Heart health when life is satisfying: evidence from the Whitehall II cohort study

Julia K. Boehm[1]*, Christopher Peterson[2], Mika Kivimaki[3], and Laura D. Kubzansky[1]

[1]Department of Society, Human Development, and Health, Harvard School of Public Health, 677 Huntington Avenue, Boston, MA 02115, USA; [2]Department of Psychology, University of Michigan, Ann Arbor, MI 48109, USA; and [3]Department of Epidemiology and Public Health, University College London, 1–19 Torrington Place, London WC1E 6T, UK

Aims	Negative psychological states such as stress and depression are associated with increased risk of coronary heart disease (CHD), but it is unclear whether some positive states are protective. We investigated satisfaction with specific life domains as predictors of incident CHD.
Methods and results	Coronary risk factors and satisfaction within seven life domains (e.g. job and family) were assessed in 7956 initially healthy members of the Whitehall II cohort. Incident CHD (angina, non-fatal myocardial infarction, or death from CHD) was ascertained from medical screening, hospital data, and registry linkage over five person-years of follow-up. Satisfaction averaged across domains was associated with reduced CHD risk (HR: 0.87; 95% CI: 0.78–0.98), controlling for demographic characteristics, health behaviours, blood pressure, and metabolic functioning. Associations with CHD risk were evident for satisfaction in four life domains—one's job, family, sex life, and self, but not one's love relationship, leisure activities, or standard of living. When examining CHD outcomes separately, average domain satisfaction was associated with angina but not myocardial infarction or coronary death.
Conclusions	Satisfaction in most life domains was associated with reduced CHD risk, with definite angina being mostly responsible for this association. These findings suggest that satisfaction with life may promote heart health. Further research should examine whether interventions to enhance life satisfaction in specific domains reduce CHD risk and whether life satisfaction is primarily associated with atherosclerosis rather than thrombotic factors associated with plaque rupture.
Keywords	Coronary heart disease • Angina • Life satisfaction • Domain satisfaction • Well-being

Introduction

Research suggests that psychological factors are associated with risk of coronary heart disease (CHD). To date, numerous studies have examined the detrimental effects of ill-being (e.g. depression, anxiety, hostility).[1–3] However, a growing body of research suggests possible protective effects of well-being (e.g. positive affect, optimism).[4,5] Given that the absence of ill-being may not indicate the presence of well-being,[6] it is critical to examine the relationship between well-being and CHD in greater detail.

Well-being comprises affective and cognitive components.[7] The former is represented by positive and negative emotions, whereas the latter is represented by judgements of global life satisfaction and satisfaction within specific life domains (e.g. relationship satisfaction). Although the affective and cognitive components are related, they are distinguishable from one another and are typically assessed independently.[8] Past research on well-being and CHD has almost exclusively considered the affective[3,4,9] rather than the cognitive component (for exceptions see[10,11]). Because affect and cognition could have different effects on behaviours and physiological systems, it is important to consider each.

Previous work has emphasized a top-down approach to well-being that uses global measures (i.e. evaluations of life in general) rather than particular life domains (i.e. evaluations of specific areas of life). Although domain satisfactions tend to be correlated with evaluations of one's life as a whole,[8,12,13] the two may have different correlates, antecedents, and consequences.[13,14] Two specific domains—work experience and social relationships—are known to be associated with CHD risk.[15–17] Thus, satisfaction

within those domains may be specifically associated with CHD. Evaluating separate life domains may provide a more finely discriminated analysis of life experiences that are especially relevant for cardiovascular health.

