

# BMJ Open All-cause mortality among young men 24–26 years after a lifestyle health dialogue in a Swedish primary care setting: a longitudinal follow-up register study

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## ABSTRACT

**Objectives** To compare mortality and socioeconomic status among men invited to a health dialogue with men from all of Sweden approximately 24 years after the start of the study, and to analyse the associations between lifestyle and all-cause mortality, incidence of cardiovascular disease (CVD) and cancer.

**Design** Longitudinal follow-up register study of men 33–42 years old at baseline.

**Setting** Primary care in a community in Sweden.

**Subjects** All 757 men aged 33–42 years old in a community in southern Sweden, and 652 of these men who participated in a health examination between 1985 and 1987.

**Interventions** Health examination, lifestyle-directed health dialogue and group activities in primary care in cooperation with local associations.

**Primary and secondary outcome measures** All-cause mortality, income and educational level, and associations between lifestyle at baseline and all-cause mortality, incidence of CVD and cancer.

**Results** At follow-up, all-cause mortality was 29% lower (OR=0.71, 95% CI 0.53 to 0.95) among all men invited to the health dialogue compared with all men from the same age cohort in all of Sweden (intention-to-treat) and 43% lower (OR=0.57, 95% CI 0.40 to 0.81) among participating men (on-treatment). A healthy lifestyle was associated with lower mortality (OR=0.16, 95% CI 0.07 to 0.36), with the strongest association for no smoking (OR=0.38, 95% CI 0.21 to 0.68) and a healthy diet (OR=0.37, 95% CI 0.20 to 0.68). A healthy lifestyle was also associated with a decreased incidence of CVD and cancer. There was a significantly higher proportion with short education among invited men compared with men from the same age cohort in all of Sweden.

**Conclusions** This study indicates that a combination of low-risk and high-risk strategies, combining a health examination with a lifestyle-directed health dialogue conducted in an ordinary primary care setting in cooperation with local associations, may have contributed to reduced premature mortality. However, we cannot exclude that there may be other factors explaining the lower mortality.

## Strengths and limitations of this study

- This study has a long follow-up time of a cohort of rather young men.
- This study has a very high participation rate in the baseline health examination.
- Individual data on morbidity and mortality from cardiovascular disease and cancer were from official registers acquired from the Swedish National Board of Health and Welfare and from Statistics Sweden.
- The cohort is rather small.
- The study is restricted to men only and no comparison is made with a similar demographic cohort.

## INTRODUCTION

Cardiovascular disease (CVD) and cancer are the predominant causes of mortality in Sweden as well as in other Western countries.<sup>1,2</sup> According to the INTERHEART study, more than 90% of the risk for myocardial infarction could be explained by nine modifiable risk factors.<sup>3</sup> Four of these are lifestyle habits (smoking, dietary habits, physical activity and alcohol consumption). The INTERSTROKE study showed that the same nine factors as in the INTERHEART study, together with cardiac disease, to more than 90% were also associated with stroke.<sup>4</sup> There is also strong evidence for an association between lifestyle habits and risk for cancer.<sup>5,6</sup> In 1981 the WHO in ‘Health for All by the Year 2000’ (HFA) recommended governments and authorities all over the world to make efforts aiming at lowering incidence and mortality from non-communicable diseases (NCDs) such as CVD and cancer.<sup>7</sup>

It is also well known that there are inequalities concerning health from a socioeconomic point of view.<sup>8</sup> This is also true for NCDs such as CVD and cancer.<sup>9</sup> As these diseases are also predominant causes of premature death,

it is important both to bring down the total incidence and mortality from these diseases and at the same time try to close the gap between different socioeconomic groups. Income and educational level are considered to be strong indicators for socioeconomic situations.<sup>8</sup> At the moment, the remaining life expectancy in Sweden at age 30 is more than 5 years shorter among both men and women with short education compared with men and women with long education.<sup>10</sup>

