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Is subjective well-being independently associated with mortality? A 14-year prospective cohort study in a representative sample of 25 139 US men and women

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ABSTRACT

Objectives To examine whether the inverse association of subjective well-being with mortality is independent of self-rated health and socioeconomic status in healthy adults.

Design A population-based prospective cohort study based on an in-person interview. Cox regression was used to examine mortality hazards for happiness alone and for a standardised summary well-being measure that included happiness, life satisfaction and negative emotions. Using prespecified analyses, we first adjusted for age and then additionally adjusted for self-rated health and then race/ethnicity, marital status, smoking and socioeconomic status.

Setting Probability sample of adult US residents interviewed in their homes in 2001.

Participants 25 139 adults free of cardiovascular disease and cancer at baseline.

Primary outcome measure All-cause mortality 14 years after the baseline interview as assessed by probabilistic matching using the National Death Index.

Results Age-adjusted unhappiness was associated with mortality (HR 1.27; 95% CI 1.11 to 1.45, p=0.001) but the association attenuated after adjusting for self-rated health (HR 1.01; 95% CI 0.88 to 1.16, p=0.85). A similar pattern was seen for the summary well-being measure in fully adjusted models (HR 1.00; 95% CI 0.99 to 1.00, p=0.30). In contrast, self-rated health was strongly associated with mortality. In the fully adjusted model with the summary well-being measure the hazards for good, very good and excellent self-rated health were 0.71 (95% CI 0.62 to 0.80, p<0.001), 0.63 (95% CI 0.55 to 0.71, p<0.001) and 0.45 (95% CI 0.39 to 0.51, p<0.001), respectively.

Conclusions In this representative sample of US adults, the association between well-being and mortality was strongly attenuated by self-rated health and to a lesser extent socioeconomic status.

INTRODUCTION

A very large study of UK women found that unhappiness was associated with increased mortality risk but also showed that the association was eliminated when statistically controlling for self-rated health.[1] Thus, it

Strengths and limitations of this study

► Large, diverse probability sample of US adults with a large number of mortality events.
► Multiple well-being operations.
► The study did not assess meaning and purpose in life, another well-being facet.

appears that perceived health status, rather than happiness per se, is most strongly associated with longevity. However, whether this finding generalises to women outside the UK or whether it applies to men is unknown.[2] The primary goal of this study is to examine whether unhappiness is associated with mortality risk and whether this association is eliminated when statistically controlling for self-rated health. We replicate Liu *et al*[1] by examining this pattern in a population-based US sample of women and extend that study by examining whether this association exists for US men. This primary study goal and analysis plan were preregistered at the Center for Open Science in December 2018 (https://osf.io/jxruq).

The second goal of this study is to evaluate whether a broader well-being assessment independently predicts mortality. To provide a stronger test of the claim that well-being is inversely associated with mortality, we also examine a well-being measure that includes happiness, life satisfaction and items assessing negative emotions.[3] Happiness and life satisfaction comprise two of three major well-being domains[4] and negative emotions are also important for well-being assessment.[5] This aggregated measure may provide a more reliable indicator of subjective well-being,[6 7] is similar to other aggregated well-being measures[6 8] and provides a sensitivity

Table 1 Baseline participant characteristics* 2001 US National Health Interview Survey

