Self-reported health, self-reported fitness, and all-cause mortality: Prospective cohort study

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Abstract

Objectives. Self reported health has a well established relationship to later mortality, although the reasons are not entirely understood. This study examined the association of a similar self-reported measure of fitness with mortality and compared it to that of self-reported health.

Design. The study had a prospective cohort design with multiple sampling points.

Methods. Participants were 858 men and women from Glasgow and the surrounding area of Scotland, aged 59 when self-reported health and fitness data were first collected in 1991/2. They were re-interviewed at age 64 and 69 and mortality was tracked for 16.5 years in total. Hazard ratios for all cause mortality were estimated for those that reported poor health or poor fitness relative to others their age, taking into account a range of covariates, some of which were also time-varying.

Results. In both unadjusted and covariate adjusted models, self-reported fitness was at least as good a predictor of mortality as self-reported health. In a mutually adjusted model, both again emerged as significant predictors. Poor subjective health with poor subjective fitness appeared to be a particularly lethal combination.

Conclusion. Both self-reported health and self-reported fitness were independent predictors of mortality. Where the objective assessment of aerobic fitness is not feasible, a simple measure of subjective fitness could prove a useful alternative.

Keywords: mortality; prospective cohort study; self-reported health; self-reported fitness

Prospective epidemiological evidence testifies that self-reported health predicts mortality in a dose-response fashion, independently of a variety of behavioural risk factors and medical status. For example, a review of 27 studies with follow-ups ranging from two to 28 years concluded that those reporting poor health have a mortality risk 1.5 to 3.0 times greater than those reporting good health (Idler & Benyamini, 1997). In all but four studies in the review, this effect withstood adjustment for covariates such as sociodemographics, smoking, and medical diagnoses (Idler & Benyamini, 1997). A more recent meta-analysis of 22 studies showed that poor self-rated health, was associated with a 1.9 times increased risk of death, again independently of diagnosed illness, as well as psychological and cognitive status (DeSalvo, Bloser, Reynolds, He, & Muntner, 2006). In contrast, no consideration has been given to the implications for mortality of self-reported fitness. However, objectively assessed fitness has been well researched and a review of 50 years of epidemiological research confirmed that low physical fitness was associated with increased cardiovascular and all-cause mortality (Erikssen, 2001). Moreover, improvements in physical fitness reduced mortality risk (Blair et al., 1995; Erikssen et al., 1998). Given the difficulty and expense of objectively measuring fitness in large-scale studies, self-reported fitness could prove a practical alternative. Just as self-reported physical activity has been associated with mortality independently of objective physical fitness in some studies (for a review see (Pedersen, 2007); it is possible that self-reported fitness might also provide unique information regarding mortality risk. Further, it would also seem important to determine the extent to which self-reported fitness and self-reported health predict mortality independently of one another and what the combined impact of poor subjective health and fitness is.

Self-reported health has largely been studied as a static variable measured only at baseline without consideration of its variation over time. However, a recent study testing the impact of self-reported health, both as a constant and as a time-varying variable, showed that, in men, the latter proved a better predictor of 10-year mortality (Lyyra, Leskinen, Jylha, & Heikkinen, 2007). Further investigation of the impact on mortality of self-reported health status, as well as self-reported fitness, over time seems warranted. It is also important that studies adjust for potential confounders. However, like self-reported health, many potential confounders are likely to vary over time. No study that we know of in this context has included measurements of covariates at multiple time points and considered the impact of their change over time on the relationship between self-reported health and fitness and mortality.

The present study reports a time-dependent analysis of the associations between self-reported health and self-reported fitness and mortality over 16.5 years in a cohort of 59-year old Scottish men and women. It was hypothesised that poorer self-reported health and self-reported fitness over time would be associated with an increased risk of mortality.