Encouraged by the goals in HFA, the primary health-care council in the community of Habo in Sweden in 1984 decided to invite all young men 33–42 years of age living in the community to a lifestyle-directed health examination and a health dialogue with the aim to reduce the future risk for CVD.<sup>11</sup> For this purpose, a visual graphic health profile comprising 10 risk factors of importance for CVD graded into four or five risk levels was developed. Seven of the risk factors in the later published INTERHEART study were included in this health profile.<sup>3</sup> This health profile and the intervention design have earlier been published in detail.<sup>11</sup> The primary preventive programme was carried out between 1985 and 1987. Habo is a small but growing community with about 8700 inhabitants in 1985 and now with almost 12 000 inhabitants. It is a neighbour-community to Jönköping with about 137 000 inhabitants. Many of the inhabitants in Habo commute to other communities to work, most of them to Jönköping. There is a higher proportion of children and a lower proportion of inhabitants 20–30 years of age in Habo than in all of Sweden.

In 1989 the health promotion programme 'Live for Life' was started in the county of Skaraborg, including the community of Habo. This programme was a combination of health dialogues, where men and women aged 30 and 35 years were invited, and several community intervention measures. Examples of these were a specially designed periodical about lifestyle, education of staff in food shops following a model from the Heartbeat Wales programme, and special intervention programmes to promote physical activity, for example, walking and jogging.<sup>12 13</sup> The main concept in both these programmes was a health dialogue targeting CVDs.

There is also growing evidence that dietary habits have a great impact on health and morbidity, as well as on longevity. On a population level, dietary habits are the risk factors that explain most of the burden of disease in Sweden.<sup>14</sup> Already in the INTERHEART study, it was possible to show how only one question about intake of fruit and vegetables could predict the risk for myocardial infarction.<sup>3</sup> High vegetable consumption is thus associated with decreased risk for all-cause mortality.<sup>15</sup> There is an inverse dose–response relationship between whole grain intake and all-cause mortality, with up to 25% decreased mortality risk at a daily intake of 100 g whole grain.<sup>15</sup>

Follow-ups of this intervention among young men 33–42 years of age, conducted between 1985 and 1987, were made after approximately 24 and 26 years, and

some results from these follow-ups have previously been published.<sup>16 17</sup> In these studies, we analysed the importance of three lifestyle factors included in the health profile (smoking, physical activity and alcohol). On the questionnaire used at the health examination were also questions about dietary habits, but those were not included in the health profile. Now, while including the questions about dietary habits, we want to report on the outcome with special reference to mortality and morbidity in CVD as well as cancer, and also to compare the mortality rate for the men in Habo invited to the health dialogues with a corresponding age cohort of men from all of Sweden. The value of health checks has been highlighted and debated in recent years in two Cochrane Systematic Reviews and a Danish study.<sup>18–20</sup> We therefore also want to discuss and try to explain the differences between 'targeted health dialogues' and general health checks.

### Aims

The aims of this study are the following:

- ▶ Compare mortality rate from 1987 up to 2010 for all men aged 33–42 (born between 1943 and 1952) who, while living in Habo between 1985 and 1987, were invited to a health dialogue (target group), as well as a subgroup of the target group (those who participated in the health dialogue [participants]), with mortality rate of the corresponding age cohort from all of Sweden (reference group).
- ▶ Compare the socioeconomic status, expressed in terms of income and educational level, of the target group in Habo with the socioeconomic status of the reference group.
- ▶ Analyse the association between lifestyle and mortality up to 2013 among those men in the target group who participated in the health dialogue (participants).
- ▶ Analyse the association between lifestyle and morbidity from CVD and cancer up to 2013 among those men in the target group who participated in the health dialogue (participants).

