Leading a meaningful life at older ages: social engagement, prosperity, health, biology, and time use

Supporting information

Data source

Data were analyzed from the English Longitudinal Study of Ageing (ELSA), a longitudinal panel study of men and women aged 50 and older living in England that started in 2002 (1). The sample is assessed on a two yearly basis and biomarkers are collected every four years. The sample is periodically refreshed to ensure the full age range is maintained. Comparisons of sociodemographic characteristics with the national census show that the sample was representative of the English population. The questionnaires and general methods of data collection are detailed at www.elsa-project.ac.uk. The data for these analyses were collected on wave 6 of ELSA in 2012, since that was the first occasion on which the ONS measure of life being worthwhile was administered. Cross-sectional analyses involved respondents in wave 6. Longitudinal analyses were carried out on data collected in wave 8 (2016), except for the time use variables which were collected in wave 7 (2014) but not wave 8. The study was approved at every wave through the National Ethics Service, and participants gave informed consent. Data are available from the UK Data Service (https://www.ukdataservice.ac.uk) and the Gateway to Global Aging (http://g2aging.org).

Worthwhile ratings

As part of a self-completion questionnaire, participants were asked:
'Overall, to what extent do you feel the things you do in your life are worthwhile'? with responses to be made on a 11-point scale were 0 = *not at all* to 10 = *very*.

Covariates

The following four covariates were included in all analyses:
Age was modeled as a continuous variable.
Gender was divided into male and female, with men being the reference category in all analyses.
Education. Educational attainment was measured as the person's highest educational qualification, divided into three categories: *no qualifications*, *basic qualifications* (O levels and equivalent, indicating attainment of qualifications at the end of state-regulated schooling), and *high school or above* (A level or equivalent up to university degree), The reference group in analyses was the no qualification category.
Socioeconomic status. We defined SES using the National Statistics classification as detailed in https://www.ons.gov.uk/methodology/classificationsandstandards/otherclassifications/thenationalstatisticssocioeconomicclassificationnssecrebasedonsoc2010. This allocates individuals to 8 categories based on the occupation of the reference person in the household (2). We collapsed the classification into 3 categories: *routine and manual occupations*, *intermediate occupations*, and *professional and managerial occupations*.

Social variables

Marital status. Participants were reported whether they were married/in a stable relationship, never married, divorced or separated, or widowed. At baseline we analyzed the proportion of

married people, while longitudinally we assessed the proportion of individuals who were married in 2012 but divorced/separated in 2016.
Living alone. Respondents indicated how many people lived in their households. People who were the only household member were classified as living alone. In longitudinal analyses, we analyzed the proportion of people who had not been living alone in 2012 but were living alone in 2016.
Number of close relationships was computed by asking respondents about the number of children, other family or friends with whom they have a close relationship. The maximum number in each category was censored at 10, so scores could range from 0 to 30. Close relationships were analyzed as a continuously distributed variable in cross-sectional and longitudinal analyses.
Contact with friends. Participants were asked if they had any friends, and if so, how much contact they had with them either meeting up, by telephone, write or email, or by text message. The response options were *three or more times a week, once or twice a week, once or twice a month, every few months, once or twice a year,* or *less than once a year or never*. Respondents who indicated that they had contact at least weekly were defined as having a high level of contact. In longitudinal analyses, we computed the proportion of people who had a high level of contact in 2016 who did not have high contact in 2012.
Organizations. Respondents were asked if they belonged to 8 types of organization, club or society: trade union or environmental group, tenant or resident group, church, charitable association, education, arts or music groups or evening classes, social clubs, sports clubs or gyms, or any other type of organization. Longitudinal associations were assessed by analyzing scores in 2016, adjusting for baseline (2012) number of organization.
Volunteering was assessed as a measure of prosocial behavior. Participants were asked whether they carried out any volunteer work. Individuals who volunteered at least once per month were classified as volunteers. The longitudinal analysis focused on continued volunteering, defined as volunteering at least once a month in 2016 among people who had volunteered in 2012.
Loneliness was measured with the three-item short form of the Revised UCLA loneliness scale (3). An example of an item is "How often do you feel you lack companionship?" with response options of *hardly ever or never*, *some of the time*, and *often*. Ratings were summed to produce a loneliness score ranging from 3 to 9, with a higher score indicating greater loneliness. In both cross-sectional and longitudinal analyses, loneliness was analyzed as a continuous variable.
Cultural activity. Participants were asked how frequently they went to art galleries, museums, theatre, concerts or opera, with the response options *twice a month or more, about once a month, every few months, about once or twice a year, less than once a year,* or *never.* Individuals who attended at least every few months were categorized as culturally active. In longitudinal analyses, we assessed the proportion that was culturally active in 2016 that had not been active in 2012.

Economic variables
Wealth was derived from a detailed assessment of the participant's economic resources, and included financial, housing and physical wealth (such as land, business wealth and jewelry), but excluded pension wealth (4). Cross-sectional analyses were based on the proportion of people who were in the highest wealth tertile, though comparable results emerged when wealth was modeled as a continuously distributed variable. In 4-year longitudinal analyses, we analyzed the proportion of people in the highest quintile in 2016 adjusting for wealth at baseline.

Income was computed as total weekly net family income from all sources including employment, state benefits, pensions and other assets. Cross-sectional analyses were based on the proportion of people in the highest income tertile, though comparable results emerged when income was modeled as a continuous variable. In 4-year longitudinal analyses, we analyzed the proportion of people in the highest tertile in 2016, adjusting for 2012 income.
Paid employment. The proportion of participants in paid employment (part-time or full-time) was analyzed. Analyses were repeated on people aged 65 and younger. Longitudinal analyses assessed the proportion of people who were in paid employment at baseline in 2012 who continued to be employed in 2016, although similar results emerged when all people in paid employment were compared with those who were not employed in 2016.

Health variables

Self-rated health is a widely used measure of health status that predicts future health and disability outcomes and all-cause mortality (5). Respondents rated their health as *excellent, very good, good, fair* and *poor*. We analyzed the proportion of individuals giving fair/poor ratings. Longitudinally we assessed the proportion rating their health as fair or poor in 2016 adjusting for baseline levels.
Limiting longstanding illness. Participants were asked if they had a limiting longstanding illness at baseline and 4 year follow-up.
Chronic diseases. Information about six physician-diagnosed chronic diseases (coronary heart disease, stroke, cancer, diabetes, chronic lung disease and arthritis) was collected. Cross-sectionally, we analyzed the proportion of people with one or more chronic diseases. Longitudinally, we calculated whether or not the respondent had developed one or more of these diseases between 2012 and 2016, and analyzed incident disease rates.
Depressive symptoms were measured using the 8-item Centre for Epidemiologic Studies Depression Scale (CES-D) as used in the HRS and other studies (6). We used a score of ≥4 or greater to indicate the presence of depressive symptoms (7). Longitudinal analyses were adjusted for baseline depression ratings.
Impaired activities of daily living (ADL). Participants were questioned about the presence of impairments in 6 ADLs (dressing, bathing or showering, walking across a room, eating such as cutting up food, using the toilet, and getting in and out of bed). The proportion of participants reporting one or more impaired ADL was analyzed cross-sectionally, Longitudinal analyses assessed the proportion of people who were free of impaired ADLs at baseline but developed one or more impairments between baseline and 2016.
Impaired instrumental ADLs. We assessed 7 more complicated instrumental ADLs: difficulty preparing a hot meal, using a map, shopping for groceries, making telephone calls, taking medication, doing work around the house and garden, and difficulty managing money. Cross-sectionally, the proportion reporting one or more impaired instrumental ADLs was analyzed. The longitudinal analyses assessed the proportion of people who were free of impaired instrumental ADLs at baseline but developed one or more impairments between baseline and 2016. These measures of ADLs have been widely used in population studies of older people (8).
Chronic pain. Participants were asked whether or not they were often troubled by pain, and if so, how intense it was (*mild, moderate,* or *severe*). The proportion of respondents who reported moderate or severe chronic pain was analyzed. The longitudinal analyses assessed the proportion who developed moderate or severe chronic pain between baseline in 2012 and 2016.

Biomarkers and physical capability

Health-related biomarkers and measures of grip strength were assessed at baseline in wave 6 (2012) during a separate home visit by a study nurse. Not all participants had this visit because of refusals and scheduling difficulties, and blood sampling was not appropriate in all cases. The sample sizes are therefore smaller than for other measures. With the exceptions of gait speed and obesity, these measures were analyzed cross-sectionally but not longitudinally, since funding prevented us carrying out nurse visits on a substantial proportion of participants in 2016.

Grip strength is a measure of upper body strength, and is a known predictor of disability and mortality (9). It was assessed using a Smedley's hand dynamometer. Respondents were asked to squeeze the dynamometer as hard as they could for 2 seconds, carrying out 3 trials with the dominant and 3 with the nondominant hand. The average maximum strength across both hands in Kg was analyzed as a continuous variable.

Gait speed is an objective test of physical function that predicts future mortality among older people (10). It was assessed with two 8-foot walking tests from a standing start by respondents aged ≥ 60 years. The tests were carried out in the participants' homes under the supervision of a trained interviewer. Individuals who had health conditions or disabilities that prevented walking were not eligible for the test. Gait speed (in m/s) was analyzed as a continuously distributed variable. The analysis of gait speed on four year follow-up included baseline gait speed as a covariate.

Obesity. Height and weight were measured by study nurses at baseline, and body mass index (BMI) was computed as weight/height^2. Obesity was defined as a BMI ≥ 30. Weight was reassessed on follow-up in 2016, and longitudinal analyses adjusted for obesity at baseline.

Central obesity is an indicator of fat distribution to central abdominal tissue, and is particularly relevant to cardiometabolic disease risk (11). Central obesity was measured as waist circumference, with the waist defined as the midpoint between the lower rib and the upper margin of the iliac crest. Gender-specific cut-points defined central obesity as recommended by the National Heart Lung and Blood Institute: 102 cm for men, and 88 cm for women. Waist circumference was measured at baseline but not at follow-up.

C-reactive protein is a widely-used indicator of inflammation. High sensitivity plasma C-reactive protein concentration was analyzed by assessing the proportion of individuals with values above or below 3 ml/L, an established threshold for elevated levels, though results were the same when C-reactive protein was analyzed as a continuous variable. Individuals with values ≥ 20 mg/L were excluded, since these may indicate the presence of an acute infection or serious acute illness.

Plasma fibrinogen in g/L assayed as a second inflammatory marker, and was analyzed as a continuous variable.

White cell count is a third measure of inflammation, and was analyzed as a continuous variable in counts per 10^9/L.

Vitamin D. Plasma 25-hydroxyvitamin D is important for bone and muscle health among older people (12), and was analyzed as a continuous variable in Universal (U) units.

High density lipoprotein (HDL) cholesterol was measured using standard methods from both fasting and non-fasting samples. Low HDL-concentration is an important cardiovascular risk factor, and participants were classified into the high risk group if they had HDL concentrations below sex-specific thresholds (<1.0 mmol/l for men and <1.2mmol/l for women) (13).

Health-related behavior

Moderate or vigorous physical activity (MVPA). Participants were questioned about the frequency with which they participated in mild, moderate, and vigorous physical activities, with response options of *more than once a week, once a week, one to three times a month,*

and *hardly ever or never*. They were presented with a card showing examples of all three activity intensity levels. MVPA was coded dichotomously as moderate or vigorous intensity activity ≥once per week vs. <once per week. This measure has been validated in a subsample of ELSA participants against objective accelerometer measurements and is predictive of healthy aging (14). In longitudinal analyses, we computed the proportion of participants who attained the threshold of ≥ once per week in 2016 among those who did not exercise at this frequency at baseline

Sedentary behavior was defined as responding *hardly ever or never* to mild, moderate and vigorous activity items. The longitudinal analysis assessed the proportion who became sedentary between baseline and 2016.

Fruit and vegetable intake was assessed by asking participants to note the total numbers of fruit and of vegetable servings they had eaten in the past day, using questions that have previously been validated against biomarkers (15). The total number of fruit and vegetable servings consumed was dichotomized at 5 per day to reflect UK public health recommendations. At 4 year follow-up we analyzed the proportion of people who attained this threshold who were below this level of consumption at baseline.

Alcohol consumption. Participants were asked how many measures of spirits, glasses of wine, and pints of beer or cider they had drunk in the past 7 days. Units over the week were analyzed as a continuous variable at baseline and follow-up.

