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A mental model of factors associated with subjective life expectancy

Barbara Griffin [a,*], Vanessa Loh [a], Beryl Hesketh [b]

[a] Macquarie University, Sydney, Australia
[b] The University of Western Sydney, Sydney, Australia

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ABSTRACT

The objective was to develop and test a framework based on a biopsychosocial model that can be used to identify factors associated with subjective (self-estimated) life expectancy (SLE). SLE predicts important work and retirement decisions so a better understanding of the factors that contribute to an individual's thoughts about their likely age at death is essential for late-career and financial planning and for developing interventions aimed at addressing inappropriate estimates. This is a sub-study of the Australian 45 and Up Study cohort. Survey data were collected at two time points (3 years apart) from 2579 participants aged over 55 years. Correlations and regression analyses tested the relationship of SLE with biomedical/genetic factors (age, health diagnoses, parental longevity), socioeconomic factors (income, education) health behaviors (exercise, smoking, alcohol use, diet), and psychosocial factors (optimism, distress, social connectedness). Variables within each set of factors except the socioeconomic set were significantly related to SLE. Healthy lifestyle behaviors significantly moderated the effect of parental longevity. The findings indicate that individuals construct an understanding of their personal life expectancy based on similar factors that predict actual life expectancy, but not all mortality risk factors appear to be weighted realistically. The findings imply that, at least to some extent, SLE is not a stable construct and might be amenable to intervention.

Introduction

Time is a fundamental dimension of human experience, providing the structure that guides short- and long-term goals and evaluations (Carstensen, 2006; Freund, Nikitin, & Ritter, 2009). In particular, the way people perceive the future appears to be of importance to their current emotions, behavior, and plans (Zimbardo & Boyd, 1999). The future becomes even more salient to those in the late-midlife period, which heralds the onset of significant change such as retirement, increased health problems, and the unmistakable physical markers of aging (Cate & John, 2007). Indeed, at this stage of life *time remaining* starts to become more important than *time since birth* (Carstensen, 2006).

Subjective (or self-estimated) life expectancy (SLE) is a measure that quantifies the perceived extent of one's remaining years, providing a personalized timeframe that can act as a guide for apportioning work, leisure, and finances (Hesketh, Griffin, & Loh, 2011). Early research on SLE demonstrated that people do have an opinion as to their own likely life expectancy (e.g., Denes-Raj & Ehrlichman, 1991; Hamermesh, 1985; Robbins, 1988), with more recent evidence (e.g., Griffin, Hesketh, & Loh, 2012; van Solinge & Henkens, 2010) suggesting that SLE actually influences behavioral intentions and decision-making. The focus of this later research has been mainly on those aged over 50 who are in the late-career stage of their working life or even transitioning to retirement. SLE appears to impact important decisions in this period. For example, it predicts intended retirement age (van Solinge & Henkens, 2010) and the amount of retirement planning a late-career worker engages in (Griffin et al., 2012). Griffin et al. (2012) also demonstrated that 12 months after nominating their SLE, workers with high SLE were less likely to have actually retired and high SLE participants already retired were more likely to have returned to some form of paid work.

These late-career decisions have important consequences for individuals' financial circumstances and for their physical health and psychological well-being in retirement (Wang & Shultz, 2010). Given the importance of SLE in late-career decisions, the aim of the current study is to identify the factors that determine how long a person expects to live.

* Corresponding author. Department of Psychology, Macquarie University, NSW 2109, Sydney, Australia. Tel.: +61 2 98509012; fax: +61 2 98508062.
E-mail address: Barbara.griffin@mq.edu.au (B. Griffin).

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Correlates of subjective life expectancy

Hesketh et al. (2011) suggest that individuals develop a mental model or internal representation of their likely age of death based on their understanding and interpretation of their personal experiences and context. However, there is scant empirical work on the factors that might contribute to an individual's mental model of their own longevity. Nevertheless, Hurd and McGarry (1995) suggest that because subjective estimates have been shown to be reasonably accurate (Kotter-Gruhn, Gruhn, & Smith, 2010; Siegel, Bradley, & Kasl, 2003) and correlate well with actuarial estimates (Hamermesh, 1985), it is possible that similar factors are associated with each.

One reason for the similarity is that people could develop an understanding of the factors that affect their life expectancy through media, public health campaigns, and observation. For example, reflecting actual statistics (Hurd & McGarry, 1995) it is generally believed that, on average, females live longer than males and that smoking can hasten death. One's personal mental model of life expectancy is also likely to be shaped by family context, in particular parental longevity. In contrast, there are some factors that affect actual life expectancy that are unlikely to be widely recognized or understood, such as optimism and social support. As discussed in more detail below, these factors may influence SLE via different mechanisms.

