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LEADING ARTICLE

Prevalence of ideal cardiovascular health in an adult Finnish population: the national FINRISK 2007 study

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Summary

Aim

Despite major reductions in cardiovascular disease (CVD) mortality rates during the past decades in Finland, the risk factor pattern of the population leaves much room for improvement. The aim of this study was to assess the prevalence of ideal cardiovascular (CV) health in Finnish men and women aged 25–74 years.

Material and methods

Cross-sectional population-based health examination survey was conducted in 2007 in Finland. Age and sex stratified random sample was drawn from the national population register. The total number of individuals in the analyses was 2,128 men and 2,613 women. Ideal CV health metrics were defined according to the recent guidelines of

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the American Heart Association (AHA), considering behavioural factors (smoking, physical activity, diet, obesity), biological and physiological risk factors (blood pressure, total cholesterol, blood glucose).

Results

The prevalence of ideal CV health was the lowest for the physical activity, diet and blood pressure among the total of seven factors considered. Taken together, the prevalence of having 5 or more health metrics as ideal out of the 7 was just 8.8 % (95% CI: 7.7–10.0) in women and 3.0 % (95% CI: 2.3–3.8) in men. In contrast, the proportions of men and women with less than 3 of the metrics as ideal were 50.4 % (95% CI: 48.5–52.3) in women and 69.0 % (95% CI: 67.0–71.9) in men. Age was negatively associated with the number of ideal CV health factors.

Conclusion

The prevalence of ideal CVD related health behaviour and health factors is low in the Finnish adult population.

Keywords

Cardiovascular health, risk factors, health behaviour, health survey, Finland

Introduction

CVD is the leading cause of death in Finland and globally. In many Western countries the age specific rates are declining, but the disease rates are increasing in most developing countries [1]. The main traditional risk factors for CVD are hypertension, hypercholesterolemia and smoking [2]. Levels of blood pressure and total cholesterol can be modified by health behaviour including diet and physical activity [2–4].

In Finland, a marked decrease in CVD mortality has been observed since late 1960s. In working-aged men, the coronary heart disease (CHD) rates have declined by 80% [5]. This decrease has been parallel with a decrease in smoking prevalence and decline in blood pressure and total cholesterol levels [5]. Majority of the decline in CHD mortality can be explained by changes in risk factors, and a smaller part is explained by advancements in treatment and care [5].

Despite the favourable trend in both CVD mortality and risk factors, there is still much room for improvement in CV health in Finland. The prevalence of smoking in Finland is 19% in men and 13% in women in the age group of 15–64 years [6], and the average levels of serum total cholesterol are above the current recommendations [5]. In international comparison, blood pressure levels are still relatively high in Finland [7].

Recently, the *AHA* developed a set of 7 metrics to measure ideal CV health [8]. The proposed concept of ideal CV health puts more focus on health behaviours and risk factors leading to morbidity and mortality, instead of the disease itself. These measurable metrics will be used to monitor the *AHA*'s Strategic Impact Goal 2020, which aims to improve CV health and reduce deaths from CVD and stroke.

The aim of this study was to assess the prevalence of ideal CV health in a population-based study of adults in Finland.

Material and methods

A cross-sectional population-based survey, the National FINRISK Study, was carried out in 2007 in Finland among men and women aged 25–74 years to monitor national risk factor levels. The study was conducted in five geographical areas: the cities of Helsinki and Vantaa (the metropolitan area), the areas of Turku and Loimaa, and the provinces of Northern Savo, North Karelia, and Oulu. A random sample of people aged 25–74 years was drawn from the national population register stratified so that in each geographical area, 200 people of each sex and 10-year age group were chosen. The total sample size was thus 10,000 people, and the eligible study sample was 9,957 people after exclusion of those who died or moved out of the geographical area between the time of the sample selection and scheduled health examination date.

