Subjective Life Expectancy as a predictor of Mortality: evidence from the NIDI Work and Retirement Panel

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Abstract

Background: An extensive literature has demonstrated that self-ratings of health predict mortality, even after controlling for more objective measures of health, health habits and socio-demographic characteristics. We examine the role of a related concept: subjective life expectancy, in predicting mortality.

Objective: To assess whether subjective life expectancy predicts mortality after controlling for subjective and objective measures of health, job strain, and status characteristics.

Methods: Using data from the Netherlands Interdisciplinary Demographic Institute (NIDI) Work and Retirement Panel, logistic regression models were estimated to assess whether subjective life expectancy predicts mortality after adjusting for self-rated health and several potential confounders that might otherwise explain this relationship. The sample included 1.731 persons (1,792 men and 611 women) who were aged 50-64 at baseline. During the 10 years of follow-up 3.3% (n=73) of the men and 4.1% of the women (n=20) died.

Results: subjective life expectancy ($p<0.001$) predicted mortality, even when several subjective and objective health measures and other confounders were included in the model.

Conclusion: Our results suggest that, although subjective life expectancy and self-rated health may be conceptually related, they have independent empirical effect on mortality.

Introduction

An extensive literature has demonstrated that self-ratings of health predict mortality, even after controlling for more objective measures of health, health habits and socio-demographic characteristics. We examine the role of a related concept: subjective life expectancy, in predicting mortality.

There is a growing interest in subjective measures of health and survival. People have expectations about their remaining length of life, and these expectations appear to make sense (Siegel, Bradley, & Kasl, 2003). Subjective – or self-rated – life expectancy shows systematic variation across individuals in accordance with known risk factors, such as poor health conditions or diagnosed diseases and socio-economic circumstances (Banks, Emmerson, & Oldfield, 2004; Mirowsky & Ross, 2000). Moreover, there is evidence that individuals adapt subjective life expectancy in response to new information, such as health change and onset of diseases (Hurd & McGarry, 1995). Subjective life expectancy has been studied in relation to a broad range of human behaviour, such as saving and consumption (Salm, 2006) , health behaviour (Ziegelmann, Lippke, & Schwarzer, 2006), and retirement (Van Solinge & Henkens, 2010). Few studies relate this issue to actual mortality (Kotter-Grühn, Grühn, & Smith, 2010; Siegel et al., 2003; Van Doorn & Kasl, 1998). These studies suggest that measures of subjective life expectancy predict mortality, even after controlling for health. Most of the existing evidence, however, is based on older populations (aged 70-plus), and it has been suggested that subjective life expectancy is not predictive in younger populations (Jylhä, 2011).

This study examines the predictive value of subjective life expectancy on adult mortality in a relatively young population: viz. employees aged 50 years at over of 3 multinational companies and the civil service. We address the following research questions. (1) Does subjective life expectancy (SLE) predict mortality, and if so, (2) what is the predictive validity SLE on adult mortality compared to other alternative measures of health. (3) Is SLE an independent predictor of adult mortality? Does the effect of SLE remain when controlling for subjective and more objective measures of health? We benefited from three waves of a prospective study on retirement in the Netherlands. The sample included 2,403 persons (1,792 men and 611 women), 50-64 years old at baseline in 2001, with vital status tracked trough 2011.

Method

Participants and Procedure

The data have been taken from a prospective study on retirement behaviour in the Netherlands: the NIDI Work and Retirement Panel. Wave 1 (2001) collected data from two sources: civil servants and employees working for four large Dutch multinational companies active in information and communication technology (ICT), retail, trade, industry and banking. A questionnaire was sent to a random sample of employees aged 50 years and older in these organisations (n=3,900). The total number of individuals who completed the survey at Wave 1 was 2,403 (response rate: 62%). In 2006 (Wave 2) and 2011 (Wave 3) follow-up surveys were conducted, in which all surviving participants from

the previous wave were re-surveyed by mail questionnaire. In 2006 and again in 2011, we obtained information about mortality status and date of dead (if applicable) for all baseline participants. This information was made available by the HRM department of each of the participating companies. Our analyses cover 2,403 persons (1,792 men and 611 women) who participated in the baseline survey in 2001. During the 10 years of follow-up 4.1% (n=73) of the men and 3.3% of the women (n=20) died.