The current research therefore draws on a version (AIHW, 2010) of the biopsychosocial model (Strecher, Champion, & Rosenstock, 1997) of factors that predict actual health and longevity to develop a framework for identifying the determinants of SLE. The proposed framework includes four categories of predictors: 1) Biomedical and genetic factors; 2) Socioeconomic factors; 3) Health behaviors; and 4) Psychosocial factors.

Biomedical and genetic factors

Obviously genetic and existing biomedical conditions are important predictors of actual longevity (Sarafino, 2004), and there is some evidence that individuals incorporate these when forming a mental model of *life expectancy*. Four factors are examined in the current research, namely gender, age, parental longevity, and personal health history.

Females live longer, on average, than males, and this fact is apparently incorporated into 'mental models' of SLE, with females estimating longer life expectancies than males (Mirowsky, 1997; van Solinge & Henkens, 2010). As discussed, mean SLE mirrors actuarial projections of life expectancy for particular age groups. It is possible that individuals use their own age to map onto these actuarial estimates, but then adjust this taking health, family history and psychological factors into account. Although younger generations can be expected to live longer than older generations, in a more age-restricted sample actuarial estimates show that having survived earlier years, the older a person the more likely they will be to live to an older age (AIHW, 2012; Mirowsky, 1997).

Parental longevity is included as a broad indicator of personal genetic history, supported by population statistics showing that longevity increases with the longevity of one's parents (Feinstein, 1993). Several studies have found that one's parents' age at death has a significant influence on subjective life expectancy (Denes-Raj & Ehrlichman, 1991; Hurd & McGarry, 1995; Robbins, 1988; van Solinge & Henkens, 2010). In contrast, the findings related to the experience of significant health problems are inconclusive in terms of SLE, despite the association between such conditions and increased mortality (AIHW, 2012). For example, Hurd and McGarry (1995) found that the incidence or prevalence of diseases significantly reduced longevity expectations, whereas Ross and Mirowsky's (2002) study showed no effect.

Socioeconomic factors

Actuarial estimates of life expectancy are calculated using socioeconomic information such as current income and education, based on their relationship to mortality risk (Feinstein, 1993). Wardle and Steptoe (2003) suggest that this risk arises from the differences in healthy lifestyles that occur across socioeconomic levels.

The current study uses income and education as two indicators of socioeconomic status (SES). There is some empirical evidence that those with higher incomes and education not only live longer but also they expect to live longer (Hurd & McGarry, 1995; Mirowsky & Ross, 2000; Ross & Mirowsky, 2008). Mirowsky and Ross (2000) hypothesized that this expectation arises either because people of lower SES have more current health problems and disability or because they sense a greater projected risk of developing future life-threatening illnesses. They may also have lower confidence in successfully managing their future health needs. Ross and Mirowsky (2002) found that education but not income influenced SLE, although neither was significant in data from Holland (van Solinge & Henkens, 2010).

Health behaviors

People tend to live longer if they engage in activities that maintain health or improve recovery, such as physical activity, maintaining appropriate weight, eating 'healthy' food, not smoking, and abstaining from excessive alcohol intake (Sarafino, 2004). Extensive public health campaigns and media coverage have advertised the benefits of such health behaviors and we therefore expect that people take into account their practice of health behaviors when developing their mental model of SLE. Indeed, Ross and Mirowsky (2002) found that smoking, alcohol consumption, and poor nutrition reduced SLE after controlling for demographic factors. However, even though obese individuals appear to internalize information about the problem of excess weight, they still underestimate the risk to their mortality (Falba & Busch, 2005).

Psychosocial factors

Little attention has been given to the effect of psychosocial constructs on SLE. This study addresses the gap by examining the role of individual differences in trait, state, and psychological environment, choosing three factors that have been most frequently associated with actual longevity. The first is dispositional optimism, which is a generalized expectancy that good things will happen in the future and bad things will not (Scheier & Carver, 1985). Berg, Smith, Henry, and Pearce (2007) summarized the large body of research showing that optimism is associated with good immune functioning, low blood pressure, and reduced mortality in the face of conditions such as breast cancer and cardiovascular disease. Optimism is thought to affect longevity because those with high levels employ more effective coping strategies (Barefoot et al., 2011), experience better social support (Brissette, Scheier, & Carver, 2002), and participate in more effective health care (Strack, Carver, & Blaney, 1987). Although it is possible that optimists have a sense of these benefits, it is more likely that their positive view of the future drives the expected relationship between optimism and SLE.

