Int.J. Behav. Med. (2013) 20:140–147
DOI 10.1007/s12529-011-9218-x

Sense of Control and Self-Reported Health in a Population-Based Sample of Older Americans: Assessment of Potential Confounding by Affect, Personality, and Social Support

Michael M. Ward

Published online: 27 January 2012

Abstract
Background Sense of control has been linked to improved health outcomes, but it is unclear if this association is independent of other psychosocial factors.
Purpose The aim of this study is to test the strength of association between sense of control and self-reported health after adjustment for positive and negative affect, "Big 5" personality factors, and social support.
Method Data on sense of control (measured by personal mastery, perceived constraints, and a health-specific rating of control), affect, personality, social support, and two measures of self-reported health (global rating of fair or poor health and presence of functional limitations) were obtained on 6,891 participants in the Health and Retirement Study, a population-based survey of older Americans. The cross-sectional association between sense of control measures and each measure of self-reported health was tested in hierarchical logistic regression models, before and after adjustment for affect, personality, and social support.
Results Participants with higher personal mastery were less likely to report fair/poor health (odds ratio 0.76 per 1-point increase) while those with higher perceived constraints were more likely to report fair/poor health (odds ratio 1.37 per 1-point increase). Associations remained after adjustment for affect, but adjustment for affect attenuated the association of personal mastery by 37% and of perceived constraints by 67%. Further adjustment for personality and social support did not alter the strength of association. Findings were similar for the health-specific rating of control, and for associations with functional limitations.
Conclusion Sense of control is associated with self-reported health in older Americans, but this association is partly confounded by affect.

Keywords Sense of control · Affect · Personality · Social support · Self-reported health

M. M. Ward (✉)
Intramural Research Program, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Building 10 CRC, Room 4-1339, 10 Center Drive, Bethesda, MD 20892, USA
e-mail: wardm1@mail.nih.gov

Introduction

Sense of control is the psychological construct related to one's perception of the degree to which events in life are determinable by one's own actions [1]. Persons with a strong sense of control more likely believe that their own actions are responsible for their experiences and expect that they can influence the likelihood of events in their life. They are less prone to believe that events are dictated by fate or chance, or are primarily determined by others. Many measures of this construct exist, including personal mastery, perceived control, helplessness, and locus of control [1]. Although these measures differ in their theoretical foundations, all share a focus on measuring perceptions of personal competence.

Extensive research over the past 50 years has demonstrated that sense of control has important associations with health. A strong sense of personal control or a more internal locus of control has been associated with better self-rated health, better physical and mental functioning, and lower rates of cardiovascular disease and diabetes [2–9]. Studies have also reported sense of control to be a significant predictor of mortality [10–13]. Psychosocial interventions can modify sense of control, suggesting this may be a means by which health can be improved [14].

Sense of control varies with other psychosocial factors. Studies have consistently demonstrated strong inverse associations between sense of control and measures of depression and anxiety [2, 7, 9, 15–18]. Dispositional characteristics such as neuroticism have also been associated with lower sense of control [17, 19, 20]. Married persons tend to have a stronger sense of perceived control than unmarried persons, as do those with better emotional support from family and friends [7–9, 18]. Because affect, personality, and social support are also associated with health outcomes, it is unclear if sense of control is associated with health independent of these other psychosocial factors.

Few studies of the association between sense of control and health have controlled for the influences of affect, personality, and social support [13, 20]. Given that psychological characteristics, particularly depression, affect how one perceives personal competence, it might be expected that sense of control is influenced by other psychological features. In this study, I examined the association between sense of control, affect, personality, and social support and self-reported health in a nationally representative sample of older adults, and tested whether sense of control was associated with self-reported health after adjustment for these psychosocial factors.