Method

Participants

Data are derived from eldest of the three age cohorts in the West of Scotland Twenty-07 Study (Ford, Ecob, Hunt, Macintyre, & West, 1994). They were all from the Glasgow area and were initially recruited in 1988/89 (wave 1). They were followed up on three subsequent occasions in 1991/92 (wave 2), 1995/96 (wave 3), and 2000/01 (wave 4). The Twenty-07 Study's principal aim was to investigate the processes that generate and maintain socio-demographic variations in health (Macintyre, 1987). Participants were chosen randomly with probability proportional to the overall population of the same age within a postal code area (Ecob, 1987). Three narrow age cohorts were chosen, each reflecting important stages of life and transitions. The oldest cohort was selected to reflect the transitions from middle to old age and from work to retirement. A comparison of the cohorts with equivalent samples drawn from the 1991 UK census indicated equivalence in terms of sex, occupational group, and home ownership (Der, 1998). The sample was almost entirely Caucasian, reflecting the West of Scotland population from which it was drawn. At wave 1 this eldest cohort comprised 1042 participants and at waves 2, 3, and 4, 858, 723, and 573, respectively. Wave 2 forms the baseline for this analysis, as self-reported fitness was not collected at wave 1. Demographic, and health-related data, such as smoking, body mass index, and blood pressure, were collected at each wave. Participants were also asked about any longstanding illnesses using the standard question from the General Household Survey. Vital status was continuously monitored. Local ethics committee approval was obtained for each wave of data collection and all the participants provided informed consent at each wave.

Procedure

On each of the occasions, participants were interviewed in their own homes by trained nurses. Household occupational group was classified as manual and non-manual from the occupational status of the head of household, using the Registrar General's Classification of Occupations (*Classification of Occupations*, 1980). For those who have retired their occupation prior to retirement is used. Smoking behaviour was determined by responses to the question, 'Do you ever smoke tobacco now? I am thinking of a pipe, cigars and your own roll ups as well as cigarettes you might buy.' Height, using the Leicester Height Measure stadiometer, and weight, using portable electronic scales (Soehnle, Nassau, Germany), were measured and body mass index computed. Systolic blood pressure (SBP) was measured while seated after 5 minutes rest. The presence of long-standing illness was measured by the following question: 'Do you have any long-standing illness, disability, or infirmity? By long-standing, I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time.'.

At waves 2, 3, and 4, participants were asked to indicate their level of health and their level of fitness in response to two prompts: 'would you say that for someone your age your own health is…' with the response options: excellent, good, fair, or poor; and 'would you say that for someone your age your own fitness is…' with the response options: very good, good, moderate, poor, and very poor. The questions were asked near the beginning of the interview in the context of general questions about the respondent's health. No guidance was given as to appropriate answers, nor was it implied that objective standards should be applied. This is the standard procedure for ascertainment of self reported health. For the present analyses, self-reported health was dichotomised into excellent and good versus fair or poor and self-reported fitness, very good and good versus moderate, poor, and very poor.

The study participants were flagged at the UK's National Health Service Central Registry, which provided notifications of death and cause.

Data analysis

Cox's regression models were used to analyse all cause mortality. For each of self-reported health and self-reported fitness a separate model was fitted, first unadjusted, then controlling for sex, household occupational group, smoking status, BMI, SBP, and long-standing illness. A mutually adjusted model was then run with self-reported fitness and self-reported health both included, in addition to the controls. As the risk factor measures - smoking status, BMI , SBP, and long-standing illness - were measured at each wave, these were treated as time varying covariates (household occupational group showed little variation across waves and was therefore treated as time constant). This approach uses the most recent values of these variables in estimating the hazards. The assumption is that, when explanatory variables change during the follow up period, using the most recent values leads to more accurate estimates of the hazard ratios. Further details and examples of the method are provided elsewhere (Andersen, 1992). For illustrative purposes, a separate model was fitted which contrasted those with both poor health and poor fitness against those with neither poor health nor poor fitness. This model used only baseline (wave 2) values of the covariates. All confidence intervals reported are at the 95% level. Finally, in sensitivity analyses, models were tested in which the full non-dichotomised versions of each of self-reported health and fitness measures were used.

