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Meaning in life and physical health: systematic review and meta-analysis

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ABSTRACT

This systematic review and meta-analysis aimed to clarify the associations between meaning in life and physical health using random-effects models. Conceptualisation of meaning (order in world vs. purpose in life), type of health indicators, participants' health status, and age issues were investigated as moderators. Systematic searches of six databases resulted in inclusion of $k = 66$ studies (total $N = 73{,}546$). Findings indicated that meaning in life and physical health formed weak-to-moderate associations (the overall estimate of the average effect = 0.258). Conceptualisation of meaning, participants' health status, and their age did not moderate these associations. Operationalisation of health moderated the relationship between meaning in life and health. The strongest associations were found for subjective indicators of physical health. Significant albeit weak associations between meaning in life and objective indices of health were found. Furthermore, stronger effects were observed when the measures of meaning combined items referring to meaning in life and meaning-related sense of harmony, peace, and well-being, compared to measures focusing solely on meaning in life. Overall, the results point to the potential role of meaning in life in explaining physical health.

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Meaning in life has become a popular concept in research on personal strength and resilience factors (Park, 2010). Making and finding meaning is a key cognitive process activated when an individual is faced with life challenges (Park & Folkman, 1997). According to the meaning-making model (Park, 2010), a widely used framework in studying meaning, situational meaning is made in the context of a stressful event (e.g. an illness diagnosis) and refers to beliefs regarding this particular stressful event. In turn, according to this model, global meaning accounts for more general beliefs such as justice, control, predictability, or coherence (Park, 2010). Global meaning also encompasses one's global goals, core schemes, and subjective sense of purpose (Park, 2010). In line with theories of stress and coping (e.g. Lazarus & Folkman, 1984), various types of meaning in life may change appraisals of taxing events, trigger effective coping, and in consequence affect health-related outcomes. As the evidence for associations between meaning in life and health outcomes mounts (cf., Roepke, Jayawickreme, & Riffle, 2013), an overarching synthesis of associations of meaning with well-being is needed.

Myriad studies have demonstrated associations between meaning in life (operationalised as either situational or global meaning) and physical health. Meaning in life may influence physical health

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outcomes through physiological and behavioural mechanisms (Bekenkamp, Groothof, Bloemers, & Tomic, 2014). In particular, meaning in life may impact physiological regulation of immune and stress-response systems or may contribute to one's sense of control, related to self-efficacy, optimism and positive affect, which in turn may improve physical health (e.g. through health-related behaviours; Roepke et al., 2013). Research indicates that higher levels of meaning in life are longitudinally related to preventive behaviours like physical activity among older individuals (Lampinen, Heikkinen, Kauppinen, & Heikkinen, 2006), whereas lower levels of meaning in life are cross-sectionally associated with risk behaviours such as alcohol use or sedentary behaviours among young people (Brassai, Piko, & Steger, 2010). Meaning in life is also longitudinally associated with the objective indicators of physical health including mortality and physiological indices among bereaved women (e.g. quantity of natural killer cells; Bower, Kemeny, Taylor, & Fahey, 2003) and cross-sectionally related to subjective health indices such as self-described health status or scope of disability in a general adult population (Shrira, Palgi, Ben-Ezra, & Shmotkin, 2011).

Whether associations between meaning in life relates differently to different aspects or indicators of health remains unknown. A systematic review by Roepke et al. (2013) showed that constructs related to meaning in life (e.g. meaning in life, meaningfulness – a sense of coherence component) were consistently associated with health behaviours, but findings were less conclusive for self-rated health indicators and objective indices of health. Importantly, Roepke et al. (2013) combined several meaning-related constructs such as posttraumatic growth and purpose in life, therefore the conclusions were drawn for a very broad construct, encompassing meaning but multiple other related but distinct variables. Furthermore, it is not clear why associations between meaning in life and self-rated or objective health indicators reviewed by Roepke et al. (2013) were not consistent and whether the effects of meaning on self-rated and objective health indices are indeed different (no meta-analysis was conducted). Another recent systematic review (Cohen, Bavishi, & Rozanski, 2016) showed associations between narrowly defined meaning in life (conceptualised as purpose in life) and mortality or cardiovascular events in 10 prospective studies conducted among patients with chronic illness. As the conceptualisation of health and meaning is crucial for making any generalisations, further studies accounting for the moderating effects of the type of population and the conceptualisation of health and meaning are needed. The present study aims to meta-analyse the effects of the meaning – health relationship and to examine potential moderating effects of the type of health index, the conceptualisation of meaning, and the type of population.

Conceptualisation of meaning in life

The conceptualisation of meaning in life varies across studies (cf., Cohen et al., 2016; Roepke et al., 2013). Differences in conceptualisations of meaning in life may lead to differences in measurement of meaning (Morgan & Farsides, 2007; Sherman, Simonton, Latif, & Bracy, 2010). Diversity in operationalisation of meaning may be a key source of discrepancies in associations between meaning in life and health indices.

In line with the model proposed by Park and Folkman (1997), meaning may be described as referring to (1) the order (or a meaningfulness) of the world, consisting of the beliefs about the world, self, and relationships between self and the world or (2) one's life's goals and purposes (Park & Folkman, 1997). Studies on associations between health and meaning in life may be divided into those that applied the operationalisation of meaning in life that encompasses the sense of order in life or sense of significance and meaningfulness of life (for brevity, we will hereafter refer to 'order' when addressing this aspect of meaning) and those that defined and measured meaning in life as purpose or possessing value (for brevity, we will refer to 'purpose'). The effect of the conceptualisation of meaning in life along order – purpose axis and its association with health indices has not been studied systematically. Therefore, in the present study, we examine if the operationalisation of meaning as referring to order versus purpose moderated the estimates of the average effect for the health – meaning relationship (Morgan & Farsides, 2008).

Other theoretical approaches also indicate that 'order/sense' or 'purpose' are the core aspects of meaning. For example, Ryff and Singer (1998) suggested that the 'meaning in life' concept refers to goal directedness in life or purposefulness of life, which is close to the conceptualisation of meaning in life as 'purpose' (Park & Folkman, 1997). Alternately, Steger, Frazier, Oishi, and Kaler (2006) defined meaning in life as 'the sense made of, and significance felt regarding, the nature of one's being and existence' (p. 81). Thus, Steger et al.'s (2006) approach captures meaning in life as the construct close to the 'order/sense', as proposed by Park and Folkman (1997). Importantly, theoretical approaches assume that meaning in life determines specific outcomes. The approaches of Steger et al. (2006) and Ryff and Singer (1998) were developed in the context of explaining psychological well-being. In contrast, the approach proposed by Park (2010) captures meaning as the construct explaining health (both physical and mental). Therefore, the theoretical developments by Park (2010; see also Park & Folkman, 1997) may be best suited for exploring associations between meaning in life and physical health indicators.

In sum, 'meaning in life' is an umbrella term that captures a number of narrower constructs (e.g. referring to purpose in life only). For this study, meaning in life was defined as beliefs that one's own life is valuable, meaningful, or purposeful.

Health status, health measurement, and age as moderators

The meaning model (Park, 2010) assumes that one's level of meaning in life may depend on adaptation to life stressors or challenges. Treatment and diagnosis of severe or life-threatening illness is one such challenging and stressful situation. Therefore, associations between meaning in life and health may depend on health status (e.g. being diagnosed with severe illness vs. being healthy). In particular, it has been found that among people with chronic illness, meaning in life forms strong associations with well-being (de Roon-Cassini, de St. Aubin, Valvano, Hastings, & Horn, 2009). The role of health status as a moderator in the meaning in life–health relationship has not been investigated systematically.