Methods

Source of Data and Subject Inclusion Data for this cross-sectional analysis were from the 2006 wave of the Health and Retirement Study (HRS) [21]. Begun in 1992, the HRS is an ongoing panel study of the economic and health characteristics of Americans as they transition through retirement. Participants were selected using a multistage clustered stratified sampling strategy to provide a nationally representative sample of noninstitutionalized persons age 50 and older living in households. African–Americans, Hispanics, and residents of Florida were over-sampled to permit subanalyses of these groups. Data on social, economic, and health factors are collected biennially by in-person interview. The HRS is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and conducted by the University of Michigan. For analysis, I used the RAND HRS data file, which includes standardized variable names across waves and imputations of selected economic variables [22]. In 2006, 18,469 subjects were interviewed.

Questions on sense of control, positive and negative affect, personality, and social support were included in the 2006 Participant Lifestyle Questionnaire. This self-administered questionnaire was distributed to a subsample of participants who were selected for an extended in-person interview (which included physical performance tests and collection of biomarkers), with instruction to mail the completed questionnaire back to study personnel; the response rate was 82% [23]. Of 6,928 respondents to the Participant Lifestyle Questionnaire, I excluded 37 participants who did not complete any of the three measures of sense of control, and had a sample of 6,891 participants.

Measures of Health Two measures of health were used as outcomes in this analysis: self-rated global health and the presence of functional limitation in activities of daily living. Self-rated global health was reported as excellent, very good, good, fair or poor. For analysis, the rating was dichotomized to fair or poor (versus excellent, very good, or good). Ratings of fair/poor health emphasizes perceptions of current disease burden rather than health risk factors, and was therefore the preferred measure [24]. Functional limitations were scored as present if the participant reported any difficulty in dressing, eating, bathing, toileting, walking, or transferring from bed, or if they reported being unable to do or that they did not do any one of these tasks.

Psychosocial Measures Three measures of sense of control were included. Measures of personal mastery and perceived constraints were based on the Midlife Developmental Inventory [7, 25]. Scores for each measure were the mean of responses to five Likert-scaled statements (1=strongly disagree; 6=strongly agree), with higher scores indicating either greater perceptions of mastery or constraints in controlling events. The personal mastery measure included statements such as "I can do just about anything I really set my mind to." The perceived constraint measure included statements such as "What happens in my life is often beyond my control." Cronbach's alpha for the personal mastery scale was 0.89 and for the perceived constraints scale was 0.86. Both scales measure general perceptions of sense of control, but are not specific to health. The third measure of sense of control included in the Participant Lifestyle Questionnaire was a health-specific measure in the form of an 11-point numerical rating scale, on which participants marked the level of control they perceived they had over their health currently (0=no control at all; 10=very much control).

Measures of positive affect and negative affect were based on ratings of how often over the preceding 30 days participants felt each of six emotions [26]. Positive affect included questions on feeling cheerful, in good spirits, extremely happy, calm and peaceful, satisfied, and full of life (alpha=0.92). Negative affect included questions on feeling depressed, hopeless, nervous, restless, and that everything was an effort (alpha=0.88). Higher scores indicated more positive or more negative affect. Measurement of the "Big 5" personality factors [neuroticism, conscientiousness, agreeableness, extraversion, and openness to experience]

was based on the Midlife Developmental Inventory Personality scale, a 26-item checklist of personality traits that participants were asked to rate as characteristic of themselves or not [27]. Higher scores indicate stronger endorsement of each characteristic. Alpha ranged from 0.67 for the conscientiousness scale to 0.79 for the openness to experience scale. The quality of positive social support was measured using three questions on how much people around you understood your feelings, could be relied upon to help with serious problems, and could be confided in [23]. This set of questions was repeated with reference to spouses (alpha 0.81), children (alpha 0.83), other family (alpha 0.86), and friends (alpha 0.84). A summary score was computed as the mean of scores of non-missing domains (e.g., spouse, family, and friends if the participant had no children); lower scores indicated more support. Data were missing for 0.6% of participants for positive affect, 0.7% for negative affect, 0.4% for positive social support, and 0.8–1.5% for the "Big 5" personality measures. Participants with missing data were included in the analyses as a subpopulation.