Sensitivity analysis revealed limited selective non-response. Neither age, nor mortality (which can be considered as a proxy for health status) predicted participation in Wave 1; there were no significant differences in non-response between the companies. Male older workers were somewhat more likely to participate in Wave 1.

Measures

Mortality—Deaths from all causes were identified during the 10-year follow-up. This information was made available by the HRM department of each of the participating companies. Surviving respondents were 60–74 years old at the follow-up. The range and descriptive statistics for all variables used in the analyses are presented in Table 1.

Table 1 about here

Subjective life expectancy. — This is the explanatory factor of interest in this study. To create this measure, we combined the responses from two survey questions. Participants were first asked [1] to express the likelihood that they would live to age 75 on a 5-point scale ranging from 1 (highly unlikely) to 5 (highly likely). Later in the questionnaire they were presented the statement [2] "I think that my chances of living to a very old age (90+) are considerable". The 5-point Likert-scaled responses ranged from 1 (totally agree) to 5 (totally disagree). On the basis of the responses to [1 - reverse coded] and [2] we constructed a single measure by summing the unweighted items. The scale, which ranges from 1 to 5, represents the older adult's subjective life expectancy. Higher values represent a shorter life horizon. (Cronbach's alpha = 0.72).

Self-Rated Health (Multiple Formulations).—The widely used measure of SRH was posed in the first questionnaire as follows (with coding in parentheses): In general, would you say your physical health is very good(1), good (2), fair (3), poor(4) or very poor (5)? The age comparison of SRH, was also asked in the first questionnaire: In general, compared to your age peers, would you say your health is better (1), about the same (2), worse (3)? To tap changes in SRH, respondents were next asked to indicate whether or not their health has changed in the previous 3 years? Answer categories ranged from much worse (1) to much better (5). Another measure is Self-rated health limitations. This measure is constructed on the basis of two questions. Respondents were asked whether or not they had chronic health problems, and if so to what extent they were impeded at work by these health problems. The answer categories on this latter question ranged from 1 (never) to 4 (always). On the basis of these responses we constructed a single measure, ranging from 0 (no limitations) to 4 (severe limitations).

Physical Health.—Studies of the relationship between subjective measures of health/survival and mortality need to account for morbidity; failure to do so would likely lead to overestimating the effect of the subjective measures on mortality. We used the self-administered inventory of health problems in the NWRP and isolated the influence of serious or life-threatening conditions as dummy variables: *hypertension/ heart problems*/*stroke*, *diabetes*, and *cancer*.

Job Strain.—To assure that the subjective evaluations of health and survival are not simply reflecting job-related psychological strain we adjust for job stress and exhaustion. *Job stress* is a 3-item scale (range 1–5; Cronbach's = 0.75) based on the responses to the following three statements: 'the workload is so great that it creates tension'; 'at times, there is so much work to be done that I am unable to do everything well'; 'I often have to push myself to the limits to be able to do my job well'. Unweighted, 5-point Likert-scaled responses ('totally agree', 'agree', 'neither agree nor disagree', 'disagree', 'completely disagree') were summed, and subsequently linearly transformed into a 1–5 range, where higher values represent greater pressure. *Emotional exhaustion* is one of the dimensions of the Utrecht Burn Out Scale (UBOS) (Schaufeli & van Dierendonck, 2000). Exhaustion was measured using 4 items 'I feel working a full day is really a strain for me', "I feel burnt out by my work', 'I feel used up at the end of the working day', and "I feel fatigued when I get up in de morning and have to face another day at the job'. Unweighted, 7-category responses ranging from 0 (never) to 6 (always) were recoded and summed, and subsequently linearly transformed into a 0-10 range, where higher values represent greater exhaustion.

Status Characteristics and Resources.— The analyses adjust for a number of demographic factors including *age* (coded in years). Binary variables for gender (*male*= 1), and partner status (having a *partner* = 1). *Education* was measured in seven categories ranging from 1 (primary school) to 7 (university graduate). *Wealth* was rated from 1 (< 500 euros) to 7 (> 500,000 euros).