Results

Table 1 shows descriptive statistics for the sample at each wave of the study. At wave 2, 858 people took part in the survey. Their mean age was 59 (SD 0.5) years, 46% of the sample were male, 38% were current smokers, and 57% were from the manual household occupational group. Mean BMI was 26 (SD 4.2) kg/m^2 and SBP was 140 (SD 20.7) mmHg. The prevalence of longstanding illness increased from 71% to 81% between waves 2 and 4. Thirty-one percent, 35%, and 29% of participants reported poor self-reported health relative to someone their own age at waves 2, 3, and 4, respectively. At waves 2 and 3, 49% rated their fitness, relative to someone their own age, as poor, and 42% at wave 4. At each wave, self-reported health and self-reported fitness were significantly, but not perfectly, correlated; r = 0.56, 0.60, and 0.58 at waves 2, 3 and 4, respectively ($p < .001$ in each case). Of the 858 participants at wave 2, 840 had complete data and these comprise the sample analysed here.

Table 2 shows the characteristics of the sample by self-assessed fitness and health. Those who reported poor health and poor fitness were more likely to be from manual occupational households, (χ^2 = 39.95 and 23.65, respectively, both p <.001) and to be current smokers (χ^2= 19.16 and 17.97, respectively, both p <.001). Those who reported poor fitness were one BMI unit heavier (CI for difference 0.43 to 1.58, p <.001). Those reporting poor fitness or poor health were twice as likely to die during the 16.5 years follow up period.

In total, 247 of the participants died. The mean age at death was 69 (SD 4.7) years. The major causes of death were: cardiovascular disease (39%), cancer (34%), respiratory disease (13%) and other causes (14%). As might be expected, higher mortality was evident for men, those in the manual household occupational group, and smokers. There were no significant associations between survival and BMI, resting SBP, or long-standing illness at baseline (data not shown).

Self-reported health, fitness, and mortality

The associations of mortality with self-reported health and self-reported fitness shown in Table 2 equate to hazard ratios of 3.25 (CI 2.52 to 4.19) for poor self reported health and 3.05 (CI 2.31 to 4.02) for poor fitness. After adjustment for potential confounders, sex, household occupational group and time-varying smoking status, BMI, SBP and longstanding illness the hazard ratios were 2.67 (CI 2.03 to 3.50) and 2.60 (CI 1.94 to 3.47) for self-reported health and fitness, respectively. All four results were significant at p <.001.

In a mutually adjusted, time varying, model containing both self-reported health and self-reported fitness, the two variables continued to predict mortality: HR = 1.95, (CI 1.42 to 2.68), for health, and HR = 1.80, (CI 1.28 to 2.55) for fitness (both p <.001). Again these analyses are adjusted for potential confounding variables, most of which were time-varying, and the full model is presented in Table 3.

Two forms of sensitivity analysis were conducted. The first was designed to assess the impact of missing data. Missing items were multiply imputed, the analysis was repeated on the imputed data, and the estimates were combined according to imputation rules for non-responses (Rubin, 1987). The results were relatively unaffected: HR 1.92 (CI 1.41 to 2.62) for poor health and 1.86 (CI 1.32 to 2.60) for poor fitness. To assess the impact of dichotomising the self reported health and fitness measures, the analysis was repeated using normal scores derived from the four or five category variables. The hazard ratios were slightly attenuated by the change of scale involved but both remained significant at $p < .001$, and the hazard ratio for fitness was somewhat larger (1.54 vs 1.42).

Finally, those with poor health and poor fitness had a substantially greater risk of dying than those with good health and fitness, HR = 2.67 (CI 1.93 to 3.72, $p < .001$). Survival curves illustrating this association are presented in Figure 1 for wave 2 data.