Statistical Analysis All analyses accounted for the complex sampling strategy used in the HRS. Analyses were also weighted to adjust the standard errors for selection and non-response to the Participant Lifestyle Questionnaire. I used four sets of logistic regression models to examine the association between measures of sense of control and self-reported health. The dependent variable for the first set of models was self-rated global health of fair or poor (versus excellent, very good, or good). The independent variables of interest in the first set of models were personal mastery and perceived control, both used as continuous variables. In the second set of models, the independent variable of interest was the health-specific measure of control based on the numerical rating scale. This measure was represented using indicator variables (for scores of 0–4, 5–6, 7–8, and 9–10) because its association with the health measure was non-linear in preliminary analyses. The dependent variable for the third and fourth sets of models was the presence of functional limitation in any activity of daily living (versus no limitations). The independent variables of interest in the third set of models were personal mastery and perceived constraints, and in the fourth set was the health-specific measure of control.

To examine inter-relationships among the psychosocial measures, hierarchical models were built that in the first step included the sense of control measures, in the second step additionally included measures of positive and negative affect, and in the third step additionally included the "Big 5" personality measures and positive social support. Confounding was assessed by the change in the strength of association of the sense of control measures after adjustment, which was estimated by comparing odds ratios (OR) of sequential models using the formula: $[(OR_{baseline} - OR_{adjusted})/(OR_{baseline} - 1)] \times 100\%$.

All models were adjusted for age, gender, education level, log of household income, race (white, black, or other), Hispanic ethnicity, and whether the participant was married/partnered. In preliminary analyses, different functional forms of age, education level, and income variables were tested to determine those that most improved the model fit, based on Akaike's information criterion. Inclusion of household income as a squared term improved the fit of all models; inclusion of an age-squared term further improved the fit of models predicting functional limitations. Models were estimated using survey logistic procedures in SAS version 9.2 (SAS Institute, Inc, Cary, NC).

Results

Participant Characteristics The mean (±standard error) age of participants was 65.5±0.2 years; 54.2% were women; 87.1% were white, 8.7% were black, and 4.1% were "other" race; 6.6% were of Hispanic ethnicity. Sixty-eight percent were married. The mean education level was 12.9±.07 years, and the median household income was $44,443 (25th percentile $22,517; 75th percentile $84,397). Self-rated global health was reported as fair or poor by 25.1%, and functional limitation was reported by 15.3%.

Associations with Measures of Sense of Control Participants generally had high levels of personal mastery and low levels of perceived constraints (Table 1). Mean levels control over health by the rating scale were also high (7.2±.03). The three measures of sense of control were only moderately highly inter-correlated. Greater sense of personal mastery and control over health were associated with lower ratings of negative affect and higher ratings of positive affect, while the inverse associations were present for perceived constraints. There were weaker correlations between measures of sense of control and the "Big 5" personality factors and positive social support. Higher levels of personal mastery were associated with higher levels of positive social support, while higher levels of perceived constraints were associated with lower levels of positive social support.

Higher levels of personal mastery and control of health were inversely associated with self-ratings of fair/poor health and functional limitations, while higher levels of perceived constraints were positively correlated with both health measures (Table 1). Positive affect and negative affect were as strongly correlated with fair/poor health and functional limitations as the sense of control measures, while personality measures and positive social support were less strongly associated.

Table 1 Correlations among sense of control measures, other psychosocial measures, and self-reported health

	Mean (SE)	Personal mastery	Perceived constraints	Health-specific rating of control	Fair/poor health	Functional limitations
Personal mastery (1–6)	4.8 (0.015)	1.0	–0.43	0.39	−0.23	−0.21
Perceived constraints (1–6)	2.2 (.019)	–	1.0	−0.40	0.29	0.25
Health-specific rating of control (0–10)	7.2 (0.03)	–	–	1.0	−0.40	−0.29
Negative affect (1–5)	1.6 (0.01)	−0.38	0.54	−0.36	0.34	0.27
Positive affect (1–5)	3.5 (0.01)	0.39	−0.46	0.36	−0.25	−0.17
Neuroticism (1–4)	2.1 (0.01)	−0.25	0.33	−0.23	0.17	0.11
Extraversion (1–4)	3.1 (0.008)	0.28	−0.27	0.22	−0.15	−0.10
Openness to experiences (1–4)	2.9 (0.009)	0.28	−0.28	0.21	−0.15	−0.10
Conscientiousness (1–4)	3.3 (0.008)	0.26	−0.28	0.21	−0.19	−0.12
Agreeableness (1–4)	3.5 (0.008)	0.18	−0.16	0.12	−0.07	−0.01
Positive social support (1–4)	1.8 (0.007)	−0.18	0.29	−0.15	0.12	0.10