The specific way health is operationalised and measured may also influence the association between meaning and health indices. In particular, associations of meaning in life may be more strongly associated with self-reports of health than with objective (e.g. physiological) measures of health. Self-reports of health may depend more strongly on appraisals, cognitions, goals, and coping processes (which are also involved in judging one's meaning in life) and people may attempt to achieve coherent self-presentation (Schlenker & Leary, 1982). Thus, meaning in life may form stronger associations with subjective health evaluations but weaker associations with objective health indices. Our study tests whether the operationalisation and measurement of health (objectively or subjectively reported) moderates the estimates of the average effect in the meaning in life – health relationship.

Meaning in life may differ across age groups. For example, it is assumed that as people age, they shift from pursuing their personal goals to experiencing a meaningful world and self (Reker & Chamberlain, 2000; Steger, Oishi, & Kashdan, 2009). Furthermore, people can experience different levels of meaning in life across the stages of life (Alter & Hershfield, 2014). In particular, experiencing meaning in life may increase with age (Steger et al., 2009). At the same time, health status declines with age (National Institute on Aging, the National Institutes of Health, 2011). Although both meaning in life and health outcomes are associated with age, it is unclear whether the association between those two variables changes across the life span. Thus, the present study investigates whether age moderates estimates of the average effect of the relationship between meaning in life and health.

Aims of the study

Applying methods of systematic review (Higgins & Green, 2011) and meta-analysis strategies (Borenstein, Hedges, Higgins, & Rothstein, 2011; Lipsey & Wilson, 2000), we investigated the strength of

associations between meaning in life and physical health indicators. Furthermore, we tested whether the operationalisation of meaning in life (purpose vs. order), the measurement applied to assess meaning in life, and operationalisation/measurement of health (objectively or subjectively assessed) would moderate the estimates of the average effect. Finally, we examined whether the estimates of the average effect would be moderated by health status of participants (i.e. with or without a severe illness) and age.

Method

Adherence to PRISMA guidelines (see Supplement 1 for the PRISMA checklist; Moher, Liberati, Tetzlaff, & Altman, 2009). The study and its protocol were not registered. Protocols are available from the first author upon request.

Literature search

We conducted database searches of studies examining associations between meaning in life and health. The following databases were included: Health Source: Nursing/Academic Edition, Masterfile Premier, Medline, PsycArticles, PsycInfo, and Academic Search Complete. Original studies published over the period 1990 to 2016 were included. Keywords related to health status were: 'health', 'disease', and 'illness'. 'Meaning in life'- related keywords were: 'meaning', 'meaning of life', 'meaning in life', 'sense of meaning', 'global beliefs', 'change of identity' and 'purpose in life'. To include the study, the keywords needed to be present in either the abstract or the title or the keywords of a publication. Exact combination/order of terms was: 'meaning' OR 'meaning of life' OR 'meaning in life' OR 'sense of meaning' OR 'global beliefs' OR 'change of identity' OR 'purpose in life' AND 'health' OR 'disease' OR 'illness'; all terms in title OR abstract OR keywords. Our goal was to include studies addressing the meaning in life construct but exclude constructs which may be conceptually partially overlapping with but distinct from meaning in life. Therefore, we did not use as keywords-related terms such as: 'control/mastery', 'self-control', 'just world/luck', 'justice', 'self-worth', 'benevolence', 'goal'. If any study used terms, such as 'control/mastery', 'self-control', 'just world/luck', 'justice', 'self-worth', 'benevolence', 'goal', but at the same time used such terms as 'meaning', 'meaning of life', 'meaning in life', 'sense of meaning', 'global beliefs', 'change of identity' and 'purpose in life' in the abstract, the title, or the keywords, then the study received further analysis. We did not use keywords such as: 'spirituality', 'religious practices', 'forgiveness', 'spiritual' and 'religious beliefs', 'growth' and 'post-traumatic growth', as they refer to constructs which may be partially overlapping yet distinct from meaning in life. Studies that included these constructs but did not use the any of our 'meaning in life'-related keywords in the abstract, the title, or the keywords, were not included.

At the first stage, the search strategy resulted in retrieving 1926 publications. In the second stage of the search, two independent researchers (K. C. and A. B.) read the titles and abstracts in order to identify potentially relevant studies. This second stage resulted in identifying 472 studies including keywords related to meaning and health as defined above and addressing the association between meaning in life and health. These studies where included for further analysis.

In the third stage, two researchers (K. C. and A. B.) read the manuscripts in order to establish their match with the inclusion criteria and included original studies that analysed the relationship between health and meaning indicators. Additionally, manual search through references was conducted. Manual search was performed in two steps. First, systematic searches through references sections were conducted using keywords defined above. Second, studies cited in a respective paper were retrieved and screened under inclusion and exclusion criteria. Consequently, 31 additional papers were identified.

In the next step, two researchers (K. C. and A. B.) extracted data regarding studies' participants, questionnaires used to measure meaning in life and health, and associations between meaning in

life and health. From 503 analysed studies, 71 met all inclusion criteria and provided information about the associations between meaning in life and health indicators. Finally, five studies were excluded due to low quality.

The stages of the data selection process are presented in Figure 1, following the PRISMA template for reporting the results of systematic reviews (Moher et al., 2009).

Inclusion criteria, exclusion criteria, and data extraction

The main inclusion criteria were: (a) meaning in life and health-related outcomes were measured quantitatively, (b) relationship between meaning in life and health-related outcomes was assessed and reported, (c) participants were 18 years or older, (d) the study reported original findings, and (e) the study was published in a peer-reviewed English language journal. Studies addressing meaning in life in the context of other outcomes (e.g. traumatic stress exposure and related mental health outcomes), theoretical contributions, reviews, case studies, publications focusing solely on children and adolescents ($k = 1157$) and duplicates ($k = 297$) were excluded. Further exclusion criteria were: (a) applying only qualitative methods or focusing only on theoretical issues ($k = 148$), (b) solely using mental health outcomes ($k = 239$), and (c) using only health behaviours or adherence with treatment measures as outcomes ($k = 17$). Finally, we excluded studies that did not provide correlation coefficients, or subgroup means, or any other values which would allow us to estimate the associations between meaning and health indices (e.g. regression coefficients from equations with

