Self rated health and mortality: a long term prospective study in eastern Finland

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Abstract

Study objective—To assess the relation between self rated health and mortality over a period of 23 years, taking into account medical history, cardiovascular risk factors, and education at the beginning of the follow up.

Design—A cohort of random population samples. The baseline studies included a self administered questionnaire and a health examination. Mortality data were collected from the national mortality register using personal identification numbers.

Setting—The provinces of North Karelia and Kuopio in eastern Finland.

Participants—Random samples of working age people (n=21 302) from the population register.

Main results—For self rated health, the age adjusted poor to good relative risk for all cause mortality was 2.36 (95% confidence intervals 2.10, 2.64) for men and 1.90 (1.63, 2.22) for women, and for cardiovascular mortality 2.29 (1.96, 2.68) for men and 2.34 (1.84, 2.96) for women. Adjusted for selected potentially fatal diseases from the subjects' medical histories, cardiovascular disease risk factors, and education, the corresponding relative risks for all cause mortality were 1.66 (1.47, 1.88) for men and 1.50 (1.26, 1.78) for women, and for cardiovascular mortality 1.54 (1.29, 1.82) for men and 1.63 (1.26, 2.10) for women. The association between self rated health and mortality attributable to external causes was fairly strong.

Conclusions—Poor self rated health is a strong predictor of mortality, and the association is only partly explained by medical history, cardiovascular disease risk factors, and education.

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Self rated health is a common measure in population studies.[1][2] Simple questions like "How would you describe your present health status?" with precoded answers have proved to be strong predictors of future health problems[3][4] and mortality.[4–15]

Idler *et al*[7] found a relation between self rated health and mortality even after adjusting for prevalent diseases and some health behaviour factors. Another study from the United States[16] showed that a long list of background factors could explain a major part of the association. Appels *et al*[12] emphasised the use of objective measures when adjusting models of self rated health and mortality, because other self reports on health may have the same personal bias as self rated health. They concluded that poor self rated health was mainly associated with mortality because of its association with cardiovascular diseases. Others[17] have suggested that psychological factors might expose people to coronary heart disease, thus explaining the strong association. Mortality differences seem to be greater in studies with a short follow up.[6][11] The literature suggests that we should have a better understanding of the mechanisms by which self rated health predicts mortality. We ask whether and to what extent can the association between self rated health and mortality be explained by different background factors, and does the association equally concern different main causes of death—that is, cardiovascular and external causes, as well as total mortality?

This paper considers these questions by assessing the relation between self rated health and mortality over a period of up to 23 years in eastern Finland, taking into account medical history, cardiovascular risk factors, and education at the starting point of the follow up.

Methods

The high coronary heart disease rates in Finland at the beginning of the 1970s[18] led to the launch of the North Karelia Project in 1972. The aim was to lower the high coronary mortality rates in the province of North Karelia by implementing a comprehensive community-based intervention programme.[19] Using population surveys, data were collected on cardiovascular disease risk factors, socioeconomic variables, medical history, health behaviour, and self reported health.

In 1972 and 1977 cross sectional surveys were conducted in the provinces of North Karelia and Kuopio. Independent random samples, 6.6% (13.2% in the city of Joensuu) of the population born during 1913–47, were drawn from the population register in both areas. In 1977 an additional 6.6% random sample of the population born between 1948 and 1952 was drawn in North Karelia. The original samples from the two surveys consisted of 13 538 men and 13 661 women, and participation rates were 86.5% and 90.1% for men and women respectively. Those who had been randomly selected in both surveys (1972 and 1977) were excluded from the 1977 sample in this study (341 men and 394 women). The subjects who had missing values in self rated health, education, smoking, serum cholesterol, systolic blood pressure, body mass index, or leisure time physical activity—that is,

Table 1 Self rated health and other variables by sex (1972 and 1977)

	Men (n=10 363)	Women (n=10 939)
Self rated health (%)		
Very good	8.4	5.8
Quite good	33.3	33.9
Average	40.9	43.8
Quite poor	15.3	14.7
Very poor	2.1	1.7
Myocardial infarction (%)	2.5	0.8
Stroke (%)	0.7	0.4
Heart failure (%)	5.3	6.0
Angina pectoris (%)	5.1	3.8
Bronchial asthma (%)	1.5	1.4
Emphysema/bronchitis (%)	6.7	3.7
Rheumatoid arthritis (%)	3.3	5.5
Smoking (%)	49.6	13.1
Leisure time physical activity (%)		
Low	31.9	47.2
Moderate	52.2	42.7
High	15.9	10.1
Education (%)		
Low	22.4	28.4
Middle	37.7	35.1
High	39.9	36.5
Age (y) (SD)	42.4 (10.4)	43.4 (10.6)
Serum cholesterol (mmol/l) (SD)	6.7 (1.3)	6.6 (1.4)
Systolic blood pressure (mm Hg) (SD)	145.3 (19.6)	144.4 (24.3)
Body mass index (kg/m^2) (SD)	25.8 (3.4)	26.1 (4.6)

1010 men and 978 women—were also excluded from the analyses. Thus 10 363 men and 10 939 women were included.