The overall participation rate in the study was 68% (N=6,733). Of these, 475 individuals who filled in the questionnaire but did not participate in the health examination of the study were excluded. The study sample was further restricted to those who participated in a substudy with fasting glucose measurement (N=5,024). In addition, 283 individuals with a history of CVD already at the time of the health examination were excluded. Thus, the analyses were done with data on 2,128 men and 2,613 women.

The survey was conducted according to the standardized protocol based on the *World Health Organisation* Multinational Monitoring of trends and determinants in CVD (WHO MONICA) Project protocol [9] and the later recommendations by the European Health Risk Monitoring Project [10]. The study protocol was approved by the Ethics Committee of the *Hospital District of Helsinki and Uusimaa*. All participants gave their written informed consent.

Study teams in each of the geographical regions, with five trained nurses in each, carried out the survey. The nurses were specially trained in survey methodology. Survey included a self-administered questionnaire and a health examination, where anthropometric measurements, blood pressure measurements and blood sampling were carried out. The questionnaire, together with the invitation letter to the health examination, was sent by mail to all the selected individuals. Physical measurements and blood sampling were carried out in local health centres or other study sites by specially trained nurses. Laboratory measurements were carried out centrally at the Disease Risk Unit at the *National Institute for Health and Welfare*, Helsinki. The testing laboratory of the Disease Risk Unit (No. T077) is accredited by the *Finnish Accreditation Service*, FINAS, and it fulfils the requirements of the standard SFS-EN ISO/IEC 17025:2005.

Ideal CV health was defined according to the recent guidelines of the *AHA* [8]. A set of 7 metrics to measure ideal CV health was developed, including health behavioural factors (smoking, physical activity, diet, obesity) and risk factors (blood pressure, total cholesterol, blood glucose). For physical activity and diet, adaptations to the original definition were made due to the lack of suitable data.

Blood pressure measurement

The nurses measuring blood pressure were circulated between the study areas to eliminate the possible observer bias in the between-areas comparisons. A standard mercury sphygmomanometer with a cuff bladder 14 cm wide and 40 cm long was used. The fifth phase of the Korotkoff sound was used as the diastolic blood pressure and the values were recorded to the nearest even numbers**.** Blood pressure was measured three times and the mean of the last two measurements was used in the present analyses.

Participants with systolic blood pressure <120 mmHg and diastolic blood pressure <80 mmHg without blood pressure lowering medication were categorized as having ideal CV health metric. Those participants with systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 were categorized as having poor CV health. All other participants were categorized in the intermediate category.

Blood sampling

Fasting venous blood samples were drawn from each participant to measure serum total cholesterol by an enzymatic method (Abbott Diagnostics Europe, Wiesbaden, Germany) using Abbott Architect c8000 clinical chemistry analyser. Cholesterol levels <5.18 mmol/l were defined as ideal cholesterol metric; ≥5.18 mmol/l up to 6.18 mmol/l as intermediate; and 6.19 mmol/l or more as poor.

Plasma glucose was determined with a hexokinase method (Abbott Laboratories, Abbott Park, IL). Plasma glucose levels <5.6 mmol/l without glucose lowering medication were defined as ideal; ≥5.6 mmol/l up to 7.0 mmol/l or <5.6 mmol/l with glucose lowering medication as intermediate; and ≥7.0 mmol/l as poor regarding CV health.

Obesity

Weight and height were measured with participants wearing light clothing and no shoes. Height was measured to the nearest 0.1cm, and weight to the nearest 100 grams. Body mass index (BMI) was calculated as weight (kg) divided by the square of height (m^2).

BMI <25 kg/m^2 was defined as ideal; 25–29.9 kg/m^2 as intermediate; and 30 kg/m^2 or more as poor metric for CV health.

Physical activity

Physical activity was assessed in leisure time and during commuting using short self-administered questionnaires. Leisure time physical activity was divided into four categories, reflecting weekly amount and intensity of physical activity. The categories do not follow the current recommendations of physical activity for health, but are able to separate the inactive persons from moderately and vigorously active persons. The two-way commuting trip was assessed in minutes spent walking, biking or otherwise exercising and was further dichotomized into low-commuting physical activity (0–29 min daily) and high-commuting physical activity (more than 30 min daily).