Discussion

The proportion of participants reporting poor or only fair health was similar to that found in other studies of samples of a similar age (Appels, Bosma, Grabauskas, Gostautas, & Sturmans, 1996; Wannamethee & Shaper, 1991) although somewhat higher than that in some cohorts (McFadden et al., 2009a). There are few comparable data on self-reported fitness. However, in a study of middle-aged men and women, just under half reported that they enjoyed either fairly good or very good fitness (Borodulin, Laatikainen, Salomaa, & Jousilahti, 2006), a figure not too dissimilar from the numbers reporting good or very good fitness in the present study.

In a time-varying analysis, poor self-reported health and poor self-reported fitness were associated with an increased risk of death from all causes over 16.5 years of follow-up. These self-report variables were related to mortality independently of sex, household occupational group, smoking status, BMI, and resting SBP. The risk associated with poor self-reported health *per se* was at the high end of the range reported in reviews (DeSalvo et al., 2006; Idler & Benyamini, 1997) although of a similar order to that recently observed in another British epidemiological study (McFadden et al., 2009a). That our risk estimates were generally high, in part, might reflect the increased sensitivity of time-dependent analyses; it has been argued that studies sampling self-reported health at only one point underestimate its true association with mortality. Studies comparing static and dynamic analytic models of self-reported health find that the later affords a stronger prediction of mortality (Han et al., 2005; Lyyra et al., 2007). In the present study, the hazard ratios were somewhat lower in single time point analyses relative to time-dependent analyses. In addition, the question used to assess self-reported health in the present study was phrased comparatively; studies using comparative questions generally yield higher mortality risk estimates than studies using non-comparative questions (DeSalvo et al., 2006).

The present study is the first we know of to demonstrate that self-reported fitness also predicts all-cause mortality. The risk associated with poor subjective fitness is the same order of magnitude as that found for poor subjective health in the present study and at least as great as that found by others for low objectively measured fitness (Blair et al., 1996; Blair et al., 1989; Brill, Kohl, & Blair, 1992). The relationship between self-reported fitness and objectively measured fitness has still to receive systematic study. Accordingly, our subjective measure of fitness may be a very poor proxy for actual aerobic fitness (Optenberg, Lairson, Slater, & Russell, 1984). However, in epidemiology, practical and financial considerations have prompted a search for non-exercise based estimates of aerobic fitness. These deploy a combination of sex, age, BMI, resting heart rate, and self-reported physical activity to calculate metabolic equivalents (METs) (Jurca et al., 2005; Lyyra et al., 2007). Such estimates have been found to be highly correlated with physiological measures of physical fitness determined from maximal or sub-maximal exercise tests (Jurca et al., 2005). As the parameters above were all measured at wave 3, estimated physical fitness could be determined, using a formula adapted from the one developed by the Cooper Institute (Jurca et al., 2005); the formula is available from the authors on request. The good and poor self-reported fitness groups differed substantially in estimated aerobic fitness, $F(1,666) = 39.80$, $p < .001$, $\eta^2 = .056$; the mean (SD) METs for the poor and good fitness groups were 6.4 (1.9) and 7.4 (1.9), respectively. Thus it would seem that self-reported fitness is to an extent reflecting actual cardio-respiratory fitness.

Self-reported health and fitness, in part, predicted mortality independently of one another. In the mutually adjusted model, both subjective health and fitness continued to confer a two-fold risk of dying during follow-up. Thus, individuals' estimates of their relative fitness would appear to tap aspects of health that are somewhat different from those which inform responses to an inquiry asking about relative health status. It is worth noting here that whereas a fair number of participants (N = 177, 122, and 89 across the three waves of measurement) reported good health but poor fitness, very few (N = 24, 24, and 18) reported the converse. Thus, good subjective health in the absence of good subjective physical fitness would appear to be reasonably common, but poor health in the presence of good self-assessed fitness is a rare experiential phenomenon. Even relative to the risk attributable to self-reported smoking status in this study, the effects of poor subjective health and fitness are impressive. Indeed, when combined they yield survival estimates, over 16.5 years, of less than 50% for some groups.