Clinical depression and subclinical distress and anxiety predict decline in physical functioning and mortality (Gruenewald & Kemeny, 2007), partly because negative physiological responses such as heightened stress reactions and autonomic dysregulation increase the risk of cardiac events and mortality (Barefoot et al., 2011). Two studies (Joubert, 1992; Lester & Abdel-Khalek, 2007)

have examined the association between SLE and stress or anxiety, finding, at least for young American students, a negative relationship. We suggest that a person's SLE will be influenced by their psychological state because current distress is likely to create negative perceptions and thoughts about the future. This is a particularly important issue as it would indicate that SLE might be, to some extent, an unstable construct able to be manipulated in counseling interventions. Given the significant financial problems associated with bad decision-making during retirement transition, inappropriately low SLE would pose a further risk for those in a state of heightened stress as they may underestimate the number of years for which they will need retirement funding.

Social interaction and support is an indicator of one's psychosocial environment. Drawing from the large body of literature attesting to the benefits of social connectedness and the positive feelings it generates (e.g., Fiori, Antonucci, & Cortina, 2006; Holt-Lunstad, Smith, & Layton, 2010), social connectedness is thought to influence actual longevity by offering a buffer against the negative physical and psychological effects of stressful events (Gruenewald & Kemeny, 2007; Menec, 2003). Ross and Mirowsky (2002) also found a positive association between SLE and social support, arguing that it creates a sense of security and protection. We therefore suggest that those who have good current and future prospects of social connection with friends and family will have longer SLE.

Interactions between factors

As discussed, the proposed framework of factors associated with SLE draws on the predictors of health and mortality identified by the biopsychosocial paradigm. Complex interactions occur between each of these determinants, and although individuals are unlikely to understand many of these sufficiently well to be incorporated formally into their mental model of subjective life expectancy, we propose that an interaction between biomedical/genetic factors and health behavior factors will have an impact. This proposed interaction is based on the health belief model (Strecher et al., 1997), which argues that a person will undertake preventive health behavior to the extent that they feel vulnerable to a serious health threat and believe that the health behavior will reduce this risk. The health belief model would suggest that participants in our sample who are engaging in high levels of health behaviors are likely to believe that they are attenuating their biomedical/genetic vulnerability to early mortality and thus give a higher SLE than those with similar biomedical/genetic background but who are not practising many health behaviors. In other words, there will be a weaker relationship between SLE and biomedical/genetic factors among those who are engaging in high levels of positive health behaviors.

Control variable and hypotheses

Self-rated health is commonly used as an indicator of general health status, which has been linked to major health outcomes including mortality (DeSalvo, Fan, McDonell, & Fihn, 2005; Sargent-Cox, Anstey, & Luszcz, 2010). It might also be seen as a proxy measure of SLE. Prior research suggests that self-rated health is positively related to SLE (van Solinge & Henkens, 2010). Self-rated health is therefore included as a control variable when testing all the hypotheses summarized below:

Hypothesis 1. Biomedical/genetic factors will be related to SLE. Specifically, those with higher SLE will be older, female, have longer living parents, and will not have been diagnosed with many health conditions.

Hypothesis 2. Socioeconomic factors will be related to SLE. Specifically, higher SLE will be associated with high income and high levels of education.

Hypothesis 3. Health behaviors will be related to SLE. Specifically, those who do not smoke, have a lower BMI, drink less alcohol, do more exercise, and eat more fruit and vegetables will have a higher SLE.

Hypothesis 4. Psychosocial factors will be related to SLE. Specifically, higher SLE will be associated with higher optimism, lower distress, and more social connectedness.

Hypothesis 5. Health behaviors will moderate the effect of biomedical/genetic factors on SLE, whereby their relationship will be weaker among those who engage in high levels of healthy lifestyle behavior.

Methods

Participants

Participants were a subgroup of those in the Australian population-based "45 and Up Study" (http://www.45andup.org.au/index.html), which began in 2006. As the largest cohort study in the Southern Hemisphere, it tracks the health of residents of New South Wales, Australia, aged 45 years and over (Banks et al., 2008). The initial baseline 45 and Up survey (Time 1) collected data on a wide range of health and demographic indicators using paper surveys sent by mail. Since then, a number of sub-studies has collected additional information from subgroups of the original sample. Our sub-study is focused on retirement transition. Given that the average retirement age in Australia for recent retirees was 60.2 years (ABS, 2009), we deliberately targeted those aged 55 and over at the time of the baseline study who were also engaged in paid work at that time. Data for the first wave of this sub-study (Time 2) were collected via on-line surveys during 2010, approximately three years after Time 1.

The response rate (of those enrolled in the main study who were invited by email to participate in our sub-study) was 39.1%. After removing those with missing data on the SLE question ($n = 131$), there were 2579 participants. Their average age was 62.06 years (SD = 2.48; range = 57–67), 48% were females, and 80.6% were married (or living with a partner). The majority (96%) spoke English at home. Participants had quite high levels of education, with 49% having a university degree. By Time 2, 13% had retired fully from paid work.