Characteristic	Total		Alive		Deceased	
Participants, no	25 139		22 143		2996	
Age year, mean (SE)	42.0	(0.10)	39.8	(0.10)	61.7	(0.40)
Female sex, % (no)	51.7	(14 084)	51.7	(12 421)	51.5	(1663)
Male sex, % (no)	48.3	(11 055)	48.3	(9722)	48.5	(1333)
Race/ethnicity, % (no)						
Hispanic	11.8	(4673)	12.0	(4217)	10.3	(456)
White (non-Hispanic)	71.7	(15 925)	71.5	(13 947)	73.4	(1978)
Black (non-Hispanic)	11.8	(3561)	11.7	(3091)	12.4	(470)
Other (non-Hispanic)	4.7	(980)	4.8	(888)	3.8	(92)
Marital status, % (no)						
Unmarried/widowed/divorced/separated	35.7	(11 567)	34.7	(9833)	44.6	(1734)
Married or cohabiting	64.3	(13 572)	65.3	(12 310)	55.4	(1262)
Education level, % (no)						
<9th grade	16.5	(4856)	14.9	(3821)	30.9	(1035)
High school	29.1	(7107)	28.8	(6183)	32.2	(924)
Some college	30.0	(7345)	30.8	(6706)	22.6	(639)
College graduate or higher	24.4	(5831)	25.5	(5433)	14.2	(398)
Home tenure, % (no)						
Owned/being purchased	69.0	(15 262)	68.6	(13 297)	72.5	(1965)
Rent/other/do not know	31.0	(9877)	31.4	(8846)	27.5	(1031)
Workforce status, % (no)						
Working	72.1	(17 640)	76.1	(16 607)	36.9	(1033)
Retired	9.7	(2781)	5.9	(1439)	42.9	(1342)
Unemployed	14.1	(3572)	14.0	(3119)	14.7	(453)
Never worked	4.0	(1125)	3.9	(957)	5.5	(168)
Unknown	0.1	(21)	0.1	(21)	0.0	(0)
Smoker, % (no)						
No	76.6	(19 181)	77.0	(16 976)	72.8	(2205)
Yes	23.4	(5958)	23.0	(5167)	27.2	(791)
Self-rated health, % (no)						
Poor	1.4	(422)	1.0	(274)	4.9	(148)
Fair	6.2	(1837)	5.2	(1337)	15.4	(500)
Good	22.9	(6013)	21.7	(5010)	32.9	(1003)
Very good	34.4	(8542)	34.9	(7685)	30.1	(857)
Excellent	35.1	(8325)	37.1	(7837)	16.7	(488)
Happiness, % (no)						
None/a little/some of the time	20.0	(5467)	19.5	(4695)	24.1	(772)
Most of the time	63.3	(15 337)	64.0	(13 663)	57.1	(1674)
All of the time	16.7	(4335)	16.4	(3785)	18.7	(550)
Life satisfaction†, % (no)						
Very dissatisfied	0.9	(243)	0.8	(193)	1.7	(50)
Dissatisfied	4.4	(1271)	4.3	(1089)	5.4	(182)
Satisfied	49.7	(12 990)	49.4	(11 410)	51.7	(1580)
Very satisfied	44.7	(10 543)	45.2	(9385)	40.3	(1158)
Missing	0.4	(92)	0.3	(66)	0.9	(26)

Continued

Table 1 Continued

Characteristic	Total		Alive		Deceased	
Negative affect items†, past 30 days, mean (SE)						
Sad	0.4	(0.007)	0.4	(0.007)	0.5	(0.020)
Nervous	0.6	(0.008)	0.6	(0.009)	0.6	(0.024)
Restless	0.6	(0.009)	0.6	(0.009)	0.6	(0.023)
Hopeless	0.2	(0.005)	0.2	(0.005)	0.2	(0.015)
Everything is an effort	0.5	(0.009)	0.5	(0.009)	0.5	(0.021)
Worthless	0.2	(0.005)	0.2	(0.005)	0.2	(0.014)

Data source: US National Center for Health Statistics.
*Participants who reported a prior diagnosis of heart attack, coronary heart disease, stroke or cancer were excluded. All percentages are weighted to represent the civilian non-institutionalised population of the United States. Mortality was ascertained through 31 December 2015.
†Sample size is slightly smaller with life satisfaction (n=25 047) and negative affect items (n=24 875).

test for the subjective well-being/mortality association. Although a meta-analytic review found evidence of an association between subjective well-being and survival, they also found evidence of small sample bias, that is, smaller studies reported larger associations between well-being and survival.[4] Thus, additional studies with larger samples are desirable. Finally, in order to affirm subjective well-being as a survival determinant, it should predict mortality independent of self-rated health and it should do so independent from other established mortality determinants such as socioeconomic status (SES). We, therefore, statistically adjust for several SES indicators including work force status, education and home ownership.