The present study investigated the prospective association between domain satisfaction and incident CHD using data from the Whitehall II cohort, a large sample of British civil servants. We measured satisfaction in several ways, including (i) averaging across life domains for mean satisfaction, (ii) assessing individual domains of satisfaction, and (iii) assessing global life satisfaction in secondary analyses. We also examined whether different forms of CHD—that is, 'hard' outcomes of fatal CHD and non-fatal myocardial infarction (MI) and 'softer' outcomes of definite angina—share similar associations with satisfaction. Most research has not distinguished between these outcomes and their association with well-being, and the few studies that have done so yield inconsistent findings.[5,18]

Methods

Participants

The Whitehall II cohort comprises 10 308 British civil servants initially examined during 1985–88 (Phase 1).[19] Phase 3 (1991–94) serves as baseline for the present study because domain satisfaction was measured then. Participants who experienced a cardiovascular-related event between Phases 1 and 3 ($n = 280$), died before participation at Phase 3 ($n = 103$), or who were withdrawn from the sample for non-response ($n = 1349$) were excluded. The remaining group of participants was further reduced by 620 individuals with missing values on satisfaction or CHD-related outcomes, yielding an analytic sample of 7956.

All participants provided written informed consent. Human research Ethics Committees at University College London and University College London Hospital approved the research.

Domain satisfaction measurement

Satisfaction was assessed with items asking: 'All things considered, how satisfied or dissatisfied are you with the following areas of your life?' Participants evaluated eight areas including their 'marital or love relationship', 'leisure time activities', 'standard of living', 'job', 'health', 'family life', 'sex life', and feelings 'about yourself as a person'. Participants rated each domain on a scale from 1 (very dissatisfied) to 7 (very satisfied). Besides using each domain satisfaction individually, participants' responses to seven of the domains were averaged ($M = 5.33$, $SD = 1.18$; health satisfaction was not included as it may be confounded with satisfaction and CHD). This mean—where higher scores indicated greater satisfaction—was standardized ($M = 0$, $SD = 1$) so that analyses could be interpreted as one standard deviation increase in satisfaction. Average domain satisfaction demonstrated good internal consistency reliability ($\alpha = 0.84$). Previous health-related research has used similar scales[10,20] and averaged domain satisfactions into a single composite. These composites correlate strongly with global assessments of life satisfaction and exhibit stability across time.[12]

We primarily used mean domain satisfaction as a continuous variable. To test for threshold effects, we also created tertiles of mean satisfaction based on the distribution of scores (naturally occurring or clinically relevant thresholds have not been established). Standardized

scores ≤ -0.28 were low (34.21%), scores between -0.28 and 0.57 were moderate (33.75%), and scores ≥ 0.57 were high (32.04%).

Morbidity and mortality measurement

Incident CHD—composed of fatal CHD, first non-fatal MI, or first definite angina—was assessed from Phase 3 to Phase 5 (1997–99), a mean follow-up of 5.42 person-years ($SD = 1.23$). The British National Health Service Central Registry provided information regarding the date and cause of all deaths. Coronary-related deaths were classified according to codes 410–414 from the ninth revision of the International Classification of Diseases and codes I20–I25 from the 10th revision. MONICA criteria (including electrocardiograms, cardiac enzymes, and biochemical markers such as abnormal troponin levels) confirmed non-fatal MI.[21] Definite angina was defined by clinical records, abnormalities on electrocardiograms or coronary angiogram, and nitrate medication use, but excluded self-report that was not clinically verified.[22] Two trained judges classified cardiac events and reached agreement on inconsistencies.

Cardiovascular risk factor measurement

Covariates related to demographics, health behaviours, cardiovascular function, and metabolic function were assessed. Demographic covariates included age (years), sex (male, female), ethnicity (White, non-White), marital status (married/cohabitating, other), and employment grade [administrative (highest level), professional (middle level), clerical/support (lowest level)]. Health behaviours included smoking status (current, former, never), alcohol consumption [low/moderate (women: <15 units/week; men: <22 units/week), high (women: ≥15 units/week; men: ≥22 units/week)], hours exercised (<1.5 h/week, ≥1.5 h/week of moderate and vigorous exercise), and daily fruit and vegetable consumption (yes, no). Covariates related to cardiovascular and metabolic functioning included systolic blood pressure (SBP; mm Hg), diastolic blood pressure (DBP; mm Hg), high-density lipoprotein cholesterol (HDL-C; mmol/L), low-density lipoprotein cholesterol (LDL-C; mmol/L), triglycerides (mmol/L), body mass index (BMI; kg/m^2), and self-reported physician-diagnosed diabetes (yes, no). Triglycerides were log transformed to achieve normality.