Based on data on both leisure time and commuting physical activity, an index was derived so that those who were physically active both at leisure-time and commuting were classified as having ideal; those who were not active either at leisure-time or commuting were classified as having poor; and all others

(i.e. those being active either at leisure-time or commuting, but not both) were classified as having intermediate physical activity level regarding CV health.

Diet

Information on diet was collected with a self-administered food-frequency questionnaire. Four components were used to define healthy diet: eating either fruits or vegetables daily, eating fish two times or more per week, drinking low fat milk, and using vegetable oils in cooking at home.

From these data, a dietary index was derived so that those having healthy consumption of all the four components (fruits and vegetables, fish, milk and fat used for cooking) were classified as having ideal diet regarding CV health. Those who did not fulfil the healthy criteria for any of these diet components were defined as having poor diet. All the others (i.e. those fulfilling at least one but not all criteria) were defined as having an intermediate diet.

Smoking

Smoking was assessed by structured questions in the self-administered questionnaire. Based on their responses, the participants were classified into three categories: never smokers (ideal); ex-smokers (intermediate); and smokers (poor).

Statistical analyses

Mean values, standard deviations, and percentages were used to describe the characteristics of the study population. Prevalences of individual health metrics were calculated separately for men and women. Total number of ideal CV health factors was estimated by sex and age. Differences between groups were evaluated with t-tests for continuous variables and chi-squared and logistic regression models for dichotomous variables. All *P*-values are two-sided, and *P*-values less than 0.05 were considered statistically significant. The Stata statistical package, version 12.1, was used.

Results

Characteristics of the study population are shown in Table 1. The mean age was 52 years (range 25–74) and mean BMI 27 kg/m^2. Men had higher blood pressure, triglycerides and glucose levels, and lower high density lipoprotein (HDL) cholesterol levels as compared to women.

All the individual health metrics except physical activity indicated lower CV health in men as compared to women (Table 2). One third of the participants had poor physical activity level, whereas just 15% were classified as having physical activity metric as ideal. Most of the participants achieved intermediate level for the metric on diet. In women, 66% were never-smokers as compared to 46% in men. More than 20% of both men and women were classified as obese (BMI ⩾30 kg/m^2) and therefore as having poor health in this metric.

For the CV risk factors, 32% of men and 45% of women were categorized as having poor health metric based on their blood pressure levels (Table 2). Total cholesterol levels were defined as ideal in 48% of women and 46% of men. Glucose levels were more favourable in women compared to men.

Taken together the 7 individual health metrics, the distribution of number of ideal CV health factors is shown in Figure 1. The prevalence of having 5 or more health factors as ideal out of the 7 was just 8.8% (95% CI: 7.7–10.0) in women and 3.0% (95% CI: 2.3–3.8) in men. In contrast, the proportions of men and women with less than 3 of the metrics as ideal were 50.4% (95% CI: 48.5–52.3) in women and 69.0% (95% CI: 67.0–71.9) in men.

Table 1. **Characteristics of the study population**

	Women		Men		
	mean	**SD**	**mean**	**SD**	***P*-value**
N	2,613		2,128		
Age, years	51.5	13.6	52.4	13.3	0.019
Body weight, kg	71.3	14.2	84.5	13.8	<0.001
Body mass index, kg/m^2	26.9	5.4	27.3	4.0	0.011
Systolic blood pressure, mmHg	131.2	20.3	136.4	18.3	<0.001
Diastolic blood pressure, mmHg	77.0	10.4	81.5	11.4	<0.001
Total serum cholesterol, mmol/l	5.31	0.98	5.30	0.99	0.636
HDL cholesterol, mmol/l	1.57	0.37	1.31	0.33	<0.001
Triglycerides, mmol/l	1.25	0.78	1.61	1.02	<0.001
Fasting plasma glucose, mmol/l	5.73	0.78	6.13	1.09	<0.001