Ethical approval for the 45 and Up Study as a whole was provided by the University of New South Wales Human Research Ethics Committee. Ethical approval for this specific study was provided by the University of Western Sydney and Macquarie University.

Measures

Variables from the baseline 45 and Up Survey have been used extensively in published research, with detailed information provided at the website listed above.

Subjective life expectancy

At Time 2 a single item, as used by Ross and Mirowsky (2002) and Griffin et al. (2012), asked "To what age do you think you will live?" Responses were given as age in years. We argue that this is as valid as asking a participant's chronological age using the standard one-item measure. Different from probability measures (percentage chance of living to a certain age) typically used by economists (e.g., Hurd & McGarry, 2002), it is more straightforward and easily answered (Griffin et al., 2012).

Biomedical/genetic variables

Variables within this category of predictors that were assessed at Time 1 (baseline) included gender (1 = male, 0 = female), age, and health conditions. The latter was computed by summing the number of 13 conditions (e.g., high blood pressure, heart disease, diabetes) that participants had ever been diagnosed with. Parental longevity, assessed at Time 2 with two items from van Solinge and Henkens (2010), asked for participants' same-sex and other sex parent's current age or age at death.

Socioeconomic variables

Highest educational qualification (from 1 = no school certificate or other qualification to 6 = university degree or higher) and household income were obtained at Time 1 (baseline). Household income referred to income in Australian dollars before tax from all sources including benefits, pensions, and superannuation, with responses ranging from 1 (Less than $5000 per year) to 8 (More than $70,000 per year).

Health behavior variables

Variables from the Time 1 database were: 1) body mass index (BMI), the most commonly used indicator of obesity, calculated from self-reported weight and height using the standard BMI formula (weight in kg/height in m^2); 2) history of smoking, using two dummy coded variables identifying those who had never smoked, ex-smokers, and current smokers, with the reference category being current smokers; 3) alcohol consumption, being the number of drinks per day; 4) exercise, using the Active Australia Survey from the Australian Institute of Health and Welfare (AIHW, 2003) calculated as per Banks, Jorm, Rogers, Clements, and Bauman (2011) with a weighted weekly average number of sessions by adding the number of sessions of moderate activity or walking for at least 10 min to twice the number of sessions of vigorous activity, and recoded 1 (up to three), 2 (four–nine), 3 (10–17), 4 (18 or more sessions per week); and 5) diet, measured by the total number of servings of fruit and vegetables per day (as used by Schneider, Huy, Schuessler, Diehl, & Schwarz, 2009).

We also calculated a health behavior or healthy lifestyle index as a summary indicator (Frech, 2012) to use when testing the moderation hypothesis (to reduce the number of analyses required). The continuous variables (BMI, alcohol, exercise, and diet) were standardized before creating their mean. Smoking was not included in the summary index because it is a categorical variable, because there were only 110 current smokers, and because of prior evidence (Rogers & Powell-Griner, 1991) that mortality differences between those who have never smoked and those who have given up smoking are small. Note that the individual variables are used to test the Hypotheses 1–4, and the healthy lifestyle index is only used to test Hypothesis 5.

Psychosocial variables

Optimism was measured at Time 2 by six items from the Life Orientation Test (LOT; Scheier & Carver, 1985), a well-validated research measure of dispositional optimism containing items such as "Am always optimistic about my future" and "If something can go wrong for me, it will" (reverse-coded). Coefficient alpha was .81.

Psychological distress was assessed at Time 2 with the Kessler Psychological Distress Scale (K10; Kessler et al., 2002), a 10-item scale that has been employed extensively in clinical, health, and epidemiological research as a measure of non-specific depression and anxiety (Andrews & Slade, 2001). Participants used a 5-point scale ranging from 1 (None of the time) to 5 (All of the time) to indicate how often they felt conditions such as "tired out for no good reason", "nervous", and "depressed" over the past four weeks. Coefficient alpha was .87.

Social connectedness was assessed at Time 2 with three items from Hesketh and Griffin (2010), with a coefficient alpha of .74. Using a 5-point scale from 1 (Not at all) to 5 (Extremely well/Very large extent), participants indicated how well they were "keeping up sufficient contact with friends and family", and the extent to which they expected to have the "opportunity to spend time with family" and "good friends" in retirement.

Subjective health was assessed at Time 2 with a single item from DeSalvo et al. (2005) asking "In your current situation, to what extent do you actually have good health?" with response options from 1 (Not at all) to 5 (Very large amount).

