J Behav Med (2012) 35:538–547
DOI 10.1007/s10865-011-9379-8

REVIEW

The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis

Sanne M. A. Lamers · Linda Bolier · Gerben J. Westerhof · Filip Smit · Ernst T. Bohlmeijer

Received: December 17, 2010 / Accepted: September 2, 2011 / Published online: September 15, 2011

Abstract This meta-analysis synthesized studies on emotional well-being as predictor of the prognosis of physical illness, while in addition evaluating the impact of putative moderators, namely constructs of well-being, health-related outcome, year of publication, follow-up time and methodological quality of the included studies. The search in reference lists and electronic databases (Medline and PsycInfo) identified 17 eligible studies examining the impact of general well-being, positive affect and life satisfaction on recovery and survival in physically ill patients. Meta-analytically combining these studies revealed a Likelihood Ratio of 1.14, indicating a small but significant effect. Higher levels of emotional well-being are beneficial for recovery and survival in physically ill patients. The findings show that emotional well-being predicts long-term prognosis of physical illness. This suggests that enhancement of emotional well-being may improve the prognosis of physical illness, which should be investigated by future research.

Keywords Meta-analysis · Emotional well-being · Recovery · Survival · Prognosis · Physical illness

Introduction

This meta-analysis investigates emotional well-being as a predictor of the prognosis of physical illness. We define emotional well-being from a positive perspective, not as the mere absence of symptoms of psychopathology. Currently, most studies on the relation between mental and physical health investigated the presence or absence of psychopathology. These studies show that psychopathology is related to the course and severity of several physical diseases. For example, depression is associated with increased osteoporosis (Michelson et al., 1996), coronary heart disease (Glassman & Shapiro, 1998), diabetes complications (De Groot et al., 2001), cancer incidence, progression (Spiegel & Giese-Davis, 2003) and cancer mortality (Satin et al., 2009), and anxiety may influence the development of coronary heart disease (Kubzansky & Kawachi, 2000).

By contrast, well-being may play an additional protective role in the course of physical diseases. After all, there is accumulating evidence that psychopathology and well-being are more than merely opposite poles of the same dimension (Huppert & Whittington, 2003; Keyes, 2005, 2007; Lamers et al., 2011; Watson & Tellegen, 1985), and both well-being and mental disorders may have independent impacts on physical health. To date, six reviews of the literature synthesized effects of well-being on physical health (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Veenhoven, 2008). In general, the conclusions are favorable with well-being being positively associated to better health (Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005), reduced risk of illness and injury (Pressman & Cohen, 2005), and lower mortality rates (Chida & Steptoe, 2008; Pressman & Cohen, 2005; Veenhoven, 2008). In samples of healthy people, the results of these studies clearly point towards the positive effects of well-being on physical health. However, results appear to be mixed in physically ill populations.

S. M. A. Lamers (✉) · G. J. Westerhof · E. T. Bohlmeijer
Psychology, Health and Technology, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands
e-mail: s.m.a.lamers@utwente.nl

L. Bolier · F. Smit
Trimbos Institute, Utrecht, The Netherlands

To illustrate, Howell et al. (2007) found positive effects of well-being on physical health for both healthy and diseased populations, although results differed across health outcomes. The findings suggest that well-being may enhance physical functioning in healthy adults and improve management of symptoms in diseased adults. For example, the likelihood of longevity increases for individuals with high well-being compared to those with low well-being, and this survival rate even increases 10% for individuals with chronic diseases who report high versus low well-being. The meta-analysis of Chida and Steptoe (2008) also shows protective effects of well-being on survival in diseased populations with renal failure and HIV. Even though Howell et al. (2007) and Chida and Steptoe (2008) show that well-being generally is related to better physical health in diseased adults, Diener and Chan (2011), Pressman and Cohen (2005), and Veenhoven (2008) report otherwise. Diener and Chan (2011) conclude that findings with respect to diseased populations are mixed. Although Pressman and Cohen (2005) and Veenhoven (2008) state that there is too little consistency in the data to draw robust conclusions, both reviews suggest that there may be no effects or even adverse effects of well-being on physical health. In general, the pattern of research findings seems to point towards positive effects or no effects in relatively mildly diseased adults, where adherence to medication and behavioral factors such as physical exercise could play a role, and negative effects in severely diseased adults with high short-term mortality rates (Pressman & Cohen, 2005; Veenhoven, 2008).

In sum, the existing reviews produce inconsistent evidence with respect to well-being as a predictor of physical health in diseased populations. Conclusions across healthy and diseased populations differ, because the outcomes differ as well. In healthy individuals, the desirable health outcome is to stay healthy and to reduce mortality and the development of physical illness. Individuals with physical diseases already experience a diminished physical health, resulting in a different set of aims, such as decreasing symptom severity, preventing worsening of disease, and increasing survival rates.

Present study

This meta-analysis will focus on physically diseased patients, aiming to prospectively study the effects of emotional well-being on the prognosis of physical disease. The objective is to broadly investigate the prognosis, including survival, disease progress, recovery, and functional status. In addition, this systematic review will investigate emotional well-being, defined in the hedonic tradition of well-being research (Diener et al., 1999). In this research tradition, emotional well-being consists of an affective component, concentrating on positive emotions such as feelings of happiness, and a cognitive component, concentrating on evaluations of life such as life satisfaction. The previous literature reviews applied diverse definitions and terminology of well-being, investigating positive emotions (Pressman & Cohen, 2005; Veenhoven, 2008), positive emotions and positive dispositions such as optimism and sense of humor (Chida & Steptoe, 2008; Diener & Chan, 2011), or all positive psychological constructs (Howell et al., 2007). Moreover, several of these reviews included studies which measured quality of life by items on physical health and functioning (Howell et al., 2007). Other studies used positive affect adjectives such as active and energetic (Pressman & Cohen, 2005). These items might measure physical health instead of well-being. Thus to avoid confounding, this meta-analysis will employ a strict and narrow focus on emotional well-being, and in doing so will try to avoid contamination.