Sleep quality was assessed using a rating with 4 categories: *very good, good, fairly bad,* or *very bad.* We defined good sleep quality as a rating of good or very good.

Smoking status was assessed in the study interview, with participants being asked if they smoked cigarettes at all nowadays. Longitudinal analyses were adjusted for smoking at baseline.

Time use

Time use was assessed with an adaptation of the Experienced Well-Being module developed for the HRS (16), which was in turn based on the Day Reconstruction Method (17). Participants were asked about a series of activities they might have carried out yesterday: time spent with friends or family, time spent at home by yourself, time spent watching TV, time spent walking or exercising, time spent working or volunteering, time spent on health-related activities, and time spent traveling or commuting. If the person said they had carried out the activity, they were asked how many hours and minutes they spent on the activity. We calculated number of minutes in each activity, giving respondents a score of zero if they did not carry out the activity yesterday. In the interests of space, we have not presented results for the last two activities. Time use was analyzed as a continuous variable. The module was repeated in wave 7 (2014) but not wave 8 (2016). Consequently, the longitudinal analyses are over a 2 rather than 4 year period. Baseline time was included as a covariate in the analyses of longitudinal associations.

Statistical analysis

Age profile of worthwhile ratings. Mean scores were computed 9 age categories: 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, and 90+. Ratings were weighted to account for non-response using methods detailed in 18. All other analyses were conducted using unweighted data.

Cross-sectional analyses. Binary logistic regression was used to analyze the binary outcomes: marital status, living alone, contact with friends, volunteering, cultural activity, wealth, income, paid employment, self-rated health, limiting longstanding illness, chronic disease prevalence, depressive symptoms, impaired ADLs, impaired instrumental ADLs, presence of moderate or severe chronic pain, obesity, central obesity, C-reactive protein, HDL-

cholesterol, MVPA, sedentary behavior, fruit and vegetable consumption, sleep quality, and smoking. All models included worthwhile ratings, age, sex, educational attainment and SES. Results are presented in the tables as odds ratios (OR) with 95% confidence intervals (CI) and *p* values for each unit increase in worthwhile rating, adjusted for covariates. The reference category was 0. Continuously distributed variables were analyzed using OLS regression: number of close relationships, number of organizations of which the individual was a member, loneliness ratings, hand grip strength (analyzed separately for men and women), gait speed, vitamin D concentration, fibrinogen concentration, white blood cell count, alcohol units consumed in the past week, and time spent with friends and family, time spent alone, time watching TV, time walking or exercising, and time working or volunteering. All models included worthwhile ratings, age, sex, educational attainment and SES, and worthwhile results are presented as standardized regression coefficients (β) with standard errors and *p* values. Preliminary analyses included age^2 as an additional factor, but this did not modify the effect estimates for worthwhile ratings, so was not included in the final models.

Longitudinal analyses assessed measures after a 4 year interval in 2016, with the exception of time use which was reassessed in 2014 after two years. The analyses investigated the association of worthwhile ratings at baseline in 2012 on later outcomes. Binary logistic regression was used to analyze the following variables: divorce by 2016 among people who were married in 2012; living alone in 2016 among people who were not living alone in 2012; contact with friends weekly or more frequently in 2016 among people who had a lower level of contact in 2012; volunteering in 2016 at least monthly among people who were volunteering at this level in 2012; cultural activity every few months or more in 2016 among people who were less active than this in 2012; wealth in the highest tertile in 2016 adjusted for wealth in 2012; income in the highest tertile in 2016 adjusted for income in 2012; paid employment in 2016 among people who were employed in 2012; fair or poor self-rated health in 2016 adjusting for self-rated health in 2012; the presence of limiting longstanding illness in 2016 adjusted for limiting illness in 2012; incidence of one or more chronic illnesses by 2016 among people who did not have this illness in 2012; significant depressive symptoms in 2016 adjusted for depressive symptoms in 2012; incidence of impaired ADLs among people who did not have impaired ADLs in 2012; incidence of impaired instrumental ADLs among people who did not have impaired instrumental ADLs in 2012; the presence of moderate or several chronic pain in 2016 among people who did not suffer from chronic pain in 2012; obesity in 2016 adjusted for obesity in 2012; MVPA ≥ 1/week in 2016 among people who did not report MVPA at this level in 2012; sedentary behavior in 2016 among people who were not sedentary in 2012; consumption of fruit and vegetables ≥ 5/day in 2016 among people who ate less than this in 2012; sleep rated good or very good in 2016 adjusted for sleep ratings in 2012; and smoking in 2016 adjusted for smoking in 2012. The odds ratio for a unit increase in worthwhile rating (and 95% CI) are presented adjusted for covariates, with zero as the reference group. Continuously distributed variables were analyzed using OLS adjusted for standard covariates plus the following: number of organizations of which the person is a member in 2016 including number of organizations in 2012 as a covariate; loneliness ratings in 2016 including loneliness in 2012 as a covariate; gait speed (in participants aged 60+ at baseline) in 2016 including gait speed in 2012 as a covariate; alcohol units over the past week in 2016 including alcohol units in 2012 as a covariate; time spent with friends and family in 2016 including time spent with friends and family in 2012 as a covariate; time spent at home alone in 2016 including time spent at home alone in 2012 as a covariate; time spent with watching TV in 2016 including time spent watching TV in 2012 as a covariate; time spent walking or exercising in 2016 including time spent walking or exercising in 2012 as a covariate; time spent working or volunteering in 2016 including time spent working or

volunteering in 2012 as a covariate. Results are presented as standardized regression coefficients (β) with standard errors and *p* values.

Sensitivity analyses. We calculated E-values for all the primary analyses (19). The E-value estimates how robust an association is to unmeasured confounding variables, and is the minimum strength of association on a risk ratio scale that an unmeasured confounder would be required to have with both the exposure and outcome to explain away observed association. E-values and SDs were calculated using the online calculator (https://evalue.hmdc.harvard.edu/app/). The sensitivity analysis exploring whether financial resources accounted for associations between worthwhile ratings and outcomes involved repeating all analyses with wealth in deciles as a covariate. The sensitivity analysis investigating whether depressed mood accounted for associations between worthwhile ratings and outcomes involved repeating all analyses with depressive symptoms as a covariate. Results are presented in *SI Appendix*, Tables S3-6. A final sensitivity analysis tested the impact of outcomes that were available from earlier waves of ELSA, applying a same set of items from the different domains examined to all analyses: marital status, wealth, self-rated health, depressive symptoms, and smoking status. These variables were assessed in wave 5 of ELSA (2010), two years before the measurement of the primary exposure (ratings of doing worthwhile things), as a further test of causal associations (20). Because the ELSA sample is refreshed periodically to maintain the age distribution of 50 and older, there were 663 new recruits in the main analyses who did not have data from wave 5. The analyses summarized in *SI Appendix*, Tables S7 and S8 are therefore based on a reduced sample size, with some loss of statistical power.

Illustration of results

The associations between ratings of doing worthwhile things and outcomes are illustrated by dividing ratings into 5 categories (0-2, 3-4, 5-6, 7-8, and 9-10) and displaying means or proportions at these 5 levels adjusted for covariates. These results are presented in Figure 1 and *SI Appendix*, Figures S2-S13. Error bars are standard error of the mean.

References

1. Steptoe A, Breeze E, Banks J, & Nazroo J (2013) Cohort profile: English Longitudinal Study of Ageing. *Int J Epidemiol* 42:1640-1648.
2. Rose D, Pevalin JD, & O'Reilly K (2005) *The National Statistics Socio-economic Classification: Origins, Development and Use* (Palgrave MacMillan, New York).
3. Hughes ME, Waite LJ, Hawkley LC, & Cacioppo JT (2004) A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Res Aging* 26:655-672.
4. Banks J, Karlsen S, & Oldfield Z (2003) Socio-economic position. *Health, Wealth and Lifestyles of the Older Population in England*, eds Marmot M, Banks J, Blundell R, Lessof C, & Nazroo J (Institute for Fiscal Studies, London), pp 71-125.
5. DeSalvo KB, Bloser N, Reynolds K, He J, & Muntner P (2006) Mortality prediction with a single general self-rated health question. A meta-analysis. *J Gen Intern Med* 21(3):267-275.
6. Steffick DE (2000) *Documentation of Affective Functioning Measures in the Health and Retirement Study* (Survey Research Center University of Michigan., Ann Arbor).
7. Demakakos P, Pierce MB, & Hardy R (2010) Depressive symptoms and risk of type 2 diabetes in a national sample of middle-aged and older adults: the English longitudinal study of aging. *Diabetes Care* 33(4):792-797.
8. Wallace RB & Herzog AR (1995) Overview of the health measures in the Health and Retirement Study. *J Hum Res* 30 (Supplement):S84-S107.
9. Cooper R, *et al.* (2010) Objectively measured physical capability levels and mortality: systematic review and meta-analysis. *BMJ* 341:c4467.
10. Studenski S, *et al.* (2011) Gait speed and survival in older adults. *JAMA* 305(1):50-58.
11. Despres JP (2012) Body fat distribution and risk of cardiovascular disease: an update. *Circulation* 126(10):1301-1313.
12. Theodoratou E, Tzoulaki I, Zgaga L, & Ioannidis JP (2014) Vitamin D and multiple health outcomes: umbrella review of systematic reviews and meta-analyses of observational studies and randomised trials. *BMJ* 348:g2035.
13. Gordon DJ, *et al.* (1989) High-density lipoprotein cholesterol and cardiovascular disease. Four prospective American studies. *Circulation* 79(1):8-15.
14. Hamer M, Lavoie KL, & Bacon SL (2014) Taking up physical activity in later life and healthy ageing: the English Longitudinal Study of Ageing. *Br J Sports Med* 48(3):239-243.
15. Cappuccio FP, *et al.* (2003) Estimation of fruit and vegetable intake using a two-item dietary questionnaire: a potential tool for primary health care workers. *Nutr Metab Cardiovasc Dis* 13(1):12-19.
16. Smith J, Ryan L, Sonnega A, & Weir D (2017) Health and Retirement Study Psychosocial and Lifestyle Questionnaire 2006-2016: Documentation report. (Institute for Social Research, Unviersity of Michigan, Ann Arbor, MI).
17. Kahneman D, Krueger AB, Schkade DA, Schwarz N, & Stone AA (2004) A survey method for characterizing daily life experience: the day reconstruction method. *Science* 306(5702):1776-1780.
18. Bridges S, Hussey D, Blake M, & Philo D. (2014) Methodology. *The Dynamics of Ageing. Evidence from the English Longitudinal Study of Ageing 2002-2012 (Wave 8),* eds Banks J, Nazroo J, Steptoe A. (Institute for Fiscal Studies, London), pp 134-161.
19. VanderWeele TJ & Ding P (2017) Sensitivity analysis in observational research: introducing the E-Value. *Ann Intern Med* 167(4):268-274.