Why might self-reported health and fitness presage death to the extent that they do? First, they may in the main simply reflect objective health and fitness status. However, self-reported health has been shown to predict mortality even in studies that have adjusted for extant medical conditions (DeSalvo et al., 2006). Indeed, in the present study, the effects remained substantial and statistically significant following adjustment for long-standing illness. Further, although self-reported fitness in this study is related to estimated aerobic fitness, the association is far from perfect, with the subjective fitness group effect explaining only 6% of the variance in estimated aerobic fitness. It has been suggested that the predictive capacity of self-reported health might reflect its global and inclusive nature, embracing health influences other than medical status, such those deriving social, psychological, and demographic factors (Idler & Benyamini, 1997). In addition, others have speculated that self-reported health may influence health by affecting health behaviours and the likelihood of lifestyle modifications (DeSalvo et al., 2006). Further, poor self-reported health and fitness might also reflect the presence of occult disease (Idler & Benyamini, 1997). There is some preliminary evidence in support of the latter with regard to self-reported fitness; an inverse association between the inflammatory marker, C-reactive protein, and both subjective and estimated physical fitness has been observed (Borodulin et al., 2006). Several years ago, 'vital exhaustion' was identified as a prodromal constellation of symptoms, including fatigue and physical exhaustion, which precedes major cardiovascular events (Appels et al., 1996). We have speculated elsewhere that 'vital exhaustion' might be the result of inflammatory processes involved in the progress of atherosclerosis (Carroll, Macleod, & Phillips, 2006). Low self-reported fitness could to some extent be another by-product of degenerative inflammatory disease.

There are some limitations to the study that should be acknowledged. In common with other longitudinal studies, there is the possibility that drop out is related to the outcome of interest. Anecdotal evidence from the interviewers does suggest that poor health is occasionally the reason for not taking part in follow up waves of the study. As vital status is determined independently of the study, by notification from the national death register, those who drop out are not censored, but the opportunity to update their self reported health and fitness is lost and their mortality risk may be underestimated as a result. However, it is unlikely that this would affect self reported health and fitness so differently that it would seriously undermine the results presented here. Secondly, a large part of the difference in numbers between waves 2 and 4 is due to deaths in the intervening period. Of the 247 deaths in the analysed sample, 140 occurred in the period between waves 2 and 4. As death and survival time constitute the outcome analysed, these should not be regarded as drop outs. Another possible limitation is the use of self-report for important health-related measure such as smoking and long-standing illness. However, again, there is no reason to suspect that self-reported health and fitness would be differentially affected by this. Although self-reported smoking levels do tend to be underestimates, smoking prevalence, the measure used in the present study, is more reliable. It is important to note that the concordance in reported smoking status between adjacent waves in the present study exceeds 90%. The methodology used to ascertain long-standing illness is more rigorous than that used elsewhere, e.g., in the UK Census or General Household survey, and previous work has shown little bias in reporting (Macintyre, 1987). As this is a moderate sized cohort, the power to detect effects is a potential limitation, particularly when compared to the size of similar epidemiological studies examining self-rated health (McFadden et al., 2009b). However, standard formulae for calculating the power of a Cox regression do not apply to the time varying model. Nevertheless, a model with time constant (wave 2) values of the predictors would have 80% power to detect a hazard ratio of 1.56 and 95% power for a hazard ratio of 1.8, as obtained for self-reported fitness in the mutually adjusted model (Table 3).

In conclusion, the present time-dependent analyses confirm that self-reported health status is related to subsequent death. We also show for the first time that self-reported fitness is similarly associated and, indeed, would appear to predict all-cause mortality independently of self-reported health. Clearly, self-reported fitness has prognostic value and where the objective assessment of aerobic fitness is not feasible, could prove a useful alternative. Similarly, self-reported health and fitness measures could easily be applied in Primary Care settings in order to identify patients most in need of lifestyle intervention programmes. The combination of poor self-reported health and poor self-reported fitness would seem to be particularly lethal. The challenge now is to determine why these subjective assessments of health and fitness are so strongly implicated in mortality.