Values in parentheses after each measure are possible ranges. Higher scores for each measure indicate greater endorsement, except for positive social support, where lower scores indicate more support. All $p<0.0001$, except for the correlation of agreeableness and functional limitations ($p=0.86$)

Multivariate Associations with Self-reported Global Health - Adjusting for demographic characteristics, participants with higher levels of personal mastery were less likely to report fair/poor health, while those with higher levels of perceived constraints were more likely to report fair/poor health (Table 2). With the addition of measures of affect to the model, both measures of affect were strongly associated with the likelihood of fair/poor health. Those with higher scores on positive affect were less likely, and those with higher scores on negative affect were more likely, to report fair/poor health. Adjustment for positive and negative affect attenuated the association of personal mastery and self-rated health by 37%, and attenuated that of perceived control by 67%. With the addition of personality measures and social support to the model, participants with greater extraversion and conscientiousness were less likely to report fair/poor health, while those with more openness to experiences and agreeableness were more likely to report fair/poor health. Positive social support was not associated with fair/poor health after accounting for other demographic and psychosocial factors. Adjustment for personality measures and positive social support did not alter the strength of association between the sense of control measures and fair/poor health.

Results of analyses using the health-specific sense of control measure were very similar. Participants with low scores for control over health on the rating scale were much more likely than those with high scores to report fair/poor health (Table 2). Both measures of affect were strongly associated with fair/poor health, and adjustment for affect decreased the strength of association between sense of control and fair/poor health by 28–37%. More extraversion and greater conscientiousness were associated with lower likelihoods of reporting fair/poor health, while greater openness to experiences and agreeableness were associated with increased likelihoods of reporting fair/poor health. Adjustment for personality measures and social support resulted in little change in the strength of association between control over health and fair/poor health.

Multivariate Associations with Functional Limitations Results for associations with functional limitations were similar to those for fair/poor health (Table 3). Measures of sense of control were significantly associated with the likelihood of functional limitations. However, adjustment for measures of affect attenuated the association of personal mastery by 26% and perceived constraint by 57%, and attenuated the association of control over health on the rating scale by 27–38%. Higher levels of negative affect (but not positive affect), openness to experiences, and agreeableness were associated with a greater likelihood of functional limitations, while greater extraversion and conscientiousness were associated with a lower likelihood of functional limitations. Social support was not associated functional limitations after adjustment for demographic and other psychosocial measures.

Discussion

In this large population-based study of older adults, sense of control was significantly associated with self-reported health, independent of demographic characteristics, and measures of affect, personality, and social support. Similar associations were found for general and health-specific measures of sense of control, and for associations with two health outcomes. Persons with higher levels of personal mastery or lower perceived constraints were less likely to report fair or poor health, and less likely to report functional limitations, than those with lower levels of mastery or

Table 2 Associations of sense of control measures, affect, personality, and social support with the likelihood of fair/poor health, by multivariate logistic regression