METHODS

We analysed National Health Interview Survey (NHIS) data that were linked to the National Death Index (NDI). Specifically, our study participants included 31 355 adults who participated in the 2001 US NHIS.[9] The NHIS is an annual in-person survey of a probability sample of non-institutionalised US residents.[10] All participants provided informed consent. The response rate for sample adults conditional on family response rates was 73.8%.[11]

The National Center for Health Statistics ascertained mortality among these NHIS participants through 31 December 2015 via the NDI[12] and a public use mortality file describing vital status that was released in February 2019.

To minimise the influence of poor health causing both low well-being and elevated mortality risk, we restricted our analyses to those who were free of diagnosed major chronic diseases at baseline (n=25 705),[4] that is, cancer and cardiovascular diseases (myocardial infarction, stroke and any coronary heart disease). These conditions were reported by the participants and we did not exclude those reporting risk factors such as diabetes and hypertension. The sample was further reduced when including only those with complete covariate data (n=25 139; 2996 deaths). All survey assessments, including diagnosed chronic diseases, were assessed at the baseline interview and mortality was assessed over the next 14 years. Analyses using the combined well-being measure are based on a sample of 24 800 (2918 deaths). This study did not require human subjects review because it involved secondary analysis of publicly available data lacking identifying information.

Table 2 Crude all-cause mortality rates (per 10 000) by happiness and self-rated health: 2001 US National Health Interview Survey

Happiness				Self-rated health			
	Rate	95% CI	Deaths		Rate	95% CI	Deaths
None of the time	7.5	(5.6 to 10.1)	52	Poor	13.5	(11.6 to 15.8)	148
A little	6.7	(5.7 to 8.1)	146	Fair	10.0	(9.2 to 10.9)	500
Some of the time	5.1	(4.7 to 5.5)	574	Good	6.2	(5.8 to 6.6)	1003
Most of the time	4.1	(3.9 to 4.4)	1674	Very good	4.0	(3.7 to 4.3)	857
All of the time	5.1	(4.6 to 5.6)	550	Excellent	2.3	(2.1 to 2.6)	488

Data source: US National Center for Health Statistics.

Patient and public involvement

Patients were not involved in the design or conduct of this study. There is no plan to disseminate the results to the participants.

Subjective well-being assessments

Participants were asked 'During the past 30 days, how often did you feel happy?' Response options were all, most, some, a little or none of the time. This item was used for the primary study question regarding happiness and mortality. For the broader well-being measure, we also included responses to a life satisfaction question and six negative emotion questions. Life satisfaction was assessed by asking 'In general, how satisfied are you with your life? Would you say very satisfied, satisfied, dissatisfied or very dissatisfied?' Negative emotion questions were assessed by asking 'During the past 30 days, how often did you feel…' (1) so sad that nothing could cheer you up; (2) nervous; (3) restless or fidgety; (4) hopeless; (5) that everything was an effort; (6) worthless. Response options were all, most, some, a little or none of the time. Although these items can be used to classify probable serious mental illness,[13] here they are used to capture unpleasant affect, a recommended practice for subjective well-being assessment.[5] We incorporated all negative emotion items along with happiness and life satisfaction into a single well-being index. Specifically, each item was standardised and summed. This aggregate index had good internal consistency (Cronbach's alpha=0.86), which was higher than a two-item index of happiness and life satisfaction (alpha=0.63). As a sensitivity analysis we also report fully adjusted hazards for a well-being index that included only happiness and life satisfaction and for life satisfaction and negative affect separately.