Table 2. **Individual metrics for ideal cardiovascular health**

		Women	Men	*P*-value
		Prevalence, %	Prevalence, %	
Health behavior:				
Smoking	Ideal*	66.3	45.9	<0.001
	Intermediate	19.1	32.7	
	Poor	14.6	21.4	
Physical activity	Ideal	13.8	15.5	0.276
	Intermediate	48.8	48.1	
	Poor	37.4	36.4	
Diet	Ideal	12.6	24.1	<0.001
	Intermediate	73.5	65.3	
	Poor	13.9	10.6	
Body mass index	Ideal	42.3	29.0	<0.001
	Intermediate	34.1	50.4	
	Poor	23.5	20.6	
Health factor:				
Total cholesterol	Ideal	47.5	45.9	0.049
	Intermediate	33.5	36.7	
	Poor	19.0	17.4	
Blood pressure	Ideal	26.7	12.2	<0.001
	Intermediate	41.2	42.4	
	Poor	32.2	45.4	
Glucose	Ideal	50.2	24.8	<0.001
	Intermediate	46.3	66.2	
	Poor	3.5	9.1	

* For definitions of ideal, intermediate and poor health metrics, see Methods.

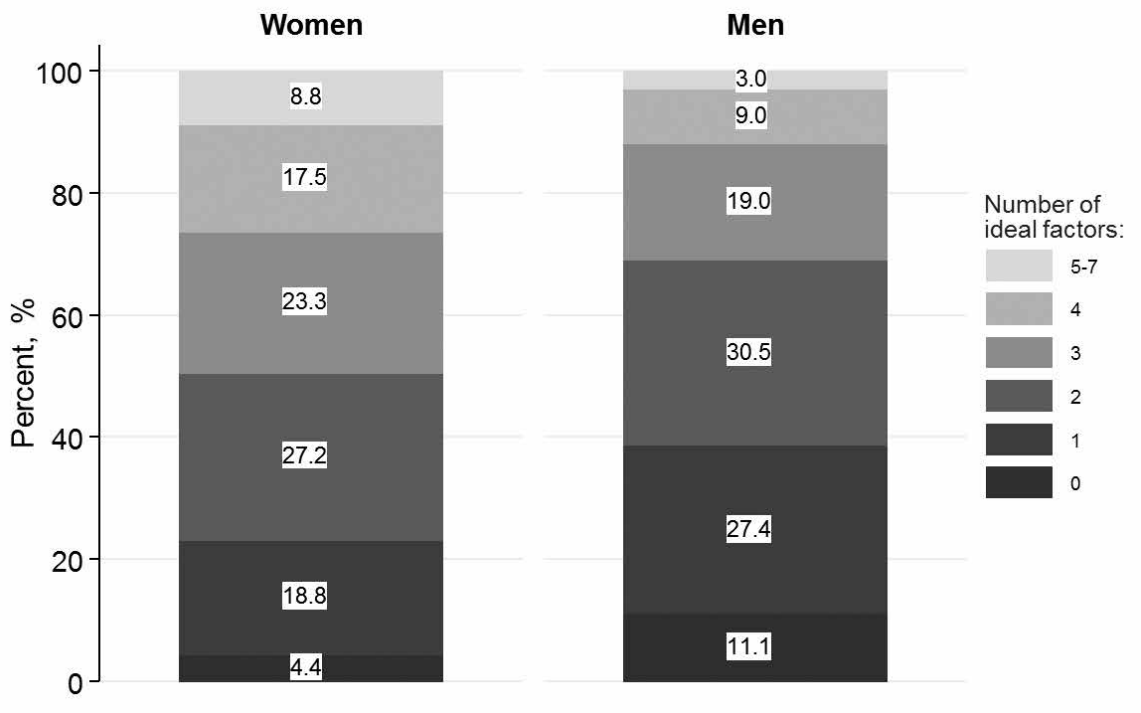

Figure 1. Distribution of the number of ideal cardiovascular health factors by sex

As expected, age was inversely associated with the number of ideal CV health metrics (Figure 2). Still, already in the youngest age group 25–34 years, the proportions with 5 or more ideal metrics were as low as 23.9% (95% CI: 19.6–28.5) in women and 8.6% (95% CI: 5.5–12.8) in men.