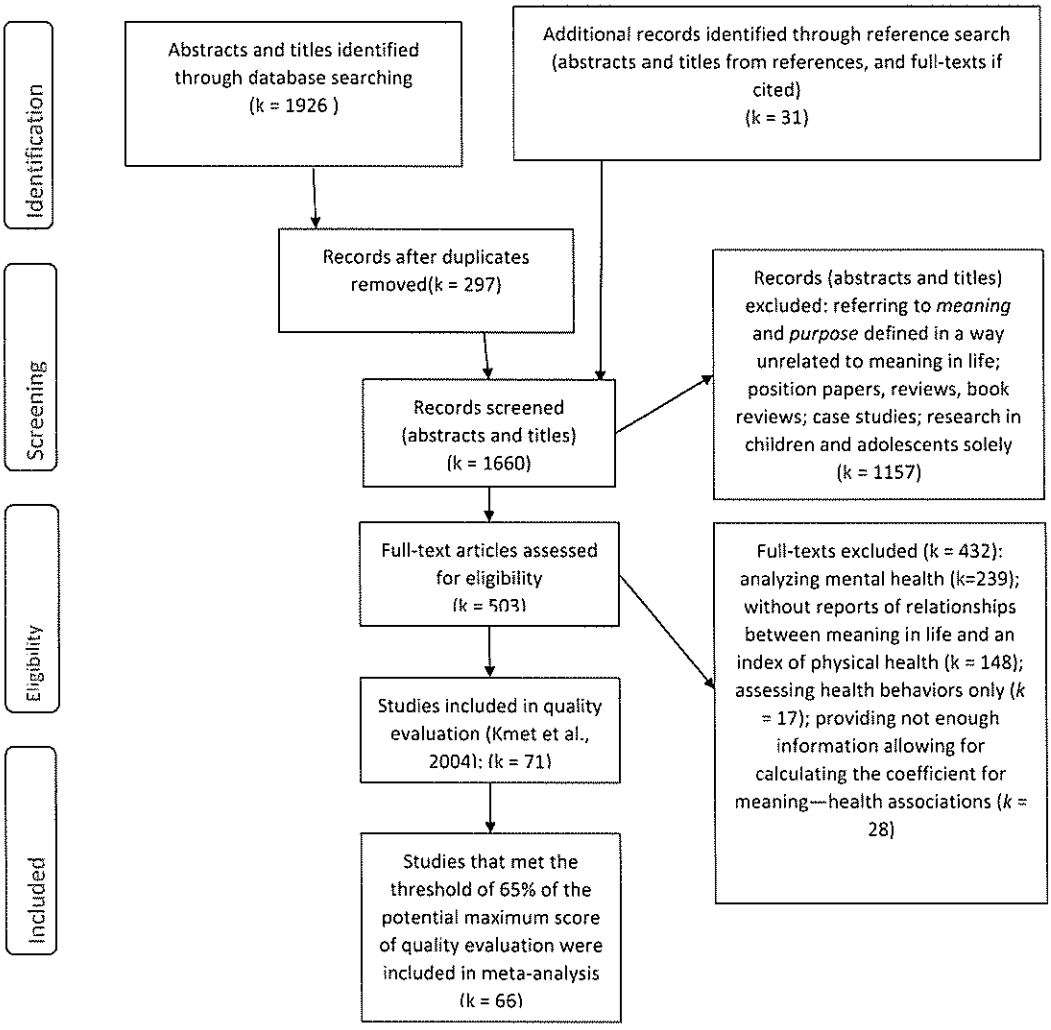

Figure 1. The stages of the data selection process following the PRISMA template for reporting the results of systematic review.

only one predictor variable [meaning] entered in the first step; information to reconstruct a 2 × 2 contingency table). The studies were excluded if respective coefficients were neither available in analysed documents nor sent by the authors of original studies after triple email requests and queries ($k = 28$; e.g., the following studies were excluded: Buck, Williams, Musick, & Sternthal, 2009; Krause, 2010; Krause & Shaw, 2003; Kim, Sun, Park, & Peterson, 2013; Kim, Sun, Park, Kubzansky, & Peterson, 2012). Manual search of references was conducted and relevant studies ($k = 31$) were chosen. The exclusion of mental health or well-being indicators, health behaviours and adherence indices is in line with Park's proposal (2007) that these factors should be treated as mediators in the relationship between meaning in life and physical health outcomes. Finally, original studies conducted by the same team of researchers were checked if they were conducted in independent samples.

Data extraction was conducted independently by two researchers (K. C. and A. B.), and then verified by the third researcher (AL). Each researcher extracted all required data from all studies, included into the review, and then compared the retrieved data. If the data allowing for estimating the association between the study variables were not available in the included document, the authors of original studies were contacted and asked to provide respective data. The disagreements (a total of three cases) in the processes of data extraction were resolved by a consensus method (Higgins & Green, 2011).

In the next step, researchers extracted descriptive data from each original study, including participants' age, participants' gender, health status of the studied population (e.g. healthy individuals, patients with cancer), and the characteristics of the measures of health and meaning in life. Statistical information, including Cronbach's alpha, values of association between meaning in life and health-related outcomes, and data necessary to conduct quality evaluation were also extracted. To account for the risk of bias in individual documents, *quality assessment* of each study was conducted using quality criteria proposed by Kmet, Lee, and Cook (2004). This method of quality evaluation was developed to analyse research using various designs (including experimental and correlational trials) and accounts for the quality of research combining quantitative and qualitative data. The following quality criteria were used: (a) research questions sufficiently described, (b) described evident and appropriate design, (c) described appropriate method of subject or comparison group selection or source of information, (d) sufficiently described characteristics of subject or comparison group, (e) described random allocation, if possible, (f) had measures well defined, (g) had appropriate sample size, (h) justified analytic methods, (i) controlled for confounding, (j) reported results in sufficient detail, and (k) supported conclusions. The quality assessment was conducted independently by two researchers (K. C. and A. B.). The response scale for quality assessment was: yes (2 points), partial (1 point), and no (0 points). Items that were not applicable for a particular study design were marked n/a and excluded from the summary score (Kmet et al., 2004). Studies that met the threshold of 65% of the potential maximum score were included (moderate to high quality; min = 68.5%, max = 100%, SD = 7.98, $M = 88.62$) (Kmet et al., 2004). Cohen's κ coefficient was moderate and ranged from 0.25 to 1 ($M = 0.623$), all $ps < .05$, indicating acceptable concordance.

Application of inclusion and exclusion criteria resulted in 71 relevant studies that met all criteria and were included in further analysis. Five studies ($k = 5$) were excluded because of low quality.

Definitions of variables and coding

For the purpose of this review, the variables for which data were sought were defined in the following way: (1) in line with the conceptualisation by Park and Folkman (1997) meaning in life was defined as beliefs that one's own life is valuable/meaningful or purposeful; (2) health was defined as a physical state, physical symptoms or ailments either self-reported or measured by physiological parameters.

Data referring to the moderating variables were coded to examine their effects on the relationship between meaning in life and health status. First, meaning in life was coded using the two conceptualisations proposed by Park and Folkman (1997). The first conceptualisation referred to the beliefs about the order of the world, one's self and relationships between one's self and the world

operationalised and measured with 'meaning-order' scales, whereas the second referred to the motivational nature of meaning in life (life's goals and purpose), operationalised and measured with 'meaning-purpose' scales. For example, a measure was coded as referring to purpose/meaning if more than 50% of items in a respective scale (or a subscale referring to meaning in life) clearly referred to purpose and included purpose-related expressions, such as 'purpose', 'future plans', 'directions', 'goals', 'aims', 'to do in life, in the future'. In turn, the measure was coded as order-related if more than 50% of items in a respective scale clearly referred to order in life, sense of significance in life, beliefs about life as meaningful and valuable, not referred to 'goals', and included expressions such as 'order in life', 'meaningful relationships', 'life has value', 'meaning'. Thus, the Psychological Well-Being (Ryff & Keyes, 1995) meaning subscale contains 10 items, 9 of which include purpose-related expressions; therefore, it was coded as 'purpose-measure'. If more than 50% of items were referring to other constructs (e.g. well-being) or were ambiguous (without words clearly related to purpose or order), respective studies using this scale were coded as ambiguous and excluded from the respective moderator analysis.

Importantly, to solely capture meaning in life and exclude broader constructs that include meaning as one of many facets of an investigated construct (e.g. posttraumatic growth, sense of coherence, hardiness), we included only these studies that used scales/subscales dedicated to measure meaning in life solely, conceptualised as 'order' or 'purpose/meaningfulness' (Park, 2010; Park & Folkman, 1997). Therefore, we excluded studies that addressed meaning in life only as a part of a broader construct. In particular, studies indicating that they account for meaning in life but used the global scores only of such measures as the FACIT-Sp, Spiritual Well-Being Scale, Geriatric Suicide Ideation Scale, Orientations to Happiness Scale, Sense of Coherence Scale, global quality of life scales, and so on were not included into analyses.

In order to avoid confounding the meaning construct with aspects of emotional well-being, only subscales specifically referring to meaning were considered, whereas global scores of the scales that account for both meaning and emotional well-being were not considered. This strategy was applied when the analysed instrument included several subscales (e.g. 3 subscales of FACIT-Sp) referring to distinguishable constructs, such as meaning in life, peace, etc.

'Meaning-order' scales included the following measures: Meaning in Life (Reker, Peacock, & Wong, 1987); Meaning and Purpose (a 4-item subscale of the WHOQOL-BREF; WHOQOL Group, 1998a); Life Meaning subscale of the Brief Stress and Coping Inventory (Rahe & Tolles, 2002; Rahe, Veach, Tolles, & Murakami, 2000); Life Engagement Test (Scheier et al., 2006); and Perceived Personal Meaning Scale (Wong, 1998).