For the primary study question, we compared those who were happy all of the time (referent) to those who were happy most of the time and to those who were unhappy (ie, happy none, a little, and some of the time). This closely parallels the largest published study of happiness and well-being in women.[1]

Using age as the time scale,[14 15] we used Cox models to estimate survival HRs for unhappiness, first adjusting for age by stratifying on 5-year age cohort[16 17] and then adding self-rated health (indicator variables for poor/fair, good, very good and excellent health), followed by race/ethnicity (white, black, Hispanic, other non-Hispanic) and other powerful mortality determinants including being married, workforce status (unemployed, never worked, retired, working), education, home ownership and current smoking (yes/no). The single four-category education variable met an interval assumption[18] and was therefore modelled as a single variable rather than as separate indicators.

Education, workforce status and home ownership capture diverse elements of SES and they represent important potential confounders of the relationship between well-being and mortality. Self-rated health was entered after age because the largest study to date found self-rated health to be the 'key characteristic' attenuating the association between happiness and mortality.[1] Race and ethnicity are relative weakly associated with subjective well-being[19] but are strongly associated with mortality[20] and thus were included as covariates. This analytical approach was specified a priori (see Introduction)—no other covariates were planned or evaluated. These analyses were repeated using the aggregated well-being measure, which were included as a sensitivity analysis and were not prespecified. We used StataMP V.15.1 (Stata Corp) incorporating the complex survey design in all estimates.

We examined the proportional hazards assumption for both sets of study questions by testing the interaction term for time and happiness and time and aggregated well-being, respectively. The happiness interaction term indicated that the proportional hazards assumption was satisfied. Proportional hazards for the aggregated well-being analyses were satisfied by additionally stratifying on current smoking status. Evaluation of squared predicted scores and graphical evaluation of residuals provided additional evidence for adequately specified Cox models.

We report several additional analyses in response to editorial feedback. To disentangle the relative contributions of self-rated health versus happiness for mortality risk, we examine mortality HRs for self-rated health within happiness categories and happiness within self-rated health categories. We also report models that evaluate life satisfaction and negative affect separately as well happiness HRs after adjusting singly for each prespecified covariate other than self-rated health. The latter clarifies the extent to which self-rated health can be considered the 'key characteristic' that attenuates the happiness/mortality association in these data.

RESULTS

Demographic and well-being information for the sample are in table 1. Crude mortality rates by happiness and by self-rated health are provided in table 2. The correlation between the three-level happiness variable and self-rated health was 0.21 (95% CI 0.19 to 0.22).

Age-adjusted unhappiness was associated with greater mortality risk relative to those who were happy all of the time (HR 1.27; 95% CI 1.11 to 1.45) whereas participants happy most of the time were similar to those happy all of the time (HR 0.96; 95% CI 0.86 to 1.08). Being unhappy was no longer associated with mortality when adding self-rated health to the model (HR 1.01; 95% CI 0.88 to 1.16), a pattern that persisted after adjustment for the remaining covariates (HR 0.97; 95% CI 0.85 to 1.11) (table 3). Age-adjusted unhappiness was associated with increased mortality risk for women and men separately. Again, adding self-rated health to the model reduced the HRs for both groups and this persisted after including the remaining covariates (table 4). In contrast, good, very good and excellent self-rated health were associated with substantially reduced mortality risk in the fully adjusted

Table 3 Happiness and all-cause mortality HRs (95% CI) before and after adjustment for self-rated health and sociodemographic variables (n=25 139)

	Model 1		Model 2		Model 3	
	HR	95% CI	HR	95% CI	HR	95% CI
Happiness						
Happy all of the time	(Referent)		–		–	
Happy most of the time	0.96	(0.86 to 1.08)	0.90	(0.81 to 1.02)	0.94	(0.84 to 1.06)
Unhappy*	1.27	(1.11 to 1.45)	1.01	(0.88 to 1.16)	0.97	(0.85 to 1.11)
Self-rated health						
Fair/poor	(Referent)		–		–	
Good			0.61	(0.53 to 0.69)	0.71	(0.62 to 0.80)
Very good			0.49	(0.44 to 0.56)	0.63	(0.55 to 0.71)
Excellent			0.34	(0.30 to 0.38)	0.45	(0.39 to 0.51)
Male sex					1.57	(1.44 to 1.72)
Race/ethnicity						
White					(Referent)	
Black					1.07	(0.93 to 1.23)
Hispanic					0.94	(0.80 to 1.11)
Other non-Hispanic race					1.09	(0.86 to 1.38)
Married					0.83	(0.75 to 0.91)
Current smoker					1.92	(1.73 to 2.14)
Education					0.93	(0.89 to 0.97)
Work force status						
Out of work					1.54	(1.34 to 1.78)
Never worked					1.71	(1.34 to 2.18)
Retired					1.38	(1.19 to 1.60)
Own home					0.82	(0.74 to 0.92)