Discussion

This study shows that the prevalence of ideal CV health is very low among adult men and women in Finland. The results demonstrate that in spite of major progress in Finland during the past decades, there is still considerable room for improvement and potential for reducing CVD burden at population level. It is noteworthy that the prevalence of ideal CV health is low already in the younger age groups. Low prevalence of ideal CV health has been observed also in other countries. Based on the *AHA* definition of ideal CV health, the prevalence was found to be extremely low in a community-based study of middle-aged individuals in the United States [11]. In Canada, based on the so called CANHEART health index, less than 10% of Canadian

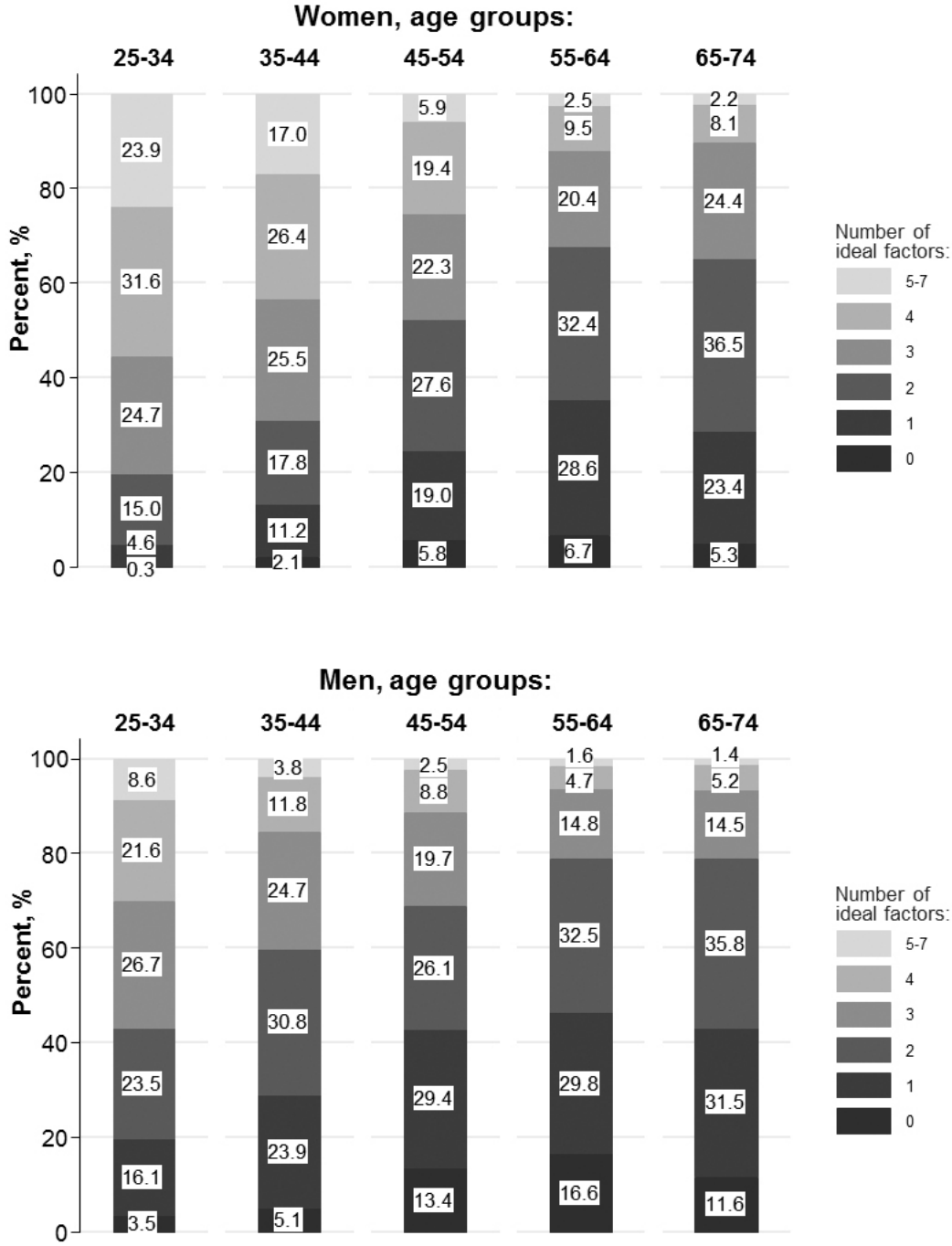

Figure 2. Distribution of the number of ideal cardiovascular health factors by sex and age

adults were in ideal CV health [12]. These results are in good agreement with results from our study.

Ideal CV health is an instrument to assess the needs and potential for CVD prevention and CV health promotion in the population. It can also be used as a tool to monitor progress at the population level. Although this instrument is primarily a tool for CV health, the risk factors, especially the behavioural ones, are also strongly related to many other non-communicable diseases (NCDs). Thus, this instrument suits well for a more general monitoring of progress in NCD prevention and promotion of public health. The metrics in the instrument are the central targets and indicators in the new *WHO* Global Action Plan for the Non-communicable Diseases 2013–2020 [13].

The concept of ideal CV health considers both the traditional risk factors for CVD, as well as health behaviours related to these. Therefore, the instrument can be used as a motivational tool in preventive work. Further, the instrument emphasises the population risk, i.e. the public health needs, and the need to change the population levels or distributions of these factors. This calls for comprehensive interventions, including government policies, health promotion and intersectoral decisions, as described e.g. in the *WHO* Global Action Plan for the Non communicable Diseases 2013–2020 [13].

The number of ideal CV health metrics has been shown to be a strong predictor of both total and CVD specific mortality in the United States [14, 15]. A similar observation was recently reported from China [16]. Several earlier studies have utilised the concept of low risk factor profile and demonstrated its association with future onset of disease [17,18]. Thus, prospective studies using the concept of ideal CV health enable estimation of the potential for improvement in CVD burden in a population by looking at actual mortality and CVD morbidity rates.