Psychological ill-being was assessed with three items from the Short Form-36.[23] Items asked whether emotional problems like depression or anxiety caused individuals to (1) 'Cut down the amount of time you spent on work or other activities', (2) 'Accomplished less than you would like', and (3) 'Didn't do work or other activities as carefully as usual'. Participants responded to each item with 'yes' (1) or 'no' (0), which yielded a total sum score ranging from 0 to 3. Higher scores indicated greater ill-being, and internal consistency reliability was adequate ($\alpha = 0.78$).

All covariates were measured at the Phase 3 baseline, except for sex (assessed at Phase 1) and ethnicity (derived from Phase 1 to 5 questionnaires). Covariates were assessed by self-report, except for medical examinations assessing blood pressure, lipids, and BMI. LDL-C had the most missing data (7%; $n = 552$), followed by HDL-C, triglycerides, SBP, DBP, and BMI (5–5.5%; $n = 380$–436). Other covariates had 2% or less missing data ($n \leq 161$).

Statistical analyses

Multiple imputation procedures were used to impute missing data on covariates. Cox proportional hazards regression models estimated hazard ratios (HRs) of CHD and 95% confidence intervals (CIs). The association between (continuous) mean domain satisfaction and CHD was examined in four nested models. The first model was

age-adjusted and the second model was minimally adjusted for demographics (i.e. age, sex, ethnicity, marital status, employment grade). The third multivariate-adjusted model additionally included health behaviours (i.e. smoking status, alcohol consumption, exercise, fruit, and vegetable consumption), blood pressure (i.e. SBP, DBP), and metabolic factors (i.e. HDL-C, LDL-C, triglycerides, BMI, diabetes). The fourth model adjusted for all covariates and ill-being; a likelihood ratio test compared the fit of the third and fourth models. Additional analyses stratified models by sex, used tertiles of mean domain satisfaction to examine threshold effects, examined whether results differed by CHD outcome (i.e. including/excluding definite angina), and examined each specific domain satisfaction in relation to CHD.

Secondary analyses determined the association between CHD and Phase 1 global life satisfaction (assessed with the Satisfaction With Life Scale).[24] A similar set of covariates from Phase 1 were used, except lipids were excluded because they were not assessed in the majority of participants. We also considered whether information from all domain satisfactions combined was more informative than considering individual domains. A likelihood ratio test compared a model with the total sum score of domain satisfactions to a model that simultaneously included all seven domain satisfactions. Additionally, analyses examined the contribution of specific domain satisfactions to the association between mean domain satisfaction and CHD risk. For each domain i, we computed a modified mean domain satisfaction score based on the mean without domain i (i.e. mean domain satisfaction − domain i). A modified mean domain satisfaction score was included in models with each domain satisfaction score. Sensitivity analyses excluded participants treated with self-reported antihypertensive or lipid-lowering medication.

Results

Preliminary findings

Of 7956 participants, 5496 were men and 2460 were women. Average baseline age was 49.5 years (SD = 6.07), with a range from 39 to 63. Baseline characteristics according to tertiles of mean domain satisfaction are shown in Supplementary material online, *Table S1*. Average domain satisfaction was associated in the expected directions with Phase 1 global life satisfaction (Pearson $r = 0.47$, $P < 0.0001$), positive affect ($r = 0.26$, $P < 0.0001$), and negative affect ($r = -0.35$, $P < 0.0001$), as well as Phase 3 ill-being ($r = -0.36$, $P < 0.0001$), providing evidence of the measure's validity. Non-significant time-dependent interaction terms between life satisfaction and the logarithm of the follow-up period confirmed that the proportional hazards assumption was met (P-values >0.27).

