Self rated health as a predictor of coronary heart disease in Copenhagen, Denmark

Lars Møller, Tage S Kristensen, Hanne Hollnagel

Abstract

Study objective – To analyse the association between self rated health and the incidence of fatal and non-fatal coronary heart disease (CHD) in a Danish cohort followed up over 16 years.

Design – This was a prospective epidemiological follow up study.

Setting – A cohort from the County of Copenhagen, Denmark.

Participants – The study included 1052 men and women born in 1936. During the 16 years' follow up 50 cases of CHD were registered in either the Danish register of deaths or the register of hospital admissions.

Main results – Univariate analysis showed the following relative risks of CHD in the four self rated health groups: 'extremely good': 1.0, 'good': 4.0, 'poor': 5.8, 'miserable': 12.1 ($p=0.02$). After control for the conventional CHD risk factors and a substantial number of other potential confounders the relative risks were: 1.0, 4.2, 6.5, and 18.6 ($p=0.02$) respectively.

Conclusions – Self rated health was an independent predictor of CHD in the present cohort. If confirmed, the association between self rated health and CHD may lead to new insight into psychosocial processes leading to this disease.

(J Epidemiol Community Health 1996;50:423-428)

Department of Social Medicine, University of Copenhagen, Panum Institute, Blegdamsvej 3, DK-2200, Copenhagen, Denmark
L Møller

The Glostrup Population Studies, Medical Department C, Glostrup Hospital, University of Copenhagen, Glostrup, Denmark. L Møller H Hollnagel
National Institute of Occupational Health, Copenhagen, Denmark
T S Kristensen

Central Research Unit for General Practice, University of Copenhagen, Panum Institute, Copenhagen, Denmark
H Hollnagel

Correspondence to:
Dr L Møller.

Accepted for publication
January 1996

Published reports show that the concepts of health and disease are very difficult to define in an unequivocal, precise, and operational way. The main reason for this seems to be that these concepts from our daily vocabulary cover a number of dimensions that should be kept apart in scientific work. The main dimensions are: medically diagnosed health, self rated health, and functional ability.¹⁻⁷ Some writers have used medically diagnosed health status as the 'gold standard' for evaluating the validity of self rated health measures. In this paper we will consider self rated health as a dimension of health that is worth studying in its own right.

During the past 30 years a large number of empirical studies have demonstrated that a person's own appraisal of her/his own health is a very powerful predictor of future mortality.⁸⁻²⁶ These studies are very different with regard to design, follow up period, population, control for health at baseline, control for confounders, and the way in which self rated health is assessed, but associations between self rated

health and total mortality are nonetheless observed with remarkable consistency across all studies.^{3 26 27}

While most of the studies have analysed the association between self rated health and total mortality, a few of the more recent studies have also used cardiovascular disease (CVD) and/or death as end points.^{15 21-25} In all of these studies an association between self rated health at baseline and future incidence of and/or death because of CVD was observed. However, most of the studies have not controlled adequately for baseline health and for CVD risk factors. In the studies by Pijls *et al*²³ and by Appels *et al*,²¹ where control for baseline health and confounders was performed, the adjusted associations between self rated health and CVD were rather weak and in most cases non-significant.

A number of possible explanations for the independent association between self rated health and total mortality have been discussed in the published reports.^{3 15 17 21 23 26}

1. Poor self rated health could reflect subclinical disease.
2. Self rated health could be linked to behaviour such as smoking, drinking alcohol, over-eating, eating a fat diet, lack of exercise, low compliance, etc.
3. Self rated health could be associated with personality characteristics such as anger, hostility, depression or other possible personality linked CHD risk factors.
4. Poor self rated health could be related to or a result of extreme fatigue, 'vital exhaustion', sleep problems, or other similar states that have been shown to predict total mortality/CHD in the published reports.
5. The association between self rated health and total mortality/CHD could be explained by psychophysiological mechanisms regulated by the central nervous system.

The purpose of the present paper is to analyse the association between self rated health and CHD in a cohort of Danish women and men followed up over 16 years while controlling for health at baseline and for a large number of variables measuring social, environmental, psychological, and physiological factors. Our hypothesis was that self rated health predicts CHD independently of the established cardiovascular risk factors.