Analytical approach

The four proposed categories of SLE predictors were assessed using correlations of individual variables with SLE and multiple regression analyses in which each category was entered in a separate analysis after controlling for self-rated health. A final model was tested, which consisted of SLE regressed on all variables at the same time while controlling for self-rated health. This model was also examined separately for males and females.

A separate moderated regression analysis was conducted to assess Hypothesis 5, that health behavior would change the relationship of biomedical/genetic factors with SLE. All the biomedical/genetic, socioeconomic, and psychosocial variables were entered as controls, but only the healthy lifestyle index and smoking were used as a representative of the health behavior category.

Finally, at a Reviewer's suggestion, we examined the characteristics of those who appeared to have under-rated or over-rated their life expectancy. Each participant's SLE was subtracted from their actuarial life expectancy based on the Australian Bureau of Statistics (ABS, 2012) 2009–2011 life tables that provides a life expectancy for each chronological age and gender. This difference variable was recoded to create three groups, one whose SLE was within 5 years of their actuarial estimate, one whose SLE was 5 years or more than their actuarial estimate (over-estimated SLE), and one whose SLE was 5 years or less than the actuarial estimate (under-estimated SLE). A multinomial logistic regression was used to identify factors that distinguished between the groups.

Results

Subjective life expectancy

A paired *t*-test showed no significant difference between mean SLE (85.06 years) and the mean actuarial estimate (85.05) using the 2009–2011 Australian life tables (ABS, 2012) for males and females ($t = .98$, $p > .05$). Although females had a higher mean SLE than males ($t = 4.13$, $p < .001$), males nominated a higher mean SLE (84.49) than their actuarial mean of 83.42 ($t = 5.22$, $p < .001$), whilst females reported a lower mean SLE (85.67) than their actuarial mean of 86.54 years of age ($t = 4.43$, $p < .001$).

Test of the four sets of variables in the proposed model

The descriptive statistics and inter-correlations are provided in Table 1, and Table 2 reports the multiple regression analyses testing each set of factors separately and together in a final model, with all analyses controlling for self-rated health.

Biomedical/genetic factors

All five variables in this category (age, gender, same and other sex parent age, and health conditions) were significant in the hypothesized direction. However, the final model (controlling for all other variables) showed differences between males and females –

Table 1
Means, standard deviations and correlations of study variables.

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. SLE	85.06	7.29																	
2. SR health	4.07	.74	.34*																
3. Gender			−.08*	−.05															
4. Age	62.08	2.48	.04	−.04	.09*														
5. SS parent	77.57	12.75	.18*	.06*	−.19*	−.01													
6. OS parent	77.63	12.91	.06*	.03	.21*	−.16*	−.02												
7. Health conditions	1.26	.95	−.14*	−.22*	.13*	.13*	−.08*	−.01											
8. Income	6.97	1.49	.03	.11*	.17*	−.16*	.02	.06*	−.02										
9. Education	4.90	1.44	.05*	.04	.02	.00	.06*	−.01	−.02	.24*									
10. BMI	26.76	4.46	−.12*	−.25*	.05*	−.01	−.09*	−.02	.18*	−.01	−.08*								
11.Never smoked			.07*	.08*	−.08*	−.03	.05	.02	−.01	.05	.08*	−.04							
12. Past smoker			−.02	−.04	.06*	.03	−.03	−.02	.01	−.03	−.05	.05	−.92*						
13. Alcohol	1.20	1.34	−.08*	−.01	.24*	.03	−.05	.02	.03	.10*	.02	.01	−.24*	.20*					
14. Exercise	2.70	.94	.07*	.17*	−.01	.01	.03	−.02	−.04	−.01	.08*	−.19*	−.01	.03	.08*				
15. Diet	5.95	3.08	.08*	.07*	−.21*	−.01	.05	−.05*	−.01	−.04	.01	−.01	.02	−.01	−.06*	.14*			
16. Optimism	3.93	.65	.28*	.27*	−.07*	.05*	.02	−.02	−.07*	.07*	.10*	−.06*	.04	−.01	.04	.08*	.06*		
17. Distress	1.36	.43	−.22*	−.25*	−.04	−.10*	.00	.03	.07*	−.07*	−.06*	.07*	−.07*	.06*	−.02	−.04	−.01	−.39*	
18 Social connectedness	3.96	.75	.24*	.28*	−.12*	−.01	.07*	−.03	−.02	.05	−.02	.00	.06*	−.04	−.00	.04	.12*	.34*	−.30*

Note. $^{*}p < .05$. SR health = self-rated health; SS parent = same-sex parent; OS parent = other sex parent; BMI = Body Mass Index.

all variables except health conditions remained significant in explaining males' SLE but only the same-sex parent age was significant for females' SLE.

Socioeconomic factors

Despite a small significant positive association between education and SLE, neither education nor income explained variance in SLE when controlling for the other categories of variables.