Satisfaction across life domains and coronary heart disease

During an average of 5.42 person-years of follow-up, there were 293 cases of incident CHD. Each standard deviation increase in mean domain satisfaction was associated with 12% reduced risk of CHD in age-adjusted models (HR: 0.88; 95% CI: 0.79−0.99; $P = 0.03$). The addition of demographic factors did not substantially change this association (HR: 0.88; 95% CI: 0.78−0.98; $P = 0.02$), nor did adding variables related to health behaviours, blood pressure, and metabolic functioning (HR: 0.87; 95% CI: 0.78−0.98; $P = 0.02$). Adding ill-being to the multivariate model

slightly widened the CI for the association between mean domain satisfaction and CHD, although each standard deviation increase in satisfaction was still associated with 10% reduced risk of CHD (HR: 0.90; 95% CI: 0.80−1.02; $P = 0.09$). Model fit did not differ significantly when comparing the multivariate model to the ill-being model ($P = 0.11$).

In sex-stratified analyses, the magnitude of association between mean domain satisfaction and CHD remained essentially the same in minimally adjusted (men, HR: 0.88; 95% CI: 0.77−1.00; $P = 0.06$; women, HR: 0.87; 95% CI: 0.70−1.07; $P = 0.19$) and multivariate-adjusted models (men, HR: 0.88; 95% CI: 0.77−1.01; $P = 0.07$; women, HR: 0.85; 95% CI: 0.68−1.06; $P = 0.16$). That is, greater satisfaction reduced CHD risk to the same extent in men and women, although CIs were slightly wider probably due to fewer incident cases (men: 213; women: 80). Furthermore, the interaction between sex and satisfaction was non-significant in minimally adjusted and multivariate-adjusted models (P-values >0.80).

A dose−response relationship was evident when considering tertiles of domain satisfaction and total CHD (*Table 1*). In multivariate-adjusted models, individuals with the highest

Table 1 Minimally adjusted and multivariate-adjusted hazard ratios (95% confidence intervals) for different definitions of incident coronary heart disease according to level of domain satisfaction

	Hazard ratio (95% confidence interval)		
	Domain satisfaction		
	Low	Moderate	High
Total CHD			
Number of cases[a]	108	96	89
Minimally adjusted[b]	1.00	0.82 (0.62−1.08)	0.75** (0.56−1.00)
Multivariate-adjusted[c]	1.00	0.80 (0.61−1.06)	0.74** (0.55−0.99)
Definite angina			
Number of cases[d]	79	67	53
Minimally adjusted[b]	1.00	0.77 (0.55−1.07)	0.60*** (0.42−0.86)
Multivariate-adjusted[c]	1.00	0.76* (0.54−1.06)	0.59*** (0.41−0.85)
Fatal CHD or non-fatal MI			
Number of cases[e]	47	49	48
Minimally adjusted[b]	1.00	1.00 (0.67−1.50)	0.99 (0.65−1.52)
Multivariate-adjusted[c]	1.00	1.00 (0.66−1.50)	1.01 (0.66−1.54)

CHD, coronary heart disease; MI, myocardial infarction.
[a]$n = 7956$.
[b]Adjusted for demographics (age, sex, ethnicity, marital status, grade of employment).
[c]Adjusted for demographics, health behaviours (smoking status, alcohol consumption, exercise, fruit, and vegetable consumption), systolic and diastolic blood pressure, and metabolic function (high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, body mass index, diabetes).
[d]$n = 8014$.
[e]$n = 8099$.
*$P < 0.10$, **$P < 0.05$, ***$P < 0.01$.

satisfaction had 26% reduced risk of total CHD and individuals with moderate satisfaction had 20% reduced risk relative to individuals with the lowest satisfaction.

Further minimally adjusted and multivariate-adjusted analyses considered tertiles of domain satisfaction in relation to different forms of CHD (Table 1). Risk of definite angina was reduced among individuals with high and moderate satisfaction compared with individuals with low satisfaction. No association between satisfaction and fatal CHD/non-fatal MI was evident. Findings were similar with continuous mean domain satisfaction in multivariate models (definite angina, HR: 0.82; 95% CI: 0.71–0.94; $P = 0.003$; fatal CHD/non-fatal MI, HR: 0.98; 95% CI: 0.82–1.16; $P = 0.81$).