Methods

Since 1964, the Glostrup population studies have been carrying out epidemiological health examinations of population groups living in the County of Copenhagen. A cohort of all 40 year

Table 1 Self rated health at baseline among 40 year old men and women*

	Men		Women		Total	
	No	%	No	%	No	%
Extremely good	49	9.8	34	6.3	83	7.9
Good	402	80.2	407	74.8	809	77.4
Poor	43	8.6	93	17.1	136	13.0
Miserable	7	1.4	10	1.8	17	1.6
Total	501	100	544	100	1045	100

* Three men and 4 women did not respond to the question.

old men and women born in 1936 and resident in four municipalities served by the county hospital of Glostrup has been followed since 1976 (the 40 year study).²⁸ Eighty eight per cent participated in the examination at baseline in 1976 - that is, 504 men and 548 women. The health examination was extensive, lasting seven hours for each participant, and comprised a questionnaire, a medical examination, clinical tests, and an interview about psychosocial conditions.

Self rated health was assessed by the following question which was asked before the health examination: 'How would you characterise your own health during the last year?' The response categories were: 'extremely good', 'good', 'poor', 'miserable'. The participants' social class was determined on the basis of a method developed by the Danish National Institute of Social Research. Three criteria were used: occupation, education, and number of subordinates.²⁹ Three questions about contacts with family and/or friends were used in an social network index (1=poor, 9=excellent). Cohabitation was determined according to whether the subject was cohabiting with a partner or was single. Four questions concerning pain in the epigastric region and indigestion were combined in an abdominal pain index (yes/no).²⁸ Two questions concerning personal and/or financial problems during the previous month were used to classify respondents as having 'problems' if the subject had at least one problem. Work absence was defined as the number of weeks with absence from work because of illness during the last year. Hospitalisation for any reason since birth was elucidated through a number of questions and coded as yes or no.³⁰ One question concerned work stress (yes/no) at the moment. The intensity and duration of physical activity at work were determined by a four-category question as (a) mainly sedentary; (b) some walking on level ground; (c) considerable amount of walking, stair climbing, and lifting; and (d) continuous, strenuous physical activity.³¹ Blood for lead analysis was taken in 10 ml polypropylene tubes with ethylenediaminetetra-acetic acid as an anticoagulant.³² Participants smoking at least one cigarette a day were characterised as smokers. Alcohol consumption was analysed as a continuous variable, where the unit of measurement constituted the number of drinks per week. One drink was defined as being equal to one glass of wine (0.15 litre) or one beer (0.33 litre) or one drink of strong alcohol (0,04 litre). The validity of the information concerning alcohol consumption

has been analysed and found to be very satisfactory.³³ The intensity and duration of leisure time physical activity were characterised by a four category question comprising the following elements: (a) fully sedentary; (b) at least four hours per week of walking, bicycling, or other activity; (c) some fitness sports training or other strenuous activities for at least three hours per week; and (d) regular competitive sports.³¹ Cholesterol was determined according to Grafnetter *et al*,³⁴ and triglycerides according to Laurell.³⁵ Serum insulin concentrations were measured by radioimmunoassay using a double antibody technique.³⁶ Fasting glucose was measured by the glucose oxidase test. Body mass index (BMI) was calculated as body weight (kg) divided by the square of height (m²). Blood pressure measurement was standardised according to WHO recommendations.³⁷ Blood pressure was determined as the mean of two measurements in the supine position after 10 minutes' rest. We used the London School of Hygiene and Tropical Medicine sphygmomanometer with a 12 x 33 cm cuff. All measurements were performed with the same apparatus and by the same person.

The follow up period with regard to hospital admissions and mortality started from the examination in 1976/1977 and lasted until 1993 (16 years). All participants have been followed through the Danish register of deaths and the register of hospital admissions (containing diagnoses), both of which are based on personal identification numbers. Two men emigrated during the follow up period; their vital status was not established with certainty and they were excluded from the analyses. Six persons had previous been hospitalised because of CHD and were excluded from all analyses. For the rest of the cohort, our information on vital status was verified through either the death register or the population register. CHD includes the diagnostic codes (International Classification of Diseases, Injuries, and Causes of Death, 8th revision (ICD-8)) 410-414. Thirty four men and 16 women with new CHD were registered.