'Meaning-purpose' scales included the following measures: 3-item measure of PIL (Crumbaugh & Maholic, 1981; King & Hunt, 1975); 4-item Meaning subscale of the Functional Assessment of Chronic Illness Therapy – Spiritual Well-Being Scale (FACIT-Sp-Ex; Noguchi et al., 2004; Peterman, Fitchett, Brady, Hernandez, & Cella, 2002; Webster, Cella, & Yost, 2003); Purpose in Life subscale of Psychological Well-Being (Ryff & Keyes, 1995); Presence of Meaning subscale of the Meaning in Life Questionnaire (Steger et al., 2006); one item referring to meaning in the Health Promoting Lifestyle Profile II (Walker, Sechrist, & Pender, 1987); one question about meaning in life from FACIT-Sp (Webster et al., 2003); and Purpose in Life measure (WHOQOL Group, 1998a).

The data on the moderating variables was also retrieved and coded: participants' health status, health measurement, and participants' age. Furthermore, we retrieved and coded data referring to two additional potential moderators, the study design and the country/region of the study. The health status of participants was coded using the following categories: healthy, people with cancer (included cancers of stomach, liver, pancreas, lung, breast, colorectal, lymphomas, non-Hodgkin's lymphoma, acute myelogenous leukaemia, plasmacytoma, and colon cancer), and people with other illnesses (e.g. osteoarthritis, HIV infection, congestive heart failure, arterial hypertension, chronic obstructive pulmonary disease (COPD) with hypercapnia, polio, spinal cord injury, multiple sclerosis, type 2 diabetes mellitus, kidney transplant patients).

Studies were divided based on the assessment of health status: subjective and objective indicators. Subjective indicators of health status included self-reports of health status or self-reports assessing scope of disability. Subjective indicators could be those validated in previous research (a standardised scale) or developed expressly for the purpose of the original study. Objective indicators of health status included mortality indicators and physiological measurements (e.g. levels of CD4). Mortality data were collected at 2-year follow-up (Zaslavsky et al., 2014), at an average follow-up of 13 years (Koizumi, Ito, Kaneko, & Motohashi, 2008), or by means of an ecological analysis linking average life meaning scores in 150 regions to standardised adjusted mortality rates in those regions (Skrabski, Kopp, Rózsa, Réthelyi, & Rahe, 2005).

Subjective assessment of health status by means of standardised scales included the following measures: Physical Health Status and Functioning subscales of Medical Outcomes Study (MOS) Short Form 12 (SF-12) (Stewart, Hays, & Ware, 1988; Ware & Sherbourne, 1992; Ware, Kosinski, & Keller, 1996); Physical Functioning subscale of The Short Form 36 Health Survey (SF-36) (Montazeri, Goshtasebi, Vahdaninia, & Gandek, 2005), subscales: Energy and Fatigue, Sleep and Rest, Pain and Discomfort, Activities of Daily Living derived from the World Health Organisation Quality of Life measure (The WHOQOL Group, 1998a, 1998b); Trial Outcome index of The Functional Assessment of Cancer Therapy-Colorectal (FACT-C) (Ward et al., 1999); Functional Assessment of Cancer Therapy-General and Breast Cancer modules (FACT-G and FACT-B) (Brady et al., 1997); Psychosomatic Symptoms Scale (PSS) (Andersson, 1981); the Symptom Distress Scale (McCorkle, 1987); Cohen-Hoberman Inventory of Physical Symptoms (Cohen & Hoberman, 1983); the Questionnaire of Physical Health (Heszen-Niejodek & Gruszczyńska, 2004; Stawiarska, 2004); the Pittsburgh Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989); Physical Functioning subscale of the Conservation of Resources-Evaluation (COR-E) (Hobfoll, Lilly, & Jackson, 1992); Visual analogue scale (VAS; 0–100 mm) measuring the level of pain; Physical Functioning subscale of the QLQ-C15-PAL (Groenvold et al., 2006); Physical Symptom subscale of the Patient Health Questionnaire (PHQ-15) (Kroenke, Spitzer, & Williams, 2002). Subjective assessment of health status with measures developed originally for the studies incorporated in this review included: single-item self-report on health status; the number of chronic physical symptoms; the number of chronic illnesses the participant was diagnosed with (e.g. Shrira et al., 2011).

Subjective assessment of the scope of disability included the Katz Index (Katz & Akpom, 1976b), Duke Older Americans Resources and Services project (Lawton & Brody, 1988), the Incapacity Status Scale (Kurtzke, 1984), Liang's disability measure (1990), Functional Disability subscale of Western Ontario and McMaster University Osteoarthritis Index (WOMAC) (Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988), Activity of Daily Living (ADL) (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963; Duke University Center for the Study of Aging and Human Development, 1978), and Kurtzke Expanded Disability Status Scale (EDSS) (Kurtzke, 1983).

Objective measures of health status were mortality rates for the main causes of death obtained from the Central Statistical Office of Hungary, weighted for cardiovascular, oncological, and total mortality rates (Skrabski et al., 2005); causes of death from Central Ministry of Health and Welfare (Japan) (Koizumi et al., 2008); and cause of death coded from hospital records, autopsy reports, and death certificates (Zaslavsky et al., 2014). Physiological measurements of objective health status included characteristics of immune system (NK cells cytotoxicity, IL-6), neuroendocrine factors, level of haemoglobin A1c, cholesterol, CD4 slope, C-reactive protein, lipid parameters (e.g. fasting glucose), blood pressure, electrocardiogram with a heart rate monitor, electron beam tomography with densitometric programme to assess the extent of calcification in the coronary arteries and in the aorta, estimated glomerular filtration rate, and medical injury severity rating conducted by a specialist.

The following age categories were created: younger (all participants in the respective study were younger than 35 years old), older (all participants were older than 55) and mixed age group. The regions in which studies were conducted were grouped into three categories: Asian region (Japan, Israel, Iran, China), European region (Finland, Poland, Sweden, Italy, Hungary, Norway, Germany), and North American-Australian region, including USA, Canada, and Australia. Depending on their

design, studies were categorised as cross-sectional, longitudinal, and experimental (with a manipulation and a control group).

Coding was conducted independently by two researchers (K. C. and A. B.), and additionally reviewed by a third researchers (A. L.). In particular, each indicator of health and meaning in each respective study was evaluated using yes–no format as representing each category (e.g. 'order', 'purpose', 'subjective indicator of physical health', etc.). Across the stages of coding the concordance was high, with Cohen's $\kappa = 1.0$, $p < .001$.

Data analysis

The principal summary measures in this study included the estimates of the average effect and heterogeneity, and the effects of the moderators were examined using Comprehensive Meta-Analysis software (version 2.2.064; Borenstein, Hedges, Higgins, & Rothstein, 2005). Statistical analysis followed the procedure described by Hunter and Schmidt (2004). Estimates were computed using the random-effect model method (Field & Gillett, 2010).

Pearson's correlation was used as the effect size indicator. All coefficients were recoded to represent the same direction of associations (i.e., higher levels of meaning in life associated with better health). Correlations were synthesised to form the cumulative effect size by transforming into Fisher's z according to the procedures described by Borenstein et al. (2011). In studies that included multiple correlations coefficients, the coefficients were combined using the methods described by Borenstein et al. (2011). This strategy was used to obtain the overall effect coefficient.

To minimise measurement error, we included only studies applying measures with internal consistency greater than .60. When no Cronbach's α was reported, it was obtained from an earlier study testing psychometric properties of that measure in other samples with similar characteristics. One study was excluded due to low values of alpha (below .60).

If values of Pearson's correlation were not reported, they were drawn from available data. The data were converted according to the procedures described by Lipsey and Wilson (2000). Sufficient data came from the first step of regression for two variables without covariates or from studies that reported enough information to reconstruct a 2×2 contingency table (Bonett, 2007).