To further unravel the inconsistencies observed in reviewed studies, this systematic review will apply meta-analytic moderator analyses to evaluate how different constructs of well-being, health-related outcome, year of publication, follow-up time and sample size introduce their own impact on outcome. Moreover, the methodological quality of the included studies will be assessed and added as a potential moderator, since effect sizes might be smaller in high-quality studies than in other studies (Cuijpers et al., 2010).

In sum, this meta-analysis will synthesize evidence that is drawn from prospective studies on the relationship between emotional well-being and the prognosis of physical illness, in physically diseased samples across a range of health outcomes. In addition, our study will encompass quality assessment of the primary studies and we will employ meta-analytical techniques such as meta-regression and meta-analytic moderator analyses. The previous reviews of the literature (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Veenhoven, 2008) included several of these aims, but none of them combined all aspects into a single systematic literature review. Since the research field of positive psychology is growing rapidly, this review will also include several new studies on the relation between emotional well-being and the prognosis of physical illnesses.

Method

Selection of studies

Studies were included if they reported on emotional well-being or aspects of emotional well-being and on the prognosis of physical illness, aiming to evaluate the prospective effects of well-being on the prognosis. Studies were excluded when (1) the study design was not prospective; (2) emotional well-being was not measured (e.g., emotional well-being was measured otherwise than the presence of general well-being, positive affect and/or life satisfaction, emotional well-being was part of a composite index, or psychopathology was examined as indicator of well-being); (3) the study population was physically healthy, mentally disordered, or consisted of institutionalized elderly; (4) the paper included insufficient information for data extraction required for meta-analysis.

Search strategy

First, we searched the reference lists of the literature reviews of Chida and Steptoe (2008), Diener and Chan (2011), Howell et al. (2007), Lyubomirsky et al. (2005), Pressman and Cohen (2005), and Veenhoven (2008) for studies fitting the inclusion criteria. Second, a systematic search was performed in two electronic databases, Medline and PsycInfo, up to March 2011. The main search strategy was based on two key components: emotional well-being and prognosis of physical illness. Terms on both components were searched in title, abstract and keywords. Emotional well-being included the following terms of which at least one had to be present: (well-being) or (wellbeing) or (happiness) or (happy) or (life satisfaction) or (positive affect) or (positive mood) or (positive emotion*). In addition, at least one term on prognosis of physical illness had to be present. With respect to prognosis, we were mainly interested in recovery outcomes, using terms as functional status, health, and survival. However, since recovery outcomes were not always explicitly mentioned, we also included search terms on recovery processes (recovery, rehabilitation, surgery, surgical, post-operative, postsurgical, morbidity, remission, convalescence), general terms of physical diseases (patient, disease, illness, pain, surviv*, mortality, injury, fracture, infarction) and terms on specific diseases (cancer, tumor, diabetes, arthritis, osteoarthritis, fibromyalgia, arthrosis, heart failure, angina, cardiac, cardiovascular, myocardial, coronary, thrombosis, stroke, cardiovascular accident, COPD, lung disease, bronchitis, aids, HIV). Only one of the search terms of prognosis of physical illness had to be present.

We searched for peer-reviewed studies in the English language with no limitations on the year in which the study was published. To minimize the presence of publication bias we also searched for dissertations. Furthermore, we cross-checked the reference lists of included studies for additional eligible studies. Potentially eligible studies were independently selected by two reviewers (SL and LB) in two phases. In the first phase, selection was based on title and abstract, and in the second phase on the full-text paper. All studies evaluated as potentially eligible by at least one of the reviewers in the first selection phase, were evaluated in the second selection phase. In the second phase, disagreements between both independent reviewers were resolved by consensus.

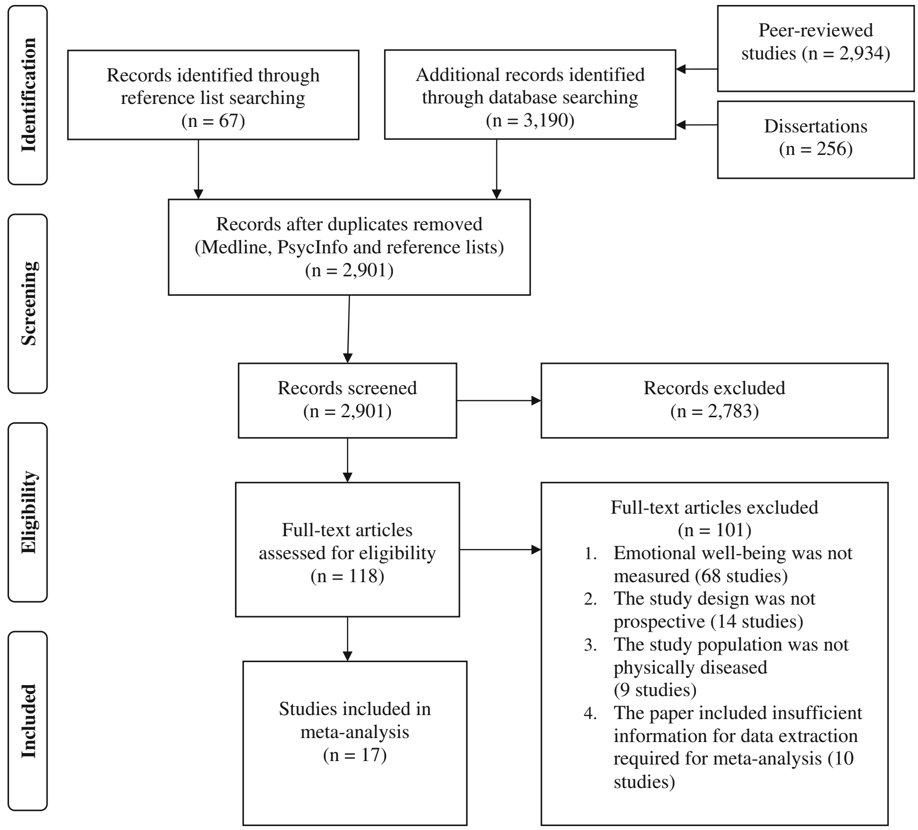
Information extraction

Our search revealed 17 eligible studies. The flow diagram of the study selection is shown in Fig. 1. Searching the reference lists of the literature reviews (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Veenhoven, 2008) and searching databases revealed in total 2,901 records. After exclusion (see Fig. 1), 17 studies were included in the meta-analysis. Of these studies, 6 studies were identified by searching the reference lists and 11 by the electronic search, thus adding new studies to the previous reviews.