The statistical analyses used included a Spearman rank correlation test, multiple regression analyses, and a Cox proportional hazards model constructed to estimate the effect of self rated health on the probability of getting CHD in the follow up period. When participants either died or were hospitalised with CHD, they were excluded at the time of the event.

Results

The distribution of self rated health at baseline is shown in table 1. The large majority of men as well as women reported 'good' self rated health while very few felt that their health was 'miserable'. The female respondents perceived their health to be somewhat worse than the males.

In table 2 the associations between a number of physiological, psychological, and social factors and baseline self rated health are analysed. Only factors associated with self

Table 2 Significant univariate associations with self rated health at baseline*

	Self rated health					p value†
	Extremely good	Good	Poor	Miserable	Total	
Work absence (wk per y)	0.8	1.1	5.5	11.2	1.8	< 10 ⁻⁴
Abdominal pain index (% pain)	24.4	46.3	64.4	87.5	47.5	< 10 ⁻⁴
Problems (%)	12.2	14.4	37.8	50.0	17.8	< 10 ⁻⁴
Stress at work (%)	12.2	21.3	42.2	50.0	23.7	< 10 ⁻⁴
Physical activity leisure time (% inactive)	25.6	33.4	45.9	56.3	34.7	< 10 ⁻⁴
Hospitalization (% ever)	63.4	68.1	85.8	100	70.5	< 10 ⁻⁴
Alcohol (units per wk)	14.3	11.7	9.8	6.4	11.6	0.0008
Social class (% low)	19.5	25.3	32.6	31.3	25.9	0.03
Cohabitation (% living alone)	7.3	9.1	14.1	25.0	9.8	0.02
Smoking (% smokers)	42.2	55.5	57.4	64.7	54.8	0.04
Gender (% women)	41.5	50.2	68.9	62.5	52.2	< 10 ⁻⁴

*Four men and two women with previous coronary heart disease are excluded. Variable significantly associated with self-rated health (p < 0.05) are shown.
† Spearman rank correlation test. For work absence and alcohol consumption a Kruskal-Wallis test has been used.

rated health in a univariate analysis with p < 0.05 are shown. All associations are in the expected direction except perhaps for alcohol consumption, where consumption decreases with decreasing self rated health. It is worth noticing that, except for smoking, none of the established coronary risk factors such as serum cholesterol, serum triglycerides, blood pressure, or BMI are associated with self rated health. These analyses were performed separately for men and women, and the associations found were very similar in the two groups (data not shown).

The incidence of fatal and non-fatal CHD during the 16 years of follow up showed a very strong association with self rated health with 0.75 cases per 1000 observation years in the 'extremely good' group and 8.65 cases in the 'miserable' self rated health group (table 3). In figure 1 the associations between CHD and self rated health are shown for men and women and for the whole group. Among women with 'extremely good' self rated health no CHD events occurred. A logarithmic scale was used for the incidence of CHD, and it can be seen that the associations are close to being linear and of similar strength in men and women.

In table 4 this association is analysed by means of a Cox regression analysis in which additional variables are added in order to control for confounding. Model 1 includes self

Table 3 Self rated health at baseline among 40 year old men and women and incidence of coronary heart disease (CHD) during 16 years of follow up (n=1039).

	Incidence per 1000 observation years (95% CI)
Extremely good	0.75 (0.02, 4.2)
Good	2.97 (2.1, 4.1)
Poor	4.26 (2.0, 6.0)
Miserable	8.65 (1.1, 31.3)
Total	3.04 (2.3, 4.0)

CI are exact 95% confidence intervals (poisson distribution). Participants are excluded at the time of the event of CHD or death.
p value 0.02 (Cox multiple regression analysis).

rated health, gender, and social class. Model 2 adds a number of social, environmental, health, and psychological factors. Model 3 includes the lifestyle factors and model 4 the physiological factors. In the final model all factors with p < 0.20 in model 4 (and gender) are included. The association between self rated health and CHD during the 16 year long follow up period is still statistically significant (p=0.03) when confounders are controlled for. The other factors associated with CHD in the final Cox model are systolic blood pressure, insulin level, and serum cholesterol. Gender is a highly significant predictor in model 1, but in the final model the p value is 0.15.