Domain satisfaction and coronary heart disease

We investigated whether each specific domain was associated with CHD (Table 2). Satisfaction with one's job, family life, sex life, and self were each independently associated with ~12% reduced risk of total CHD in minimally adjusted and multivariate-adjusted models. No association was evident for individual domain satisfaction and fatal CHD/non-fatal MI. However, findings for definite angina were consistent with those for mean domain satisfaction. These findings suggest important life domains that bear on cardiovascular health.

Secondary analyses

After excluding people with a cardiovascular event between Phases 1–3 and imputing missing data on Phase 1 covariates, Phase 1 global life satisfaction was not associated with incident CHD at Phase 5 in minimally adjusted (HR: 1.01; 95% CI: 0.88–1.15; $P = 0.92$) or multivariate-adjusted (HR: 1.02; 95% CI: 0.89–1.16; $P = 0.82$) models.

Likelihood ratio tests found no significant differences between models with summed domain satisfactions and models with all seven domain satisfactions included simultaneously (P-values >0.05). Analyses that included modified mean domain satisfaction

with a specific domain satisfaction were consistent with those presented in Table 2. Job, family life, sex life, and self satisfaction were all associated with CHD, controlling for modified mean domain satisfaction (P-values <0.05). For other life domains (marital/love relationship, leisure, standard of living), the modified mean score was significantly associated with CHD (P-values <0.05) but the individual domain was generally not.

Excluding participants treated with antihypertensive or lipid-lowering medication at baseline ($n = 616$) did not meaningfully alter the findings.

Discussion

This study examined whether satisfaction with specific life domains was prospectively associated with incident CHD after controlling for conventional risk factors and ill-being. In minimally adjusted and multivariate-adjusted models, satisfaction averaged across seven life domains was significantly associated with a modest reduced risk of total CHD. The size of the effect was comparable for both men and women, although fewer case counts attenuated statistical power. A statistically significant dose–response effect existed such that individuals reporting the most satisfaction had the greatest risk reduction compared with individuals reporting moderate and low satisfaction levels. Effects seem to be driven largely by a statistically significant association with definite angina. Phase 1 global life satisfaction was not significantly associated with CHD in secondary analyses.

Limited work has examined the association between CHD and life satisfaction. Moreover, well-being has rarely been measured by combining domain-specific evaluations. It is unclear exactly why Phase 1 global satisfaction was unrelated to CHD in secondary analyses. However, the moderate association between global satisfaction and mean domain satisfaction suggests that these measures may capture something different, and that satisfaction within particular life domains may be especially relevant for coronary outcomes. Furthermore, positive affect has not consistently been

Table 2 Hazard ratios (95% confidence intervals) of incident coronary heart disease for one standard deviation increase in specific domain satisfactions[a]

	Mean (standard deviation)	Hazard ratio (95% confidence interval)	
		Minimally adjusted[b]	Multivariate-adjusted[c]
Marital/love relationship satisfaction	5.39 (1.92)	0.93 (0.82–1.05)	0.91 (0.80–1.03)
Leisure satisfaction	5.17 (1.61)	0.96 (0.85–1.08)	0.96 (0.86–1.08)
Standard of living satisfaction	5.68 (1.46)	0.97 (0.95–1.09)	0.99 (0.88–1.11)
Job satisfaction	5.19 (1.69)	0.87* (0.78–0.97)	0.86** (0.77–0.97)
Family life satisfaction	5.77 (1.45)	0.88* (0.79–0.98)	0.86** (0.77–0.96)
Sex life satisfaction	4.93 (1.81)	0.87* (0.78–0.98)	0.87* (0.77–0.98)
Self satisfaction	5.18 (1.56)	0.89* (0.80–1.00)	0.89* (0.79–0.99)