Table 1 shows an overview of the included studies. All eligible studies were peer-reviewed articles. The study populations were diverse, including heart and vascular diseases ($n = 6$), cancer ($n = 1$), renal disease ($n = 1$), spinal cord injury ($n = 1$), HIV ($n = 1$), diabetes ($n = 1$), arthritis ($n = 1$), stroke ($n = 1$), hip fracture ($n = 1$), respiratory disorder ($n = 1$), general acute events, including stroke, hip fracture and heart attack ($n = 1$), and general medical patients ($n = 1$). The sample sizes ranged from 44 to 5,025 ($M = 749.7$; $SD = 1139.5$). Three types of well-being constructs were extracted: general well-being ($n = 1$), positive affect ($n = 13$), and life satisfaction ($n = 3$). The studies measured general well-being using the WHO-5 well-being index ($n = 1$; Heun et al., 1999), positive affect using the subscale Positive affect of the Center for Epidemiological Studies Depression Scale ($n = 7$; Radloff, 1977), the subscale Positive affect of the Hospital Anxiety and Depression Scale ($n = 2$; Herrmann, 1997), the Mood Adjective Check List ($n = 2$; Nowlis, 1965), and the Global Mood Scale ($n = 2$; Denollet, 1993). Life satisfaction was measured by the Satisfaction With Life Scale ($n = 1$; Diener et al., 1985), the MOS short form general health survey ($n = 1$; Stewart et al., 1988), and the Life Situation Questionnaire ($n = 1$; Krause, 1992).

The type of outcome measures included functional status ($n = 6$), health status ($n = 1$), and survival ($n = 10$). We combined functional status and health status as recovery outcomes. Functional status was measured by the Duke Activity Status Index ($n = 1$; Hlatky et al., 1989), (modified version of the) Katz's Activities of Daily Living scale ($n = 2$; Katz et al., 1963), the Inpatient Rehabilitation Facilities-Patient Assessment Instrument ($n = 1$; Ottenbacher et al., 1996), the EuroQol (Euroqol group, 1990), and by measuring usual walking speed, rapid walking speed and chair stands ($n = 1$). Of the 10 studies

Fig. 1 Flow chart



measuring survival as outcome, 9 studies measured survival status (alive or deceased at follow-up) and 1 study measured survival time. The studies reported hazard ratios ($n = 6$), risk ratios ($n = 3$), odds ratios ($n = 4$), regression coefficients ($n = 3$) or means ($n = 1$). The follow-up time ranged from 3 months to 11 years with a mean of 4.47 years (SD = 3.93), and the papers were published between 1996 and 2009.

Information was extracted on study design, type of study population (e.g., cancer patients), sample size, type of well-being construct, type of outcome measures, and the study's outcome measure. For each paper, we extracted the relevant and most reliable outcome which was most completely adjusted for potential confounders, such that we obtained a single outcome per paper. For one study (Versteeg et al., 2009) we performed a meta-analysis to synthesize three odds ratios on mobility, self-care, and activities, into a single odds ratio. Moreover, we extracted the results based on baseline emotional well-being instead of change in emotional well-being over time. For one study (Moskowitz, 2003), the result based on multiple measurements of well-being was extracted, since the study did not report results based on baseline emotional well-being. When a paper included insufficient information for data extraction required for meta-analysis, we contacted the authors for additional information.

Quality assessment

Two reviewers (SL and LB) independently assessed methodological quality of the included studies, using a protocol based on the quality checklist for observational studies of Wong et al. (2008). We adapted the checklist to our study aims into a checklist consisting of five quality criteria on external validity, response rate, reliability, control for confounding demographic variables, and control for confounding health variables. For the studies on recovery we included an additional item on the objectiveness of the recovery measurements (i.e., self-report versus laboratory test). Each criterion was rated as 0 (study does not meet criterion) or 1 (study meets criterion). The interrater reliability was 89.1%. The overall quality of the study was assessed by dividing the total score by the total number of applicable items, resulting in a quality score between 0 and 1.00.

The quality of the studies ranged from 0.50 to 1.00 ($M = 0.74$; SD = 0.17). Three of the studies met all quality criteria. In ten studies the reliability of the scale measuring emotional well-being was not reported ($n = 1$) or Cronbachs alpha was lower than .60 ($n = 9$), mainly because well-being was measured by positive affect subscales from depression and anxiety questionnaires. The criterion assessing whether course of disease was measured

Table 1 Descriptives of the studies on emotional well-being as predictor of the course of physical disease