The surveys were carried out by mailing a self administered questionnaire to the subjects. Thereafter the respondents had a health examination, in which a trained research team at the local health centre carried out standardised risk factor measurements, for example, blood pressure, height, weight, and blood samples. Serum cholesterol was analysed centrally in the laboratory of the National Public Health Institute.

Table 2 Self rated health in relation to mortality between 1972/1977–1995: relative risks (RR) with 95% confidence intervals (CI). "Good" health = 1.00

		Men RR (95% CI)	Women RR (95% CI)
All cause mortality		n=2701	n=1424
Model 1	Average	1.50 (1.36, 1.67)	1.27 (1.10, 1.46)
	Poor	2.36 (2.10, 2.64)	1.90 (1.63, 2.22)
Model 2	Average	1.31 (1.18, 1.45)	1.17 (1.01, 1.35)
	Poor	1.69 (1.50, 1.91)	1.50 (1.27, 1.78)
Model 3	Average	1.29 (1.16, 1.44)	1.17 (1.01, 1.35)
	Poor	1.66 (1.47, 1.88)	1.50 (1.26, 1.78)
CVD mortality		n=1448	n=692
Model 4	Average	1.53 (1.32, 1.77)	1.46 (1.16, 1.84)
	Poor	2.29 (1.96, 2.68)	2.34 (1.84, 2.96)
Model 5	Average	1.47 (1.27, 1.71)	1.40 (1.11, 1.76)
	Poor	1.89 (1.60, 2.23)	1.93 (1.50, 2.47)
Model 6	Average	1.30 (1.12, 1.51)	1.29 (1.03, 1.63)
	Poor	1.56 (1.32, 1.85)	1.63 (1.27, 2.10)
Model 7	Average	1.29 (1.11, 1.49)	1.29 (1.02, 1.63)
	Poor	1.54 (1.29, 1.82)	1.63 (1.26, 2.10)
External causes mortality		n=316	n=83
Model 8	Average	1.42 (1.10, 1.85)	1.88 (1.10, 3.22)
	Poor	1.73 (1.23, 2.42)	1.76 (0.87, 3.57)
Model 9	Average	1.40 (1.08, 1.82)	1.83 (1.07, 3.14)
	Poor	1.66 (1.18, 2.35)	1.67 (0.81, 3.41)

n = Number of deaths in the cohort between 1972/1977 and 1995. CVD = cardiovascular diseases. Models 1 to 3 were adjusted for age (continuous variable) and survey year and, furthermore, models 2 and 3 for myocardial infarction, stroke, heart failure, angina pectoris, bronchial asthma, emphysema/bronchitis, rheumatoid arthritis, smoking, serum total cholesterol, systolic blood pressure, body mass index, and leisure time physical activity and, furthermore, model 3 for education. Models 4 to 7 were adjusted for age (continuous variable) and survey year and, furthermore, models 5 to 7 for myocardial infarction, stroke, heart failure, and angina pectoris and, furthermore, models 6 and 7 for smoking, serum total cholesterol, systolic blood pressure, body mass index, and leisure time physical activity and, furthermore, model 7 for education. Models 8 and 9 were adjusted for age (continuous variable) and survey year and, furthermore, model 9 for education.

In the questionnaire the subjects were asked to rate their present health status along a five point scale: very good, quite good, average, quite poor, and very poor. This health measure has proved to be a reliable one in test-retest analysis,[20 21] and it seems to form a continuum from poor through average to good in relation to most risk factors and ill health indicators.[22] The distribution of the responses is given in table 1, in which we present background information on the sample. In the analyses, we classified the respondents into three groups according to self rated health by combining those who responded "very good" or "quite good" to "good", and those who responded "quite poor" or "very poor" to "poor".