Analytic Plan

In order to examine the validity of Subjective Life Expectancy (SLE) as a predictor of adult mortality, two analyses have been performed. In the first analysis we estimate the influence of SLE on mortality with logistic regression, while adjusting for age, gender and status characteristics. This first set of analyses compares the predictive validity SLE on adult mortality with other alternative subjective measures of health. That is: conventional SRH (5 response categories), age/peer comparison SRH (3 response categories) as well as time comparison SRH (5-point version), and self-rated health limitations (5 response categories). In order to be able to compare the size effects of the various alternative subjective measures of health and survival these predictors have been standardized. That is, they have been transformed into a z-score (mean = 0 and standard deviation = 1). In the tabular presentations of results, odds ratios (ORs) and confidence intervals are shown (Table 2).
In the second analysis, we estimate the independent effect of SLE as a predictor of adult mortality

Using a logistic regression model, we assess whether subjective life expectancy predicts mortality after adjusting for various subjective and objective measures of health and several potential confounders that might otherwise explain this relationship (Table 3).

Results

As shown in Table 1, about 4% of the analytic sample died during the follow-up period (*n* = 93). This is a slightly lower proportion than could be expected on the basis of national life tables for the period 2001-2011 in the Netherlands (CBS Statline, 2013). In this period, 10-year survival for men aged 50-64 was 5.1 for women and 6.6 for men (own calculations). The lower mortality in the analytical sample may be attributed to the so-called 'healthy worker effect'[1]. Mean SLE, our measure for subjective life expectancy, is 2.91, which can be considered as an average score on the 5-point scale. The mean for self-rated health (SRH) is slightly lower (1.94), indicating that the respondents on average rated their health as good.

The multivariate analysis began by comparing the predictive validity SLE on adult mortality with other alternative subjective measures of health. We compare SLE with other alternative subjective measures of health. That is: conventional SRH, age/peer comparison SRH, time comparison SRH, and self-rated health limitations. Models 1 to 5 of Table 2 display the OR for each of these measures. As described in the Table 2 note, all five models adjust for the full vector of independent variables described in Table 1 (but not shown). For each equation, we present both Akaike's Information Criterion (AIC) and Schwarz's Bayesian Information Criterion (BIC) for assessing model fit. Both adjust for the number of parameters estimated, but BIC also adjusts for *N* of cases. Models with low values on both criteria are generally favored (Kuha, 2004). When each measure is isolated, SLE manifests a strong relationship with mortality (OR = 1.566, $p < .0001$). Because the variable is standardized, it means that for each standard deviation increase, the probability of death decreases by a factor of 1.566. All other measures of self-rated health perform worse. All other measures of self-rated health perform worse than SLE. Surprisingly, self-rated health compared to age-peers turns out to be a better predictor than conventional SRH. On the basis of AIC and BIC values it can also be concluded that the first model (with SLE) is favored.

In the second analysis, we estimate the independent effect of SLE as a predictor of adult mortality
Using a logistic regression model, we assess whether subjective life expectancy predicts mortality after adjusting for various subjective and objective measures of health and several potential confounders that might otherwise explain this relationship. Table 3 reports the multiple regression analyses testing each set of factors separately and together in a final model. The first column of Table 3 reveals that that age, physical health (diagnosed cancer and heart disease), emotional exhaustion as well as subjective life

[1] HWE is a phenomenon initially observed in studies of occupational diseases: Workers usually exhibit lower overall death rates than the general population because the severely ill and chronically disabled are ordinarily excluded from employment.

expectancy are related to mortality in the expected direction. Surprisingly, none of the subjective health measures is significantly related to mortality. This may have to do with the fact that they are highly correlated (multicollinearity). Whenever SRH is added to the basic model (demographics only) without the other subjective measures, the coefficient is indeed significant (OR=1.438, $p<0.01$, R^2 =0.039). In the final model, we controlled for all categories of variables. The results reveal that many but not all factors that turned out to be predictors of mortality in the separate analyses, predict mortality in the full model as well. Somewhat surprisingly, none of the health variables is significantly related to mortality. However, SLE does predict mortality. SLE is associated with higher mortality. That is, persons who perceived a shorter life horizon were more likely to die than those who had more favorable ratings, independent of subjective and objective measures of health.

Conclusion

Subjective life expectancy ($p<0.01$) predicted mortality, even when several subjective and objective health measures were included in the model. Our results suggest that, although subjective life expectancy and self-rated health may be conceptually related, they have independent empirical effect on mortality. This suggests that subjective life expectancy measures add value to mortality predictions that use the conventional measures for objective and/or subjective health.