Study	Quality[a]	Follow-up (years)	Participants	Predictive measure[b]	Outcome measure[c]	Results Likelihood ratio (95% confidence interval)	Conclusion[d]
Birket-Smith et al. (2009)	1.00	6	Chronic heart disease ($N = 85$)	Well-being (WHO-5)	Survival	1.024 (1.005–1.042)	+
Brown et al. (2003)	0.80	10	Cancer ($N = 205$)	Positive affect (MACL)	Survival	0.990 (0.938–1.045)	0
Brummett et al. (2009)	0.67	3	Coronary artery disease, age 60+ ($N = 948$)	Positive affect (CES-D)	Functional status (DASI)	1.609 (1.039–2.492)	+
Denollet et al. (2008)	0.80	2	Coronary artery disease ($N = 874$)	Positive affect (HADS)	Survival	2.550 (1.479–4.397)	+
Fisher et al. (2004)	0.67	2	Arthritis, age 65+ ($N = 937$)	Positive affect (CES-D)	Functional status (ADL)	1.099 (1.024–1.181)	+
Fredman et al. (2006)	0.50	2	Hip fracture, age 65+ ($N = 432$)	Positive affect (CES-D)	Functional status: usual and rapid walking speed, chair stands	2.700 (1.096–6.654)	0
Kimmel et al. (1998)	1.00	4	Hemodialysis patients ($N = 295$)	Life satisfaction (SWLS)	Survival	1.205 (0.960–1.513)	0
Konstam et al. (1996)	0.80	3	Congestive heart failure ($N = 5{,}025$)	Life satisfaction (MOS)	Survival	0.949 (0.899–1.001)	0
Krause et al. (1997)	1.00	11	Spinal cord injury ($N = 330$)	Life satisfaction (LSQ)	Survival	1.990 (1.373–2.885)	+
Moskowitz (2003)	0.60	10.8	HIV + patients ($N = 407$)	Positive affect (CES-D)	Survival	1.163 (1.042–1.299)	+
Moskowitz et al. (2008)	0.80	10	Diabetic patients ($N = 715$)	Positive affect (CES-D)	Survival	1.111 (0.962–1.284)	0
Olofson et al. (2009)	0.60	8	Chronic alveolar hypoventilation ($N = 44$)	Positive affect (MACL)	Survival	1.961 (0.901–4.167)	0
Ostir et al. (2002)	0.50	1	Acute events (stroke, heart attack or hip fracture), age 65+ ($N = 240$)	Positive affect (CES-D)	Functional status (ADL)	2.700 (1.096–6.653)	+
Ostir et al. (2008)	0.50	0.25	Stroke, age 55+ ($N = 823$)	Positive affect (CES-D)	Functional status (IRF-PAI)	4.241 (0.939–19.151)	0
Pelle et al. (2009)	0.83	1	Chronic heart failure ($N = 276$)	Positive affect (GMS)	Health status (HCS)	0.865 (0.603–1.241)	0
Scherer and Hermann-Lingen (2009)	0.80	1	Patients of the general medical ward ($N = 575$)	Positive affect (HADS; 1 item on enjoyment)	Survival	1.400 (1.016–1.930)	+
Versteeg et al. (2009)	0.83	1	Coronary artery disease ($N = 533$)	Positive affect (GMS)	Functional status (EQ5D mobility)	1.031 (0.649–1.667)	0

[a] Range from 0.00 (low quality) to 1.00 (high quality), based on external validity, response rate, reliability, control for confounding demographic variables, control for confounding health variables, and objectiveness of the recovery outcomes (not applicable for studies on survival)

[b] Zung = Zung self-rating depression scale (SDS subscale well-being); WHO = WHO-5 well-being index; *MACL* Mood Adjective Check list, *HADS* Hospital Anxiety and Depression Scale (subscale positive affect), *SWLS* Satisfaction with Life Scale; *MOS* MOS short form general health survey, *LSQ* Life Situation Questionnaire (subscale), *CES-D* Center for Epidemiologic Studies Depression Scale (subscale positive affect), *GMS* Global Mood Scale

[c] *DASI* Duke Activity Status Inventory, *ADL* Activities of Daily Living Scale, *IRF-PAI* Inpatient Rehabilitation Facilities—Patient Assessment Instrument, *HCS* Health Complaints Scale (subscale cardiac symptoms), *EQ5D* EuroQol-5D

[d] + = Positive effect ($P \leq .05$); 0 = No effect ($P > .05$); − = Negative effect ($P \leq .05$)

objectively (i.e., no self-report), was only applicable for the studies measuring functional status or health status. Of these studies ($n = 7$), only one met this quality criterion.

Meta-analysis

We used the software Comprehensive Meta Analysis (CMA) to meta-analytically combine study outcomes. For each study, we extracted the hazard ratio, risk ratio or odds ratio and its confidence intervals. Regression coefficients and means were converted to odds ratios using CMA. We combined the ratios, referring to the hazard ratios, risk ratios and odds ratios as likelihood ratios (LR). When necessary the ratio was inverted such that all LRs above 1 indicate a positive relationship of emotional well-being to the prognosis of physical illness. The meta-analysis included weighting of the study LRs by the inverse of the standard errors, based on the confidence intervals. With small studies tending to have wider confidence intervals and large studies to have narrow confidence intervals, the confidence interval reflects the precision of the LR. The LR is considered statistically significant if the confidence interval (95%) excludes the null value of 1.

A random-effects meta-analysis was performed, because of the heterogeneity across the studies. The random-effects method allows to assume that the studies are estimating different but related effects, thus relacing the assumption that all studies are replicas. In addition, the random-effects model makes an adjustment to the study weights according to the extent of heterogeneity (Deeks et al., 2008), which translates into a broad 95% confidence interval around the pooled effect estimate.

We performed an overall analysis, as well as subgroup analyses and meta-regression analyses to identify potential moderators. In the subgroup analyses, we examined the effects of emotional well-being on the prognosis of physical illness separately for positive affect and for each measure of prognosis (survival; recovery). No subgroup analyses were performed on overall well-being and life satisfaction, since few studies measured these aspects of emotional well-being ($n = 1$ and 3, respectively). The study population could not be split into more homogeneous subgroups because of its (too large) diversity. In the meta-regression analyses, we evaluated the potentially confounding relationship of sample size, the quality of the studies, the follow-up length, and the publication year on the relationship of interest: the impact of emotional well-being on the prognosis of physical illness. To this end, we used an unrestricted maximum likelihood mixed effects regression. Moreover, we examined heterogeneity between the studies by using the Q-test, indicating the probability of heterogeneity, and the I^2 index, indicating the magnitude of the heterogeneity. An I^2 between 0 and 30% was considered as low, between 30 and 75% as moderate, and between 75 and 100% as high heterogeneity (Deeks et al., 2008).