20. Vanderweele TJ, Mathur MB, & Chen Y (2018) Outcome-wide longitudinal designs for causal inference: a new template for empirical studies. *https://arXiv.org/abs/1810.10164*

TABLE S1 Distribution of covariates and associations with ratings of life being worthwhile

Factor	Levels	Number (%)	Worthwhile rating Mean (SD)	*P*
Sex	Men	3250	7.35 (2.21)	0.039
	Women	4054	7.46 (2.27)	
Educational attainment	No qualifications	2827 (38.7)	7.34 (2.43)	<0.001
	Basic qualifications	2059 (28.2)	7.30 (2.21)	
	High school or above	2418 (33.1)	7.59 (2.02)	
Occupational SES	Routine and manual	2725 (37.3)	7.25 (2.40)	<0.001
	Intermediate	1893 (25.9)	7.48 (2.23)	
	Professional and managerial	2686 (36.8)	7.52 (2.07)	

TABLE S2 Sample size in the different analyses

Factor	Cross-sectional N	Longitudinal N	Factor	Cross-sectional N	Longitudinal N
Social variables					
Married (%)	7,302	3,919[1]	Living alone (%)	7,303	4,429[2]
Close relationships (n)	7,304	5,302	Contact with friends ≥ 1/week (%)	7,304	1,805[3]
Organizations (n)	6,983	4,900	Volunteer ≥ monthly (%)	7,294	1,938[4]
Loneliness	7,261	5,167	Cultural activity ≥ every few months (%)	7,072	3,144[5]
Economic variables					
Wealth highest tertile (%)	6,893	5,187	Income highest tertile (%)	7,175	5,572
Paid employment (%)	7,303	1,779[6]			
Health variables					
Poor/fair self-rated health (%)	7,302	5,656	Limiting longstanding illness (%)	7,303	5,761
Chronic disease (%)	7,304	5,762	Depressive symptoms (%)	7,240	4,965
Impaired ADL (%)	7,304	4,914	Impaired IADL (%)	7,304	5,176
Chronic pain (%)	7,300.	4,062[7]			
Biomarkers and physical capability					
Hand-grip – men	2,910		Hand-grip – women	3,557	
Obesity (%)	6,356	4,761	Central obesity (%)	6,493	
Gait speed (m/s)	5,218[8]	3,796	Vitamin D (U)	5,088	
C-reactive protein ≥ 3 mg/l	5,088		Fibrinogen (g/L)	5,005	
HDL-cholesterol below threshold (%)	5,097		White cell count (10^9/L)	5,043	
Health-related behaviors					
MVPA ≥ 1/week (%)	7,303	1,832[9]	Sedentary behavior (%)	7,304	5,559[11]
Fruit & vegetables ≥ 5/day (%)	7,196	2,019[10]	Alcohol (units/week)	7,251	5,262
Sleep rating good/very good (%)	7,298	5,649	Smoking (%)	7,304	594[12]

Factor	Cross-sectional N	Longitudinal N	Factor	Cross-sectional N	Longitudinal N
Time use yesterday					
Time with friends (min)	7,138	5,654	Time alone (min)	7,159	5,613
Time TV (min)	7,134	5,660	Time walk/exercise (min)	7,166	5,679
Time work/volunteer (min)	7,131	5,719			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.

[1]Divorce among those married in 2012; [2]Living alone among those who were not living alone in 2012; [3]Among people without weekly contact in 2012;[4] Continuing volunteering among people who volunteered in 2012; [5] Among people who were not culturally active in 2012; [6] Among people employed in 2012; [7] Among people with no chronic pain in 2012; [8] Only assessed in people aged 60 and older; [9]Among people inactive in 2012; [10] Among people not eating ≥5 fruit/vegetables per day on 2012; [11] Among people not sedentary in 2012;11[12] Adjusting for smoking in 2012.

TABLE S3 Living a worthwhile life: cross-sectional associations with social, economic, health, and time use

Adjusted for age, sex, educational attainment and social class
Additional adjustment for wealth

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Married (%)	1.13 [1.11-1.16]	<0.001	Living alone (%)	0.89 [0.87-0.91]	<0.001
Close relationships (n)	0.232 (0.012)	<0.001	Contact with friends ≥ 1/week (%)	1.13 [1.10-1.15]	<0.001
Organizations (n)	0.114 (0.011)	<0.001	Volunteer ≥ monthly (%)	1.14 [1.11-1.17]	<0.001
Loneliness	-0.411 (0.011)	<0.001	Cultural activity ≥ every few months (%)	1.09 [1.06-1.12]	<0.001
Economic variables					
Wealth highest tertile (%)			Income highest tertile (%)	1.05 [1.03-1.08	<0.001
Paid employment (%)	1.11 [1.07-1.14]	<0.001			
Health variables					
Poor/fair self-rated health (%)	0.81 [0.79-0.83]	<0.001	Limiting longstanding illness (%)	0.85 [0.83-0.87]	<0.001
Chronic disease (%)	0.94 [0.91-0.96]	<0.001	Depressive symptoms (%)	0.67 [0.65-0.69]	<0.001
Impaired ADL (%)	0.85 [0.82-0.87]	<0.001	Impaired IADL (%)	0.82 [0.79-0.84]	<0.001
Chronic pain (%)	0.89 [0.87-0.91]	<0.001			
Biomarkers and physical capability					
Hand-grip – men	0.052 (0.016)	<0.001	Hand-grip – women	0.058 (0.015)	<0.001
Obesity (%)	0.97 [0.94-0.99]	0.005	Central obesity (%)	0.98 [0.96-1.00]	0.058
Gait speed (m/s)	0.105 (0.012)	<0.001	Vitamin D (U)	0.076 (0.014)	<0.001
C-reactive protein ≥ 3 mg/l	0.96 [0.93-0.99]	0.0061	Fibrinogen (g/L)	-0.031 (0.014)	0.026
HDL-cholesterol below threshold (%)	0.96 [0.92-0.99]	0.026	White cell count (10^9/L)	-0.073 (0.014)	<0.001
Health-related behaviors					
MVPA ≥ 1/week (%)	1.14 [1.12-1.17]	<0.001	Sedentary behavior (%)	0.79 [0.75-0.82]	<0.001
Fruit & vegetables ≥ 5/day (%)	1.12 [1.10-1.15]	<0.001	Alcohol (units/week)	0.001 (0.011)	0.94
Sleep rating good/very	1.19 [1.16-1.22]	<0.001	Smoking (%)	0.95 [0.92-0.98]	0.003

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
good (%)					
Time use yesterday					
Time with friends (min)	0.083 (0.012)	<0.001	Time alone (min)	-0.161 (0.012)	<0.001
Time TV (min)	-0.077 (0.012)	<0.001	Time walk/exercise (min)	0.108 (0.012)	<0.001
Time work/volunteer (min)	0.033 (0.011)	0.004			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.

TABLE S4 Living a worthwhile life: longitudinal associations with social, economic, health, and time use over 4 years

Adjusted for age, sex, educational attainment and social class
Additional adjustment for wealth

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Divorce[1] (%)	0.88 [0.78-0.99]	0.046	Living alone[2] (%)	0.93 [0.88-0.99]	0.014
Close relationships[3] (n)	0.080 (0.012)	<0.001	Contact with friends ≥ 1/week[4] (%)	1.06 [1.01-1.11]	0.019
Organisations[5] (n)	0.026 (0.010)	0.012	Volunteer ≥ monthly[6] (%)	1.09 [1.04-1.15]	<0.001
Loneliness rating[7]	-0.096 (0.012)	<0.001	Cultural activity ≥ every few months[8] (%)	1.05 [1.00-1.10]	0.050
Economic variables					
Wealth highest tertile[9] (%)			Income highest tertile[10] (%)	1.02 [0.99-1.05]	0.31
Paid employment[11] (%)	0.98 [0.92-1.03]	0.35			
Health variables					
Poor/fair self-rated health[12] (%)	0.92 [0.89-0.95]	<0.001	Limiting longstanding illness[13] (%)	0.93 [0.90-0.96]	<0.001
Chronic disease[14] (%)	0.95 [0.92-0.98]	<0.001	Depressive symptoms[15] (%)	0.90 [0.87-0.92]	<0.001
Impaired ADL[16] (%)	0.87 [0.83-0.91]	<0.001	Impaired IADL[17] (%)	0.86 [0.82-0.90]	<0.001
Chronic pain[18] (%)	0.95 [0.91-0.99]	0.007	Obesity[19] (%)	0.95 [0.90-0.99]	0.017
Gait speed[20] (m/s)	0.042 (0.012)	<0.001			
Health-related behaviors					
MVPA ≥ 1/week[21] (%)	1.09 [1.04-1.13]	<0.001	Sedentary behavior[22] (%)	0.85 [0.81-0.89]	<0.001
Fruit & vegetables ≥ 5/day[23] (%)	1.08 [1.03-1.13]	0.001	Alcohol (units/week)[24]	0.030 (0.010)	0.005
Sleep rating good/very good[25] (%)	1.12 [1.08-1.15]	<0.001	Smoking[26] (%)	1.02 [0.96-1.09]	0.52
Time use[27]					
Time with friends (min)	0.028 (0.013)	0.031	Time alone (min)	-0.047 (0.011)	<0.001
Time TV (min)	-0.039 (0.011)	<0.001	Time walk/exercise (min)	0.038 (0.013)	0.003
Time work/volunteer (min)	0.027 (0.012)	0.026			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.
[1]Divorce among those married in 2012; [2]Living alone among those who were not living alone in 2012;[3]Adjusting for close relationships in 2012; [4]Among people without weekly contact in 2012;[5] Adjusting for organizational membership in 2012; [6] Continuing volunteering among people who volunteered in 2012; [7] Adjusting for loneliness in 2012; [8] Among people who were not culturally active in 2012; [9] Adjusting for wealth in 2012; [10] Adjusting for income in 2012; [11]Among people employed in 2012;[12] Adjusting for self-rated health in 2012; [13] Adjusting for limiting illness in 2012;[14] Incident chronic disease since 2012; [15] Incident depressive symptoms in 2016; [16] Incident impaired ADLs; [17] Incident impaired IADLs; [18] Incident chronic pain among people with no chronic pain in 2012; [19] Adjusting for obesity in 2012; [20] Adjusting for gait speed in 2012; [21] Among people inactive in 2012; [22] Among people not sedentary in 2012; [23] Among people not eating ≥5 fruit/vegetables per day on 2012; [24] Adjusting for alcohol in 2012; [25] Adjusting for sleep quality in 2012; [26] Adjusting for smoking in 2012; [27] Time use reassessed in 2014, analyses adjusted for time use in 2012.

TABLE S5 Living a worthwhile life: cross-sectional associations with social, economic, health, and time use

Adjusted for age, sex, educational attainment and social class
Additional adjustment for depression

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Married (%)	1.13 [1.11-1.16]	<0.001	Living alone (%)	0.89 [0.87-0.91]	<0.001
Close relationships (n)	0.231 (0.012)	<0.001	Contact with friends ≥ 1/week (%)	1.13 [1.11-1.16]	<0.001
Organizations (n)	0.135 (0.012)	<0.001	Volunteer ≥ monthly (%)	1.14 [1.11-1.17]	<0.001
Loneliness	-0.327 (0.011)	<0.001	Cultural activity ≥ every few months (%)	1.09 [1.06-1.12]	<0.001
Economic variables					
Wealth highest tertile (%)	1.08 [1.05-1.11]	<0.001	Income highest tertile (%)	1.07 [1.04-1.09]	<0.001
Paid employment (%)	1.06 [1.02-1.09]	<0.001			
Health variables					
Poor/fair self-rated health (%)	0.85 [0.83-0.87]	<0.001	Limiting longstanding illness (%)	0.88 [0.86-0.90]	<0.001
Chronic disease (%)	0.95 [0.93-0.98]	<0.001	Depressive symptoms (%)		
Impaired ADL (%)	0.88 [0.86-0.91]	<0.001	Impaired IADL (%)	0.86 [0.83-0.89]	<0.001
Chronic pain (%)	0.92 [0.90-0.95]	<0.001			
Biomarkers and physical capability					
Hand-grip – men	0.036 (0.017)	0.034	Hand-grip – women	0.044 (0.016)	0.005
Obesity (%)	0.96 [0.94-0.99]	<0.001	Central obesity (%)	0.98 [0.95-0.99]	0.039
Gait speed (m/s)	0.083 (0.013)	<0.001	Vitamin D (U)	0.071 (0.015)	<0.001
C-reactive protein ≥ 3 mg/l	0.95 [0.92-0.98]	0.008	Fibrinogen (g/L)	-0.026 (0.015)	0.075
HDL-cholesterol below threshold (%)	0.96 [0.92-0.99]	0.047	White cell count (10^9/L)	-0.073 (0.015)	<0.001
Health-related behaviors					
MVPA ≥ 1/week (%)	1.12 [1.01-1.15]	<0.001	Sedentary behavior (%)	0.82 [0.79-0.86]	<0.001
Fruit & vegetables ≥ 5/day (%)	1.12 [1.10-1.15]	<0.001	Alcohol (units/week)	-0.010 (0.012)	0.42
Sleep rating good/very	1.10 [1.07-1.13]	<0.001	Smoking (%)	0.96 [0.92-0.99]	0.009

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
good (%)					
Time use yesterday					
Time with friends (min)	0.084 (0.013)	<0.001	Time alone (min)	-0.149 (0.012)	<0.001
Time TV (min)	-0.074 (0.012)	<0.001	Time walk/exercise (min)	0.099 (0.013)	<0.001
Time work/volunteer (min)	0.021 (0.012)	0.081			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.