The estimated relative risks of CHD in the four self rated health groups are shown in table 5. Confidence intervals are very wide due to the small numbers in each group, but the trend is strong and statistically significant. In this table we first controlled for the factors that were shown to predict CHD (table 4) and then added the factors that correlated univariately with self rated health (table 2). The table demonstrates that control for these potential confounders changes the estimates of relative risks very little. If the first five years of follow up are excluded from the analysis we find the following relative risks of CHD in the four self rated health groups: 'extremely good': 1.0, 'good': 3.3, 'poor': 4.5, and 'miserable': 6.2.

Discussion

In this study a simple measurement of self rated health was associated with a number of other factors at baseline such as work absence, stress at work, social class, smoking, and physical activity. Lower alcohol consumption was associated with decreasing self rated health.

Self rated health and coronary heart disease over 16 years of follow up. Incidence (fatal and non-fatal) per 1000 person years. *No cases of coronary heart disease were registered among women with extremely good self rated health.

Table 4 Cox regression analysis on coronary heart disease incidence. Variables recorded at age 40 with 16 years of follow up. Model 5 includes gender and variables with *p* value less than 0.20 in model 4

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>
Self rated health (1 = extremely good, 4 = miserable)	0.68	0.005	0.67	0.02	0.68	0.02	0.56	0.07	0.56	0.03
Gender (1 = female, 2 = male)	1.01	0.001	0.76	0.04	0.71	0.07	0.21	0.62	0.48	0.15
Social status (1 = high, 4 = low)	0.08	0.54	−0.006	0.97	−0.01	0.94	−0.09	0.57		
Social network (1 = high, 9 = low)			0.06	0.47	0.05	0.52	0.09	0.27		
Cohabitation (1 = yes, 2 = alone)			0.07	0.88	0.03	0.95	−0.44	0.43		
Abdominal pain index (1 = no, 2 = pain)			−0.01	0.96	−0.05	0.88	−0.12	0.71		
Problems (1 = no, 2 = problems)			0.10	0.79	0.10	0.80	0.23	0.57		
Work absence (wks per y)			−0.007	0.81	−0.007	0.81	−0.004	0.99		
Hospitalization ever (1 = yes, 2 = no)			−0.10	0.77	−0.09	0.78	−0.14	0.68		
Stress (1 = no, 2 = stress)			0.19	0.58	0.15	0.65	0.23	0.53		
Physical activity at work (1 = high, 4 = low)			0.23	0.27	0.23	0.28	0.20	0.35		
Lead (μg/100ml)			0.03	0.10	0.03	0.16	0.02	0.53		
Tobacco smoking (1 = no, 2 = yes)					0.13	0.68	0.23	0.48		
Alcohol (drinks/wk)					0.006	0.56	0.003	0.79		
Physical activity leisure time (1 = high, 2 = low)					−0.13	0.57	0.04	0.88		
Cholesterol (mmol/l)							0.37	0.002	0.34	0.004
Triglycerides (mmol/l)							−0.15	0.20	−0.14	0.28
Insulin (mU/l)							0.04	0.003	0.03	0.003
Glucose (mmol/l)							−0.30	0.22		
BMI (kg/m ²)							0.07	0.08	0.05	0.13
Systolic blood pressure (mmHg)							0.02	0.03	0.02	0.03

Table 5 Relative risk of coronary heart disease with 95% confidence interval during 16 years of follow up. Cox multiple regression analysis

	Self rated health				<i>p</i> -value
	Extremely good	Good	Poor	Miserable	
Relative risk without adjusting for confounders	1.0	4.0 (0.5 to 29.0)	5.8 (0.7 to 45.5)	12.1 (1.1 to 133.1)	0.02
Relative risk controlled for insulin level, systolic blood pressure and cholesterol level	1.0	4.0 (0.5 to 29.1)	4.2 (0.5 to 33.6)	15.4 (1.4 to 171.6)	0.04
Relative risk also controlled for variables*	1.0	4.2 (0.5 to 31.1)	6.5 (0.8 to 54.5)	18.6 (1.5 to 228.7)	0.02

* Variables = gender, work absence, problems, stress, social class, cohabitation, abdominal pain index, alcohol, physical activity leisure time, hospitalisation, and smoking

The follow up analyses showed the following relative risks of CHD in the four self rated health groups: ‘extremely good’: 1.0, ‘good’: 4.0, ‘poor’: 5.8, ‘miserable’: 12.1 (*p*=0.02) (table 5). After control for conventional CHD risk factors and a substantial number of other potential confounders the relative risks were: 1.0, 4.2, 6.5, and 18.6 (*p*=0.02) (table 5).