Publication bias in the studies was evaluated using three indices: the funnel plot, the Egger's test of intercept and the Rosenberg fail-safe number. The funnel plot is a graph of effect size (LR) against sample size (N). When publication bias is absent, the observed studies are expected to be distributed symmetrically around the pooled effect size. The Egger's test of intercept is a correlation between study precision (the inverse of the standard error) and the standardized effect (the effect size divided by its standard error). The fail-safe number indicates the number of non-significant unpublished studies needed to reduce the overall significant effect to non-significance (Sterne et al., 2008). We used Rosenberg's (2005) weighted method for calculating fail-safe numbers, where studies with small variance are given higher weight than those with large variance. For the reporting of this meta-analysis, we applied PRISMA guidelines (Moher et al., 2009).

Results

An overview of the 17 selected studies is presented in Table 1. The studies investigated the prospective relationship of general well-being, positive affect or life satisfaction to survival or recovery. None of the studies reported negative effects of emotional well-being on the prognosis of physical illness. The results of the 17 studies and the meta-analysis are presented in Fig. 2. Meta-analytically summarizing the effects across the studies revealed an overall likelihood ratio of 1.14 ($P < 0.001$), indicating a small but significant effect of emotional well-being on the course of physical disease. Since the studies were weighted, we also conducted a meta-analysis without the study of Konstam et al. (1996), which is an outlier in sample size ($n = 5{,}025$) as reflected by its narrow confidence interval. Meta-analytically combining the remaining 16 studies revealed a higher likelihood ratio of 1.18 ($P < .001$), indicating the positive relation of emotional well-being to recovery and survival is even stronger when excluding the study with the highest weight. The 17 studies were heterogeneous as the variability of the effect sizes is larger than would be expected from sampling error alone. This high heterogeneity indicated that variability across the primary studies largely stems from systematic factors, such as the type of studied well-being, type of outcome or differences in methodological quality of the studies.

We performed two subgroup analyses to evaluate whether the effects differed for positive affect or course of disease outcomes. When examining the effects separately for positive affect, the 13 studies on positive affect

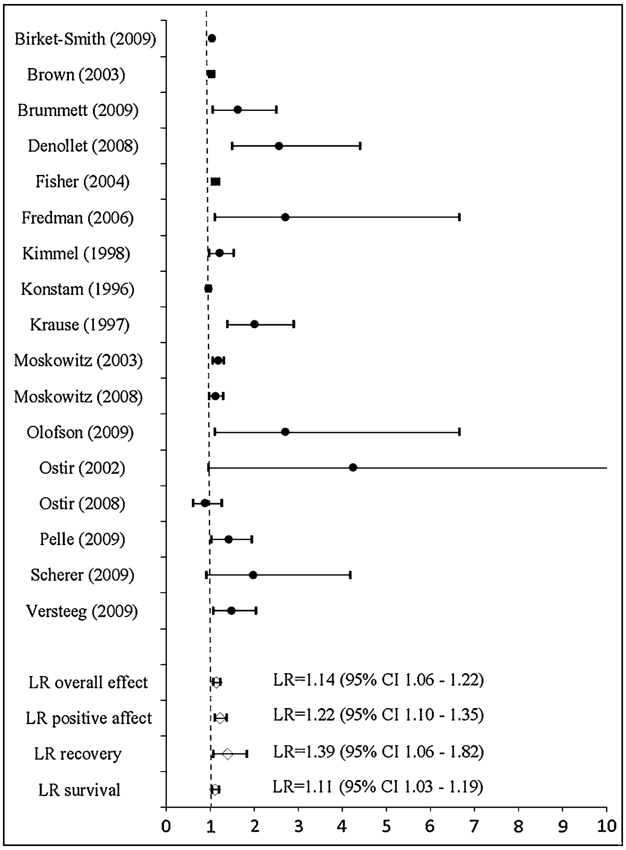


Fig. 2 Forest plot

revealed an LR of 1.22 ($P < .001$). Positive affect was significantly related to more survival and recovery. The distribution of effect sizes within studies on positive affect remained heterogeneous. Second, we performed a subgroup analysis on type of outcome. We split the studies in two groups, measuring recovery ($n = 7$) or survival ($n = 10$). Meta-analytically combining the studies on recovery and survival resulted in LRs of 1.39 ($P = .02$) and 1.11 ($P = .01$), respectively. Emotional well-being significantly predicted both survival and recovery later in time, with the strongest relation to recovery. Although the LR is higher for recovery, the confidence intervals show that the ratio for recovery is estimated with less precision than the ratio for survival. When taking type of outcome into account as a moderator, the heterogeneity remained moderate to large within studies on recovery and survival.

Moreover, we evaluated quality of the studies, follow-up length, publication year, and sample size as moderators of the relation between emotional well-being and course of disease by performing three meta-regression analyses. Results of the meta-regression were insignificant for study quality ($B = -.56$; $P = .24$), follow-up length ($B = -.01$; $P = .53$), publication year ($B = .01$; $P = .59$), and for sample size ($B = -.00$; $P = .23$).