TABLE S6 Living a worthwhile life: longitudinal associations with social, economic, health, and time use over 4 years

Adjusted for age, sex, educational attainment and social class
Additional adjustment for depression

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Divorce[1] (%)	0.85 [0.75-0.96]	0.009	Living alone[2] (%)	0.97 [0.91-1.02]	0.23
Close relationships[3] (n)	0.074 (0.013)	<0.001	Contact with friends ≥ 1/week[4] (%)	1.06 [1.01-1.12]	0.014
Organisations[5] (n)	0.028 (0.011)	0.011	Volunteer ≥ monthly[6] (%)	1.10 [1.04-1.16]	<0.001
Loneliness rating[7]	-0.083 (0.012)	<0.001	Cultural activity ≥ every few months[8] (%)	1.08 [1.02-1.13]	0.004
Economic variables					
Wealth highest tertile[9] (%)	1.04 [1.00-1.08]	0.083	Income highest tertile[10] (%)	1.02 [0.98-1.05]	0.32
Paid employment[11] (%)	0.97 [0.92-1.03]	0.32			
Health variables					
Poor/fair self-rated health[12] (%)	0.93 [0.90-0.97]	<0.001	Limiting longstanding illness[13] (%)	0.95 [0.92-0.98]	0.001
Chronic disease[14] (%)	0.96 [0.93-0.99]	0.012	Depressive symptoms[15] (%)		
Impaired ADL[16] (%)	0.89 [0.85-0.93]	<0.001	Impaired IADL[17] (%)	0.88 [0.85-0.92]	<0.001
Chronic pain[18] (%)	0.96 [0.92-1.00]	0.063	Obesity[19] (%)	0.94 [0.90-0.99]	0.015
Gait speed[20] (m/s)	0.041 (0.013)	0.002			
Health-related behaviors					
MVPA ≥ 1/week[21] (%)	1.08 [1.03-1.13]	0.001	Sedentary behavior[22] (%)	0.87 [0.83-0.92]	<0.001
Fruit & vegetables ≥ 5/day[23] (%)	1.08 [1.03-1.13]	0.002	Alcohol (units/week)[24]	0.035 (0.011)	0.002
Sleep rating good/very good[25] (%)	1.10 [1.07-1.13]	<0.001	Smoking[26] (%)	1.04 [0.97-1.11]	0.31
Time use[27]					
Time with friends (min)	0.033 (0.014)	0.015	Time alone (min)	-0.044 (0.011)	<0.001
Time TV (min)	-0.051 (0.011)	<0.001	Time walk/exercise (min)	0.037 (0.013)	0.005
Time work/volunteer (min)	0.023 (0.013)	0.073			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.
[1]Divorce among those married in 2012; [2]Living alone among those who were not living alone in 2012;[3]Adjusting for close relationships in 2012; [4]Among people without weekly contact in 2012;[5] Adjusting for organisational membership in 2012; [6] Continuing volunteering among people who volunteered in 2012; [7] Adjusting for loneliness in 2012; [8] Among people who were not culturally active in 2012; [9] Adjusting for wealth in 2012; [10] Adjusting for income in 2012; [11]Among people employed in 2012;[12] Adjusting for self-rated health in 2012; [13] Adjusting for limiting illness in 2012;[14] Incident chronic disease since 2012; [15] Not included; [16] Incident impaired ADLs; [17] Incident impaired IADLs; [18] Incident chronic pain among people with no chronic pain in 2012; [19] Adjusting for obesity in 2012; [20] Adjusting for gait speed in 2012; [21] Among people inactive in 2012; [22] Among people not sedentary in 2012; [23] Among people not eating ≥5 fruit/vegetables per day on 2012; [24] Adjusting for alcohol in 2012; [25] Adjusting for sleep quality in 2012; [26] Adjusting for smoking in 2012; [27] Time use reassessed in 2014, analyses adjusted for time use in 2012.

TABLE S7 Living a worthwhile life: cross-sectional associations with social, economic, health, and time use

Adjusted for age, sex, educational attainment and social class
Additional adjustment for marital status, wealth, self-rated health, depressive symptoms and smoking two years before assessment of living a worthwhile life

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Married (%)	1.21 [1.12-1.30]	<0.001	Living alone (%)	0.93 [0.89-0.97]	<0.001
Close relationships (n)	0.210 (0.013)	<0.001	Contact with friends ≥ 1/week (%)	1.13 [1.11-1.16]	<0.001
Organizations (n)	0.111 (0.012)	<0.001	Volunteer ≥ monthly (%)	1.13 [1.10-1.17]	<0.001
Loneliness	-0.318 (0.011)	<0.001	Cultural activity ≥ every few months (%)	1.07 [1.04-1.11]	<0.001
Economic variables					
Wealth highest tertile (%)	1.05 [1.01-1.09]	0.036	Income highest tertile (%)	1.04 [1.01-1.07]	0.028
Paid employment (%)	1.05 [1.01-1.09]	0.012			
Health variables					
Poor/fair self-rated health (%)	0.87 [0.84-0.90]	<0.001	Limiting longstanding illness (%)	0.91 [0.88-0.93]	<0.001
Chronic disease (%)	0.98 [0.95-1.00]	0.098	Depressive symptoms (%)	0.72 [0.69-0.75]	<0.001
Impaired ADL (%)	0.92 [0.89-0.95]	<0.001	Impaired IADL (%)	0.89 [0.86-0.92]	<0.001
Chronic pain (%)	0.95 [0.92-0.97]	<0.001			
Biomarkers and physical capability					
Hand-grip – men	0.013 (0.018)	0.046	Hand-grip – women	0.033 (0.016)	0.041
Obesity (%)	0.98 [0.96-1.01]	0.21	Central obesity (%)	0.99 [0.96-1.01]	0.44
Gait speed (m/s)	0.051 (0.012)	<0.001	Vitamin D (U)	0.064 (0.016)	<0.001
C-reactive protein ≥ 3 mg/l	0.97 [0.94-1.00]	0.062	Fibrinogen (g/L)	-0.016 (0.016)	0.32
HDL-cholesterol below threshold (%)	0.97 [0.93-1.02]	0.23	White cell count (10^9/L)	-0.061 (0.015)	<0.001
Health-related behaviors					
MVPA ≥ 1/week (%)	1.10 [1.08-1.13]	<0.001	Sedentary behavior (%)	0.85 [0.81-0.89]	<0.001
Fruit & vegetables ≥ 5/day (%)	1.10 [1.08-1.12]	<0.001	Alcohol (units/week)	0.000 (0.013)	0.97

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Sleep rating good/very good (%)	1.14 [1.11-1.18]	<0.001	Smoking (%)	1.00 [0.94-1.08]	0.88
Time use yesterday					
Time with friends (min)	0.073 (0.013)	<0.001	Time alone (min)	-0.090 (0.011)	<0.001
Time TV (min)	-0.069 (0.013)	<0.001	Time walk/exercise (min)	0.092 (0.013)	<0.001
Time work/volunteer (min)	0.022 (0.013)	0.092			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.

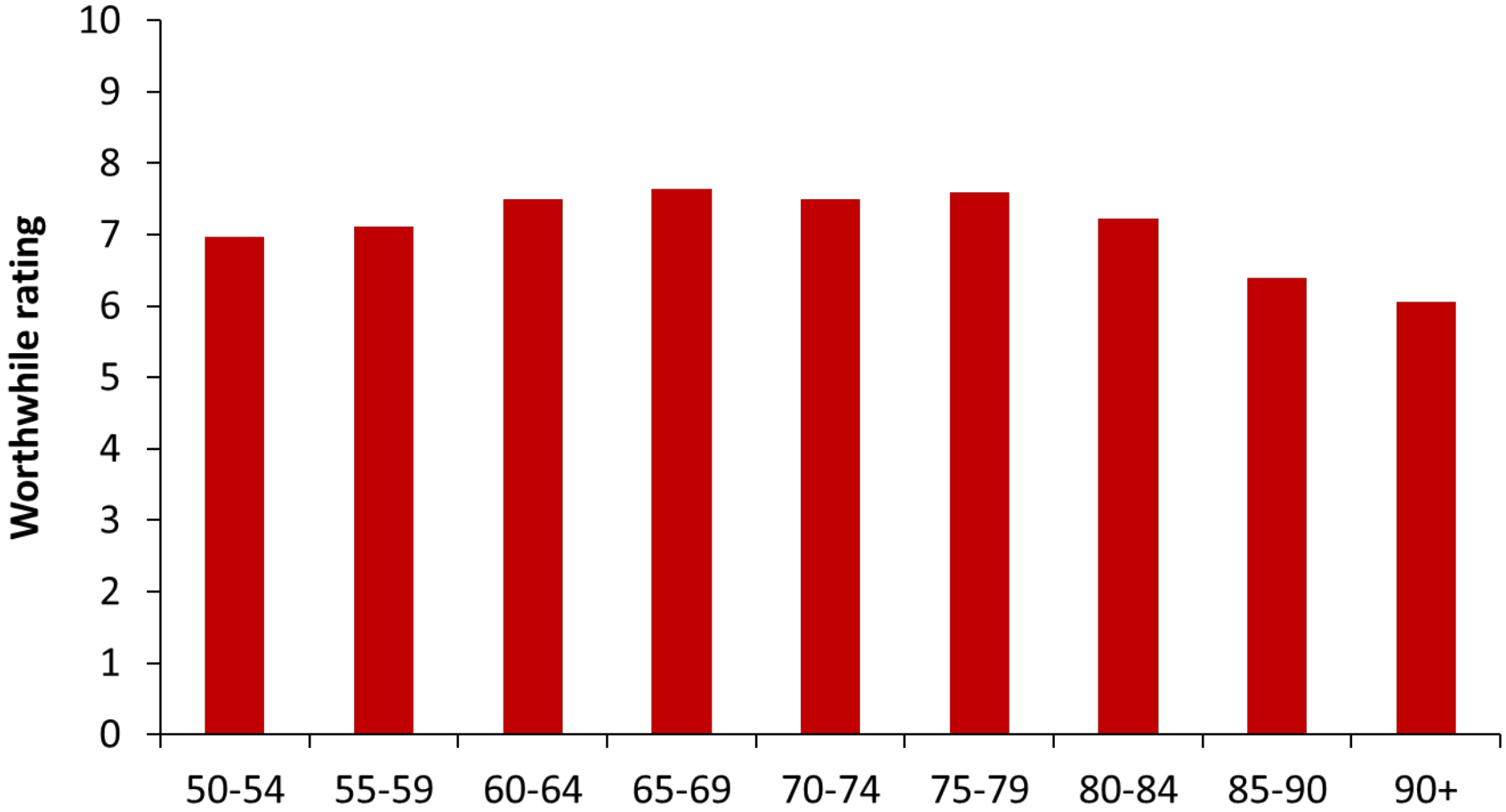
TABLE S8 Living a worthwhile life: longitudinal associations with social, economic, health, and time use over 4 years

Adjusted for age, sex, educational attainment and social class
Additional adjustment for marital status, wealth, self-rated health, depressive symptoms and smoking two years before assessment of living a worthwhile life

Factor	Odds ratio [95% CI] / β (SE)	P	Factor	Odds ratio [95% CI] / β (SE)	P
Social variables					
Divorce[1] (%)	0.87 [0.75-1.00]	0.063	Living alone[2] (%)	0.97 [0.91-1.02]	0.28
Close relationships[3] (n)	0.065 (0.013)	<0.001	Contact with friends ≥ 1/week[4] (%)	1.09 [1.03-1.15]	0.002
Organisations[5] (n)	0.012 (0.011)	0.30	Volunteer ≥ monthly[6] (%)	1.07 [1.02-1.14]	0.013
Loneliness rating[7]	-0.073 (0.013)	<0.001	Cultural activity ≥ every few months[8] (%)	1.04 [0.99-1.10]	0.13
Economic variables					
Wealth highest tertile[9] (%)	1.03 [0.99-1.09]	0.17	Income highest tertile[10] (%)	1.00 [0.96-1.04]	0.90
Paid employment[11] (%)	1.02 [0.96-1.09]	0.61			
Health variables					
Poor/fair self-rated health[12] (%)	0.95 [0.92-0.99]	0.015	Limiting longstanding illness[13] (%)	0.97 [0.94-1.00]	0.058
Chronic disease[14] (%)	0.95 [0.92-0.99]	0.004	Depressive symptoms[15] (%)	0.86 [0.81-0.91]	<0.001
Impaired ADL[16] (%)	0.92 [0.87-0.96]	<0.001	Impaired IADL[17] (%)	0.91 [0.87-0.95]	<0.001
Chronic pain[18] (%)	0.99 [0.94-1.03]	0.58	Obesity[19] (%)	0.96 [0.91-1.01]	0.14
Gait speed[20] (m/s)	0.030 (0.013)	0.020			
Health-related behaviors					
MVPA ≥ 1/week[21] (%)	1.04 [0.99-1.10]	0.091	Sedentary behavior[22] (%)	0.89 [0.84-0.94]	<0.001
Fruit & vegetables ≥ 5/day[23] (%)	1.07 [1.02-1.12]	0.007	Alcohol (units/week)[24]	0.026 (0.011)	0.026
Sleep rating good/very good[25] (%)	1.08 [1.04-1.12]	<0.001	Smoking[26] (%)	1.01 [0.93-1.11]	0.78
Time use[27]					
Time with friends (min)	0.026 (0.014)	0.071	Time alone (min)	-0.028 (0.011)	0.012
Time TV (min)	-0.034 (0.012)	0.004	Time walk/exercise (min)	0.018 (0.014)	0.21
Time work/volunteer (min)	0.024 (0.014)	0.078			