Seen from a methodological point of view there are two main problems in connection with this study: the relatively small sample size and the small variation in the responses regarding self rated health. As a consequence of the sample size of about 1000 persons and the age of the cohort at baseline (40 years) there are only 50 new cases of CHD in spite of the long follow up period of 16 years. Thirty eight of these cases are in the ‘good’ self rated health category, while there is only one case in the ‘extremely good’ category and two in the ‘miserable’ category. Although the trend of CHD incidence across self rated health categories is clear and steep, several of the confidence intervals are very wide.

The international reports on self rated health show that the seemingly simple concept of self rated or self perceived health has been measured in a large number of different ways. Preliminary results from a nationwide Danish population study of health and health behaviour carried out by the Danish Institute of Clinical Epidemiology show that the global self rated health question in the short form 36 (SF-36) questionnaire³⁸ works very well in a Danish context. The SF-36 questionnaire has five

response categories (excellent, very good, good, fair, poor), and in the Danish study the distribution on these categories was: 13%, 40%, 36%, 9% and 2% in a representative national sample of 1632 persons (Rasmussen, personal communication). This example suggests that we might have achieved a more even distribution on self rated health if we had used one more positive response category. We recommend that standardised and well validated questions such as the SF-36 question should be used in future studies in this field. This would also greatly facilitate international comparisons.

While the present study has the above mentioned shortcomings, it also has a number of strong features:

1. All the standard cardiovascular risk factors and a considerable number of additional social, occupational, psychological, and physiological factors are included.
2. The participants were examined by a physician (HH) at baseline, and prevalent cases of CHD were excluded from the analyses.
3. Very few participants (two persons) were lost to follow up, and we have valid and accurate information on hospitalisation and vital status of the remaining ones due to the personal registration numbers and the national patient and mortality registers.
4. There is a long follow up period lasting 16 years.
5. The cohort members were 40 years old at baseline, while most other self rated health studies have followed older cohorts.

Our results are in agreement with the associations found between self rated health and (fatal and/or non-fatal) CHD in six other studies.^{15 21-25} Four of these studies were not methodologically satisfactory with regard to control for CHD at baseline and control for confounders, but the very clear self rated health-CHD associations demonstrated were very suggestive indeed. The relative risks in the study by Wannamethee and Shaper²⁵ are of particular interest in this connection. They found crude relative risk values for CHD deaths of 1.0, 3.5, 10.4, and 13.5 in the four self rated health categories, which is very close to the trend found in this study (table 5).

The studies by Pijls *et al*²³ and by Appels *et al*²¹ are in many ways similar to ours. In these studies all the standard CVD risk factors as well as cardiovascular health at baseline are included and controlled for. The main differences are that the two studies have shorter follow up periods (5 and 10 years), fewer social and psychological variables, and include men only. Pijls *et al* found relative risks for CVD mortality of 1.0, 1.3, and 1.9 in the three self rated health categories after controlling for baseline health and potential confounders. The p value for the trend was 0.09. Appels *et al*²¹ dichotomised the self rated health categories and compared 'poor' with 'good' in Kaunas as well as Rotterdam. Relative CHD mortality risk in the 'poor' group was 1.45 in Kaunas and 1.94 in Rotterdam. When using a self rated health question in which the men were asked to compare their health with that of age peers, the relative risk values were 2.23 and 2.11 respectively. In both cases the Kaunas relative risk values were non-significant while the Rotterdam values were statistically significant. In other words, the trends are clear in the two best studies performed so far, but the relative risk values are not very high, and only the Rotterdam results by Appels *et al* are significant at the 0.05 level.