### METHODS

#### Baseline examination and intervention

From the register of inhabitants in Habo, a list was obtained comprising all men born between 1943 and 1952, living in Habo at the end of 1984. These men were, with start from 1985, consecutively invited to a health examination and a lifestyle-directed health dialogue at the primary healthcare centre of Habo. Due to moving in and out from Habo, an updated list was obtained in April 1986. Altogether 757 men were available for invitation between 1985 and 1987. The participation rate was high (86%), with 652 men attending the health examination. Before the health dialogue the men answered a questionnaire with questions about own history of CVD and diabetes, prevalence of mental symptoms, lifestyle habits, mental stress and life situation. Most of the questions had been used before in other studies. Blood samples were collected

for analysis of serum cholesterol, serum triglycerides and blood glucose. Other biological risk markers measured were blood pressure and the anthropometric measures of weight, length, and waist and hip circumference. Family history of premature mortality, family history of diabetes, self-estimated mental stress, mental illness, body mass index, blood pressure and cholesterol were, together with the lifestyle habits of smoking, alcohol consumption and physical activity/fitness, included in a visual graphic pedagogic health profile. Each factor was graded into four or five risk levels according to the roughly estimated risk for CVD.<sup>11</sup>

The graphic health profile was used in the health dialogue to give a global coherent visual picture of the 10 risk factors included in the profile with the aim to serve as a reinforcement tool. The health dialogue was carried out by a specially trained nurse in a person-centred way trying to motivate and support the men to improve their lifestyle habits if needed. Depending on what came out from the health dialogue, all men in a defined high-risk group were invited to see a general practitioner. Altogether 418 men were recommended some kind of group intervention measure.<sup>11</sup>

### Lifestyle habits at baseline

Smoking, alcohol consumption and physical activity/fitness were all included in the health profile. To analyse the association between lifestyle habits and the outcome with respect to all-cause mortality, morbidity and mortality from CVD and cancer, these factors were dichotomised into two categories based on the risk grading. Smoking was divided into smokers and never-smokers/ex-smokers, respectively. Alcohol consumption was divided into high intake (>109 g of spirits/week) and low intake, and physical activity/aerobic fitness was divided into low-to-intermediate and high level. Dietary habits were not included in the health profile. However, on the questionnaire used at the health examination, there were four questions about dietary habits. For these four questions we assigned dietary points based on the answers. The sum of these dietary points was dichotomised into a healthy diet and an unhealthy diet, where 5–7 dietary points were considered a healthy diet, while 0–4 dietary points were considered

an unhealthy diet. The questions about dietary habits are shown in [table 1](#).

### Lifestyle index

To further analyse the association between all four lifestyle habits taken together and outcome with respect to all-cause mortality, morbidity and mortality from CVD and cancer, a lifestyle index was developed. In the 'Swedish National Guidelines for prevention and treatment of unhealthy lifestyle habits' from the Swedish National Board of Health and Welfare, lifestyle habits are graded according to severity with respect to health outcome.<sup>21</sup> According to these guidelines daily smoking is considered a very severe condition concerning health outcome, unhealthy diet a severe condition, and physical inactivity and harmful drinking a moderate to severe condition. Based on this grading we assigned four lifestyle points for daily smoking, three points for unhealthy diet, and two points for physical inactivity/unfitness and harmful drinking, respectively. The lifestyle index, that is, the sum of the lifestyle points, was divided into three categories, where less than 6 points were considered low risk, 6–8 points moderate risk and more than 8 points high risk.

### Follow-up: register studies

For comparisons at the group level with regard to mortality rate in Sweden and Habo, respectively, data were gathered from healthcare registers at the Swedish National Board of Health and Welfare up to 2010. To analyse the lifestyle habits among participants in Habo with respect to total mortality and morbidity from CVD and cancer, supplementary data were gathered up to 2013. The International Classification of Diseases (ICD) was used. ICD-9 diagnoses until 1997 were 410, 411 and 431–6, and the ICD-10 diagnoses from 1997 were G45, I21–22, I61, I63–66 and FN (surgical operations of coronary arteries). Register data concerning cancer were diagnosis, time of death and cause of death. Data from the register of patients treated in hospital and causes of mortality were also available. This gave two groups: those men who at least once had received a CVD diagnosis or a cancer diagnosis, and those who had never received any of these diagnoses.