References

Andersen, P. K. (1992). Repeated Assessment of Risk Factors in Survival Analysis. *Statistical Methods in Medical Research,* **1**, 297-315.

Appels, A., Bosma, H., Grabauskas, V., Gostautas, A., & Sturmans, F. (1996). Self-Rated Health and Mortality in a Lithuanian and a Dutch Population. *Social Science and Medicine,* **42**, 681-689.

Blair, S. N., Kampert, J. B., Kohl, H. W., 3rd, Barlow, C. E., Macera, C. A., Paffenbarger, R. S., Jr., et al. (1996). Influences of Cardiorespiratory Fitness and Other Precursors on Cardiovascular Disease and All-Cause Mortality in Men and Women. *Journal of the American Medical Association,* **276**, 205-210.

Blair, S. N., Kohl, H. W., 3rd, Barlow, C. E., Paffenbarger, R. S., Jr., Gibbons, L. W., & Macera, C. A. (1995). Changes in Physical Fitness and All-Cause Mortality. A Prospective Study of Healthy and Unhealthy Men. *Journal of the American Medical Association,* **273**, 1093-1098.

Blair, S. N., Kohl, H. W., 3rd, Paffenbarger, R. S., Jr., Clark, D. G., Cooper, K. H., & Gibbons, L. W. (1989). Physical Fitness and All-Cause Mortality. A Prospective Study of Healthy Men and Women. *Journal of the American Medical Association,* **262**, 2395-2401.

Borodulin, K., Laatikainen, T., Salomaa, V., & Jousilahti, P. (2006). Associations of Leisure Time Physical Activity, Self-Rated Physical Fitness, and Estimated Aerobic Fitness with Serum C-Reactive Protein among 3,803 Adults. *Atherosclerosis,* **185**, 381-387.

Brill, P. A., Kohl, H. W., & Blair, S. N. (1992). Anxiety, Depression, Physical Fitness, and All-Cause Mortality in Men. *Journal of Psychosomatic Research,* **36**, 267-273.

Carroll, D., Macleod, J., & Phillips, A. C. (2006). Intervening for Exhaustion. *Journal of Psychosomatic Research,* **61**, 9-10.

Der, G. (1998). *A Comparison of the West of Scotland Twenty-07 Study Sample and the 1991 Census Sars.*: MRC Medical Sociology Unit.

DeSalvo, K. B., Bloser, N., Reynolds, K., He, J., & Muntner, P. (2006). Mortality Prediction with a Single General Self-Rated Health Question. A Meta-Analysis. *Journal of General Internal Medicine,* **21**, 267-275.

Erikssen, G. (2001). Physical Fitness and Changes in Mortality: The Survival of the Fittest. *Sports Medicine,* **31**, 571-576.

Erikssen, G., Liestol, K., Bjornholt, J., Thaulow, E., Sandvik, L., & Erikssen, J. (1998). Changes in Physical Fitness and Changes in Mortality. *The Lancet,* **352**, 759-762.

Ford, G., Ecob, R., Hunt, K., Macintyre, S., & West, P. (1994). Patterns of Class Inequality in Health through the Lifespan: Class Gradients at 15, 35 and 55 Years in the West of Scotland. *Social Science and Medicine,* **39**, 1037-1050.

Han, B., Phillips, C., Ferrucci, L., Bandeen-Roche, K., Jylha, M., Kasper, J., et al. (2005). Change in Self-Rated Health and Mortality among Community-Dwelling Disabled Older Women. *Gerontologist,* **45**, 216-221.

Idler, E. L., & Benyamini, Y. (1997). Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies. *Journal of Health and Social Behavior,* **38**, 21-37.

Jurca, R., Jackson, A. S., LaMonte, M. J., Morrow, J. R., Jr., Blair, S. N., Wareham, N. J., et al. (2005). Assessing Cardiorespiratory Fitness without Performing Exercise Testing. *American Journal of Preventive Medicine,* **29**, 185-193.