In our final analyses (table 5) the confidence intervals are wide, as already mentioned, but the trend is clear and virtually unaffected by control for potential confounders, and the overall p value is low. The clear pattern revealed by our analyses of possible confounders is noteworthy. We found no factors that are associated with CHD and at the same time associated with self rated health during the 16 years' follow up. From a methodological point of view this means that we have 'no confounding', while from a theoretical point of view it means that we cannot explain the self rated health-CHD association. All we can say is that according to our analyses the relationship between self rated health and CHD can neither be explained by well established nor by a large number of suspected CVD risk factors.

In this paper we have tried to shed light on possible explanations for the association between self rated health and CHD. Subclinical CHD at age 40 could be the explanation for the association between self rated health and CHD. Only 10 of the 50 incident cases took place during the first five years of follow up. If the analysis is performed by using only new

cases from the last 11 years, the trend is weaker. This shows that part of the association between self rated health and CHD can be explained by subclinical disease. As regards behavioural factors we found that self rated health was related to physical activity in leisure time, smoking, and alcohol consumption, but these factors were not predictors of CHD in this cohort when controlled for other factors. Univariately smoking predicts CHD in this cohort. We do not have good data on dietary habits, but we included cholesterol, BMI, triglycerides and other physiological variables that partly reflect food intake. Since the associations between behavioural variables and self rated health have different strengths and even directions in different populations, it cannot be ruled out that behavioural factors may explain some of the self rated health-CHD association in other populations.

The accumulated results of studies on self rated health and mortality have implications not only for future research but also for clinical and preventive medicine. Seen from a clinical point of view the self rated health research results ought to remind the clinician of the importance of listening carefully to what the patient has to say about his/her own health. This is especially the case when the patient has a health assessment that differs from that of the physician. These patients should not be discarded as hypochondriacs (when the patient feels ill while the physician finds no disease) or disease deniers (the opposite situation). It should be recognised that the patient's perception of health status has an informative value of its own. In preventive medicine, attention should be paid to the factors that shape an individual's own health assessment. An example could be screening activities where otherwise healthy persons with, for example, high blood pressure or high cholesterol levels are labelled as 'patients' in need of treatment. Another example could be the 'labelling' of persons in the social system in connection with early pensioning, workers' compensation or other health related disbursements. To shed light on these questions intervention studies on causes and consequences of self rated health are badly needed.

- Blackwell B. Illness behaviour labelling and compliance. *Clin Invest Med* 1981; 4: 209-14.
- Hunt LM, Jordan B, Irwin S. Views of what's wrong: diagnosis and patients' concepts of illness. *Soc Sci Med* 1989;28: 945-56.
- Idler EL. Self-assessed health and mortality: a review of studies. *Int Rev Health Psychol* 1992; 1: 33-54.
- Kohoe R, Wu S, Leske MC, Chylack LT. Comparing self-reported and physician-reported medical history. *Am J Epidemiol* 1994;139: 813-8.
- Linn BS, Linn MW. Objective and self-assessed health in the old and very old. *Soc Sci Med* 1980;14A: 311-5.
- Taylor DC. The components of sickness: diseases, illnesses, and predicaments. *Lancet* 1979; ii: 1008-10.
- Tishelman C, Taube A, Sachs L. Self-reported symptom distress in cancer patients: reflection of disease, illness or sickness? *Soc Sci Med* 1991;33: 1229-40.
- Heyman DK, Jeffers FC. Effect of time lapse on consistency of self-health and medical evaluations of elderly persons. *J Gerontol* 1963;18: 160-4.
- Palmore E. Predicting longevity: a follow-up controlling for age. *Gerontologist* 1969;4: 247-50.
- Pfeiffer E. Survival in old age: physical, psychological and social correlates of longevity. *J Am Geriatr Soc* 1970;18: 273-85.
- Singer E, Garfinkel R, Cohen SM, Srole L. Mortality and mental health: evidence from the Manhattan Restudy. *Soc Sci Med* 1976;10: 517-25.