Heterogeneity of the data included in the meta-analysis was tested using a *Q-statistic*. The *Q-statistic* evaluates how effect sizes scatter on a χ^2 distribution (Cochran, 1954). Furthermore, between-studies data heterogeneity was also evaluated with I^2 that measures the percentage of variability in observed effect estimates that is due to between-study heterogeneity rather than chance (Borenstein et al., 2011).

In the moderation analysis, an effect size was calculated for each level of moderator, and group mean effect sizes were compared using the Q_B statistic. Q_B is used as an omnibus test for detecting between-groups differences (Hedges & Pigott, 2004). A significant Q_B score indicates that estimates of the average effect differ significantly for the respective levels of the moderator.

To investigate the asymmetry that may be caused by publication bias, the funnel plot (see Figure 2) and Egger's test were conducted.

Results

Table 1 displays information about samples, procedures, and measurement applied in 66 original studies. Across included studies, a total of 73,546 participants were enrolled. The sample size varied from 23 to 27,609 participants, with a mean of 1114.54 (SD = 3766.21 and median of 158). Data were collected among healthy people (59% of studies; $k = 39$; the estimate of the average effect: .233), individuals suffering from cancer (14% of studies; $k = 9$; the estimate of the average effect: .341), and individuals with other illnesses (e.g. AIDS, CVD; 27% of studies, $k = 18$; the estimate of the average effect: .260). Original research enrolled participants from three age groups: individuals from 17 to 35 years old (4.5% of studies, $k = 3$; the estimate of the average effect: .334), individuals

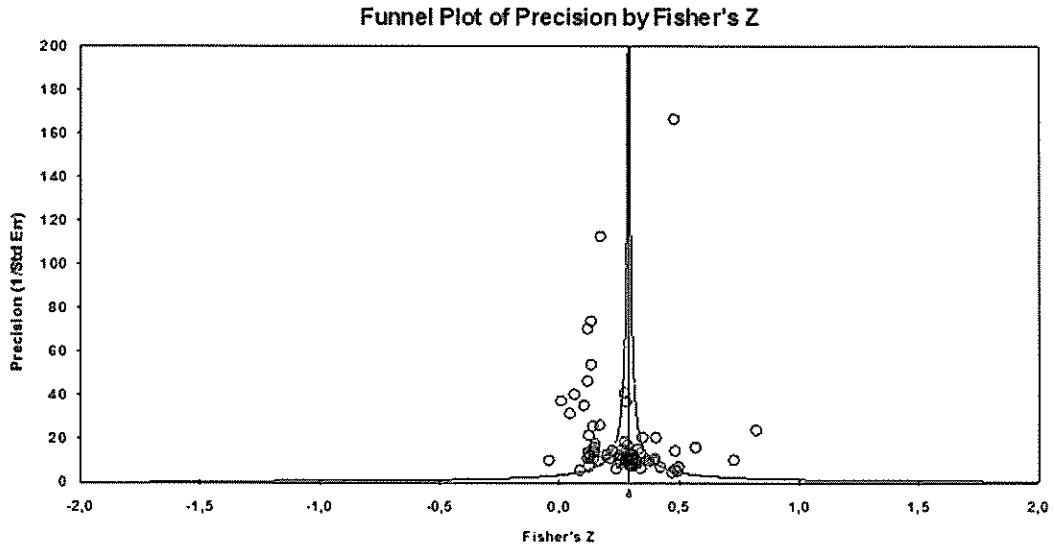

Figure 2. Funnel plot investigating the asymmetry which may be caused by the publication bias.

older than 55 (40% of studies, $k = 27$; the estimate of the average effect: .212) and mixed age group over 18 years old (54.5% of studies, $k = 36$; the estimate of the average effect: .281).

Physical health – meaning in life associations and the effects of moderators

The meta-analysis results conducted for 66 original studies yielded the estimate of the average effect of.258 (95% CI: .211, .304). The findings indicate that the associations are of moderate size and that better health indices are related to higher reports of meaning in life (Table 2). Estimates of the average effects derived from cross-sectional studies were .243 and from longitudinal studies were .306. To investigate if the findings may be affected by the publication bias, the funnel plot (see Figure 2) was inspected for asymmetry and Egger's test was conducted. There was no evidence of funnel plot asymmetry (see Figure 2), which was confirmed by Egger's test, with the intercept value of −1.39, SE = 0.91, $p = .13$.

To examine the effect of the conceptualisation of meaning in life as 'order' or 'purpose', studies were divided into two groups: those (a) using meaning as the sense of order and significance (14% of studies) and (b) using meaning as the purpose or possessing value (33% of studies); for these analyses, studies (53%) with scales that equally combined 'purpose' and 'order' and well-being constructs were excluded. Results of the moderation analysis showed that there were no significant differences between these types of conceptualisations: the same level of estimates of the average effect were found in research conceptualising meaning in life as 'purpose' as were found in those conceptualising meaning in life as 'order' (see Table 2).

In the next step, to test the effect of the measurement of meaning, original research was divided into five groups: studies using the Purpose in Life measure (Crumbaugh & Maholic, 1981; 39% of studies), studies using the Purpose in Life measure (Ryff, 1989; 34% of studies), studies using The Functional Assessment of Chronic Illness Therapy – Spiritual Well-Being Scale – meaning/peace subscale (Webster et al., 2003; 15% of studies), and investigations using the Spiritual Well-Being Scale – Existential Well-being Subscale (Paloutzian & Ellison, 1982; 12% of studies). These measures capture meaning in life as either 'purpose', or 'order' or both (see Table 1). The moderation analysis (see Table 2) showed a difference in the estimates of the average effect: significantly weaker estimates of the average effect were found for studies using the Purpose in Life measure (Ryff, 1989), comparing to studies using The Functional Assessment of Chronic Illness Therapy – Spiritual Well-Being Scale – meaning/peace subscale (Webster et al., 2003) or research using the Spiritual Well-Being Scale Existential Well-being Subscale (Paloutzian & Ellison, 1982).

Table 1. Summary of the studies included in the meta-analysis.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's α)	Health measure[a] (Cronbach's α)	Correlation coefficient[b]	Categorisation/coding[c]
Ando et al. (2010)	68 (53)	64.5	Cancer: lung, stomach, breast, liver, pancreas, others	Japan	ex	FACIT-Sp – 8-item meaning/peace scale (Noguchi et al., 2004) (.87)	(1) Physical pain (2) physical symptoms	(1) .36* (2) .21	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – older Design – experimental Region – Asian
Ardelt and Koenig (2006)	122 (66)	74 (61–98)	Healthy	USA	cs	PIL (Crumbaugh & Maholick, 1981; King & Hunt, 1975): 3 items (.62)	Self-rated health (.78)	.28**	Meaning – goal Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
Bower et al. (2003)	43 (100)	42.14 (24–60/ 8.32)	Healthy	USA	ex	The Life Goals Inventory: Intrinsic Goals Subscale (.85)	Type of cells of immune system: NK cells cytotoxicity	.33*	Meaning – ambiguous (order vs. goal) Health indicators – objective Illness – healthy Age – mixed Design – experimental Region – American
Bower, Kemeny, Taylor, and Fahey (1998)	40 (0)	Mean 39.5 (range 28–50)	HIV	USA	lg	Coded interviews (yes/ no): yes = shift in values, priorities, or perspectives, enhanced sense of living, commitment to enjoying life	Blood samples – quantity of CD4 T lymphocytes (6 draws, every 6 months, 1–3 year)	.45**	Meaning – ambiguous (order vs. goal) Health indicators – objective Illness – others Age – mixed Design – longitudinal Region – American
Boyle, Barnes, Buchman, and Bennett (2009)	1238 (73.6)	78 (7.8)	Healthy	USA	cs	PIL (Ryff & Keyes, 1995), 10 items (.75)	(1) Disability; (Katz & Akpom, 1976b) (2) Number of medical conditions. (Katz & Akpom, 1976a)	(1) 16*** (2) .05*	Meaning – goal Health indicators – subjective Illness – health Age – older Design – cross-sectional Region – American
Chow and Ho (2012)	132 (61.4)	75.61 (55–90/ 6.78)	Healthy	China	cs	PIL (Crumbaugh & Maholic, 1981; Shek, 1988): 20 items (.84)	Number of chronic illnesses	.12	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – Asian