[a]$n = 7956$; 293 cases.
[b]Adjusted for demographics (age, sex, ethnicity, marital status, grade of employment).
[c]Adjusted for demographics, health behaviours (smoking status, alcohol consumption, exercise, fruit, and vegetable consumption), systolic and diastolic blood pressure, and metabolic function (high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglycerides, body mass index, diabetes).
*$P < 0.05$; **$P < 0.01$.

associated with incident CHD.[4,9] For example, research with the Whitehall II cohort reported that positive affect was unrelated to CHD over 10 years, although it is unclear whether or not it was associated with CHD across 5 years or with definite angina.[9]

The seven specific life domains shared similar distributions and were moderately to strongly interrelated (Pearson *r*s ranged from 0.27 to 0.73), but only four life domains were significantly associated with CHD-related outcomes—job, family, sexual, and self satisfaction. Prior research indicates that work and love are central to human functioning,[25] which suggests categories that may be particularly relevant for cardiovascular health. Indeed, job satisfaction, family satisfaction, and sexual satisfaction fall within the categories of work and love. However, this cannot fully account for why satisfaction with one's marital/love relationship was not significantly associated with reduced CHD risk, or why satisfaction with one's self was.

Satisfaction was not significantly associated with 'hard' outcomes of coronary death and MI. Instead, the association between satisfaction and total CHD was driven primarily by definite angina. Other research on psychological well-being has not routinely separated 'hard' outcomes from angina, although the few studies that have done so report inconsistent results. For example, in one prospective study of older women, the association between optimism and CHD was stronger when MI was considered alone than in a composite of angina, angioplasty, and coronary artery bypass grafting.[5] In an investigation of ageing men, the magnitude of association between optimism and fatal CHD, non-fatal MI, and angina (separately) was similar.[18] Finally, in work with other psychological constructs, stress was associated with angina but not 'objective' cardiovascular-related outcomes.[26]

Given inconsistencies in past work, how can stronger findings for angina be reconciled? One explanation involves a reporting bias. Angina is often established through self-reports of chest pain. Individuals with favourable views of their lives may be more likely to report favourable views of their health and have higher pain tolerance.[27–29] All self-reported instances of angina were confirmed clinically in the present investigation, but the extent of misclassification due to undiagnosed angina was probably dependent on self-report, which introduces a potential reporting bias according to one's psychological outlook. Previous work, however, suggests that angina is a strong predictor of future cardiovascular events.[30,31]

Other explanations may relate to the relatively young age of the present sample (average of 50 years) and how that coincides with the course of CHD. Because angina may be a sign or symptom of underlying atherosclerosis—or, in other words, a precursor to MI—it is feasible that in the age group we studied and for the relatively short period in which we studied them, angina occurred more frequently than fatal CHD/non-fatal MI. Indeed, there were more cases of angina than coronary death or MI. Perhaps findings for fatal CHD/non-fatal MI would more closely resemble those for angina if participants had been followed for a longer period of time to capture a more complete trajectory of CHD. Furthermore, as all patients with MI have coronary atherosclerosis but only a few with atherosclerosis develop MI, satisfaction might be related to overall risk of atherosclerosis but not with the unique factors that predispose individuals to plaque rupture or MI.

Use of the Whitehall II cohort may limit generalizability because participants were employed and relatively healthy. Other limitations concern the measurement of life satisfaction. Analyses may have been overly simplistic by separately averaging domain satisfactions and asking about general life satisfaction. Integrating the two approaches may be more informative than either approach on its own.[8] Additionally, averaging domain satisfactions may not have adequately represented life satisfaction. Instead, a more complex relationship may exist whereby some domains weigh more heavily in overall judgements of life satisfaction[13] or a balance of satisfaction across some critical set of domains may better reflect overall life satisfaction.[32]