Model 1 is stratified by 5 year age cohort. Model two adds self-rated health as a covariate. Model three adds to Model two sex, race/ethnicity, marital status, smoking (yes, no), education, workforce status and home tenure (own vs rent/other).
Data source: U.S. National Centre for Health Statistics.
*Unhappy was defined as happy none, a little, and some of the time.

models (HR$_{good}$ 0.71; 95% CI 0.62 to 0.80; HR$_{very good}$ 0.63; 95% CI 0.55 to 0.71; HR$_{excellent}$ 0.45; 95% CI 0.39 to 0.51; table 3) and for women and men separately (table 4). HR estimates in the full sample were very similar when excluding persons who died within either 1 or 3 years of the baseline interview (data not shown). In addition, happiness was not associated with mortality within self-rated health categories whereas self-rated health remained strongly associated with mortality risk within happiness categories (figure 1).

Findings using the aggregated subjective well-being variable were similar to the happiness analyses. Well-being was inversely associated with mortality in the model stratifying on age cohort and smoking (HR 0.98; 95% CI 0.97 to 0.98) but this association was reduced when adjusting for self-rated health (HR 0.99; 95% CI 0.99 to 1.00) and sociodemographic variables (HR 1.00; 95% CI 0.99 to 1.00) (online supplementary table 1). This pattern was also observed when examining men and women separately (online supplementary table 2). Fully adjusted

hazards were similar for a well-being index that included only happiness and life satisfaction (HR 0.99; 95% CI 0.96 to 1.01) and the same pattern of HR attenuation was observed when evaluating life satisfaction and negative affect by themselves (online supplementary table 3).

When substituting the planned covariates for self-rated health in model 2, we found that although each of these also reduced the unhappiness HRs, the hazards for being unhappy remained statistically significant when adjusting for each of these singleton covariates (table 5). Rather than infer differences in hazards based on differences in significance tests,[21][22] we directly compared the unhappiness HR adjusted for self-rated health with the unhappiness HRs adjusted for each of the seven covariates individually. Self-rated health adjusted unhappiness HRs were significantly smaller than those adjusting for sex, race/ethnicity, being married, education and home ownership but were not different from hazards adjusted for either smoking or work force status (table 5). These patterns suggest that self-rated health attenuates the

Table 4 Sex-specific happiness and all-cause mortality HRs (95% CI) before and after adjustment for self-rated health and sociodemographic variables

Women	Model 1 HR	95% CI	Model 2 HR	95% CI	Model 3 HR	95% CI
Happiness						
Happy all of the time	(Referent)					
Happy most of the time	1.05	(0.90 to 1.22)	1.01	(0.87 to 1.18)	1.03	(0.88 to 1.20)
Unhappy*	1.34	(1.11 to 1.61)	1.12	(0.93 to 1.35)	1.03	(0.85 to 1.24)
Self-rated health						
Fair/poor	(Referent)		–		–	
Good			0.62	(0.52 to 0.73)	0.69	(0.58 to 0.83)
Very good			0.50	(0.42 to 0.59)	0.59	(0.50 to 0.71)
Excellent			0.43	(0.36 to 0.52)	0.54	(0.44 to 0.66)
Race/ethnicity						
White					(Referent)	
Black					0.98	(0.82 to 1.18)
Hispanic					0.89	(0.71 to 1.12)
Other non-Hispanic race					1.58	(1.11 to 2.25)
Married					0.84	(0.74 to 0.95)
Current smoker					1.98	(1.70 to 2.31)
Education					0.92	(0.87 to 0.98)
Work force status						
Working					(Referent)	
Out of work					1.65	(1.37 to 1.99)
Never worked					1.78	(1.34 to 2.38)
Retired					1.54	(1.27 to 1.88)
Own home					0.83	(0.72 to 0.95)

