.* Scand J Soc Med **1986**; 14: 141-146.

30. **Hannay D R**. *Factors associated with formal symptom referral.* Soc Sci Med **1979**; 13A: 101–104.

31. **Bell R**. *Over-the-Counter drugs: Factors in adult use of sedatives, tranquilizers, and stimulants.* Publ Health Rep **1984**; 99: 319–323.

32. **Chesney A P, Gentry W D**. *Psychosocial factors mediating health risk: A balanced perspective.* Prev Med **1982**; 11: 612–617.

33. **Gottlieb N H, Green L W**. *Life events, social network, life-style, and health: an analysis of the 1979 national survey of personal health practices and consequences.* Health Educ Quarterly **1984**; 11: 91–105.

34. **Hörnquist J O, Elton M A**. *A prospective longitudinal study of abusers of alcohol granted disability pension.* Scand J Soc Med **1983**; 11: 91–96.

35. **Mossey J M, Shapiro E**. *Self-rated health: a predictor of mortality among the elderly.* Am J Public health **1982**; 72: 800–808.

36. **Kaplan G A, Camacho T**. *Perceived health and mortality: a nine-year follow up of the Human Population Laboratory Cohort.* Am J Epidemiol **1983**; 117: 291–304.

37. **Singer E, Garfinkel R, Cohen S M**. *Mortality and mental health evidence from the Midtown Manhattan Restudy.* Soc Sci Med **1976**; 10: 517–525.

38. **von Döbeln W**. *Anthropometric determination of fat-free body weight.* Acta Med Scand **1959**; 165: 37.

39. **Keys A B**. *Overweight, obesity, coronary heart disease, and mortality.* Nutrition Today **1980**; 15: 16–22.

40. **Larsson B, Björntorp P, Tibblin G**. *The health consequences of moderate obesity.* Int J Obes **1981**; 5: 97–116.

41. **Drenick E J, Bale G S, Seltzer F, Johnson D G**. *Exessive mortality and causes of death in morbidly obese men.* JAMA **1980**; 243: 443–445.

42. **Kannel W B, Gordon T, Schwartz M J**. *Systolic versus diastolic blood pressure and risk of coronary disease: The Framingham study.* Amer J Cardiol **1971**; 21: 335–346.

43. **Cooper K H, Pollock M L, Martin R P, White S R, Linnerud A C, Jackson A**. *Physical fitness levels vs selected coronary risk factors — a cross-sectional study.* JAMA **1976**; 236: 166–169.

44. **Poole G W**. *Exercise, coronary heart disease and risk factor.* A brief report. Sports Med **1984**; 1: 341–349.

45. **Brown T E, Myles W S, Allen C L**. *The relationship between aerobic fitness and certain cardiovascular risk factors.* Aviation, Space, and Environmental Med **1983**; June: 543–547.

46. **Åstrand I**. *Aerobic work capacity in men and women with special reference to age.* Acta Physiol Scand **1960**; 49: suppl 169.

47. **Åstrand P O, Rodahl K**. *Textbook of work physiology.* McGraw-Hill, New York **1977**. Chapter 10.

48. **von Döbeln W**. *Fysisk profil.* Svenska Läkartidningen **1965**; 3.

49. **Atterhög J-H, Jonsson B P E, Samuelsson R**. *Exercise testing: a prospective study of complication rates.* Am Heart J **1979**; 98: 572–579.

50. **Borg G A V**. *Psychophysical bases of perceived exertion.* Med and Science in Sports and Exercise **1982**; 14: 377–381.

51. **Andrén L, Dahlöf B, Eggertsen R et al**. *Läkartidningens behandlingsschema: Högt blodtryck.* Läkartidningen **1983**; 80.

52. **Malmgren S, Andersson G**. *Health Profile Assessment as revelatory communication.* Dep of Prev and Soc Med, Linköping University. (submitted).

53. **Bjurö T, Wilhelmsen L**. *Attityder och orsaker till fysisk inaktivitet hos medelålders män.* Svenska Läkartidningen **1975**; 72: 347–349.

54. **Furu M, Engström L M, Lindänge F**. *Kost, motion, hälsa — en undersökning bland medelålders män i Malmö.* Forskningsgruppen för idrottspedagogik, Högskolan för lärarutbildning, Stockholm **1978**.

55. **Malmgren S, Andersson G**. *Who were reached by and participated in a one year newspaper health information campaign?* Scand J Soc Med **1986**; 14: 133-140.

56. **Stubbe I, Hansson P, Gustafsson A, Nilsson-Ehle P**. *Plasma lipoproteins and lipolytic enzyme activities during endurance training in sedentary men: changes in HDL subfractions and composition.* Metabolism **1983**; 12:1120–1128.

LINKÖPING UNIVERSITY MEDICAL DISSERTATIONS
No. 245
Editor: The Dean of Faculty of Health Sciences

---

229. MIKAEL MADSEN: The low T_3 state. An experimental study. 1986.
230. LILIAN MOLIN: Factors of importance for valid digitalis assays particularly for the determination of digoxin in plasma and urine. 1986.
231. GÖRAN NYLANDER: Tissue Ischemia and Hyperbaric Oxygen Treatment an experimental study. 1986.
232. JØRGEN NÆSDAL: Omeprazole. A clinical and pharmacokinetic study. 1986.
233. ARNE E. NILSON: Radiography of liquid interfaces. Model experiments and clinical studies. 1986.
234. MAGNUS STRÖM: Cimetidine and parietal-cell vagotomy in severe juxtapyloric ulcer disease. 1986.
235. ERIK JÖRTSÖ: Hyperthyroidism in Diffuse and Nodular Goiter. A clinical and experimental study with special reference to the nude mouse model. 1986.
236. BJÖRN R. LINDGREN: New aspects on the treatment of inflammatory reactions and broncho-obstruction in bronchial asthma. 1987.
237. FREDRIK HESSELVIK: Plasma fibronectin: prognostic and therapeutic value in sepsis. 1987.
238. EVA SWAHN: Unstable Coronary Artery Disease. A Study of Risk-indicators. 1987.
239. STEN DREBORG: The Skin Prick Test. Methodological studies and clinical applications. 1987.
240. JAN ERNERUDH: Nervous system involvement in systemic diseases. A clinical and immunological study. 1987.
241. KARIN FÄLTH-MAGNUSSON: Intrauterine sensitization and gut permeability in relation to childhood allergy. 1987.
242. MELCHER FALKENBERG: Diabetes mellitus and hyper- and hypothyroidism in a community. Epidemiological and therapeutic aspects. 1987.
243. HANS STARKHAMMAR: On the effect of degradable starch microspheres in intra-arterial chemotherapy. 1987.
244. RAGNAR HEDE: Effects of halogenated volatile solvents on pharmacological functions on the lung with special reference to 5-hydroxytryptamine. 1987.

ISBN 91-7870-028-0 ISSN 0345-0082