Data on the subjects' medical history were collected by asking if a doctor had diagnosed or treated certain diseases during the past 12 months, namely, myocardial infarction, stroke, heart failure, angina pectoris, bronchial asthma, emphysema/bronchitis, and rheumatoid arthritis. The questionnaire also asked the respondents' smoking status. Those who reported they were current smokers or had stopped smoking less than six months before the survey were regarded as smokers, all others were regarded as non-smokers. We sorted the respondents into three groups (low, moderate, high) according to self reported average leisure time physical activity.

Education was measured as the total number of school years, defined as containing all education beginning with elementary school. Because the mean length and the structure of the education system had changed markedly during the 20th century, we divided the respondents into educational tertiles according to year of birth by sex, tertile 1 having the lowest education.

Mortality data until 1985 and 1995 were collected from the national mortality register using personal identification numbers. Cardiovascular disease mortality and external causes mortality were analysed separately, in addition to all cause mortality. The statistical analyses were done using SAS programs[23] and proportional hazards (Cox) regression. All the models were controlled for age and study year. Self rated health was added into the models as dummies (good, average, poor), using the "good" group as a reference. Age, serum cholesterol, systolic blood pressure, and body mass index (weight (kg)/height (m)^2) were used as continuous variables. Adding the squared terms of serum cholesterol and body mass index in the models did not affect the association between self rated health and mortality.

Results

For self rated health, the age adjusted "poor" to "good" relative risk for all cause mortality was 2.36 (95% confidence intervals 2.10, 2.64) for men and 1.90 (1.63, 2.22) for women, and for cardiovascular mortality 2.29 (1.96, 2.68) for men and 2.34 (1.84, 2.96) for women (table 2). Adjusted for the selected potentially fatal diseases from the medical history, cardiovascular disease risk factors, and education, the

Table 3 Covariates from the full models (models 3 and 7) in relation to mortality between 1972/1977–1995: relative risks (RR) with 95% confidence intervals (CI)

	Men RR (95% CI)		Women RR (95% CI)	
	All cause mortality	CVD mortality	All cause mortality	CVD mortality
Age (y)	1.08 (1.07, 1.08)	1.09 (1.08, 1.10)	1.09 (1.08, 1.10)	1.11 (1.09, 1.12)
Survey year (1972=1, 1977=2)	1.03 (0.94, 1.12)	0.95 (0.85, 1.07)	1.03 (0.91, 1.16)	1.17 (0.97, 1.40)
Average *v* good SRH	1.29 (1.16, 1.44)	1.29 (1.11, 1.49)	1.17 (1.01, 1.35)	1.29 (1.02, 1.63)
Poor *v* good SRH	1.66 (1.47, 1.88)	1.54 (1.29, 1.82)	1.50 (1.26, 1.78)	1.63 (1.26, 2.10)
Myocardial infarction (yes/no)	2.12 (1.81, 2.48)	2.97 (2.47, 3.57)	1.48 (1.06, 2.08)	2.08 (1.41, 3.05)
Stroke (yes/no)	1.25 (0.91, 1.72)	1.10 (0.72, 1.69)	0.92 (0.55, 1.54)	1.11 (0.62, 1.99)
Heart failure (yes/no)	1.30 (1.15, 1.47)	1.31 (1.11, 1.53)	1.47 (1.26, 1.70)	1.66 (1.37, 2.02)
Angina pectoris (yes/no)	1.00 (0.87, 1.14)	1.10 (0.92, 1.30)	1.09 (0.88, 1.34)	1.19 (0.92, 1.56)
Bronchial asthma (yes/no)	1.26 (1.00, 1.58)		0.98 (0.68, 1.42)	
Emphysema/bronchitis (yes/no)	1.11 (0.99, 1.26)		0.97 (0.75, 1.24)	
Rheumatoid arthritis (yes/no)	1.06 (0.91, 1.25)		1.07 (0.91, 1.27)	
Smoking (yes/no)	2.09 (1.93, 2.27)	1.95 (1.75, 2.17)	2.07 (1.77, 2.42)	2.56 (2.04, 3.22)
Serum cholesterol (mmol/l)	1.08 (1.05, 1.11)	1.20 (1.16, 1.25)	1.01 (0.97, 1.05)	1.10 (1.05, 1.16)
Systolic blood pressure (mm Hg)	1.01 (1.01, 1.01)	1.01 (1.01, 1.02)	1.01 (1.01, 1.01)	1.02 (1.01, 1.02)
Body mass index (kg/m^2)	1.00 (0.99, 1.02)	1.03 (1.01, 1.04)	1.01 (0.99, 1.02)	1.01 (0.99, 1.03)
Leisure time physical activity*	0.89 (0.83, 0.95)	0.93 (0.85, 1.02)	0.86 (0.78, 0.94)	0.84 (0.73, 0.96)
Education (low, middle, high)	0.95 (0.91, 1.00)	0.95 (0.89, 1.02)	1.00 (0.93, 1.07)	0.99 (0.90, 1.09)