ADL = activities of daily living; IADL = instrumental activities of daily living; HDL = high density lipoprotein; MVPA = moderate/vigorous physical activity; TV = television.
[1]Divorce among those married in 2012; [2]Living alone among those who were not living alone in 2012;[3]Adjusting for close relationships in 2012; [4]Among people without weekly contact in 2012;[5] Adjusting for organisational membership in 2012; [6] Continuing volunteering among people who volunteered in 2012; [7] Adjusting for loneliness in 2012; [8] Among people who were not culturally active in 2012; [9] Adjusting for wealth in 2012; [10] Adjusting for income in 2012; [11]Among people employed in 2012;[12] Adjusting for self-rated health in 2012; [13] Adjusting for limiting illness in 2012;[14] Incident chronic disease since 2012; [15] Not included; [16] Incident impaired ADLs; [17] Incident impaired IADLs; [18] Incident chronic pain among people with no chronic pain in 2012; [19] Adjusting for obesity in 2012; [20] Adjusting for gait speed in 2012; [21] Among people inactive in 2012; [22] Among people not sedentary in 2012; [23] Among people not eating ≥5 fruit/vegetables per day on 2012; [24] Adjusting for alcohol in 2012; [25] Adjusting for sleep quality in 2012; [26] Adjusting for smoking in 2012; [27] Time use reassessed in 2014, analyses adjusted for time use in 2012.

Figure S1



Mean worthwhile ratings categorized by 5 year age groups. ELSA data are weighted for representativeness. For further details, see *SI Appendix*, page 5.

Figure legends

Figure S2 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and social outcomes adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the adjusted % married; % living alone; mean number of close relationships; % who have contact with friends ≥ weekly; number of organizations to which the participants belong; % volunteering ≥ monthly; average loneliness rating; % engaging in cultural activity ≥ every few months.

Figure S3 Longitudinal associations between worthwhile ratings in 2012 (divided into 5 categories from lowest (0-2) to highest (9-10) and social outcomes in 2016, adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % of participants married/partnered in 2012 who are divorced in 2016; the % participants who were not living alone in 2012 and are living alone in 2016; mean number of close relationships in 2016 adjusted for number of close relationships in 2016; % of people without weekly contact with friends in 2012 who do have contact at this level in 2016; mean loneliness ratings in 2016 adjusted for loneliness in 2012; % who were not culturally active in 2012 but are active ≥ every few months in 2016.

Figure S4 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and economic outcomes adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % participants with wealth in the top tertile; % participants with income in the top tertile; % participants in paid employment.

Figure S5 Longitudinal associations between worthwhile ratings in 2012 (divided into 5 categories from lowest (0-2) to highest (9-10) and economic outcomes in 2016, adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % participants with wealth in the top tertile, adjusted for wealth in 2012; % participants with income in the top tertile, adjusted for income in 2012; % participants in paid employment in 0216 among people employed in 2012.

Figure S6 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and health and disability outcomes adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % reporting their health was fair or poor; % reporting a limiting longstanding illness; % suffering from a serious chronic illness (coronary heart disease, stroke, cancer, diabetes, chronic lung disease, and arthritis); % with depressive symptoms ≥ 4 on the CESD; % with impaired ADLs; % with impaired instrumental ADLs; % reporting moderate or severe chronic pain.

Figure S7 Longitudinal associations between worthwhile ratings in 2012 (divided into 5 categories from lowest (0-2) to highest (9-10) and health and disability outcomes in 2016 adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % reporting their health was fair or poor in 2016, adjusting for self-rated health in 2012; % reporting a limiting longstanding illness in 2016, adjusting for limiting illness in 2012; % recording new impaired ADLs since 2012; % recording new impaired instrumental ADLs; % reporting incident moderate or severe chronic pain; % obese in 2016, adjusting for obesity in 2012.

Figure S8 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and biomarkers adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the average maximum grip strength of men and women; % obese; % with central obesity; average gait speed; average concentration of plasma vitamin D.

Figure S9 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and additional biomarkers adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % with plasma C-reactive protein ≥ 3 mg/L; average plasma fibrinogen concentration; % with HDL-cholesterol below threshold; average white blood cell counts.

Figure S10 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and health behaviors adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % engaging in moderate or vigorous physical activity at least once per week; % sedentary participants; % eating ≥5 servings of fruit and vegetables a day; average units of alcohol per week; % reporting good or very good sleep; % current smokers.

Figure S11 Longitudinal associations between worthwhile ratings in 2012 (divided into 5 categories from lowest (0-2) to highest (9-10) and health behaviors in 2016 adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the % sedentary individuals in 2016 among those who were not sedentary in 2012; average alcohol consumption in 2016 adjusted for alcohol in 2012; % reporting good or very good sleep in 2016 adjusting for sleep quality in 2012; % smokers in 2016 adjusting for smoking in 2012;

Figure S12 Cross-sectional associations between worthwhile ratings (divided into 5 categories from lowest (0-2) to highest (9-10) and time use yesterday adjusted for age, sex, education and SES. Error bars are standard errors. The panels show the average time spent socializing with family and friends; average time spent alone; average time spent watching TV; average time spent walking or exercising; average time spent working or volunteering.

Figure S13 Longitudinal associations between worthwhile ratings in 2012 (divided into 5 categories from lowest (0-2) to highest (9-10) and time use yesterday in 2014 adjusted for age, sex, education and SES. Error bars are standard errors. All panels are adjusted for time use in 2012. The panels show the average time spent socializing with family and friends; average time spent walking or exercising; average time spent working or volunteering.

Figure S2 Social factors in relation to worthwhile ratings

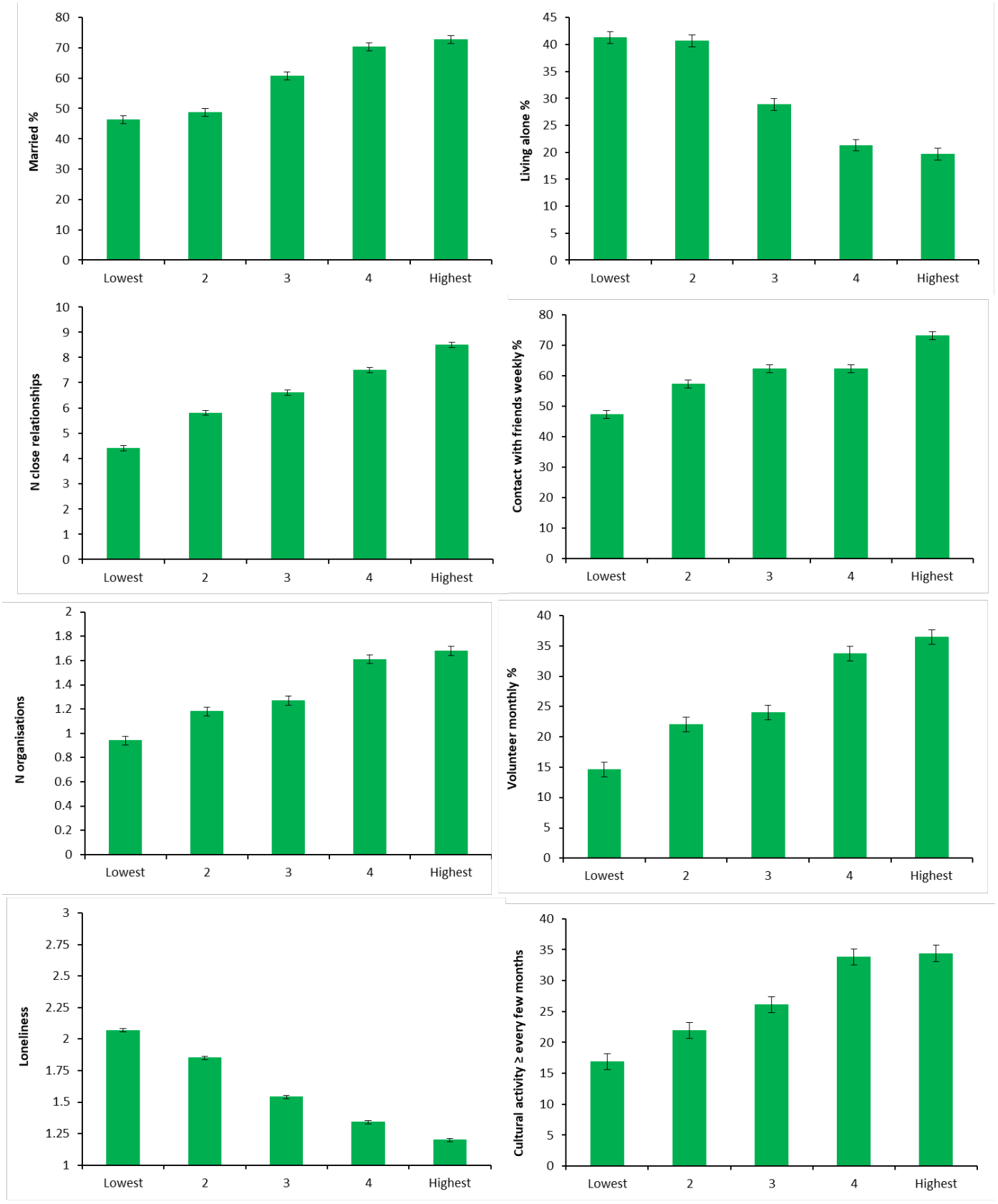


Figure S3 Social factors at 4 year follow-up in relation to baseline worthwhile ratings