### Educational level

For comparisons with regard to educational level for the target group in Habo and the reference group in all of Sweden, respectively, data were gathered from Statistics Sweden from the year 1985. Educational level was categorised into three levels, where ≤9 years of education was defined as short education, 10–12 years as medium education and ≥13 years as long education.

### Income

With regard to income, data about the average and median income were gathered for men born between 1943 and 1952 living in Habo and Sweden, respectively, on 31 December 1992, the year when these data were for the first time available from Statistics Sweden.

**Table 1** Dietary points based on four questions about dietary habits from the health questionnaire

Questions	Answer	Dietary points
How many days a week do you eat vegetables?	Not every day	0
	Every day	1
How many slices of fine white bread do you eat each day?	>2 slices	0
	≤2 slices	1
How many slices of coarse, fibre-rich bread do you eat each day?	≤4 slices	0
	>4 slices	3
Do you usually trim off visible fat when eating meat?	No	0
	Yes	2

**Table 2** Mortality rate and OR for deaths in Habo in comparison with Sweden

	Men 1985 born between 1943 and 1952	Death 1987–2009	Mortality rate*	OR compared with Sweden	95% CI
Sweden (Habo excluded)	656 686	60 612	92.3	1.00	
Habo					
Invited	757	51	67.4	0.71	0.53 to 0.95
Participants	652	36	55.2	0.57	0.40 to 0.81
Non-participants	105	15	142.9	1.64	0.91 to 2.90

\*Mortality rate calculated as (number of deaths/person-years of observation) × 1000.

### Statistical methods

Descriptive results are presented as numbers and percentages. Mortality rate was calculated as (number of deaths/person-years of observation) × 1000. Total mortality, incidence of CVD (both inclusive and exclusive death) and cancer (both inclusive and exclusive death) were used as outcome variables. The lifestyle variables smoking, alcohol intake, physical activity/fitness and dietary habits, as well as the total lifestyle risk level (lifestyle index), were used as explanatory variables. X<sup>2</sup> test was used to analyse differences between categories and the results are presented as OR with 95% CIs, where CIs not overlapping 1.00 are considered being of statistical significance. Statistical analyses were conducted using SPSS V.24.

### Patient and public involvement

Patients have not been involved in the development of the research questions, design or recruitment, and we have not planned for dissemination of the results to study patients.

## RESULTS

### Mortality

The 'reference group' comprised 657 443 men, born between 1943 and 1952, and living in Sweden on 31 December 1985. The 'target group' was 757 men living in the community of Habo who were invited to the lifestyle health dialogue, and the 'participants' were 652 (86%) of these men who participated in this dialogue. Between 1987 and 2009, 60 612 of men in all of Sweden (Habo excluded) had died (mortality rate=92.3) (table 2). Of those men living in Habo, 51 had died (mortality rate=67.4, OR=0.71, 95% CI 0.53 to 0.95), in comparison with all of Sweden. Among men who attended the health examination, the mortality rate was 55.2 (OR=0.57, 95% CI 0.40 to 0.81). The non-participants had a higher but non-significant OR.

### Causes of death

For Habo (but not for Sweden) further information was available about deaths and causes of death up to 2013. Including 2012, there were 69 deaths in Habo and 49 of these occurred among those men who participated.

Cancer (37.7%) and CVD (33.3%) were the two predominant causes of death.

### Lifestyle habits and mortality

A healthy lifestyle at baseline was associated with decreased mortality (table 3), with the strongest association for no smoking (OR=0.38, 95% CI 0.21 to 0.68) and for a healthy diet (OR=0.37, 95% CI 0.20 to 0.68). The mortality risk was also reduced for low alcohol intake and physical activity/fitness, but these associations were not statistically significant. With regard to total lifestyle index, there was also a strong association between healthy

**Table 3** Lifestyle habits at baseline and total mortality among men aged 33–42 years old participating in a health dialogue between 1985 and 1987, at follow-up after approximately 26 years (n=652)