Men	Model 1 HR	95% CI	Model 2 HR	95% CI	Model 3 HR	95% CI
Happiness						
Happy all of the time	(Referent)					
Happy most of the time	0.91	(0.77 to 1.09)	0.83	(0.69 to 0.99)	0.84	(0.70 to 1.00)
Unhappy	1.29	(1.04 to 1.59)	0.96	(0.77 to 1.18)	0.88	(0.71 to 1.10)
Self-rated health						
Fair/poor	(Referent)		–		–	
Good			0.59	(0.48 to 0.71)	0.71	(0.58 to 0.87)
Very good			0.48	(0.40 to 0.59)	0.65	(0.53 to 0.81)
Excellent			0.26	(0.21 to 0.32)	0.36	(0.29 to 0.45)
Race/ethnicity						
White					(Referent)	
Black					1.17	(0.96 to 1.44)
Hispanic					1.00	(0.80 to 1.24)
Other non-Hispanic race					0.75	(0.52 to 1.10)
Married					0.81	(0.70 to 0.93)
Current smoker					1.88	(1.61 to 2.20)
Education					0.93	(0.87 to 0.99)
Work force status						

	Model 1		Model 2		Model 3	
Men	**HR**	**95% CI**	**HR**	**95% CI**	**HR**	**95% CI**
Working					(Referent)	
Out of work					1.45	(1.17 to 1.80)
Never worked					1.89	(1.08 to 3.28)
Retired					1.19	(0.97 to 1.47)
Own home					0.83	(0.70 to 0.97)

Table 4 Continued

Model one is stratified by 5 year age cohort. Model two adds self-rated health as a covariate. Model three adds to Model two race/ethnicity, marital status, smoking (yes, no), education, workforce status and home tenure (own vs rent/other).
Sample sizes are 14 084 and 11 055 for women and men, respectively.
Data source: United States National Centre for Health Statistics.
*Unhappy was defined as being happy none, a little, or some of the time.

happiness/mortality association more so than important sociodemographic mortality determinants but is comparable to other mortality risk markers.

DISCUSSION

In a racially and ethnically diverse sample representing 164.9 million US adults without cardiovascular disease or cancer, we found that the association of unhappiness with 14-year mortality risk is eliminated when statistically controlling for self-rated health. These results closely replicate a very large study of UK women[1] and extend them to US men and women. These findings parallel other population-based studies.[23 24] A more comprehensive index of well-being including life satisfaction, happiness and negative emotions was associated with all-cause mortality but this association was also statistically eliminated when adjusting for self-rated health and SES. More broadly, these patterns suggest that the apparent survival advantage for high well-being, as measured by happiness or by a comprehensive well-being index, is driven by established health risk markers.

A meta-analysis that found an association between well-being and mortality also reported '…strong evidence for publication bias and small study effects.[4]' Thus, larger studies such as reported here should be especially diagnostic for this question. In addition, inadequate control of health status is a limitation of prior work[4] which we addressed through selection of initially healthy participants and by using sensitivity tests excluding participants with early mortality. Other strengths of the present study include multiple well-being operations, long follow-up and a representative sample of US adults. Conversely, this study is limited in that another well-being facet, meaning and purpose in life, was not included. There is evidence this facet is independently associated with mortality[25–27] and thus our conclusions are limited to happiness, life satisfaction and negative affect. Our work also does not address the potential bidirectional association of socioeconomic indicators such as workforce status and home ownership with subjective well-being.