Set	Variables	Model 1	Model 2	Model 3
1	Personal mastery	0.76 (0.72–0.82)	0.85 (0.79–0.92)	0.85 (0.79–0.92)
	Perceived constraints	1.37 (1.27–1.49)	1.12 (1.03–1.22)	1.11 (1.02–1.22)
	Negative affect		1.70 (1.45–1.99)	1.64 (1.37–1.96)
	Positive affect		0.71 (0.60–0.83)	0.75 (0.62–0.90)
	Neuroticism			0.97 (0.78–1.21)
	Extraversion			0.72 (0.59–0.88)
	Openness to experiences			1.32 (1.09–1.60)
	Conscientiousness			0.66 (0.54–0.82)
	Agreeableness			1.40 (1.17–1.67)
	Positive social support			1.08 (0.93–1.27)
2	Health-specific rating of control 0–4	13.03 (10.07–16.85)	8.60 (6.56–11.28)	9.28 (7.06–12.20)
	Health-specific rating of control 5–6	4.96 (4.09–6.02)	3.81 (3.08–4.72)	3.89 (3.15–4.80)
	Health-specific rating of control 7–8	1.99 (1.65–2.40)	1.71 (1.41–2.08)	1.76 (1.45–2.13)
	Health-specific rating of control 9–10	1.00	1.00	1.00
	Negative affect		1.67 (1.43–1.94)	1.58 (1.31–1.90)
	Positive affect		0.76 (0.66–0.90)	0.80 (0.68–0.96)
	Neuroticism			0.99 (0.80–1.24)
	Extraversion			0.73 (0.60–0.89)
	Openness to experiences			1.41 (1.15–1.72)
	Conscientiousness			0.68 (0.55–0.84)
	Agreeableness			1.32 (1.11–1.59)
	Positive social support			1.07 (0.92–1.25)

Values are odds ratios (95% confidence intervals)

All models also included age, gender, race, Hispanic ethnicity, education level, marital status, log (household income), and log (square of household income)

higher perceived constraints. Affect and the personality characteristics of extraversion, conscientiousness, openness to experiences, and agreeableness were also independently associated with self-reported health.

Sense of control has previously been identified as an important correlate and predictor of health outcomes, including mortality. Despite well-documented associations between sense of control and other psychosocial factors, particularly depression and anxiety, few studies tested if the associations between sense of control and health were independent of measures of affect and other psychosocial factors. Mackenbach and colleagues examined the association of locus of control, neuroticism, and social support with self-rated health, but did not include measures of affect [13]. Willis and colleagues found personality factors, anxiety, and social interaction to be related to the accumulation of health conditions over time, but locus of control was not [20]. In contradistinction, studies in occupational epidemiology of the relationship between decisional control at work, work demands, and cardiovascular disease have situated mental health and physiological markers of stress as mediators between low decisional control and cardiovascular disease [28, 29].

Associations between sense of control and self-reported health in this study were confounded to some extent by measures of positive and negative affect. Adjustment for affect attenuated these associations by more than 25%, and by up to 67% for associations of perceived constraints. Measures of personality and positive social support did not confound associations of the sense of control measures, after accounting for positive and negative affect. The finding that affect can confound the association between sense of control and health may not be surprising when the interrelationships of these constructs are considered. Sense of mastery reflects a belief in personal competence; this belief can be undermined by negative affect. Repeated experiences of failure or frustration because of inadequate control beliefs can promote anxiety, hopelessness, and depression. To the extent that mastery helps a person achieve his or her goals, this sense of accomplishment and power may offer protection from negative affect and promote happiness. Sense of control and affect are thus mutually reinforcing. The finding that confounding by measures of affect was greater for perceived constraints than personal mastery suggests that negative affect may have a stronger impact on sense of control than positive affect. Previous studies that did not adjust for measures of affect may have overestimated associations with sense of control.

Of the "Big 5" personality factors, extraversion and conscientiousness were associated with better self-reported

Table 3 Associations of sense of control measures, affect, personality, and social support with the likelihood of functional limitations, by multivariate logistic regression