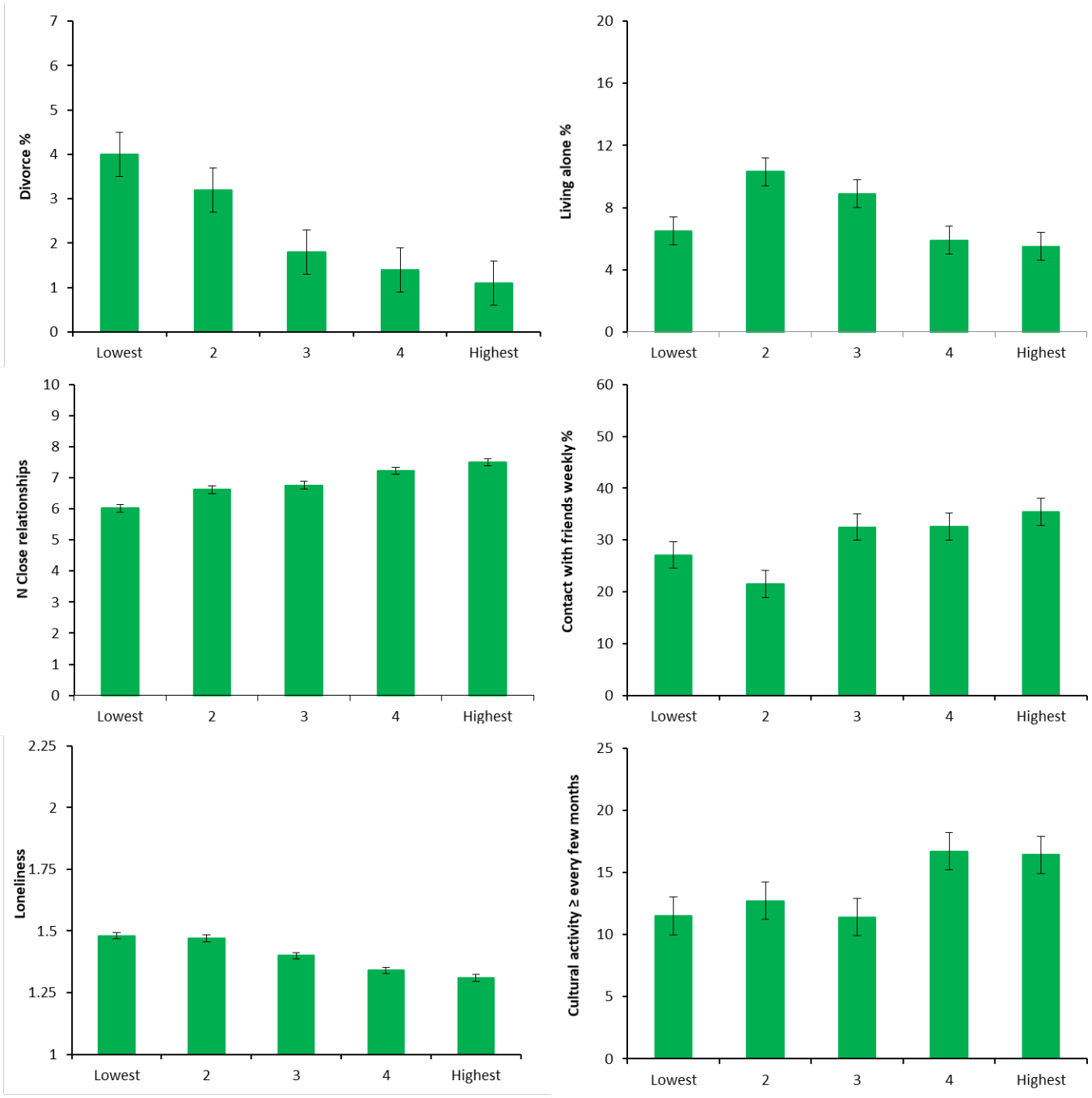


Figure S4 Economic factors in relation to worthwhile ratings

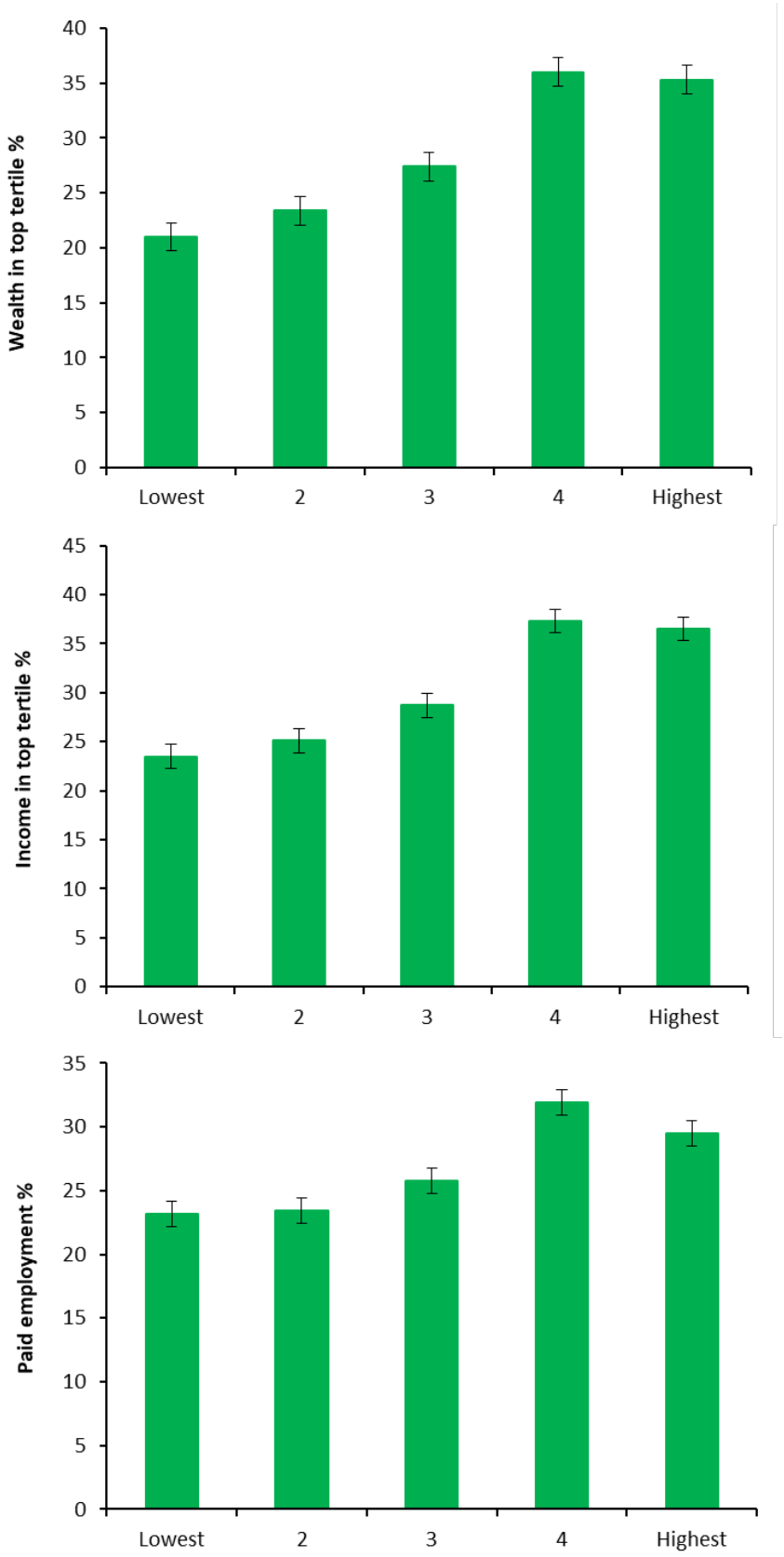
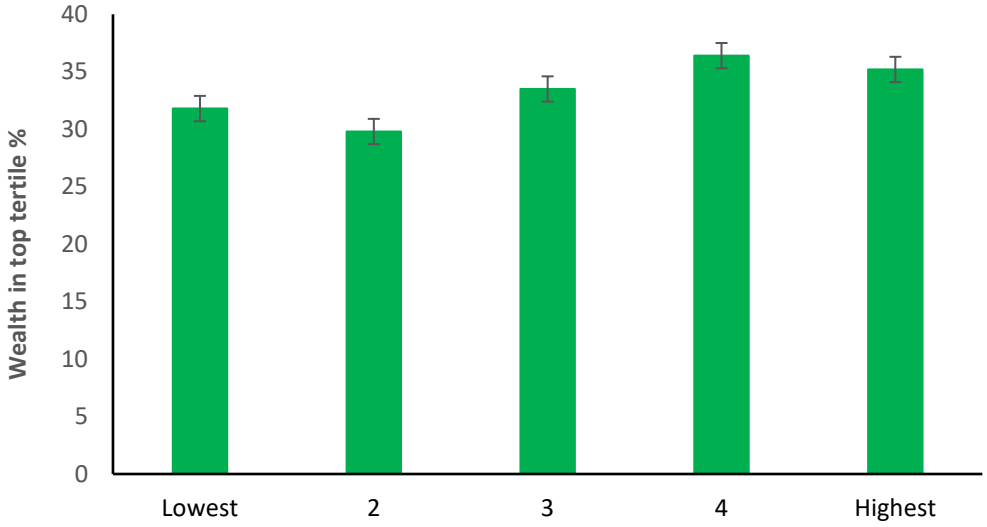
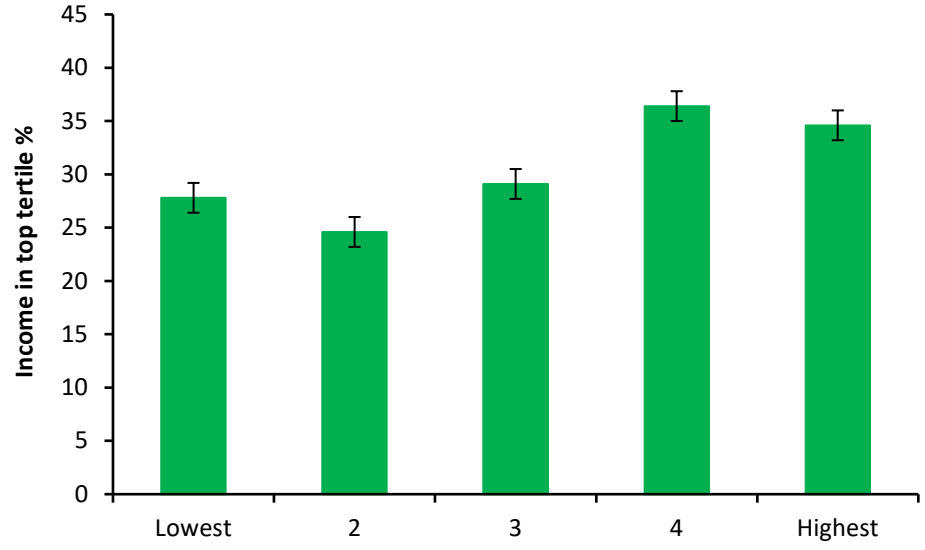


Figure S5 Economic factors at 4 year follow-up in relation to baseline worthwhile ratings