Lifestyle habit	Persons at risk (n)	Deaths	OR for deaths	95% CI
Smoking				
Yes	195	25	1.00	
No	457	24	0.38	0.21 to 0.68
Dietary score*				
Unhealthy	291	33	1.00	
Healthy	356	16	0.37	0.20 to 0.68
Alcohol consumption				
High intake	65	6	1.00	
Low intake	587	43	0.78	0.32 to 1.90
Physical activity/fitness†				
Low	288	20	1.00	
Moderate to high	352	28	0.86	0.48 to 1.57
Lifestyle index‡				
High risk	102	21	1.00	
Moderate risk	286	17	0.24	0.12 to 0.48
Low risk	247	10	0.16	0.07 to 0.36

\*Missing data about diet for 5 persons.

†Missing data about physical activity/fitness for 12 persons.

‡Missing data about lifestyle index for 17 persons.

**Table 4** Lifestyle at baseline and risk for morbidity and mortality from CVD or cancer among men aged 33–42 years old participating in a health dialogue between 1985 and 1987, at follow-up after approximately 26 years

Diagnosis group	Persons at risk	Cases	OR	95% CI
<b>CVD (including deaths)</b>				
High risk*	102	32	1.00	
Medium risk*	286	30	0.26	0.15 to 0.45
Low risk*	247	27	0.27	0.15 to 0.48
<b>CVD (excluding deaths)</b>				
High risk	81	21	1.00	
Medium risk	269	25	0.29	0.15 to 0.56
Low risk	237	23	0.31	0.16 to 0.59
<b>Cancer (including deaths)</b>				
High risk	102	21	1.00	
Medium risk	286	45	0.72	0.41 to 1.28
Low risk	247	26	0.45	0.24 to 0.85
<b>Cancer (excluding deaths)</b>				
High risk	81	8	1.00	
Medium risk	269	34	1.32	0.59 to 2.98
Low risk	237	22	0.93	0.40 to 2.19

\*According to lifestyle index.  
CVD, cardiovascular disease.

lifestyle and reduced mortality risk, with OR=0.16 (95% CI 0.07 to 0.36) for those with the healthiest lifestyle in comparison with those with the unhealthiest lifestyle.

#### Lifestyle habits and incidence of CVD and cancer

There were also statistically significant associations between lifestyle habits at baseline and CVD and cancer, respectively, most clearly shown for CVD (table 4).

#### Educational level

There was a significantly higher proportion of men in Habo with short education ( $\leq 9$  years) in comparison with all of Sweden (table 5).

#### Income level

With regard to income level there were no differences of statistical significance between men in Habo and men in all of Sweden. The median income in 1992 among men in Habo was SEK186 600 compared with SEK186 800 for

men in all of Sweden (NS). The average income for men in Habo was SEK202 200 and for the men in all of Sweden SEK203 500 (NS).

#### DISCUSSION

The main finding in our study was that the all-cause mortality rate at follow-up was almost 30% lower among all men in Habo, calculated as intention-to-treat, in comparison with men from the same age cohort in all of Sweden. An even greater difference was shown in the ‘on-treatment group’ of all men in Habo, with a 43% lower mortality rate compared with men in all of Sweden. The mortality rate for the non-participants was three times higher compared with participants. In the non-participant group, there were more high consumers of healthcare, more smokers and more who were registered at temperance board and social welfare office.<sup>11</sup>

CVD and cancer dominated and explained 71% of all deaths. We found an association between lifestyle habits at baseline and all-cause mortality at follow-up, most clearly shown for smoking and dietary habits, but also between lifestyle index and incidence both from CVD and from cancer.

Significantly more men in Habo had short education compared with men in all of Sweden. There was no difference with regard to income between men in Habo and men in all of Sweden. This indicates that the concept may also work in a setting with a lower socioeconomic situation.

The strength in our study is a high baseline participation rate, together with a long follow-up time of a rather young cohort of men. Another strength is that we had access to individual follow-up data acquired from the Swedish National Board of Health and Welfare based on personal code numbers, whereas data from Statistics Sweden were gathered on group level.