CVD = cardiovascular diseases, SRH = self rated health. *Low, moderate, high.

corresponding relative risks for all cause mortality were 1.66 (1.47, 1.88) for men and 1.50 (1.26, 1.78) for women, and for cardiovascular mortality 1.54 (1.29, 1.82) for men and 1.63 (1.26, 2.10) for women. A gradient from "good" through "average" to "poor" self rated health in relation to all cause and cardiovascular mortality was found. Among women the relative risks for the "average" group were only marginally significant after the adjustments. Table 3 presents the relative risks for the covariates in the full models for all cause and cardiovascular mortality.

The association between self rated health and mortality attributable to external causes was fairly strong among men, and the adjusted "poor" to "good" relative risk was 1.66 (1.18, 2.35). For women the relative risk for "average" self rated health, 1.83 (1.07, 3.14), was greater than that for "poor" health, 1.67 (0.81, 3.41).

Table 4 presents the relative risks for mortality between 1972/1977–1985 for self rated health. Among men the association between self rated health and mortality was slightly stronger than during the longer follow up 1972/1977–1995. The relatively small number of deaths among women may explain that the association was not so strong as during the longer follow up. Combining men and women, the association between self rated health and all cause and cardiovascular mortality was statistically significant, and there was a gradient from "good" through "average" to "poor" health.

Discussion

In this study self rated health strongly predicted mortality in a randomly selected population cohort in eastern Finland. This association was only partly explained by medical history, cardiovascular disease risk factors, and education. The relation was strong among both men and women, and it was evident during a shorter as well as a longer follow up. A clear gradient was found from "good" through "average" to "poor" self rated health in relation to all cause and cardiovascular mortality. These results are in line with several earlier studies published in recent years.[4–15] The exact questions, settings, populations, and background variables used in these studies vary greatly, but in most studies the basic finding has been similar—that is, self rated health is associated with subsequent mortality even when the models are adjusted for several background variables. Large samples, a wide age range of the cohort, a long follow up with two assessing points, reliable links with the mortality register, specific causes of mortality, data on several self reported medical history items, and measured cardiovascular disease risk factors were the specific advantages of this study.

The association between self rated health and mortality can be understood so that certain conditions make one feel unhealthy, and these conditions also cause mortality. However, after adjusting for several background variables something seems to remain unexplained.

It has been suggested that the predictive value of self rated heath could be partly caused by a "healthy attitude" in life: the individual attempts to achieve the high level of health that one has chosen and works for.[8] Thus self rated health may reflect the level of life control. Moreover, it may indicate the respondent's personal, possibly unconscious, assessment of

Table 4 Self rated health in relation to mortality between 1972/1977–1985: relative risks (RR) with 95% confidence intervals (CI). "Good" health = 1.00

		Men RR (95% CI)	Women RR (95% CI)	All* RR (95% CI)
All cause mortality		n=1173	n=475	n=1648
Model 10	Average	1.35 (1.13, 1.60)	0.99 (0.77, 1.27)	1.23 (1.07, 1.42)
	Poor	1.71 (1.41, 2.07)	1.32 (0.99, 1.77)	1.59 (1.35, 1.86)
CVD mortality		n=661	n=217	n=878
Model 11	Average	1.35 (1.07, 1.72)	0.97 (0.65, 1.46)	1.26 (1.03, 1.55)
	Poor	1.55 (1.19, 2.02)	1.50 (0.96, 2.33)	1.55 (1.23, 1.94)
External causes mortality		n=170	n=39	n=209
Model 12	Average	1.66 (1.16, 2.39)	2.00 (0.92, 4.33)	1.73 (1.25, 2.41)
	Poor	1.89 (1.18, 3.03)	1.05 (0.33, 3.36)	1.72 (1.11, 2.67)

*Adjusted also for sex. n = Number of deaths in the cohort between 1972/1977 and 1985. CVD = cardiovascular diseases. Model 10 was adjusted for age (continuous variable), survey year, myocardial infarction, stroke, heart failure, angina pectoris, bronchial asthma, emphysema/bronchitis, rheumatoid arthritis, smoking, serum total cholesterol, systolic blood pressure, body mass index, leisure time physical activity, and education. Model 11 was adjusted for age (continuous variable), survey year, myocardial infarction, stroke, heart failure, angina pectoris, smoking, serum total cholesterol, systolic blood pressure, body mass index, leisure time physical activity, and education. Model 12 was adjusted for age (continuous variable), survey year, and education.

his or her life expectancy,[8] taking into account all that he or she knows to have an effect on health and mortality. For an outside health professional, even several specific questions might not be enough to collect all the information the subject possesses about his or her own present health, health behaviour, or family background, among other things.[24] The association between self rated health and external causes mortality could be partly explained by some kind of "risk taking behaviour".