Health behaviors

As reported in Table 1, all variables showed significant, albeit small, associations with SLE in the expected direction. However, after controlling for self-rated health and the other variables, the health behaviors were not significant predictors for females, and only alcohol and smoking remained significant predictors for males.

Psychosocial factors

The three variables related to SLE in the expected direction. However, while optimism remained significant for both males and females when all other variables were accounted for, psychological distress was only significantly associated with females' SLE and social support was only related to males' SLE.

Interaction between biomedical/genetic factors and health behaviors. Interaction terms were computed by multiplying the standardized healthy lifestyle index with each of the standardized versions of the five biomedical/genetic variables (age, gender, same and other sex parent longevity, and health conditions). Each interaction effect was tested separately in a series of five moderated regression analyses to test Hypothesis 5. Only the interaction between same-sex parent longevity and lifestyle was significant ($\beta = -.06$; $F = 45.23$, $p < .001$) and it remained so when all other variables were entered

Table 2
Multiple regression analyses of subjective life expectancy on four categories of predictors, where the final model contains all independent variables controlling for self-rated health.

	Separate analyses for each set of factors			Final model			Final model: Males			Final model: Females		
	B	SE *B*	*β*	*B*	SE *B*	*β*	*B*	SE *B*	*β*	*B*	SE *B*	*β*
Control − Self-rated health				2.20**	.24	.22	2.03**	.34	.20	2.26**	.35	.24
Biomedical and genetic factors	($F = 64.74^{**}$; $R^2 = .15$)											
Gender	−.82**	.31	−.06	−.21	.36	−.01	–	–	–	–	–	–
Age	.18**	.06	.06	.16*	.07	.06	.22*	.09	.07	.07	.10	.03
Same-sex parent age	.08**	.01	.14	.09**	.01	.15	.10**	.02	.17	.07**	.02	.12
Other sex parent age	.04**	.01	.07	.04**	.01	.06	.06**	.02	.10	.01	.02	.03
Health conditions	−.40*	.16	−.05	−.32	.17	−.04	−.43	.22	−.06	−.21	.27	−.03
Socioeconomic factors	($F = 106.88^{**}$; $R^2 = .11$)											
Income	−.09	.10	−.02	−.02	.11	−.01	.11	.18	.02	−.09	.14	−.02
Education	.24*	.10	.05	.03	.12	.01	−.02	.17	.00	.11	.16	.02
Health behaviors	($F = 44.42^{**}$; $R^2 = .13$)											
Body mass index	−.04	.04	−.03	−.05	.04	−.03	−.08	.06	−.04	−.05	.05	−.04
Smoker vs. Never smoked	3.68**	.84	.25	2.84**	.88	.19	3.03**	1.09	.22	.92	1.56	.07
Smoker vs. Past smoker	3.32**	.85	.22	2.73**	.89	.18	3.63**	1.09	.23	.33	1.57	.02
Alcohol	−.29*	.12	−.05	−.30*	.12	−.06	−.29*	.14	−.06	−.38	.26	−.05
Exercise	.19	.17	.02	.12	.17	.02	.39	.23	.05	−.22	.26	−.03
Diet	.15**	.05	.06	.04	.05	.05	.07	.02	.02	.03	.08	.01
Psychosocial factors	($F = 123.02^{**}$; $R^2 = .16$)											
Optimism	1.75**	.24	.16	1.82**	.28	.16	2.09**	.38	.18	1.42**	.40	.13
Psychological distress	−1.01**	.35	−.06	−.62	.41	−.04	−.17	.57	−.01	−1.34*	.60	−.09
Social connectedness	1.00**	.20	.10	.91**	.23	.09	1.16**	.32	.11	.58	.34	.06
F; R^2				$F = 27.42^{**}$; $R^2 = .20$			$F = 19.06^{**}$; $R^2 = .23$			$F = 10.24^{**}$; $R^2 = .16$		

Note. $^{**}p < .01$; $^{*}p < .05$. All analyses controlled for self-rated health (coefficients not added as slightly different for separate analyses of each set of factors).

into the analysis ($\beta = -.07$). However, when tested separately for males and females, the interaction term was only significant for males ($\beta = -.07$; $F = 26.52$; $p < .001$). As illustrated in Fig. 1, the results supported the hypothesis that healthier behaviors would reduce the relationship between a biomedical/genetic factor and SLE. The graph indicates that healthy behavior seemed particularly important in increasing SLE for those whose same-sex parent had died at an early age.