Finally, we evaluated publication bias. The funnel plot indicated asymmetry, since the studies are mainly concentrated on the right side of the plot. The Egger's test of intercept ($t = 4.41$; $df = 15$; $P < .001$) also suggests that bias exists. There is a significant correlation between study precision (the inverse of the standard error) and the standardized effect (the effect size divided by the standard error). Moreover, the fail-safe number indicated that 2.4 non-significant unpublished studies must be included in our random-effects model to reduce the overall significant effect to non-significance. The funnel plot, Egger's test of intercept and fail-safe number indicated the presence of publication bias. To gain insight in the grey literature, we searched the electronic databases for eligible dissertations. Three dissertations were eligible (Caron, 1997; Hamilton, 1996; Ostir, 2001), but excluded because the studies were already included in the meta-analysis (Ostir, 2001) or data required for meta-analysis were unavailable despite contacting the authors for additional information (Caron, 1997; Hamilton, 1996). These three dissertations reported positive effects in the dissertation abstract, showing positive effects of well-being on course of disease in unpublished studies. Furthermore, given the novelty of the focus on positive well-being in relation to physical health, it is unlikely that many studies with negative findings are unreported (Diener & Chan, 2011). However, we have to interpret the results in our meta-analysis carefully, since effects of well-being on course of disease might be overestimated.

Discussion

Main findings

This meta-analysis synthesized studies on emotional well-being as predictor of the prognosis of physical illness, while in addition evaluating the impact of putative moderators such as type of outcome. Although previous literature reviews included several of these study aims (Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Howell et al., 2007; Chida & Steptoe, 2008; Veenhoven, 2008; Diener & Chan, 2011), this is the first study to our knowledge that combines all aspects into a single review. Our literature search identified 17 eligible papers, of which nine new studies in addition to the studies included in earlier reviews. This shows that the research field on the relation of positive well-being to physical health is growing rapidly.

Meta-analytically combining these studies showed that positive emotional well-being is favorably related to the prognosis of physical illness. Patients with higher baseline levels of emotional well-being have better recovery and survival rates than patients with low levels of emotional well-being. Although the effect is small, it is remarkable that emotional well-being at baseline has significant effects on physical health later in time, since the average follow-up is approximately after 4 years. The effect size of the relation between emotional well-being and course of disease is even similar for studies with short and long follow-ups.

Subgroup analyses indicated that emotional well-being is related to both survival and recovery. Moreover, positive affect is beneficial. Positive affect may influence immune and cardiovascular systems directly by activating the autonomic nervous system and the Hypothalamic–Pituitary–Adrenal axis (HPA) thus buffering the impact of stress. Positive affect has also an indirect favorable effect by increasing health behavior and engagement in social networks (Pressman & Cohen, 2005; Howell et al., 2007). There were not enough studies to conduct a subgroup analysis on life satisfaction (3 studies) and well-being (1 study).

Recommendations for future research

It is important for future research to take into account that the impact of emotional well-being on course of disease might differ across health outcomes, well-being measures, and study populations. As suggested in previous literature reviews, effects might also differ across diseases (Chida and Steptoe, 2008). In addition, Pressman and Cohen (2005) and Veenhoven (2008) state that well-being has beneficial effects in relatively mildly diseased adults and negative effects in severely diseased adults. For our future understanding of the role of well-being in disease progression, it is highly relevant whether well-being has similar effects in various disease populations. Unfortunately, the study populations in the current meta-analysis were too diverse to further investigate effects across diseases.

Moreover, other population characteristics could play a role in the relation between emotional well-being and course of disease. Pressman and Cohen (2005) found that positive affect was associated with lower mortality rates, mainly in older community-residing adults. They suggest that the association is possibly stronger in older participants. This meta-analysis could not unravel the effects of age and health outcome, since the studies on survival included patients of all ages, whereas studies on recovery more often included only older patients. Additionally, results could differ across gender. Brummett et al. (2009) and Fisher et al. (2004) found that effects of well-being on recovery were stronger for males than for females. In the current meta-analysis, the patient populations were too diverse to examine differential effects across well-being and outcome measures, diseases, age and gender, but we recommend investigating these aspects in future research.

Strengths and limitations

One of the strengths of this systematic review is the focus on emotional well-being as the presence of well-being, positive affect, or life satisfaction. We investigated positive psychological aspects, whereas previous reviews also included studies on quality of life which use items on physical functioning and health. The focus on other aspects than emotional well-being was our main criterion for exclusion of studies. Aspects as vitality, energy, and optimism might indirectly measure health (Pressman & Cohen, 2005). In addition, we included control for baseline health status as a quality criterion, which was present in 14 of the 17 included studies.

Most studies used subscales from depression scales to measure positive affect. For example, both the Hospital Anxiety and Depression Scale (HADS) and the Center for Epidemiologic Studies Depression Scale (CES-D) include a subscale on positive affect. However, these questionnaires are designed to screen for depressive symptoms rather than to measure positive affect, resulting in low subscale reliability (Penninx, 2000). Additional studies need to be conducted, using reliable questionnaires which are designed to measure well-being, such as the Positive and Negative Affect Scales (PANAS; Watson et al., 1988) and Mental Health Continuum-Short Form (MHC-SF; Lamers et al., 2011).

Although most studies used depression scales to measure aspects of positive well-being, few studies included negative aspects of mental health such as psychopathology and negative affect as a confounding variable, to evaluate the unique effects of emotional well-being. Studies that did evaluate the unique effects of positive emotional well-being report positive results, such as Brummett et al. (2009).

In addition, the results from our meta-analysis have to be interpreted carefully. First, the studies used different covariates varying from baseline health characteristics to demographic characteristics such as gender and age, making the studies diverse. The high heterogeneity confirmed that the variability across the studies was larger than would be expected from sampling error alone. Although study quality, in which control for baseline health status and for demographics were used as quality criteria, was not related to the effect size of the study, we have to take the high variability and diversity in covariates across studies into account. Moreover, the results have to be interpreted carefully because of potential publication bias. The effects of emotional well-being on recovery and survival might be overestimated.

Conclusion and implications

Emotional well-being predicts long-term prognosis of physical illness. Higher levels of emotional well-being are beneficial for recovery and survival rates in physically diseased patients. Although the effects are small, the findings are important. Recovery and survival are highly relevant outcomes. Moreover, since physical diseases such as coronary heart disease and cancer are highly prevalent, small effects of emotional well-being on prognosis of physical illness have a large impact in the population. In addition, several psychological interventions are effective in enhancing well-being, such as Acceptance and Commitment Therapy (Fledderus et al., 2010) and well-being therapy (Fava et al., 1998). By the enhancement of well-being, these interventions might also improve recovery and survival in physical illness. Future research should investigate effects of psychological interventions on the prognosis of physical illness.