Set	Variables	Model 1	Model 2	Model 3
1	Personal mastery	0.77 (0.72–0.83)	0.83 (0.77–0.91)	0.83 (0.76–0.91)
	Perceived constraints	1.35 (1.23–1.48)	1.15 (1.03–1.29)	1.15 (1.04–1.29)
	Negative affect		1.68 (1.45–1.96)	1.68 (1.44–1.96)
	Positive affect		0.92 (0.79–1.08)	0.94 (0.81–1.09)
	Neuroticism			0.95 (0.81–1.12)
	Extraversion			0.66 (0.51–0.86)
	Openness to experiences			1.40 (1.14–1.73)
	Conscientiousness			0.76 (0.61–0.94)
	Agreeableness			1.70 (1.27–2.27)
	Positive social support			1.04 (0.87–1.25)
2	Health-specific rating of control 0–4	5.95 (4.68–7.57)	4.06 (3.08–5.34)	4.11 (3.11–5.44)
	Health-specific rating of control 5–6	3.13 (2.60–3.77)	2.55 (2.07–3.15)	2.57 (2.09–3.18)
	Health-specific rating of control 7–8	1.38 (1.13–1.67)	1.24 (1.02–1.50)	1.25 (1.04–1.51)
	Health-specific rating of control 9–10	1.00	1.00	1.00
	Negative affect		1.75 (1.52–2.01)	1.73 (1.49–2.00)
	Positive affect		0.94 (0.80–1.10)	0.96 (0.82–1.12)
	Neuroticism			0.97 (0.83–1.14)
	Extraversion			0.67 (0.51–0.87)
	Openness to experiences			1.41 (1.15–1.73)
	Conscientiousness			0.78 (0.63–0.97)
	Agreeableness			1.61 (1.20–2.14)
	Positive social support			1.06 (0.88–1.27)

Values are odds ratios (95% confidence intervals)

All models also included age, square of age, gender, race, Hispanic ethnicity, education level, marital status, log (household income), and log (square of household income)

health, and agreeableness and openness to experiences were associated with poorer self-reported health. Similar findings for extraversion and conscientiousness have been reported previously [20, 30, 31]. The association of agreeableness with self-reported health has been inconsistent, with prior studies reporting no association, positive associations, and negative associations with poor health [32–34]. Divergent results have been reported in studies of the same sample, suggesting an important role for the analytic approach, including the choice of covariates and stratifying variables [33, 34]. Openness to experiences has been associated with increased functional limitations, but has not previously been associated with poor self-rated global health [32]. Our results should be considered in the context of the sample. Studies of the elderly are necessarily studies of individuals who have survived to old age. To the degree that personality factors are associated with mortality, the personality composition of elderly samples will differ from those of younger samples [35–37]; these selection factors may contribute to differences between studies of older and younger samples. Age may also modify the association between personality factors and health outcomes, resulting in differences in both the strength and direction of association in older individuals [32], Although much previous research has linked neuroticism and health, the lack of association between neuroticism and self-reported health in this study is likely due to adjustment for negative affect [31, 38].

The strengths of this study include the large population-based sample, examination of three measures of sense of control, testing of several psychosocial measures as potential confounders, and replication using two measures of self-reported health. However, the study also has limitations. The psychosocial factors were chosen based on evidence associating them with either measures of sense of control or health outcomes. Other psychosocial measures may have similar associations, but affect, personality, and social support were considered the most well established. Both measures of health in this study were self-reported. It is not known if the association of sense of control with other outcomes, such as disease occurrence or mortality, would be confounded to a similar degree by affect. Because sense of control and affect were also self-reported, their association may be susceptible to single source bias. However, their association was different from that of the personality measures and positive social support, although the latter measures were also self-reported. Lastly, the study was cross-sectional and cannot establish causal associations between sense of control and self-reported health. Health and sense of control may have reciprocal relationships similar to those that may occur between sense of control and affect.

Longitudinal studies, and particularly studies of interventions that either enhanced sense of control or improved affect, would be needed to directly assess the relative contribution of sense of control and affect to future health status.

Future studies of the relationship between sense of control and health should include data on affect and consider it as an important likely confounding factor. Although adjustment for affect attenuated the association between sense of control and health, higher levels of control and lower levels of perceived constraints were associated with better self-reported global health and lower likelihood of functional limitations. These findings suggest that better understanding of the connections between sense of control and health may stimulate novel approaches to optimize health.