Factors explaining the gap between SLE and actuarial estimates. Despite the lack of significant overall mean difference between SLE and actuarial life estimates reported above, 22.1% of participants gave an SLE five or more years younger than their actuarial estimate and 23.1% over-estimated by five years or more. Table 3 reports the results of a multinomial regression analysis, where those with an SLE within 5 years of their actuarial life expectancy formed the reference group. Being female increased the odds of being in the under-estimated group by 63%. Other significant factors included current self-rated health, same and other sex parent's age at death, health conditions, smoking, and all the psychological variables. In comparison to the reference group, and controlling for self-rated health, those who thought they would live at least five years longer than their actuarial estimate were more likely to be male, drink less alcohol, have a longer living same-sex parent, and be more optimistic.

Table 3
Multinomial logistic regression, using the group whose SLE was within 5 years of their actuarial estimate as the reference category.

	SLE ≤ 5yrs LE				SLE ≥ 5yrs LE			
	B	Exp*B*	95% CI		*B*	Exp*B*	95% CI	
Self-rated health	−.52	.59**	.491	.718	.48	1.62**	1.326	1.975
Gender	−1.00	.37**	.273	.494	1.29	3.64**	2.716	4.873
Age	−.03	.97	.923	1.025	−.01	1.00	.882	1.057
Same-sex parent age	−.02	.98**	.969	.988	.02	1.02**	1.008	1.029
Other sex parent age	−.01	.99**	.978	.997	.00	1.00	.994	1.014
Health conditions	.15	1.16*	1.013	1.325	−.04	.96	.845	1.099
Income	−.01	.99	.912	1.081	−.04	.97	.882	1.057
Education	−.03	.97	.887	1.060	−.05	.95	.869	1.042
Body mass index	.00	1.00	.973	1.028	−.02	.98	.953	1.014
Smoker vs. Never smoked	−.80	.45**	.244	.828	−.01	.99	.458	2.127
Smoker vs. Past smoker	−.47	.63	.339	1.155	.32	1.38	.639	2.965
Alcohol	.04	1.04	.944	1.149	−.13	.88**	.796	.967
Exercise	.02	1.02	.887	1.169	.07	1.08	.941	1.228
Diet	.00	1.00	.957	1.041	.03	1.03	.993	1.072
Optimism	−.23	.79*	.642	.979	.52	1.68**	1.339	2.079
Psychological distress	.34	1.41*	1.036	1.913	.25	1.29	.918	1.811
Social connectedness	−.34	.71**	.594	.847	.14	1.15	.952	1.385

Note. *$p < .05$; **$p < .01$. Nagelkerke $R^2 = .258$. Exp*B* refers to change in odds ratio with one unit change in the predictor.

Discussion

The early hypothesis that subjective life expectancy (SLE) may have important implications for economic behavior (Hamermesh, 1985) has been empirically supported in recent research (Griffin et al., 2012; van Solinge & Henkens, 2010) showing that SLE predicts retirement financial planning, intended retirement age, actual retirement, and return to paid work from retirement. These results suggest that SLE would be a useful construct for those who help guide the decisions of older workers. However, its effective use requires a better understanding of the factors that contribute to a person's mental model of their life expectancy. Such knowledge may help temper unrealistically high or low SLEs.

The current study therefore proposed and tested a framework for identifying the factors associated with SLE based on a biopsychosocial health model (AIHW, 2010; Strecher et al., 1997). The analysis of data from over 2500 older workers found that three of the four categories of variables (biogenetic, health behaviors, and psychosocial factors) were significantly related to SLE, suggesting that individuals take into account their own unique history when formulating an idea or possible mental model of their remaining time. However, the role of these variables differed for males and females.

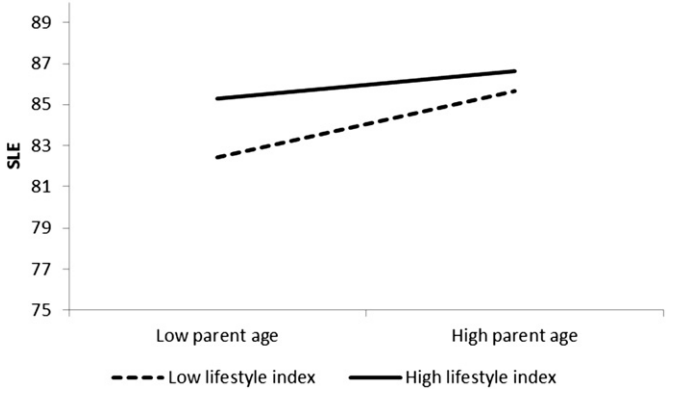

Fig. 1. Interaction of same-sex parent age with lifestyle index for males (at values of one SD above and below the mean).