There are some limitations in our study. The cohort is rather small and this study is not a randomised study. We have instead used men from the same age cohort from all of Sweden as reference group. We think that one must take into consideration that lifestyle changes to some degree can be ‘contagious’ or ‘communicable’ that people talk to each other and discuss with relatives and work colleagues what they have been advised to do to improve their health. We therefore do not think a randomised controlled trial can be applied in a small community like Habo. Instead we think that comparing data with all of Sweden is the best possible way to

**Table 5** Educational level among men born between 1943 and 1952 in Habo and all of Sweden

	Short education ( $\leq 9$ years)	Medium education (10–12 years)	Long education ( $\geq 13$ years)		
Sweden* (Habo excluded)	34% (n=210 392)	43% (n=266 817)	23% (n=140 990)		
Habo†	40% (n=305)	40% (n=307)	20% (n=156)	$\chi^2=11.1$	P=0.004

\*No data for 6% (n=39 244).

†No data for 2.3% (n=18).

evaluate this type of intervention. When it comes to analysis of the association between lifestyle habits and morbidity and mortality, respectively, we have only registration of lifestyle at one occasion, and many men could have changed their lifestyle habits during follow-up time. But according to the British Regional Heart Study, these changes do not matter on a group level, at least not for a larger group.<sup>22</sup> Another weakness in our study is that there was only one question about physical activity and only four questions on dietary habits in our questionnaire at baseline. In another Swedish population-based, prospective cohort study, it was possible to predict reduced risk for CVD and all-cause mortality by means of only seven modifiable lifestyle factors, that is, the same number of factors as in our study.<sup>23</sup>

In the INTERHEART study, it was also shown that the risk for myocardial infarction was strongly reduced with an overall healthy lifestyle characterised by no smoking, daily intake of fruit and vegetables, and regular physical activity (OR=0.21), which is similar to what we found in our study.<sup>3</sup>

We have earlier in the 'Live for Life' study shown favourable outcomes with regard to dietary habits, mental stress, cholesterol, systolic and diastolic pressure, body mass index, waist circumference and metabolic profile among young men and women 5 years after participation in a targeted health dialogue.<sup>24</sup>

We have further shown a faster decline with regard to premature death (before the age of 75) from ischaemic heart disease in the community of Habo in the county of Skaraborg compared with all of Sweden and with other Swedish communities with similar size and demographic situation up to 12 years after a targeted health dialogue combined with a health promotive community strategy.<sup>25</sup>

As seen in our study there were no differences with regard to income between men from Habo and men from all of Sweden. There were however more men with short education and fewer men with long education in Habo compared with all of Sweden. This indicates that this preventive concept can also work in a lower socioeconomic setting.

In the pedagogic health profile used in the health dialogue, the variables included are primarily associated with risk for CVD, and both morbidity and mortality from CVD were strongly associated with lifestyle. There was also an association between lifestyle and incidence of cancer, which indicates that this concept can also be used to lower this incidence.

The concept to invite all inhabitants from selected age groups to a health examination and a lifestyle-directed health dialogue in a primary healthcare setting has also been in use for several years in Västerbotten County in Sweden in the 'Västerbotten Intervention Programme (VIP)'.<sup>26</sup> The VIP concept is quite similar to that used in Habo, with health questionnaires focusing on lifestyle habits, blood samples concerning cholesterol and glucose, as well as anthropometric data of importance for CVD. The results from the individual health examinations are visualised in a graphic 'health star', instead of the

health profile used in Habo, reinforcing the pedagogic message for the participant in the health dialogue. In VIP all inhabitants aged 40, 50 or 60 years residing in Västerbotten County, invited to the health dialogue between 1990 and 2006, were followed from their first opportunity to participate until the age of 75, study end point or prior death. At a follow-up evaluation study, the standardised all-cause mortality rate was 90.6% for the whole target group in Västerbotten, compared with all of Sweden, analysed according to the intention-to-treat principle.<sup>27</sup> For participants, subject to further impact as well as selection, the standardised mortality rate was 66.3%.