Self-rated health and subjective well-being are both important health-related quality of life indicators[28] that
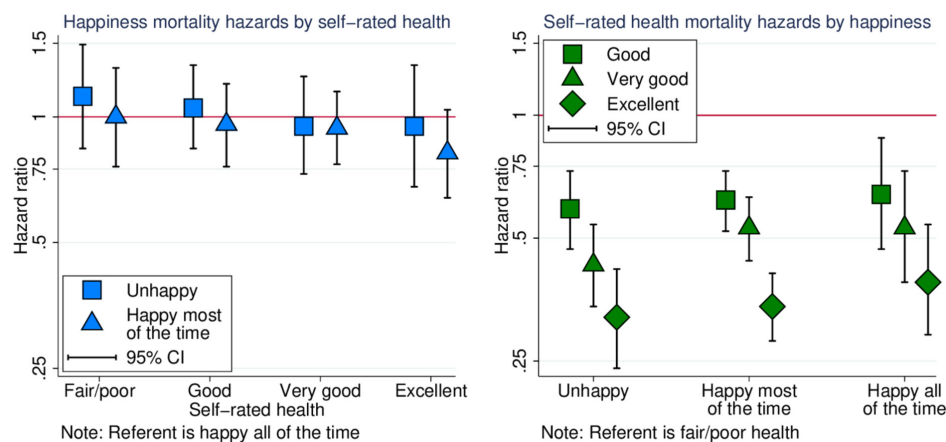

Figure 1 All-cause mortality HRs for happiness within self-rated health and self-rated health within happiness note: analyses stratify on 5-year age cohorts.

Table 5 Heterogeneity tests comparing unhappiness HRs (95% CI) adjusted for age and self-rated health versus adjusted for age and individual prespecified covariates (n=25 139)

Unhappiness HRs adjusted for age and:

	Sex		Race/ethnicity		Being married		Smoking		Education		Home ownership		Work force status	
	HR	95%CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI	HR	95% CI
Happiness														
Happy all of the time	(Referent)		–		–		–		–		–		–	
Most of the time	0.99	(0.88 to 1.11)	0.98	(0.88 to 1.11)	0.96	(0.85 to 1.07)	0.95	(0.85 to 1.07)	0.99	(0.89 to 1.11)	0.96	(0.86 to 1.08)	0.96	(0.86 to 1.08)
Unhappy*	1.32	(1.15 to 1.51)	1.29	(1.13 to 1.47)	1.23	(1.07 to 1.41)	1.19	(1.04 to 1.36)	1.25	(1.09 to 1.43)	1.23	(1.08 to 1.41)	1.22	(1.07 to 1.40)
Heterogeneity z (p value)	**2.71**	(0.007)	**2.52**	(0.012)	**1.98**	(0.048)	1.67	(0.095)	**2.16**	(0.031)	**2.01**	(0.044)	1.92	(0.055)

Heterogeneity tests compare the unhappiness HR adjusted for age and self-rated health (HR=1.01, 95% CI 0.88 to 1.16) with those adjusted for age and the singleton covariates above. This z-test evaluates the null hypothesis the subgroup estimates differ by more than sampling variability alone.[22] Five of seven comparisons (in **bold**) show heterogeneity, that is, that self-rated health reduces the unhappiness HR more than does entry of the singleton covariate.
*Unhappy was defined as being happy none, a little, or some of the time.

have utility irrespective of their association with survival. However, there is greater certainty regarding the prognostic value of self-rated health for mortality.[29 30] Additionally, self-rated health is tightly linked with established disease pathways such as 10-year cardiovascular disease risk[31] and improves mortality risk prediction in combination with coronary artery calcium scores.[32] This study adds to a large body of evidence that a single question regarding perceived health is strongly predictive for survival. These data also indicate that other mortality determinants attenuate the happiness/mortality association, with smoking and work force status being the strongest. In sum, as in the largest study to date[1] we found no robust association of any type of well-being measure with mortality after adjusting for established health determinants.

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