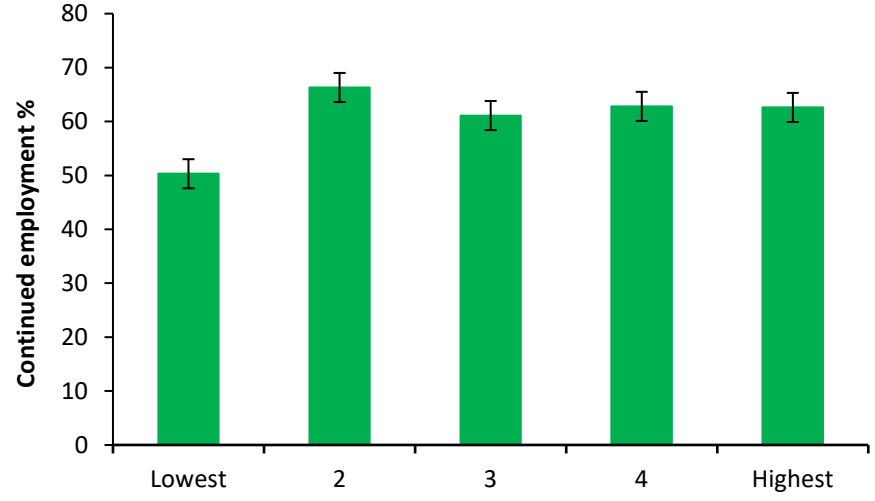


Figure S6 Health and disability variables in relation to worthwhile ratings

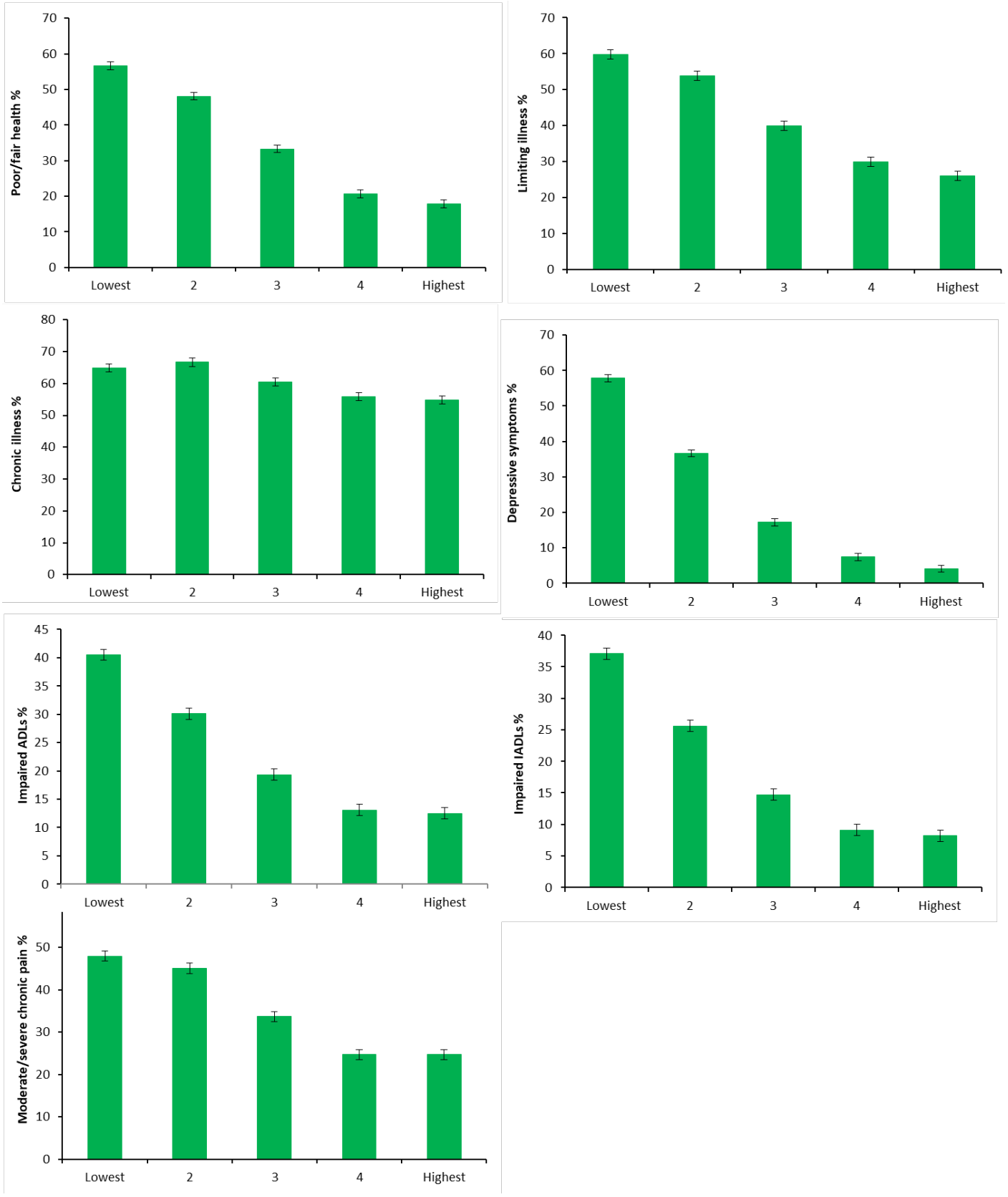


Figure S7 Biomarkers in relation to worthwhile ratings

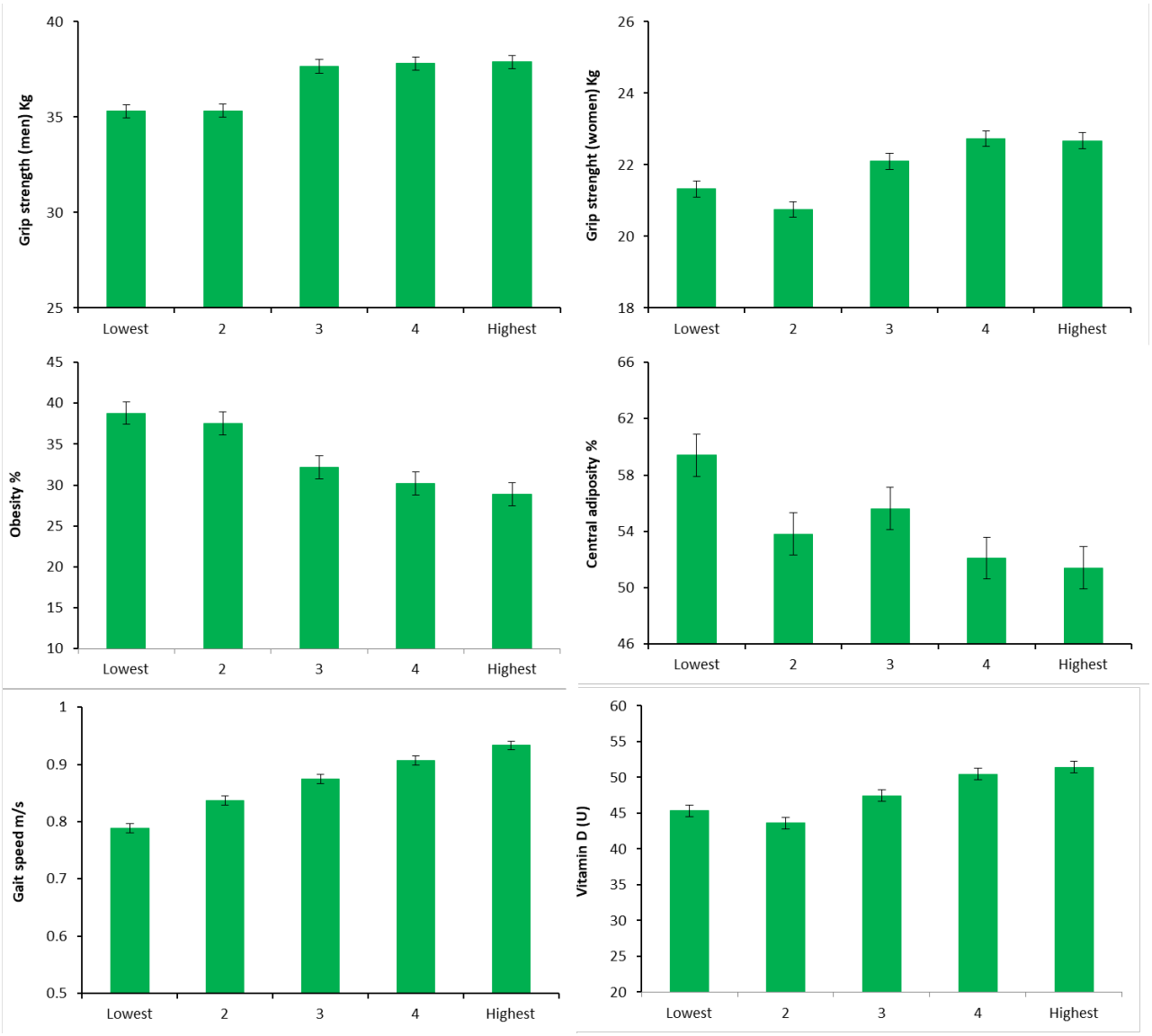


Figure S8 Biomarkers in relation to worthwhile ratings

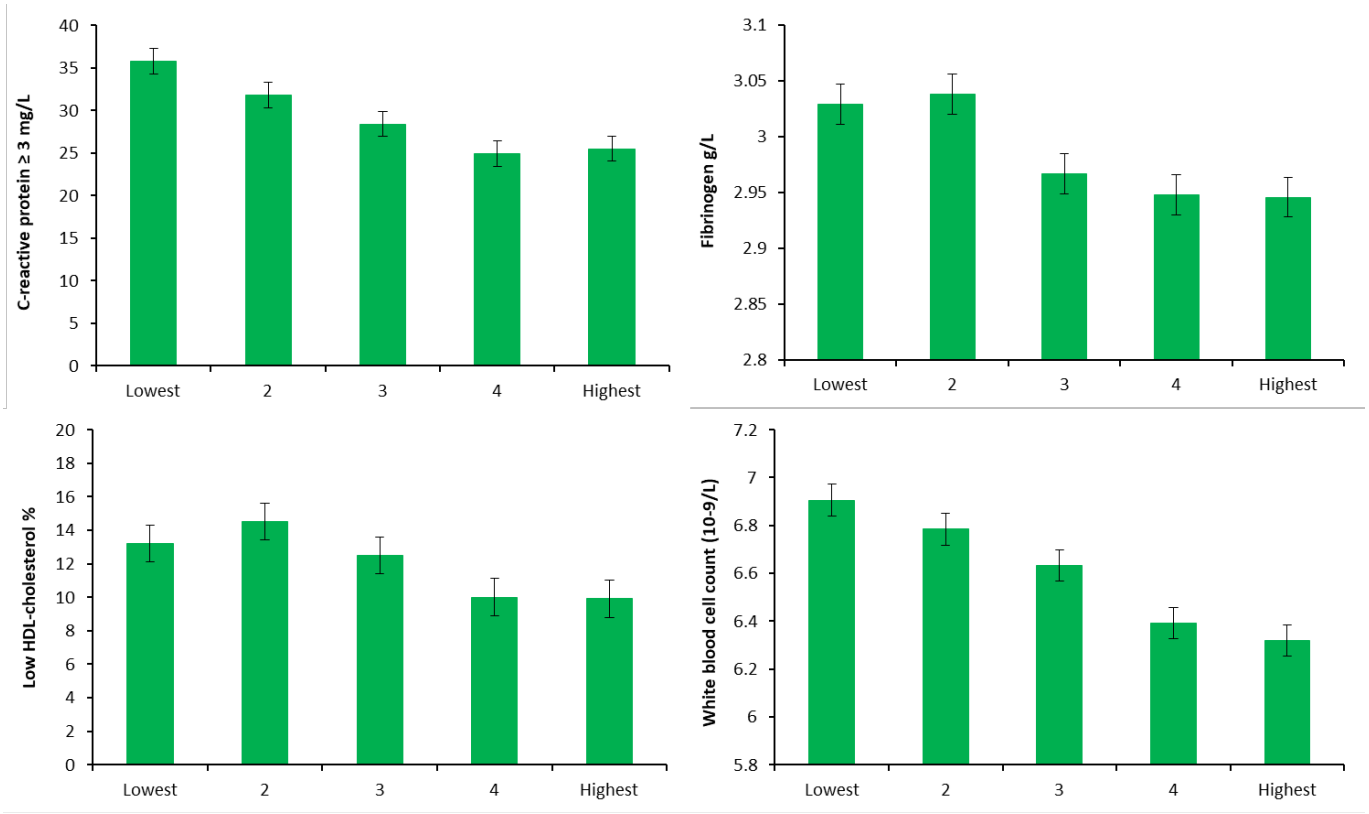


Figure S9 **Health and disability variables at 4 year follow-up in relation to baseline worthwhile ratings**