There is another Swedish study showing successful work with regard to the prevention of CVD. In Sollentuna, a municipality in Stockholm County, a cardiovascular prevention programme, which combined an individual and a population-based strategy, was launched within primary healthcare in 1988.<sup>28</sup> Up to 2010 the incidence of acute myocardial infarction among women decreased more in Sollentuna compared with the rest of Stockholm County.<sup>29</sup>

It is a limitation that our study is restricted to men only and we therefore cannot say anything about women. However, in similar studies mentioned above where also women were included, the outcomes were at least as good as for men.<sup>25 27 29</sup>

It is hard to find international studies conducted in a way resembling the Swedish concept. A CVD prevention programme running for 40 years in Franklin County in Maine in USA has similarities with our study.<sup>30</sup> Their intervention showed significant reductions in mortality from CVD over time, and it was also community-based and integrated in primary care.

### Why this concept may work

There has been some controversy with regard to the value of inviting healthy people to health checks.<sup>18-20</sup> According to a systematic review and meta-analysis, the so-called 'general health checks' in adults are not effective to reduce morbidity, neither overall nor for cardiovascular or cancer causes. Then, how can the promising results seen in our study and the other studies mentioned above be explained? We think there are some important differences between the studies included in the Cochrane analysis and our study and the two other Swedish studies. The Cochrane review defined 'general health checks' as examinations including different tests to detect different diseases in a population without symptoms. Using 'targeted health dialogues' focusing on CVD may be more effective than 'general health checks'.

The targeted health dialogues in the Swedish concept are further characterised by the following:

- ▶ Long-term work with staying power.
- ▶ Integration in regular primary healthcare.
- ▶ Population-based.
- ▶ A combination of health promotive low-risk strategy and disease preventive high-risk strategy.
- ▶ More focus on lifestyle habits than blood tests and medicines.

- ▶ Focus on the health dialogue taking individual preferences, life situation and cardiovascular risk factors into consideration.
- ▶ A person-centred dialogue using motivational techniques supported by a visual pedagogic tool.
- ▶ Medical evidence for cardiovascular prevention.
- ▶ Adaptation to local conditions.
- ▶ Systematic structure for competence and method support.

Considering the combination of a low-risk strategy and a high-risk strategy, this means that those persons with high risk for CVD and every participating person will have a health dialogue with a locally often well-known established health provider at the local primary health-care centre. This means, according to the 'preventive paradox', that 'it is better if many people with a low or moderate risk make small changes than that a few persons with high risk make large changes' to get effect at the community level.<sup>31</sup> To offer a health dialogue to all participants also means that a higher proportion of the population will be involved in local health-promoting activities. This will generate a local movement in the community, which can further reinforce the demand for healthy options. We therefore think that this concept of targeted health dialogues will have the best effect in the context of a community-based health promotion strategy, as we have described earlier, where the demands for healthy choices are met with a supply of healthy options.<sup>25</sup>

## CONCLUSIONS

This study indicates that the intervention may have contributed to reduced mortality, but we cannot exclude that there may be other factors explaining the lower mortality rate in Habo. A higher proportion of the men in the study had short education compared with the corresponding age cohort in all of Sweden, indicating that this concept may work in a setting with a lower socioeconomic situation. We also found a strong association between lifestyle habits and mortality as well as incidence of CVD and cancer.

**Contributors** HL is the principal author and the main contributor to the design of the present study. He wrote and revised the paper. He wrote the statistical analysis plan, and cleaned and analysed the data. He is the guarantor. L-GP is responsible for the baseline study and has given valuable contributions to the design and has revised the manuscript of the present study. Both authors (HL and L-GP) had full access to all of the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of data analysis.

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**Competing interests** None declared.

**Patient consent for publication** Not required.

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**Data sharing statement** No additional data are available.

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