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's *α*)	Health measure[a] (Cronbach's *α*)	Correlation coefficient[b]	Categorisation/coding[c]
Clarke et al. (2000)	4960	75.5(5.2/68–103)	Healthy	Canada	cs	PIL (Ryff & Keyes, 1995) (.26)	ADL	.12***	Meaning – goal Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
O'Connor and Vallerand (1998)	129 (86)	80.5 (65–96)	Healthy	Canada	cs	Meaning in life: 4 questions adopted from (Reker et al., 1987) (.87)	Self-rated health	.30***	Meaning – order Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
de Roon-Cassini et al. (2009)	79 (4)	55.9 (11.0)	Spinal cord injury	USA	cs	PIL (Crumbaugh, 1968): 20 items (.92)	(1) Conservation of Resources-Evaluation (COR–E; Hobfoll et al., 1992) and SF-36 (Ware, Snow, Kosinski, & Gandek, 1993): physical functioning (.63) (2) Medical injury severity (American Spinal Injury Association [ASIA])	(1) .45** (2) .03	Meaning – ambiguous (order vs. goal) Health indicators – subjective, objective Illness – others Age – mixed Design – cross-sectional Region – American
Edmondson et al. (2005)	52 (100)	21.24 (18–43)	Healthy	USA	ex	SWBS (Paloutzian & Ellison, 1982): EWBS (.89)	(1) Cohen-Hoberman Inventory of Physical Symptoms (Cohen & Hoberman, 1983) (2) Physiological measurement - measures of cardiovascular responses: HR; (3) Mean blood pressure	(1) .46** (2) .42** (3) .50**	Meaning – ambiguous (order vs. goal) Health indicators – subjective, objective Illness – healthy Age – mixed Design – experimental Region – American
Friedman and Ryff (2012)	998 (55)	58.0 (0.4)	Healthy	USA	cs	PIL (Ryff & Keyes, 1995) (.69)	(1) IL-6, (2) CRP (C-reactive protein), (3) Chronic conditions (a diagnosis)	(1) .07* (2) .01 (3) .06	Meaning – goal Health indicators – objective, subjective Illness – healthy Age – mix Design – cross-sectional Region – American

Glasberg, Pellfolk, and Lagerstrom (2014)	2901 (54)	65–75	Healthy	Finland Sweden	cs	1 question: How meaningful do you experience your life as being right now? (Fagerstrom, Gustafson, Jakobsson, Johansson, & Vartiainen, 2011)	(1) SF-36 (2) ADL (3) Pain (Visual analogy scale [VAS; 0–100 mm]) (.62 to .93)	(1) .182 (2) .133 (3) .09	Meaning – order Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – European
Harrison and Stuifbergen (2006)	2153 (69)	62	Polio survivors	USA	cs	Health Promoting Lifestyle Profile II – one item (Walker et al., 1987)	the Incapacity Status Scale (Kurtzke, 1984) (0.81)	.12***	Meaning – goal Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Haugan (2014)	202 (72.3)	85.87 (7.65)	Healthy	Norway	cs	PIL (Crumbaugh & Maholick,1981) (.82)	QLQ-C15-PAL: physical functioning (Groenvold et al. 2006) (.78)	.148*	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – European
Hedberg, Gustafson, and Brulin (2010)	189 (65)	85–103	Healthy	Sweden	cs	PIL (Crumbaugh & Maholic, 1981; Åkerberg, 1987) (.84)	(1) SF-36: one question (Ware & Sherbourne, 1992) (2) ADL (Katz et al., 1963)	(1) .154* (2) .09	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – European
Heidrich, Forsthoff, and Ward (1994)	108 (63)	62 (26–86)	Cancer: breast cancer (27%), colorectal cancer (20%), lung cancer (13%), lymphomas (12%)	USA	cs	PIL (Ryff, 1989) (.87)	ADL (Duke University Center for the Study of Aging and Human Development, 1978) (.87)	.31*	Meaning – goal Health indicators – subjective Illness – cancer Age – older Design – cross-sectional Region – American
Heidrich et al. (2006)	42 (100)	>65; with breast cancer: 74.16 (7.12); without breast cancer: 76.33 (5.31)	Cancer	USA	cs	PIL (Ryff, 1989) (.89)	Cancer diagnosis	.236	Meaning – goal Health indicators – objective Illness – cancer Age – older Design – cross-sectional Region – American
Heisel and Flett (2008)	107 (76)	81.5 (7.7)	Healthy	Canada	cs	Geriatric Suicide Ideation Scale:	Self-rated health	.30**	Meaning – ambiguous (order vs. goal)

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's α)	Health measure[a] (Cronbach's α)	Correlation coefficient[b]	Categorisation/coding[c]
						Perceived Meaning in Life subscale (.81)			Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
Holahan and Suzuki (2006)	162 (49)	86.36 (75–95/4)	Healthy	USA	cs	PIL (Ryff, 1989) (.70)	Perceived health limitation, one item	.20*	Meaning – goal Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
Holahan, Holahan, and Suzuki (2008)	130 (51)	60.22 (12.37)	Cardiac patients (e.g. with heart attack, angina, valve disease, aortic disorders, blocked/ closed artery, coronary artery disease, arrhythmia, other)	USA	cs	PIL (Ryff & Keyes, 1995) (.90)	Self-rated health	.26	Meaning – goal Health indicators – subjective Illness – others Age – older Design – cross-sectional Region – American
Holstad, Pace, De, and Ura (2006)	120 (35)	36.5 (8.5)	HIV/AIDS	USA	cs	SWBS (Paloutzian & Ellison, 1982): EWBS (.89)	Self-rated health	.38**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Holt et al. (2011)	100 (50)	58.54 (10.69)	Cancer	USA	cs	(FACIT-SP-12 version 4) (Peterman et al., 2002).	MOS SF-12 (Stewart et al., 1988): physical health status and functioning subscale (0.80)	−.04	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – mixed Design – cross-sectional Region – American
Holt-Lunstad, Steffen, Sandberg, and Jensen (2011)	100 (50)	28.28 (19–71)	Healthy	USA	cs	(FACIT-Sp-Ex) (Peterman et al., 2002) (.90): the 4-items from the meaning subscale	BP monitor for 24 h, blood samples	Systolic blood pressure: .27*; Diastolic blood pressure: .25*; C-reactive protein: .1; Triglycerides: .12; Fasting glucose: .01	Meaning – goal Health indicators – objective Illness – healthy Age – mixed Design – cross-sectional Region – American

Ishida and Okada (2006)	32	31.56 (22–47)	Healthy	Japan	ex	PIL (Crumbaugh & Maholic, 1981)	Measurements of heart rate variability – sympathetic nervous activity	.089*	Meaning – ambiguous (order vs. goal) Health indicators – objective Illness – healthy Age – mixed Design – experimental Region – Asian
Jafary, Farahbakhsh, Shafiabadi, and Delavar (2011)	349 (100)	18.91% 45- to 47-year-old, 22.06%: 47–49, 18.91%: 49–51, 22.34%: 51–53, 17.47%: 53–55	Healthy	Iran	cs	MIL (Salehi, 1994) (.91)	SF-36 (Montazeri et al., 2005): dimensions of physical function, physical functioning, role limitation (.65 to .90)	.27**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – mixed Design – cross-sectional Region – Asian
Johnson et al. (2011)	210 (41.5)	66.6 (12.32)	Cancer, congestive heart failure, COPD	USA	cs	FACIT-Sp, 8-item Meaning/Peace Subscale (Webster et al., 2003)	Disease severity	.45***	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Katerndahl (2008)	237 (67)	42.6	Patients seeking non-acute care	USA	cs	FACIT-Sp: one question about meaning in life (Webster et al., 2003)	Number of chronic medical problems	.32*	Meaning – goal Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Koenig et al. (2014)	129 (69.8)	51.5 (13.5/24–84)	Chronic illness	USA	cs	PIL (Crumbaugh & Maholic, 1981)	(1) Physical functioning (2) Disease severity	.35**** .23**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Koizumi et al. (2008)	1618 (47.5)	40–73	Healthy	Japan	lg	1-item question about sense of purpose	Mortality	Men: .092; Women: .041	Meaning – goal Health indicators – objective Illness – healthy Age – mixed Design – longitudinal Region – Asian