Self ratings of health usually deteriorate with advancing age,[25–27] and age was an important factor explaining the association between self rated health and mortality, as expected. When assessing their health, people may use their own previous health status or, on the other hand, the health status of their age peers as a reference, which makes the concept of age rather complex.

It is easy to understand that prevalent diseases make one feel unhealthy, and some diseases may later lead to death.[13] Even so, only a minor part of the association between self rated health and mortality could be explained by pre-existing diseases. Our follow up of about two decades, however, is a long period of time, during which much happens in people's health status. Yet self rated health has shown stronger associations with chronic conditions than acute ones.[26 28–30] The association between self rated health and mortality among men was slightly stronger during the 8 to 13 year follow up than it was during the 18 to 23 year follow up.

The medical history variables used in this paper were self reported. Self reports have proved to be quite reliable as compared with more objective information sources, especially when the health conditions are severe and clearly defined.[31]

In our study, adding serum cholesterol and systolic blood pressure into the model explained a part of the association between self rated health and mortality. High serum cholesterol and blood pressure are commonly known to be risk factors for cardiovascular diseases. Kaplan *et al*[13] found strong relations between self rated health and cardiovascular risk factors, for example, blood pressure, LDL cholesterol, and smoking, unlike Fylkesnes *et al*.[26] If a person knows he or she has one or the other of these "silent" risk factors, that might influence his or her self assessments of health even without a prevalent disease.[32] However, among those who have no related disease and are ignorant of their risk factors, blood pressure and cholesterol level should have no effect on self rated health.[8 33]

Obesity is a controversial predictor of death.[34 37] According to a recent paper[38] both underweight and obesity were associated with poor self rated health among young people. Smoking, an undisputed mortality risk, was associated with poor health ratings among all age groups in that study.

Socioeconomic status is associated with health, self reports of health, and mortality, which has been showed in different countries, for example, Finland,[27 39 40] Scandinavian

countries,[41–45] Britain,[41 42 46–50] Ireland,[51] Germany,[52 53] the Netherlands,[54] the United States,[55–57] and Australia.[58 59] In many countries education, in particular, has been found to be a powerful factor determining health outcomes.[60 61] High education is also strongly associated with good self reported health.[27 62] Thus the explanatory power of education in our models was possibly smaller than one would have expected. The other possibly education dependent variables, however, may have explained part of this variable's effect. As a measure of socioeconomic status, education is individual and does not change over the course of life as occupations and income often do, and measurement by education avoids the problems of comparability caused by unemployment.[60]

When large groups of people are assessed, we have to bear in mind the variation between individuals among the population. Certain conditions or health behaviour do not lead to death in a similar manner for all people. In addition, the concept of "good" health has many dimensions[63–65] that vary, for example, by age, cultural background,[66–68] and possibly by sex. Furthermore, even for a given individual the concept of "good" health may be context bound.[69] Older people may tend to rate their general health referring to health problems, whereas younger subjects more frequently use health behaviour as a reference.[1] Self rated health has been found to be associated with physical functioning among men, but more closely among women with subjective health variables, particularly those with painful symptoms.[70] Thus the mechanisms by which self rated health predicts mortality are necessarily not the same among different subgroups of the population. Self rated health is, however, a unique tool for population surveys, although we do not yet fully understand its contents and the ways through which it is associated with future health events. The predictive power of self rated health confirms the importance of self reports of health—that is, what people say about themselves to health professionals.

In conclusion, self rated health was a strong predictor of mortality in a randomly selected population cohort in eastern Finland, and its predictive power was only partly explained by a

variety of items from the medical history, cardiovascular disease risk factors, and education. The association existed among both sexes for all cause and cardiovascular mortality and, especially among men, for mortality attributable to external causes. A clear gradient was found from "good" through "average" to "poor" self rated health in relation to all cause and cardiovascular mortality.

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