Lyyra, T. M., Leskinen, E., Jylha, M., & Heikkinen, E. (2007). Self-Rated Health and Mortality in Older Men and Women: A Time-Dependent Covariate Analysis. *Archives of Gerontology and Geriatrics*.

Macintyre, S. (1987). *West of Scotland Twenty-07: Health in the Community. The Survey's Background and Rationale (Working Paper No. 7)*. Glasgow: MRC Medical Sociology Unit.

McFadden, E., Luben, R., Bingham, S., Wareham, N., Kinmonth, A. L., & Khaw, K. T. (2009a). Does the Association between Self-Rated Health and Mortality Vary by Social Class? *Social Science and Medicine,* **68**, 275-280.

McFadden, E., Luben, R., Bingham, S., Wareham, N., Kinmonth, A. L., & Khaw, K. T. (2009b). Self-Rated Health Does Not Explain the Socioeconomic Differential in Mortality: A Prospective Study in the Epic-Norfolk Cohort. *Journal of Epidemiology and Community Health,* **63**, 329-331.

Optenberg, S. A., Lairson, D. R., Slater, C. H., & Russell, M. L. (1984). Agreement of Self-Reported and Physiologically Estimated Fitness Status in a Symptom-Free Population. *Preventive Medicine,* **13**, 349-354.

Pedersen, B. K. (2007). Body Mass Index-Independent Effect of Fitness and Physical Activity for All-Cause Mortality. *Scandinavian Journal of Medicine and Sports Science,* **17**, 196-204.

Registrar General's *Classification of Occupations*. (1980).). London: HMSO.

Rubin, D. B. (1987). *Multiple Imputation for Non-Response in Surveys.* New York: John Wiley & Sons.

Wannamethee, G., & Shaper, A. G. (1991). Self-Assessment of Health Status and Mortality in Middle-Aged British Men. *International Journal of Epidemiology,* **20**, 239-245.

Table 1: Descriptive statistics for self-reported health, self-reported fitness, and risk factor variables.

Mean (SD) / Percent	Wave		
	2	3	4
Age, years	59.1	63.6	69.0
	(0.5)	(0.6)	(1.0)
Systolic blood pressure, mmHg	140.2	146.7	151.1
	(20.7)	(22.9)	(21.9)
Body mass index, kg/m^2	26.2	26.9	27.4
	(4.2)	(4.6)	(4.3)
Male	46%	44%	43%
Manual household occupational group	57%	56%	52%
Current smoker	38%	32%	23%
Longstanding illness	71%	75%	81%
Poor fitness for age	49%	49%	42%
Poor health for age	31%	35%	29%
N interviewed	858	723	573
N with complete data	840	683	508

Table 2: Baseline characteristics of the sample by self assessed health and fitness.