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's α)	Health measure[a] (Cronbach's α)	Correlation coefficient[b]	Categorisation/coding[c]
Koren and Lowenstein (2008)	180 (71.1)	75.5 (6.2)	Healthy	Israel	cs	PIL (Crumbaugh & Maholic, 1981) (.89)	Self-rated health	.33**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – Asian
Krause (2009) (wave 4)	1361 (60)	<65 (78.6)	Healthy	USA	cs	Meaning in life scale, (Krause, 2004) (.85)	(1) Self-rated health (2) Disability (Liang, 1990)	(1) .265** (2) .285**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – American
Lindfors and Lundberg (2002)	23 (52)	24–62	Healthy	Sweden	cs	PIL (Ryff, 1989; Ryff & Keyes, 1995; Ryff, Lee, Essex, & Schmutte 1994)	Mean-levels of total cortisol	.44*	Meaning – goal Health indicators – objective Illness – healthy Age – mixed Design – cross-sectional Region – European
Lampinen et al. (2006)	663	Male: 70.9 (5.00) female: 72.2 (5.11)	Healthy	Finland	lg	One question: 'Right now, how meaningful do you consider your life?	(1) Number of chronic illnesses, (2) Mobility status	(1) .08* (2) .20**	Meaning – order Health indicators – subjective Illness – healthy Age – older Design – longitudinal Region – European
Lawler and Younger (2002)	80 (76)	42.2 (27–60)	Healthy	Israel	cs	SWBS (Paloutzian & Ellison, 1982): EWBS (.89)	(1) Cohen-Hoberman Inventory of Physical Symptoms (Cohen & Hoberman, 1983) (.88)	(1) .32**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – mixed Design – cross-sectional Region – Asian
Low and Molzahn (2007)	420 (73.6)	74.36 (8.5)	Healthy	Canada	cs	(1) Purpose in Life (WHOQOL Group, 1998a) (2) Meaning in life (WHOQOL Group, 1998b)	Self-rated health	(1) .45** (2) .32**	(1) Meaning – goal and (2) Meaning – order Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – America

Martinez, Martin, Liem, and Colmar (2012)	213	T2 data only: 18 years (0.60) (at T1 participants were younger than 18)	Healthy	Australia	cs	Meaning and purpose: by a 4-item subscale (WHOQOL Group, 1998a) (.88 to .89)	WHOQOL Group (1998a): 1) energy and fatigue; 2) sleep and rest; (3) pain and discomfort; 4) activities of daily living (.73-.86)	T2 meaning & T2 physical health: .22**	Meaning – order Health indicators – subjective Illness – healthy Age – younger Design – cross-sectional Region – American
Matthews, Owens, Edmundowicz, Lee, and Kuller (2006)	155 (100)	65.1	Healthy	USA	lg	Life Engagement Test (.80) (Scheier et al., 2006)	Electron beam tomography (EBT): densitometric program to assess the extent of calcification in the coronary arteries and in the aorta	.25*	Meaning – order Health indicators – objective Illness – healthy Age – mixed Design – longitudinal Region – America
Meraviglia (2004)	59 (61)	33–83	Lung cancer	USA	cs	Life Attitude Profile–Revised (LAP–R), (Reker, 1992) (.87)	Symptom Distress Scale (McCorkle, 1987) (.84)	.30	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – mixed Design – cross-sectional Region – American
Moe et al. (2013)	120 (65)	87.5 (80–101)	Chronic illness	Norway	cs	PIL (Crumbaugh & Maholic, 1981) (.89)	SF-36: PCS (.87)	.144	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – older Design – cross-sectional Region – European
Moon and Mikami (2007)	Japanese ethnicity: $n = 221$ (61.5); Korean: $n = 204$ (62)	74.9 (6.8/65–97) 74.7 (7.1/65–92)	Healthy	Japan	cs	A question about sense of purpose in life	ADL (.93)	.336***	Meaning – goal Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – Asian
Muller et al. (2015)	471 (59)	61.45 (16.11)	Functional disabilities	USA	cs	Orientations to Happiness Scale (OTH): meaning domain (.72)	Pain intensity (.91)	.125**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Neter, Litvak, and Miller (2009)	101 (69)	41.21 (11.82)	MS	Israel	cs	PIL (Ryff, 1989) (.92)	Disability-Kurtzke Expanded Disability	.271*	Meaning – goal Health indicators – subjective

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's *α*)	Health measure[a] (Cronbach's *α*)	Correlation coefficient[b]	Categorisation/coding[c]
							Status Scale (EDSS) (Kurtzke, 1983)		Illness – others Age – mixed Design – cross-sectional Region – Asian
Nygren et al. (2005)	125 (69)	21%: 95 years or older, 37%: 90–95 years old 42%: 85–90 years olf	Healthy	Sweden	cs	PIL (Crumbaugh & Maholic, 1981) (.85)	SF-36: PCS (.83)	.21*	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – European
Park, Malone, Suresh, Bliss, and Rosen (2008)	163 (4.9)	65.6 (44–85)	CHF	USA	lg	Perceived Personal Meaning Scale (.92)	SF-36: PCS (.74)	T1 Meaning & T2 PCS: .30***	Meaning – order Health indicators – subjective Illness – others Age – mixed Design – longitudinal Region – American
Phillips, Mock, Bopp, Dudgeon, and Hand (2006)	107 (33.3)	40.0 (7.3)	HIV-infected	USA	cs	SWBS (Paloutzian & Ellison, 1982): EBWS (.73 to .98)	(1) PSQI: (Buysse et al., 1989) (.83); (2) SF-12 (Ware, Kosinski, & Keller, 1998)	(1) .29*** (2) .45***	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed Design – cross-sectional Region – American
Pinquart and Fröhlich (2009)	163 (43)	54.0 (18–82/15.2)	Cancer: non-Hodgkin's lymphoma (26.4%), acute myelogenous leukaemia (14.7%), plasmacytoma (9.8%), and colon cancer (8.6%)	Germany	lg	PIL (Crumbaugh & Maholic, 1981) (T1: .78; T2: .82)	Functional status (World Health Organisation, 1979)	T1: .13 T2: .01	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – mixed Design – cross-sectional, longitudinal Region – European
Rasmussen et al. (2013)	312 (54)	62.4(14.1)	Type 2 diabetes mellitus vs. control group	USA	cs	The Life Engagement Test (LET; Scheier et al., 2006)	Level of haemoglobin A1c (acceptable hemoglobinA1c (AH) was defined as less than 8%, and high haemoglobin A1c (HH) equal to or greater than 8%)	.190*** .111	Meaning – order Health indicators – objective Illness – excluded Age – mixed Design – cross-sectional Region – American