Acknowledgment This work was supported by the Intramural Research Program, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health.

References

1. Skinner EA. A guide to constructs of control. J Pers Soc Psychol. 1996;71:549–70.
2. Bailis DS, Segall A, Mahon MJ, Chipperfield JG, Dunn EM. Perceived control in relation to socioeconomic and behavioral resources for health. Soc Sci Med. 2001;52:1661–76.
3. Bosma H, van Jaarsveld CHM, Tuinstra J, Sanderman R, Ranchor AV, van Eijk JThM, Kempen GIJM. Low control beliefs, classical coronary risk factors, and socioeconomic differences in heart disease in older persons. Soc Sci Med. 2005;60:737–45.
4. Cardarelli KM, Vernon SW, Baumler ER, Tortolero S, Low MD. Sense of control and diabetes mellitus among U.S. adults: a cross-sectional analysis. Biopsychosoc Med. 2007;1:19.
5. Gale CR, Batty GD, Deary IJ. Locus of control at age 10 years and health outcomes and behaviors at age 30 years: the 1970 British Cohort Study. Psychosom Med. 2008;70:397–403.
6. Koster A, Bosma H, Kempen GIJM, Penninx BWJH, Beekman ATF, Deeg DJH, van Eijk JThM. Socioeconomic differences in incident depression in older adults: the role of psychosocial factors, physical health status, and behavioral factors. J Psychosom Res. 2006;61:619–27.
7. Lachman ME, Weaver SL. Sociodemographic variations in the sense of control by domain: findings from the MacArthur Studies of Midlife. Psychol Aging. 1998;13:553–62.
8. Lachman ME, Weaver SL. The sense of control as a moderator of social class differences in health and well-being. J Pers Soc Psychol. 1998;74:763–73.
9. Pudrovska T, Schieman S, Pearlin LI, Nguyen K. The sense of mastery as a mediator and moderator in the association between economic hardship and health in late life. J Aging Health. 2005;17:634–60.
10. Seeman M, Lewis S. Powerlessness, health, and mortality: a longitudinal study of older men and older women. Soc Sci Med. 1995;41:517–25.
11. Dalgard OS, Håheim LL. Psychosocial risk factors and mortality: a prospective study with special focus on social support, social participation, and locus of control in Norway. J Epidemiol Community Health. 1998;52:476–81.
12. Bosma H, Schrijvers C, Mackenbach JP. Socioeconomic inequalities in mortality and importance of perceived control: cohort study. BMJ. 1999;319:1469–70.
13. Mackenbach JP, Simon JG, Looman CWN, Joung IMA. Self-assessed health and mortality: could psychosocial factors explain the association? Int J Epidemiol. 2002;31:1162–8.
14. Rodin J, Timko C, Harris S. The construct of control: biological and psychological correlates. In: Eisdorfer MP, Lawton GL, Maddox GL, editors. 1986; New York: Springer, p. 3–55.
15. Beekman ATF, de Beurs E, van Balkom AJLM, Deeg DJH, van Dyck R, van Tilburg W. Anxiety and depression in later life: co-occurrence and communality of risk factors. Am J Psychiatry. 2000;157:89–95.
16. Molinari V, Niederehe G. Locus of control, depression, and anxiety in young and old adults: a comparison study. Int J Aging Hum Dev. 1984;20:41–52.
17. Smits CHM, Deeg DJH, Bosscher RJ. Well-being and control in older persons: the prediction of well-being from control measures. Int J Aging Hum Dev. 1995;40:237–51.
18. Wolinsky FD, Stump TE. Age and the sense of control among older adults. J Gerontol Soc Sci. 1996;51B:S217–20.
19. Judge TA, Erez A, Bono JE, Thoresen CJ. Are measures of self-esteem, neuroticism, locus of control, and generalized self-efficacy indicators of a common core construct? J Pers Soc Psychol. 2002;83:693–710.
20. Willis L, Goodwin J, Lee K-O, Mosqueda L, Garry P, Liu P, Linn R, Wayne S. Impact of psychosocial factors on health outcomes in the elderly: a prospective study. J Aging Health. 1997;9:396–414.
21. Health and Retirement Study. http://hrsonline.isr.umich.edu/index/php. Accessed 5 May 2011.
22. St. Clair P, Blake D, Bugliari D, et al. RAND HRS Data Documentation, Version 1; 2009. http://www.rand.org/labor/aging/dataprod/randhrsi.pdf. Accessed 5 May 2011.
23. Clarke P, Fisher G, House J, Smith J, Weir D. Guide to content of the HRS Psychosocial Leave-Behind Participant Lifestyle Questionnaire: 2004 & 2006. Documentation Report v2.0 [December 2008]. http://hrsonline.isr.umich.edu/sitedocs/userg/HRS2006LBQscale.pdf. Accessed 5 May 2011.
24. Benyamini Y, Leventhal EA, Leventhal H. Elderly people's ratings of the importance of health-related factors to their self-assessments of health. Soc Sci Med. 2003;56:1661–7.
25. Pearlin LI, Schooler C. The structure of coping. J Health Soc Behav. 1978;19:2–21.
26. Mroczek DK, Kolarz CM. The effect of age on positive and negative affect: a developmental perspective on happiness. J Pers Soc Psychol. 1998;75:1333–49.
27. Lachman ME, Weaver SL. Midlife Development Inventory [MIDI] Personality scales: Scale construction and scoring. Technical report. Waltham, MA: Brandies University, 1997. http://www.brandies.edu/departments/psych/lachman/pdfs/midi-personality-sclaes.pdf.
28. Theorell T, Karasek RA. Current issues relating psychosocial job strain and cardiovascular disease research. J Occup Health Psychol. 1996;1:9–26.
29. Belkić K, Landsbergis P, Schnall P, Baker D, Thorell T, Siegrist J, Peter R, Karasek RA. Psychosocial factors: review of the empirical data among men. In: Schnall P, Belkić K, Landsbergis P, Baker D, editors. The workplace and cardiovascular disease. Philadelphia, PA: Hanley and Belfus, Inc; 2000, p. 24–49.
30. Chapman BP, Duberstein PR, Sörensen S, Lyness JM. Personality and perceived health in older adults: the five factor model in primary care. J Gerontol Psych Sci. 2006;61B:P362–5.
31. Friedman HS, Booth-Kewley S. The "disease-prone personality". A meta-analytic view of the construct. Am Psychol. 1987;42:539–55.
32. Duberstein PR, Sörensen S, Lyness JM, King DA, Conwell Y, Seidlitz L, Caine ED. Personality is associated with perceived