References

References marked with an asterisk [*] indicate studies included in the meta-analysis.

*Birket-Smith, M., Hansen, B. H., Hanash, J. A., Hansen, J. F., & Rasmussen, A. (2009). Mental disorders and general well-being in cardiology outpatients—6 year survival. *Journal of Psychosomatic Research, 67*, 5–10.

*Brown, K. W., Levy, A. R., Rosberger, Z., & Edgar, L. (2003). Psychological distress and cancer survival: A follow-up 10 years after diagnosis. *Psychosomatic Medicine, 65*, 636–643.

*Brummett, B. H., Morey, M. C., Boyle, S. H., & Mark, D. B. (2009). Prospective study of associations among positive emotion and functional status in older patients with coronary artery disease. *Journal of Gerontology: Psychological Sciences, 64B*, 461–469.

Caron, M. D. (1997). Psychological and environmental factors of rehabilitation outcome in the elderly. *Dissertation Abstracts International, 57*, 4335. (UMI No. 9638939).

Chida, Y., & Steptoe, A. (2008). Positive psychological well-being and mortality: A quantitative review of prospective observational studies. *Psychosomatic Medicine, 70*, 741–756.

Cuijpers, P., Van Straten, A., Bohlmeijer, E., Hollon, S. D., & Andersson, G. (2010). The effects of psychotherapy for adult depression are overestimated: A meta-analysis of study quality and effect size. *Psychological Medicine, 40*, 211–223.

De Groot, M., Anderson, R., Freedland, K. E., Clouse, R. E., & Lustman, P. J. (2001). Association of depression and diabetes complications: A meta-analysis. *Psychosomatic Medicine, 63*, 619–630.

Deeks, J. J., Higgins, J. P. T., & Altman, D. G. (2008). Analysing data and undertaking meta-analysis. In J. P. T. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions* (pp. 243–297). Chichester: Wiley.

Denollet, J. (1993). Emotional distress and fatigue in coronary heart disease: The global mood scale (GMS). *Psychological Medicine, 23*, 111–121.

*Denollet, J., Pedersen, S. S., Daemen, J., De Jaegere, P., Serruys, P. W., & van Domburg, R. T. (2008). Reduced positive affect (anhedonia) predicts major clinical events following implantation of coronary-artery stents. *Journal of Internal Medicine, 263*, 203–211.

Diener, E., & Chan, M. Y. (2011). Happy people live longer: Subjective well-being contributes to health and longevity. *Applied Psychology: Health and Well-being, 3*, 1–43.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Psychological Assessment, 5*, 164–172.

Diener, E., Suh, E. M., Lucas, R., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125*, 276–302.

Euroqol group. (1990). A new facility for the measurement of health-related quality of life. *Health Policy, 16*, 199–208.

Fava, G. A., Rafanelli, C., Cazzaro, M., Conti, S., & Grandi, S. (1998). Well-being therapy. A novel psychotherapeutic approach for residual symptoms of affective disorders. *Psychological Medicine, 28*, 475–480.

*Fisher, M. N., Snih, S. A., Ostir, G. V., & Goodwin, J. S. (2004). Positive affect and disability among older Mexican Americans with arthritis. *Arthritis and Rheumatism, 51*, 34–39.

Fledderus, M., Bohlmeijer, E. T., Smit, F., & Westerhof, G. J. (2010). Mental health promotion as a new goal in public mental health care: A randomized controlled trial of an intervention enhancing psychological flexibility. *American Journal of Public Health, 100*, 2372–2378.

*Fredman, L., Hawkes, W. G., Black, S., Bertrand, R. M., & Magaziner, J. (2006). Elderly patients with hip fracture with positive affect have better functional recovery over 2 years. *Journal of the American Geriatrics Society, 54*, 1074–1081.

Glassman, A. H., & Shapiro, P. A. (1998). Depression and the course of coronary artery disease. *American Journal of Psychiatry, 155*, 4–11.

Hamilton, A. B. (1996). Do psychosocial factors predict metastatic cancer survival? A longitudinal assessment of breast, colon, and lung cancer patients. *Dissertation Abstracts International, 57*, 4029. (UMI No. 9632697).

Herrmann, C. (1997). International experiences with the hospital anxiety and depression scale: A review of validation data and clinical results. *Journal of Psychosomatic Research, 42*, 17–41.

Heun, R., Burkart, M., Maier, W., & Bech, P. (1999). Internal and external validity of the WHO well-being scale in the elderly general population. *Acta Psychiatrica Scandinavica, 23*, 56–62.

Hlatky, M. A., Boineau, R. E., Higginbotham, M. B., Lee, K. L., Mark, D. B., Califf, R. M., et al. (1989). A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). *American Journal of Cardiology, 64*, 651–654.

Howell, R. T., Kern, M. L., & Lyubomirsky, S. (2007). Health benefits: Meta-analytically determining the impact of well-being on objective health outcomes. *Health Psychology Review, 1*, 83–136.

Huppert, F. A., & Whittington, J. E. (2003). Evidence for the independence of positive and negative well-being: Implications for quality of life assessment. *British Journal of Health Psychology, 8*, 107–122.

Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., & Jaffe, M. W. (1963). The index of ADL: A standardized measure of biological and psychosocial function. *Journal of the American Medical Association, 185*, 914–919.

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology, 73*, 539–548.

Keyes, C. L. M. (2007). Promoting and protecting mental health as flourishing: A complementary strategy for improving national mental health. *American Psychologist, 62*(2), 95–108.