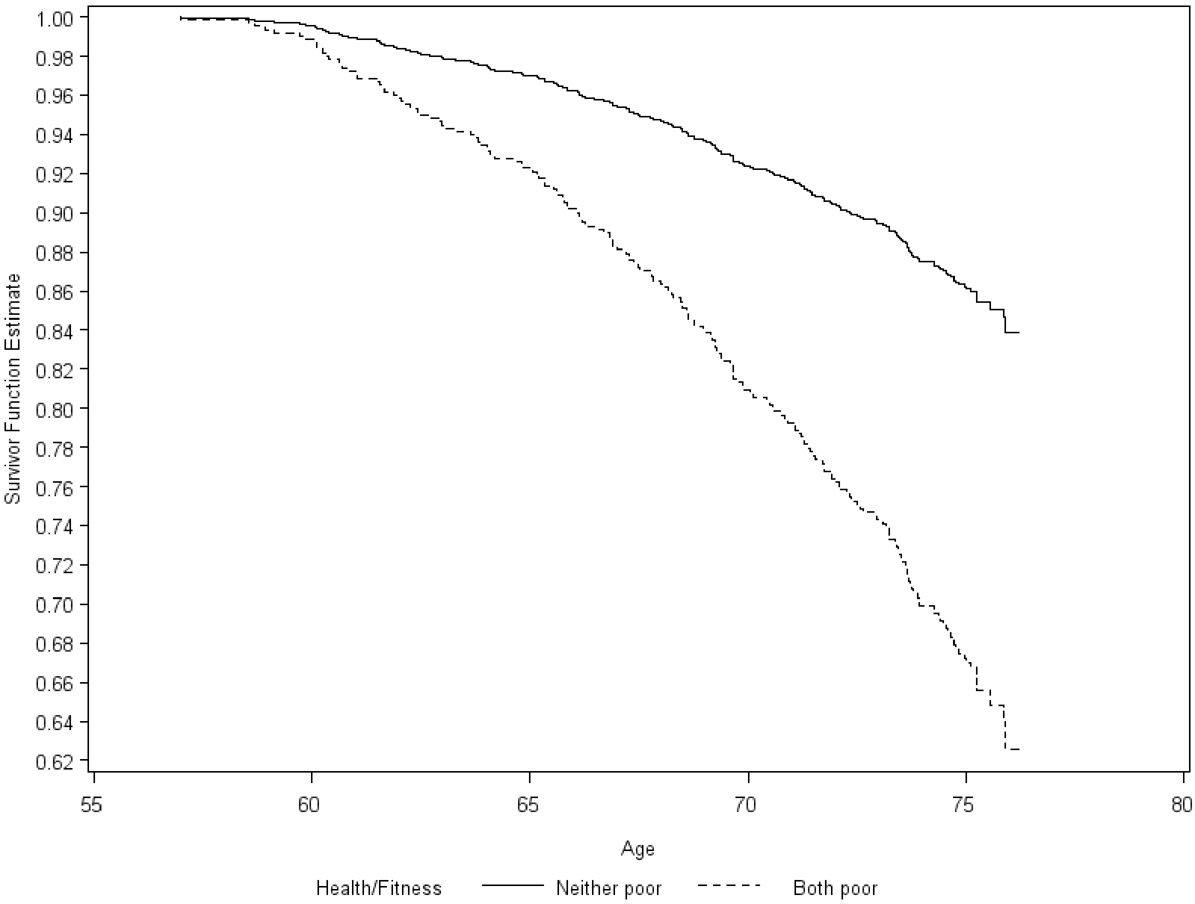
Mean (SE) / Percent	Self assessed fitness			Self assessed health		
	Not poor	Poor	*p*	Not poor	Poor	*p*
Systolic blood pressure, mmHg	138.9 (0.9)	141.6 (1.0)		140.5 (0.8)	139.5 (1.2)	
Body mass index, kg/m^2	25.7 (0.1)	26.7 (0.2)	<.001	26.1 (0.1)	26.4 (0.3)	
Male	43%	49%		45%	49%	
Manual household occupational group	49%	66%	<.001	50%	74%	<.001
Current smoker	31%	45%	<.001	33%	49%	<.001
Longstanding illness	60%	82%		61%	93%	
Died during follow up	17%	41%	<.001	22%	45%	<.001
N	430	410		582	258	

SE: Standard Error

Table 3: Full mutually adjusted model predicting mortality

Variable	Hazard Ratio	Confidence Interval	p
SA health	1.95	1.42 to 2.68	<.001
SA fitness	1.80	1.28 to 2.55	<.001
male	1.44	1.12 to 1.86	.005
smoker	1.63	1.24 to 2.14	<.001
Manual SC	1.24	0.94 to 1.62	.13
Body mass index	0.98	0.95 to 1.01	.13
Systolic blood pressure	1.00	0.99 to 1.00	.25
Longstanding illness	1.30	0.89 to 1.91	.18

Figure 1: Survival curves comparing poor self-reported health and fitness to good health and fitness.



Survivor Function Estimate
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.84
0.82
0.80
0.78
0.76
0.74
0.72
0.70
0.68
0.66
0.64
0.62
55
60
65
70
75
80
Age
Health/Fitness
Neither poor
Both poor