There are some limitations, which need to be considered. Available data on physical activity and diet did not allow exactly the same definition as in the *AHA* metrics; adapted definitions, which take into account some aspects of healthy diet and physical activity, were used instead. The validity of these metrics to measure national recommendations and guidelines should be evaluated. Second, the non-participation rates in population surveys are considerable, especially in the younger age groups. It is difficult to point out exactly the effect of non-participation on our estimates of prevalence of ideal CV health. Historically, non-participation in population-based surveys in Finland has been associated with lower CV health [19]. Thus, it is possible that our estimates of ideal CV health, while indicating a very low prevalence, are still too optimistic. Third, our estimates of ideal CV health were derived from the population without a history of CVD. Therefore, taken the population as a whole, the burden of CV risk factors and behaviours is even larger as those with a history of CVD cannot be regarded as having ideal CV health.

In the present study, we have used a cross-sectional population-based study to evaluate the prevalence of ideal CV health. In the future, this metric or adapted metric could be used to monitor changes in the population by looking at changes in ideal CV health and its components (both health factors and behaviours) over time. This type of monitoring could especially be beneficial for younger age groups where disease rates and total risk are still reasonably low.

Development of validated, culturally adapted indicators to be used in the definition of ideal CV health would increase the value of this tool. This could involve inclusion of other relevant health related behaviours in the definition. Evaluation of ideal CV health in subgroups of the population, e.g. in different socioeconomic groups, could be used to identify more targeted health promotion activities.

Conclusion

Despite major reductions in CVD rates during the past decades in Finland, the risk factor pattern of the population leaves much room for improvement. Strategies to increase healthy lifestyles at population level should be developed and implemented.

Conflict of interest: None declared

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