- 12 LaRue A, Bank L, Jarvik L, Hetland M. Health in old age: how do physicians ratings and self-ratings compare? *J Gerontol* 1979;34: 687-91.
- 13 Taubman T, Rosen S. Healthiness, education, and marital status. In: Fuchs VR, ed. *Economic aspects of health*. Chicago: The University of Chicago Press, 1982;121-140.
- 14 Mossey JM, Shapiro E. Self-rated health: a predictor of mortality among the elderly. *Am J Public Health* 1982;72: 800-8.
- 15 Kaplan GA, Camacho T. Perceived health and mortality: a nine-year follow-up of the human population laboratory cohort. *Am J Epidemiol* 1983;117: 292-304.
- 16 Welin L, Svärdsudd K, Ander-Peciva S, et al. Prospective study of social influences on mortality. *Lancet* 1985;ii: 915-8.
- 17 Kaplan G, Barell V, Lusky A. Subjective state of health and survival in elderly adults. *J Gerontol* 1988;43: S114-20.
- 18 Idler EL, Kasl SV, Lemke JH. Self-evaluated health and mortality among the elderly in New Haven, Connecticut, and Iowa and Washington Counties, Iowa, 1982-1986. *Am J Epidemiol* 1990;131: 91-103.
- 19 Idler EL, Angel RJ. Self-rated health and mortality in the NHANES-I epidemiologic follow-up study. *Am J Public Health* 1990;80: 446-52.
- 20 Rakowski W, Mor V, Hiris J. The association of self-related health with two-year mortality in a sample of well elderly. *J Aging Health* 1991;3: 527-45.
- 21 Appels A, Bosma H, Grabauskas V, Gostautas A, Sturmans F. Self-rated health and mortality in a Lithuanian and a Dutch population. *Soc Sci Med* 1996;42:681-91.
- 22 Kryzanowski M, Wysocki M. The relation of thirteen-year mortality to ventilatory impairment and other respiratory symptoms: The Cracow study. *Int J Epidemiol* 1986;15: 56-64.
- 23 Pijls LTJ, Feskens EJM, Kromhout D. Self-rated health, mortality, and chronic diseases in elderly men. The Zutphen Study, 1985-1990. *Am J Epidemiol* 1993;138: 840-8.
- 24 Svärdsudd K, Tibblin G. Is quality of life affecting survival? *Scand J Prim Health Care* 1990; suppl 1: 55-60.
- 25 Wannamethee G, Shaper AG. Self-assessment of health status and mortality in middle-aged British men. *Int J Epidemiol* 1991;20: 239-45.
- 26 Idler EL, Kasl S. Health perceptions and survival: do global evaluations of health status really predict mortality? *J Gerontol* 1991;46: s55-65.
- 27 Idler EL. Age differences in self-assessments of health: age changes, cohort differences, or survivorship? *J Gerontol* 1993;48: s289-300.
- 28 Hollnagel H. The health structure of 40-year-old men and women in the Glostrup area, Denmark - an epidemiological survey. *Dan Med Bull* 1980;27: 121-30.
- 29 Møller L, Kristensen TS, Hollnagel H. Social class and cardiovascular risk factors in Danish men. *Scand J Soc Med* 1991;19: 116-26.
- 30 Hollnagel H, Kamper-Jørgensen F. Utilisation of health services by 40-year-old men and women in the Glostrup area, Denmark. *Dan Med Bull* 1980;27: 130-9.
- 31 Møller L, Kristensen TS, Hollnagel H. Physical activity, physical fitness and coronary risk factors. *Dan Med Bull* 1991;38: 182-7.
- 32 Møller L, Kristensen TS. Blood lead as a cardiovascular risk factor. *Am J Epidemiol* 1992; 136: 1091-100.
- 33 Sælan H, Møller L, Køster A. Alcohol consumption in a Danish cohort during 11 years. *Scand J Soc Med* 1992;20: 87-93.
- 34 Grafnetter D, Fodor J, Teply V, Zacek K. The effect of storage on levels of cholesterol in serum as measured by a simple, direct method. *Clin Chim Acta* 1967;16: 33-7.
- 35 Laurell S. A method for routine determination of plasma triglycerides. *Scand J Clin Lab Invest* 1966;18: 668-72.
- 36 Møller LF, Jespersen J. Fasting serum insulin levels and coronary heart disease in a Danish cohort: 17-year follow-up. *J Cardiovasc Risk* 1995;2: 235-40.
- 37 Rose GA, Blackburn H, Gillum RF, Prineas RJ. *Cardiovascular survey methods*. Geneva: WHO, 1982.
- 38 Ware JE. Measuring patients' views: the optimum outcome measure. SF36: a valid, reliable assessment of health from the patient's point of view. *BMJ* 1993;306: 1430.