This study has numerous strengths, including a large and well-characterized cohort, prospectively measured well-being, detailed follow-up of objectively assessed CHD, and clinically assessed CHD risk factors. The current investigation also evaluated whether conventional covariates related to health behaviours or cardiovascular and metabolic functioning might explain the observed association between satisfaction and angina. Effects were not attenuated when these covariates were added, which either suggests that the relationship is largely a function of self-report bias or that other mechanisms may be important to consider. In fact, other investigations of psychological factors and CHD frequently find that conventional risk factors explain little of the observed associations.[33]

Taken together, this research indicates that being satisfied with specific life domains—in particular, one's job, family, sex life, and self—is associated with a reduction in incident CHD independently of traditional risk factors and ill-being, but these findings are primarily due to an association with angina. Additional research is needed to determine whether there is truly an association with specific forms of CHD, or if this is primarily an artifact of self-report bias. Disentangling these possibilities should be considered of high clinical relevance. A more definitive understanding may help determine whether interventions to enhance life satisfaction in specific domains could improve CHD outcomes in high-risk individuals. Moreover, findings may suggest that assessing the psychological profile of patients with angina adds predictive value for evaluating risk of subsequent CHD events.

Supplementary material

Supplementary material is available at *European Heart Journal* online.

References

1. Chida Y, Steptoe A. The association of anger and hostility with future coronary heart disease: a meta-analytic review of prospective evidence. *J Am Coll Cardiol* 2009;**53**:936–946.
2. Rugulies R. Depression as a predictor for coronary heart disease: A review and meta-analysis. *Am J Prev Med* 2002;**23**:51–61.
3. Suls J, Bunde J. Anger, anxiety, and depression as risk factors for cardiovascular disease: the problems and implications of overlapping affective dispositions. *Psychol Bull* 2005;**131**:260–300.
4. Davidson KW, Mostofsky E, Whang W. Don't worry, be happy: Positive affect and reduced 10-year incident coronary heart disease: The Canadian Nova Scotia Health Survey. *Eur Heart J* 2010;**31**:1065–1070.
5. Tindle HA, Chang YF, Kuller LH, Manson JE, Robinson JG, Rosal MC, Siegle GJ, Matthews KA. Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. *Circulation* 2009;**120**:656–662.
6. Ryff CD, Love GD, Urry HL, Muller D, Rosenkranz MA, Friedman EM, Davidson RJ, Singer B. Psychological well-being and ill-being: do they have distinct or mirrored biological correlates? *Psychother Psychosom* 2006;**75**:85–95.
7. Diener E, Suh EM, Lucas RE, Smith HL. Subjective well-being: three decades of progress. *Psychol Bull* 1999;**125**:276–302.
8. Pavot W, Diener E. The Satisfaction With Life Scale and the emerging construct of life satisfaction. *J Positive Psychol* 2008;**3**:137–152.
9. Nabi H, Kivimaki M, De Vogli R, Marmot MG, Singh-Manoux A. Positive and negative affect and risk of coronary heart disease: Whitehall II prospective cohort study. *Br Med J* 2008;**337**:a118.
10. Einvik G, Ekeberg O, Klemsdal TO, Sandvik L, Hjerkinn EM. Physical distress is associated with cardiovascular events in a high risk population of elderly men. *BMC Cardiovasc Disord* 2009;**9**:14.
11. McCall-Hosenfeld JS, Freund KM, Legault C, Jaramillo SA, Cochrane BB, Manson JE, Wenger NK, Eaton CB, McNeeley SG, Rodriguez BL, Bonds D. Sexual satisfaction and cardiovascular disease: the Women's Health Initiative. *Am J Med* 2008;**121**:295–301.