*Kimmel, P. L., Peterson, R. A., Weihs, K. L., Simmens, S. J., Alleyne, S., Cruz, I., et al. (1998). Psychosocial factors, behavioral compliance and survival in urban hemodialysis patients. *Kidney International, 54*, 245–254.

*Konstam, V., Salem, D., Pouleur, H., Kostis, J., Gorkin, L., Shumaker, S., et al. (1996). Baseline quality of life as a predictor of mortality and hospitalization in 5, 025 patients with congestive heart failure. *American Journal of Cardiology, 78*, 890–895.

Krause, J. S. (1992). Life satisfaction after spinal cord injury: A descriptive study. *Rehabilitation Psychology, 37*, 61–70.

*Krause, J. S., Sternberg, M., Lottes, S., & Maides, J. (1997). Mortality after spinal cord injury: An 11-year prospective study. *Archives of Physical Medicine and Rehabilitation, 78*, 815–821.

Kubzansky, L. D., & Kawachi, I. (2000). Going to the heart of the matter: Do negative emotions cause coronary heart disease? *Journal of Psychosomatic Research, 48*, 323–337.

Lamers, S. M. A., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M., & Keyes, C. L. M. (2011). Evaluating the psychometric properties of the mental health continuum-short form. *Journal of Clinical Psychology, 67*, 99–110.

Lyubomirsky, S., King, L., & Diener, E. (2005). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin, 131*, 803–855.

Michelson, D., Stratakis, M. D., Hill, L., Reynolds, J., Galliven, E., Chrousos, G., et al. (1996). Bone mineral density in women with depression. *The New England Journal of Medicine, 335*, 1176–1181.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine, 6*, 1–6.

*Moskowitz, J. T. (2003). Positive affect predicts lower risk of AIDS mortality. *Psychosomatic Medicine, 65*, 620–626.

*Moskowitz, J. T., Epel, E. S., & Acree, M. (2008). Positive affect uniquely predicts lower risk of mortality in people with diabetes. *Health Psychology, 27*, 73–82.

Nowlis, V. (1965). Research with the mood adjective checklist. In S. S. Tompkins & C. E. Izard (Eds.), *Affect, cognition and personality* (pp. 352–389). New York: Springer.

*Olofson, J., Dellborg, C., Sullivan, M., Midgren, B., Caro, O., & Bergman, B. (2009). Quality of life and palliation predict survival in patients with chronic alveolar hypoventilation and nocturnal ventilatory support. *Quality of Life Research, 18*, 273–280.

Ostir, G. V. (2001). Emotional well-being and subsequent health, functional ability and mortality in older non-Hispanic Whites, Blacks and Mexican Americans. *Dissertation Abstracts International, 61*, 2865. (UMI No. 9981512).

*Ostir, G. V., Berges, I., Ottenbacher, M. E., Clow, A., & Ottenbacher, K. J. (2008). Associations between positive emotion and recovery of functional status following stroke. *Psychosomatic Medicine, 70*, 404–409.

*Ostir, G. V., Goodwin, J. S., Markides, K. S., Ottenbacher, K. J., Balfour, J., & Guralnik, J. M. (2002). Differential effects of premorbid physical and emotional health on recovery from acute events. *Journal of the American Geriatrics Society, 50*, 713–718.

Ottenbacher, K. J., Hsu, Y., Granger, C. V., & Fiedler, R. C. (1996). The reliability of the functional independence measure: A quantitative review. *Archives of Physical Medicine and Rehabilitation, 77*, 1226–1232.

*Pelle, A. J., Pedersen, S. S., Szabo, B. M., & Denollet, J. (2009). Beyond type D personality: Reduced positive affect (anhedonia) predicts impaired health status in chronic heart failure. *Quality of Life Research, 18*, 689–698.

Penninx, B. (2000). A happy person, a healthy person? *Journal of the American Geriatrics Society, 48*, 590–592.

Pressman, S. D., & Cohen, S. (2005). Does positive affect influence health? *Psychological Bulletin, 131*, 925–971.

Radloff, L. S. (1977). The CES-D scale: A self report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401.

Rosenberg, M. S. (2005). The file-drawer problem revisited: A general weighted method for calculating fail-safe numbers in meta-analysis. *Evolution, 59*, 464–468.

Satin, J. R., Linden, W., & Phillips, M. J. (2009). Depression as a predictor of disease progression and mortality in cancer patients. *Cancer, 115*, 5349–5361.

*Scherer, M., & Hermann-Lingen, C. (2009). Single item on positive affect is associated with 1-year survival in consecutive medical inpatients. *General Hospital Psychiatry, 31*, 8–13.

Spiegel, D., & Giese-Davis, J. (2003). Depression and cancer: Mechanisms and disease progression. *Biological Psychiatry, 54*, 269–282.

Sterne, J. A. C., Egger, M., & Moher, D. (2008). Addressing reporting biases. In J. P. T. Higgins & S. Green (Eds.), *Cochrane handbook for systematic reviews of interventions* (pp. 297–333). Chichester: Wiley.

Stewart, A. L., Hays, R. D., & Ware, J. E. (1988). The MOS short form general health survey: Reliability and validity in a patient population. *Medical Care, 26*, 724–735.

Veenhoven, R. (2008). Healthy happiness: Effects of happiness on physical health and the consequences for preventive health care. *Journal of Happiness Studies, 9*, 449–469.

*Versteeg, H., Pedersen, S. S., Erdman, R. A. M., van Nierop, J. W. I., de Jaegere, P., & Van Domburg, R. T. (2009). Negative and positive affect are independently associated with patient-reported health status following percutaneous coronary intervention. *Quality of Life Research, 18*, 953–960.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–1070.

Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98*, 219–235.

Wong, W. C. W., Cheung, C. S. K., & Hart, G. J. (2008). Development of a quality assessment tool for systematic reviews of observational studies of HIV prevalence in men having sex with men and associated risk behaviours. *Emerging Themes in Epidemiology, 5*, 23–26.