health and functional status in older primary care patients. Psychol Aging. 2003;18:25–37.
33. Goodwin R, Engstrom G. Personality and the perception of health in the general population. Psychol Med. 2002;32:325–32.
34. Turiano NA, Pitzer L, Armour C, Karlamangla A, Ryff CD, Mroczek DK. Personality trait level and change as predictors of health outcomes: findings from a national study of Americans (MIDUS). J Gerontol B Psychol Sci Soc Sci. 2011. doi:10.1093/geronb/gbr072.
35. Donnellan MB, Lucas RE. Age differences in the Big Five across the life span: evidence from two national samples. Psycho Aging. 2008;23:558–66.
36. Roberts BW, Kuncel NR, Shiner R, Caspi A, Goldberg LR. The power of personality: the comparative value of personality traits, socioeconomic status, and cognitive ability on predicting important life outcomes. Perspect Psychol Sci. 2007;2:313–45.
37. Ferguson E, Bibby PA. Openness to experience and all-cause mortality: a meta-analysis and $r_{equivalent}$ from risk ratios and odds ratios. Br J Health Psychol. 2011, [Epub]. doi:10.1111/j.2044-8287.2011.02055.x.
38. Watson D, Pennebaker JW. Health complaints, stress, and distress: exploring the central role of negative affectivity. Psychol Rev. 1989;96:234–54.