Tables

Table 1 Descriptive Statistics Means and *SD*'s of Variables in NWRP (*N*=2,403)

	Range	Mean	*SD*
Demographic variables			
Mortality (1=death)	0-1	0.04	
Age	50-65	54.2	2.82
Gender (1=male)	0-1	0.74	
Partner status (1=partner)	0-1	0.87	
Socio-economic status			
Education	1-7	4.14	1.76
Wealth	1-7	4.23	1.68
Subjective measures of health [a]			
Self-rated health (SRH) ¥	1-5	1.94	0.83
SRH: Age comparison ¥	1-3	1.81	0.59
SRH: time comparison ¥	1-5	3.30	0.64
SRH: health limitations ¥	0-5	0.95	1.43
Physical Health			
Cancer (1=yes)	0-1	0.01	
Hearth disease (1=yes)	0-1	0.06	
Diabetes (1=yes)	0-1	0.02	
Job strain [a]			
Job pressure ¥	1-5	2.85	0.90
Emotional Exhaustion ¥	0-10	2.59	1.84
Subjective Life Expectancy [a]			
SLE ¥	1-5	2.91	0.82

a All health variables have been recoded so that higher scores indicate poorer health , shorter horizon etc.

¥ These variables have been standardized in the multivariate analyses

Table 2 Binary Logistic Regression of Mortality on Subjective Life Expectancy and Alternative Subjective Health Ratings

	Model 1 Subjective Life Expectancy	**Model 2** Self-rated health (SRH)	**Model 3** Self-rated Health Age comparison	**Model 4** Self-rated Health changes in past three years	**Model 5** Self-rated Health limitations
Odds ratio	1.566***	1.431***	1.479***	1.344**	1.299**
(confidence interval)	(1.268-1.934)	(1.189-1.735)	(1.197-1.828)	(1.100-1.642)	(1.071-1.574)
AIC	699.23	759.95	753.75	764.42	764.88
BIC	739.26	800.41	794.17	804.87	805.30
Observations	2,251	2,392	2,382	2,389	2,379
R^2	0.0616	0.0513	0.0505	0.0454	0.0438

AIC= Akaike's Information Criterion; BIC=Baysian Information Criterion;
Each equation adjusted for age, gender, marital status and status characteristics (education and wealth) listed in Table 1.
* < 0.05; ** p < 0.01; *** p < 0.001

Table 3 Binary Logistic Regression of Mortality on Subjective Life Expectancy, controlling for five categories of predictors, where the final model contains all independent variables (N=2,251)

	Separate analyses for each set of factors		Final model	
	OR	95% CI	OR	95% CI
Demographic variables	*LR chi²(3)= 14.39***; R^2=0.019*			
Age	1.128**	1.052-1.210	1.150***	1.067-1.239
Gender (1=male)	1.351	0.785-2.325	1.533	0.867-2.709
Partner status (1=partner)	0.615	0.342-1.107	0.688	0.375-1.262
Socio-economic status	*LR chi²((2)= 13.15***; R^2=0.037*			
Education	0.811*	0.703-0.935	0.822**	0.711-0.951
Wealth	0.935	0.814-1.073	0.959	0.833-1.104
Subjective measures of health	*LR chi²((4)= 19.46***; R^2=0.046*			
Self-rated health (SRH) ¥	1.193	0.874-1.628	1.109	0.795-1.548
SRH: Age comparison ¥	1.293	0.928-1.654	1.151	0.856-1.547
SRH: time comparison ¥	1.039	0.801-1.349	1.042	0.795-1.365
SRH: health limitations ¥	1.098	0.832-1.449	1.019	0.762-1.358
Physical Health	*LR chi²((3)= 10.02*; R^2=0.033*			
Cancer (1=yes)	4.691*	1.013-21.716	2.247	0.488-12.516
Hearth disease (1=yes)	2.713**	1.419-5.185	1.653	0.797-3.431
Diabetes (1=yes)	0.960	0.223-4.11*	0.694	0.156-3.085
Job strain	*LR chi²((2)= 7.11*; R^2=0.029*			
Job pressure ¥	0.912	0.705-1.179	0.937	0.722-1.216
Emotional Exhaustion ¥	1.358**	1.082-1.706	1.018	0.766-1.352
Subjective Life Expectancy	*LR chi²((1)= 18.50***; R^2=0.045*			
SLE ¥	1.589***	1.286-1.962	1.313*	1.031-1.672
			*LR chi²((15)= 54.40***; R^2=0.071*	

* < 0.05; ** p < 0.01; *** p < 0.001

¥ standardized variable

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