Biogenetic factors were related to subjective life expectancy in the same way that they relate to actual life expectancy. Consistent with prior research (e.g., van Solinge & Henkens, 2010), parental longevity remained significantly associated with SLE in the presence of all other variables. Females' mothers appeared to provide the strongest guide, while males' view of their life trajectory was influenced by both parents. This was also one of few studies to incorporate actual health conditions as well as self-ratings of health, showing a significant effect in discriminating those with low SLE compared to their actuarial estimate. However, the measure of health conditions was collected up to three years prior to the subjective life expectancy measure, so additional diagnoses may have occurred during this interval that were better captured by current self-rated health.

It was of some concern that females had significantly higher odds of being in the group who under-estimated their SLE by five or more years (in comparison to actuarial estimates) even after controlling for health and all other factors. This could leave females vulnerable to under-funding their retirement (Griffin et al., 2012) and suggests their SLE might be challenged during financial and career planning sessions.

The significant findings related to the range of health behaviors suggest that individuals have some awareness of the negative association promoted in the public media between mortality and smoking and high alcohol intake by showing the tendency to use this information when estimating their own life expectancies. However, exercise, diet and obesity had less impact on SLE, despite the increasing evidence of their effect on actual life expectancy (Whitlock et al., 2009; Woodcock, Franco, Orsini, & Roberts, 2011). These results suggest the need for awareness campaigns about these factors to be directed at older workers (Falba & Busch, 2005).

SLE has been conceived as a mental model of remaining lifetime (Hesketh et al., 2011). Mental models are internal representations of situations that are constructed by individuals based on their unique life experiences, perceptions, and understandings of the world (Langan-Fox, Anglim, & Wilson, 2004). Although still speculative, if

individuals do form an internal representation of their life expectancy, two qualities of mental models have relevance: First, people can develop inaccurate or distorted mental models by inappropriate weighting of different environmental cues. The results of the current study indicate that exercise, diet, alcohol, and obesity may not be sufficiently accounted for, especially by women. Furthermore, a pessimistic view of the world appeared to have a strong effect in potentially distorting SLE. Even after controlling for more objective facts (such as parental longevity, health and age), those with low optimism were significantly more likely to be among those whose SLE was at least five years lower than actuarial estimates.

The second characteristic of mental models is that they can vary over time as they are refined through learning, training, and experience (Langan-Fox et al., 2004). The important finding from the moderation analysis in this study (showing that healthy lifestyle reduced the effect of same-sex parent longevity on SLE) illustrates how males in particular feel that they can reduce their biogenetic risk and manipulate their life expectancy. Therefore, interventions that enhance long-term thinking about health and increase engagement in positive health-related behaviors may actually be useful for those individuals whose quality of life can be extended by such changes (Ziegelmann, Lippke, & Schwarzer, 2006). Undertaking healthy behaviors might give individuals a sense of control or mastery over their life course. However, there is also evidence to suggest that those with a sense of control are more likely to engage in health behavior in the first place (Skaff, 2007) and two studies (Scott-Sheldon, Carey, Vanable, & Senn, 2010; Ziegelmann et al., 2006) found that SLE preceded health behavior. The reciprocal relationship between SLE, health behavior, and control or mastery is an important area for future research, as is a more fine-grained examination of how these factors are integrated in a mental model.

The strong effect of the psychosocial factors is further evidence to indicate that SLE is not a completely stable construct. Those who were particularly distressed or who feel they lacked social support had greater odds of being in the group who under-estimated their life expectancy. This carries the risk of premature retirement, insufficient planning, and unwise investment choices (Griffin et al., 2012), and points to the need for future research to develop appropriate interventions able to be used in late-career planning.

Limitations and future research

A potential limitation to the generalizability of this research is our use of an Australian sample, predominantly from Anglo or Western cultural backgrounds with relatively high education. There is some evidence (Lester & Abdel-Khalek, 2007) suggesting that the correlates of SLE differ between Middle Eastern and American students, so the impact of culture on the development of SLE mental models is an avenue for further investigation. Given the restrictions on survey length, some of our measures were single item (e.g., alcohol and self-rated health), so future research may take a more in-depth investigation of these factors using larger scales. Common method bias may have been a risk, although the health behaviors and some of the biomedical/genetic and socio-economic data were collected three years prior to the SLE information, and while self-report, many of these variables asked about objective data. However, assessing the health behaviors earlier than SLE may also be a limitation as people may have increased or decreased their engagement in such behavior, by Time 2 thus limiting the effect of Time 1 health behavior on SLE.

Conclusion

The strengths of this research include its theoretical basis, large longitudinal sample, and a comprehensive set of variables that builds on and extends prior research. Participants' SLE was associated with a set of variables that are known to contribute to actuarial estimates of life expectancy, but was also influenced by more subjective, psychological variables pointing to the potential value of financial planners and career counselors accounting for such variables.

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