12. Schimmack U, Krause P, Wagner GG, Schupp J. Stability and change of well being: an experimentally enhanced latent state-trait-error analysis. *Soc Indic Res* 2010;**95**:19–31.
13. Rojas M. Life satisfaction and satisfaction in domains of life: is it a simple relationship? *J Happiness Stud* 2006;**7**:467–497.
14. Demoussis M, Giannakopoulos N. Analysis of domain satisfactions: evidence from a panel of Greek women. *J Soc Econ* 2008;**37**:1347–1362.
15. Barth J, Schneider S, von Kanel R. Lack of social support in the etiology and the prognosis of coronary heart disease: a systematic review and meta-analysis. *Psychosom Med* 2010;**72**:229–238.
16. Kivimaki M, Virtanen M, Elovainio M, Kouvonen A, Vaananen A, Vahtera J. Work stress in the etiology of coronary heart disease: a meta-analysis. *Scand J Work Environ Health* 2006;**32**:431–442.
17. Kuper H, Marmot M. Job strain, job demands, decision latitude, and risk of coronary heart disease within the Whitehall II study. *J Epidemiol Community Health* 2003;**57**:147–153.
18. Kubzansky LD, Sparrow D, Vokonas P, Kawachi I. Is the glass half empty or half full? A prospective study of optimism and coronary heart disease in the Normative Aging Study. *Psychosom Med* 2001;**63**:910–916.
19. Marmot MG, Brunner E. Cohort Profile: the Whitehall II study. *Int J Epidemiol* 2005;**34**:251–256.
20. Melin R, Fugl-Meyer KS, Fugl-Meyer AR. Life satisfaction in 18- to 64-year-old Swedes: In relation to education, employment situation, health and physical activity. *J Rehabil Med* 2003;**35**:84–90.
21. Tunstall-Pedoe H, Kuulasmaa K, Amouyel P, Arveiler D, Rajakangas AM, Pajak A. Myocardial infarction and coronary deaths in the World Health Organization MONICA Project. Registration procedures, event rates, and case-fatality rates in 38 populations from 21 countries in four continents. *Circulation* 1994;**90**:583–612.
22. Rose GA, Blackburn H, Gillum RF, Prineas RJ. *Cardiovascular Survey Methods*. 2nd ed. Geneva: World Health Organization; 1982.
23. Ware J, Sherbourne C. The MOS 36-item short-form health survey (SF-36). Conceptual framework and item selection. *Med Care* 1992;**30**:473–483.
24. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. *J Pers Assess* 1985;**49**:71–75.
25. Hazan C, Shaver PR. Love and work: an attachment-theoretical perspective. *J Pers Soc Psychol* 1990;**59**:270–280.
26. Macleod J, Davey Smith G, Heslop P, Metcalfe C, Carroll D, Hart C. Psychological stress and cardiovascular disease: empirical demonstration of bias in a prospective observational study of Scottish men. *Br Med J* 2002;**324**:1247–1251.
27. Achat H, Kawachi I, Spiro A III, DeMolles DA, Sparrow D. Optimism and depression as predictors of physical and mental health functioning: The Normative Aging Study. *Ann Behav Med* 2000;**22**:127–130.
28. Alden AL, Dale JA, DeGood DE. Interactive effects of the affect quality and directional focus of mental imagery on pain analgesia. *Appl Psychophysiol Biofeedback* 2001;**26**:117–126.
29. Roysamb E, Tambs K, Reichborn-Kjennerud T, Neale MC, Harris JR. Happiness and health: environmental and genetic contributions to the relationship between subjective well-being, perceived health, and somatic illness. *J Pers Soc Psychol* 2003;**85**:1136–1146.
30. Hemingway H, McCallum A, Shipley M, Manderbacka K, Martikainen P, Keskimaki I. Incidence and prognostic implications of stable angina pectoris among women and men. *JAMA* 2006;**295**:1404–1411.
31. Murphy NF, Stewart S, Hart CL, MacIntyre K, Hole D, McMurray JJ. A population study of the long-term consequences of Rose angina: 20-year follow-up of the Renfrew-Paisley study. *Heart* 2006;**92**:1739–1746.
32. Sirgy MJ, Wu J. The pleasant life, the engaged life, and the meaningful life: what about the balanced life? *J Happiness Stud* 2009;**10**:183–196.
33. Kubzansky LD, Thurston RC. Emotional vitality and incident coronary heart disease: benefits of healthy psychological functioning. *Arch Gen Psychiatry* 2007;**64**:1393–1401.