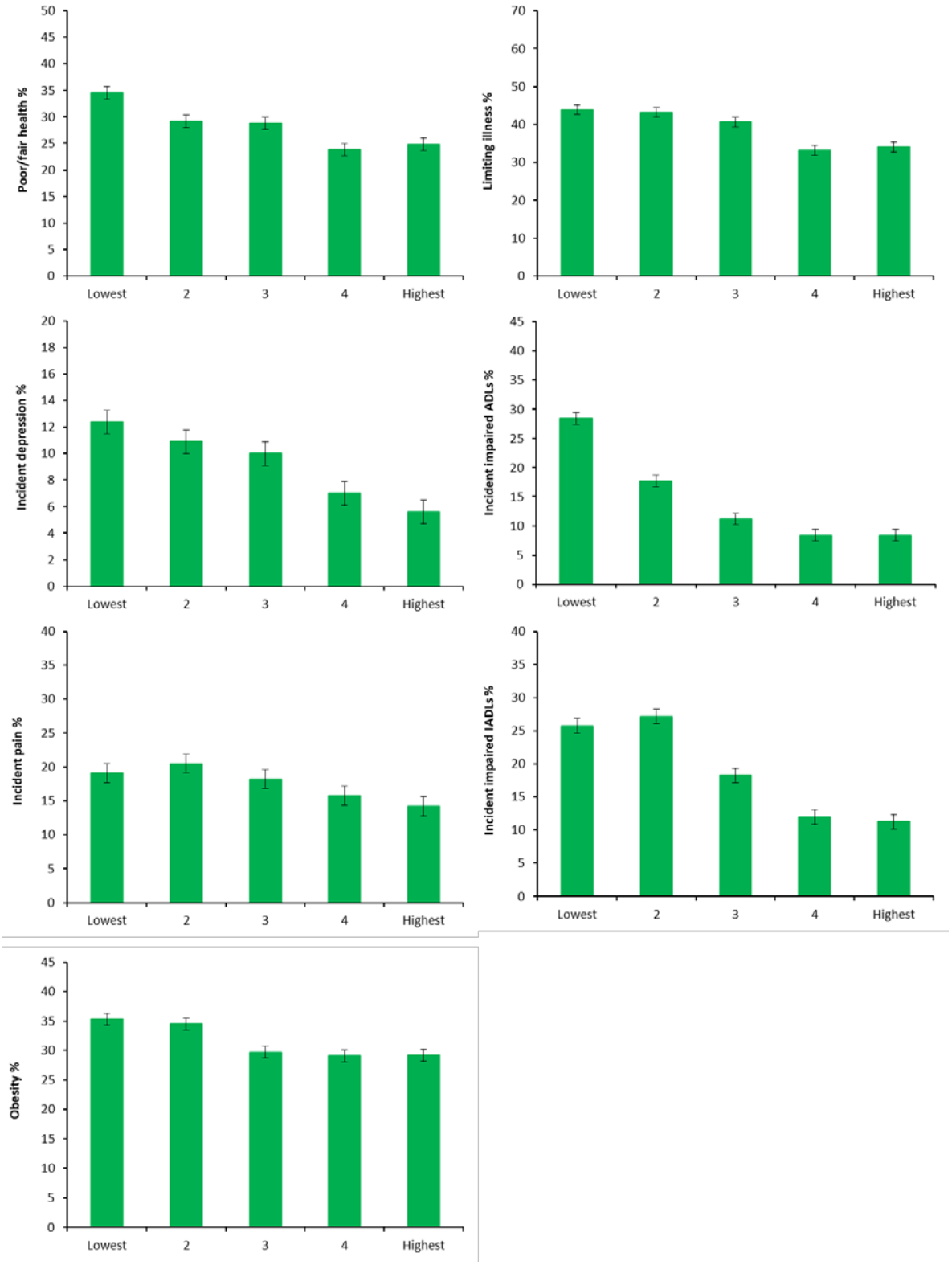


Figure S10 Health behavior in relation to worthwhile ratings

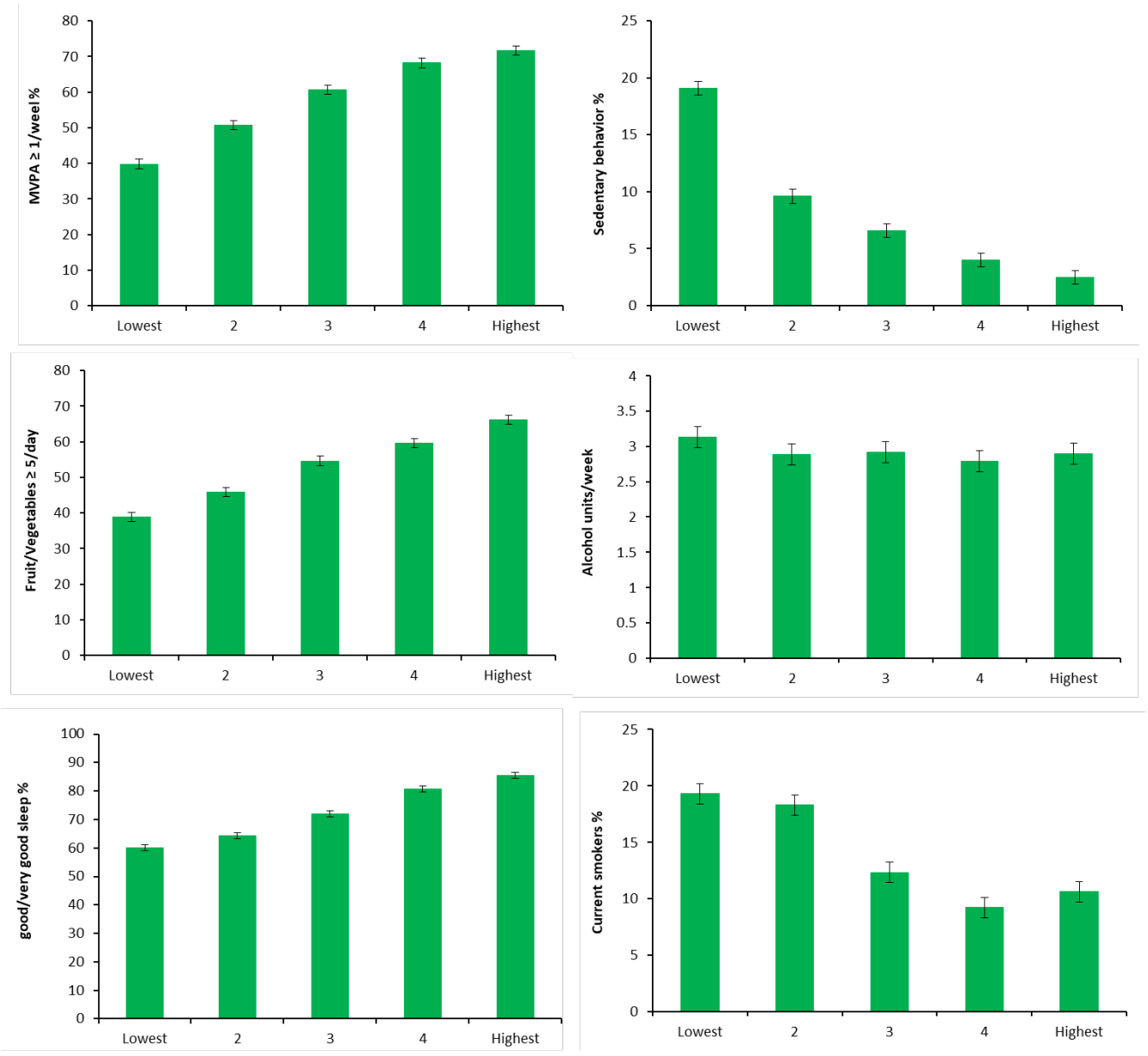


Figure S11 Health behavior at 4 year follow-up in relation to baseline worthwhile ratings

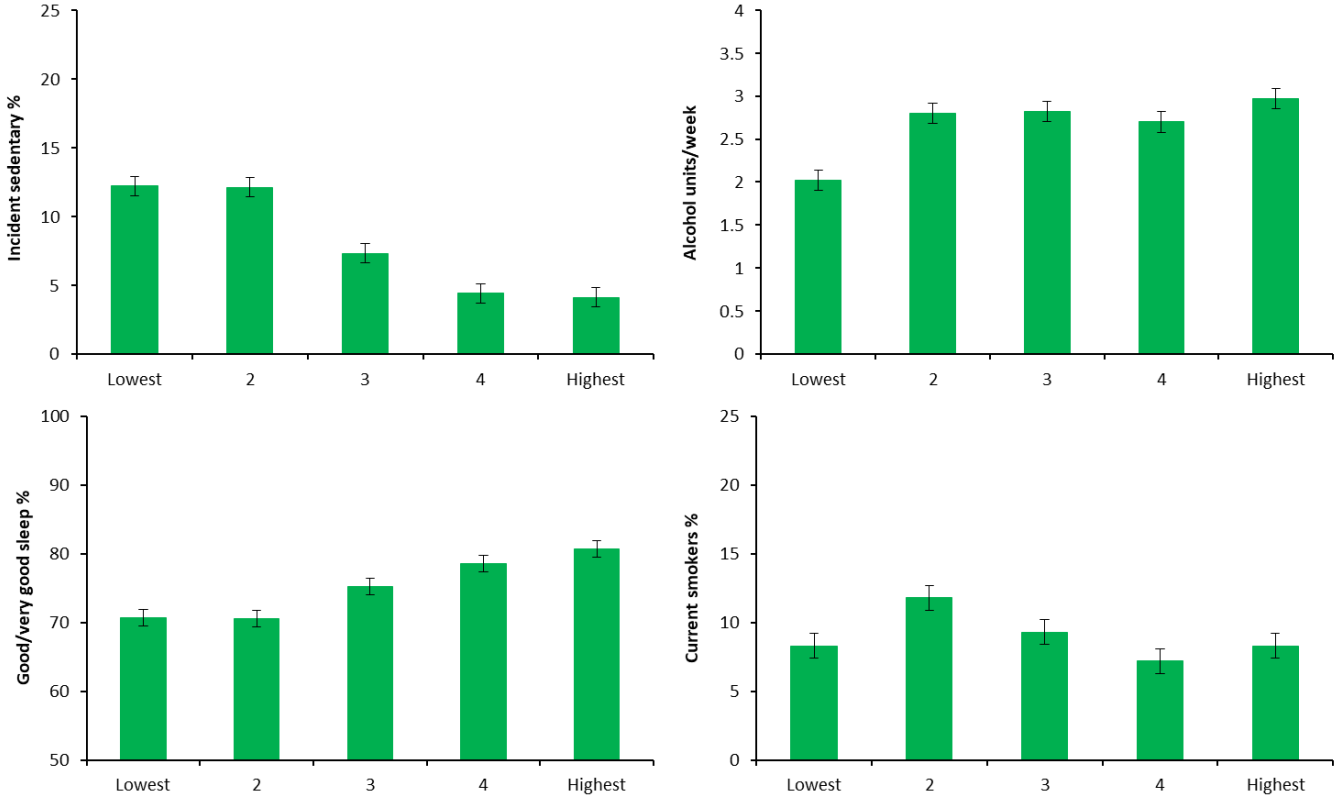


Figure S12 Time use in relation to worthwhile ratings

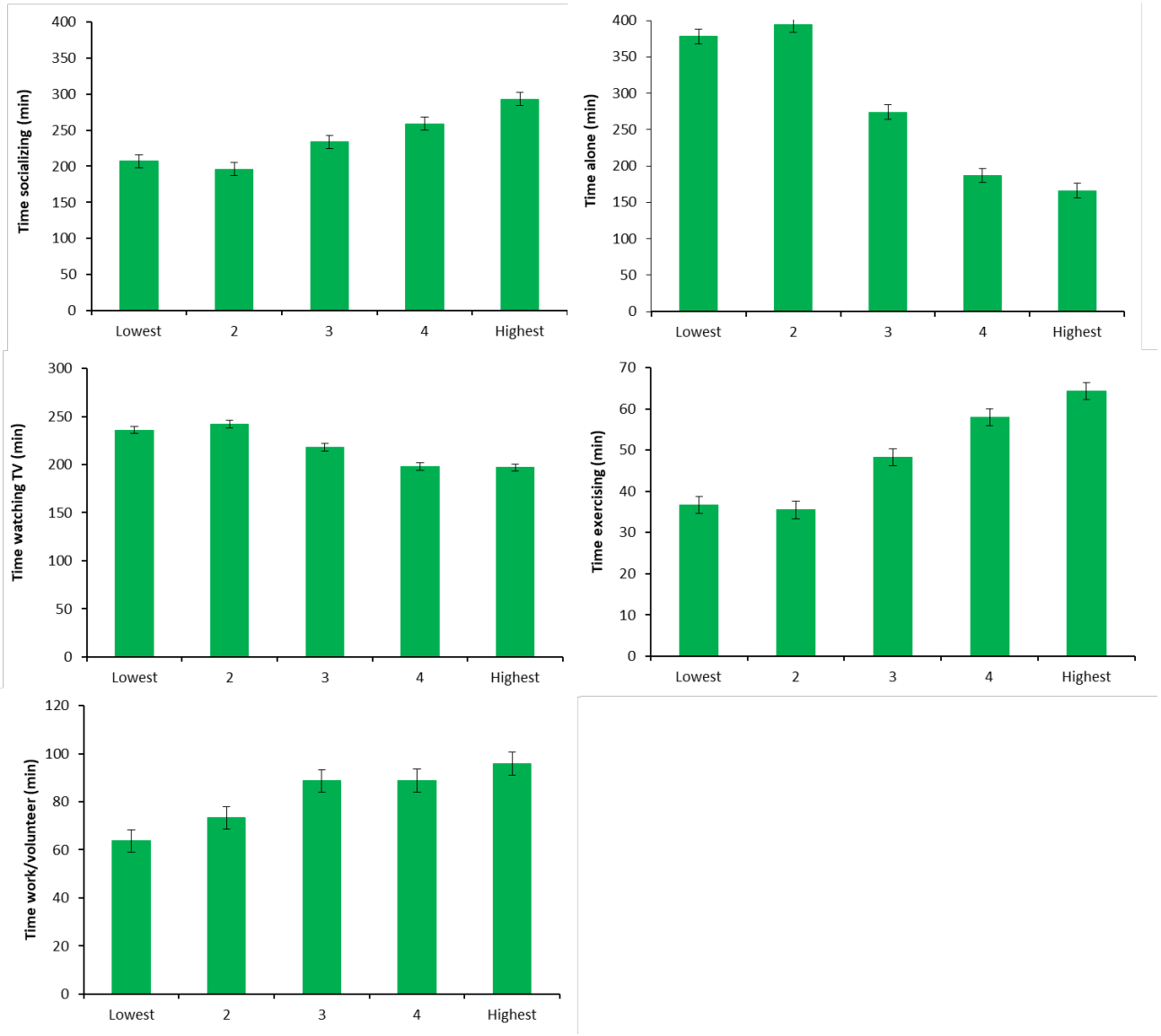


Figure S13 Time use at 2 year follow-up in relation to worthwhile ratings