							HHxNDR AHxNDR		
Ryff et al. (2006)	135 (100)	74.0 (7.08/61–91)	Healthy	USA	cs	PIL (Ryff, 1989) (.85 to .91)	(1) Neuroendocrine factors: salivary cortisol (daily slope), epinephrine, norepinephrine, DHEA-S (2) Cardiovascular factors: weight, waist-hip ratio, systolic blood pressure, HDL cholesterol, total/ HDL cholesterol, glycosylated haemoglobin	(1) .29, .02, .02, .05 (2) .15, .17*, .09, .22**, .15, .13	Meaning – goal Health indicators – objective Illness – healthy Age – older adults Design – cross-sectional Region – American
Salsman, Yost, West, and Cella (2011)	Study 1: $n = 258$ (43); Study 2: $n = 568$ (51)	Study 1: 61(25–90); Study 2: 67 (40–84)	Colorectal cancer	USA	cs	FACIT-Sp, 8-item: meaning/peace subscale (.75) (Webster et al., 2003)	FACT- C: trial outcome index (TOI, 21 items) (.85)	Study 1: .52*** Study 2: .68***	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – mixed Design – cross-sectional Region – American
Sarvimäki and Stenbock-Hult (2000)	300 (71)	75–97	Healthy	Finland	cs	PIL (Crumbaugh & Maholic, 1981) (.86)	(1) Self-rated health; (2) PSS (Andersson, 1981) (.79)	(1) .30*** (2) .26***	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older Design – cross-sectional Region – European
Sherman et al. (2010)	73(100)	58.4 (10.8)	Breast cancer	USA	lg	Sense of Coherence Scale (Antonovsky, 1987): Meaning subscale (.80)	FACT (Brady et al., 1997) (.93)	.31**	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer Age – mixed Design – longitudinal Region – American
Shrira et al. (2011)	1665	63.08 (10.04)	Healthy	Israel	cs	MIL (Steger et al., 2006): presence of meaning subscale (.66)	(1) List of illnesses; (2) list of health conditions; (3) self-rated health; (4) disability (Katz,	(1) .14*** (2) .25*** (3) .25*** (4) .32***	Meaning – goal Health indicators – subjective Illness – healthy Age – mixed

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's *α*)	Health measure[a] (Cronbach's *α*)	Correlation coefficient[b]	Categorisation/coding[c]
							Downs, Cash, & Grotz, 1970) and the instrumental activities of daily life developed by (Lawton & Brody, 1969)		Design – cross-sectional Region – Asian
Skrabski et al. (2005)	12,640		Healthy	Hungary	cs	Brief Stress and Coping Inventory (Rahe & Tolles, 2002); (Rahe et al., 2000): life meaning subscale	Self-rated health	.17***	Meaning – order Health indicators – subjective Illness – healthy Age – mixed Design – cross-sectional Region – European
	4265 (53)	45–64	Healthy	Hungary	cs	Brief Stress and Coping Inventory (Rahe & Tolles, 2002); (Rahe et al., 2000): life meaning subscale	Mortality	Men: .09*** Women: .06***	Meaning – order Health indicators – objective Illness – healthy Age – mixed Design – cross-sectional Region – European
Smith and Zautra (2004)	64	67.20 (8.3)	Osteoarthritis of the knee, knee replacement surgery (TKR)	USA	lg	PIL (Ryff & Keyes, 1995) (.83)	WOMAC (Bellamy et al., 1988): functional disability subscale (.96)	.29*	Meaning – goal Health indicators – subjective Illness – others Age – older Design – longitudinal Region – American
Smith et al. (2010)	259 (64)	21.09 (4.29)	Healthy	USA	cs	PIL (Ryff & Keyes, 1995) (.79)	Physical symptom (the Patient Health Questionnaire [PHQ-15], Kroenke et al., 2002) (.75)	.15*	Meaning – goal Health indicators – subjective Illness – healthy Age – younger Design – cross-sectional Region – American
Sone et al. (2008)	27,609 (54)	60.8	Healthy	Japan	lg	One item, asking about ikigai	Self-rated health	.445*	Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – mixed Design – longitudinal Region – Asian
Sougleris and Ranzijn (2011)	227 (47)	75.04 (6.66/55–91)	Healthy	Australia	cs	PIL (Ryff, 1989) (.84)	Self-rated health	.258**	Meaning – goal Health indicators – subjective Illness – healthy Age – older

Stawiarska (2004)	104		Healthy	Poland	ex	PIL (Crumbaugh & Maholic, 1981) (.90)	The Questionnaire of Physical Health (Heszen-Niejodek & Gruszczyńska, 2004) (.85)	T1: .57*** T2: .67***	Design – cross-sectional Region – American Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – younger
Steger, Mann, Michels, and Cooper (2009)	99	46 (19–71)	Various patients	USA	cs	The Meaning In Life Questionnaire (.88)	Self-rated health	.36***	Design – experimental and longitudinal Region – European Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed
Tsuang et al. (2007)	690 (0)	47.8(3.3/41–58)	Healthy	USA	cs	SWBS (Ellison, 1983): EWB subscale (.87 to .95)	(1) Systolic blood pressure (2) Diastolic blood pressure (3) SF-36: physical functioning (4) SF-36: general health	(1) .03 (2) .06 (3) .16*** (4) .41***	Design – cross-sectional Region – American Meaning – ambiguous (order vs. goal) Health indicators – subjective, objective Illness – healthy Age – mixed
Takkinen and Ruoppila (2001)	55 (67)	<65	Healthy	Finland	lg	Meaning in life – two questions (.60)	(1) Self-rated health (2) Functional disability (.75)	(1) .13 (2) .12	Design – cross-sectional Region – American Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – healthy Age – older
Thompson et al. (2003)	1391(20)	40.1 (13.0)	Spinal cord injury	USA	cs	PIL (Crumbaugh & Maholic, 1981) (.92) 20 items	Level of injury	.01	Design – longitudinal Region – European Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – others Age – mixed
Wnuk, Marcinkowski and Fobair (2012)	50 (92)	55.16 (12.69/24–83)	Cancer: breast, lung	Poland	cs	PIL (Crumbaugh & Maholic, 1981)	Duration time of disease	.40*	Design – cross-sectional Region – American Meaning – ambiguous (order vs. goal) Health indicators – subjective Illness – cancer

(*Continued*)

Table 1. Continued.

Study	*N* (% of women)	Mean age (range/SD)	Group	Country	Study design	Meaning measure[a] (Cronbach's *α*)	Health measure[a] (Cronbach's *α*)	Correlation coefficient[b]	Categorisation/coding[c]
									Age – mixed Design – cross-sectional Region – European
Zaslavsky et al. (2014)	5444	Healthy: 88.2 (2.3) Disabled: 87.5 (1.8) Deceased: 88.9 (2.7)	Healthy	USA	lg	PIL (Ryff & Keyes, 1995) (.65)	(1) Mortality (2) disability	(1) .149* (2) .118*	Meaning – goal Health indicators – objective, subjective Illness – healthy Age – older Design – longitudinal Region – American
Zegarow et al. (2014)	30 (47)	48.40 (12.64/22–69)	Postkidney transplant patients	Poland	cs	PIL (Crumbaugh & Maholic, 1981)	Estimated glomerular filtration rate	.459*	Meaning – ambiguous (order vs. goal) Health indicators – objective Illness – others Age – mixed Design – cross-sectional Region – European

Note: CHF: Congestive heart failure; DAI: The Drug Attitude Inventory; EWBS: Existential Well-being Subscale; FACT-B: Functional Assessment of Cancer Therapy – Breast Cancer; FACT-C: The Functional Assessment of Cancer Therapy – Colorectal Cancer; FACIT-Sp: The Functional Assessment of Chronic Illness Therapy – Spiritual Well-Being Scale; IADL: Instrumental Activities of Daily Living; MIL: Meaning in Life Questionnaire; MOS SF: Medical Outcomes Study Short Form; PCS: subscales of physical functioning, bodily pain, role-physical, and general health; PIL: The Purpose in Life Test; PSS: Psychosomatic Symptoms Scale; PSQI: Pittsburgh Sleep Quality Index; SWBS: Spiritual Well-Being Scale; WHOQOL: World Health Organisation Quality of Life measure; WOMAC: Western Ontario and McMaster University Osteoarthritis Index; QLQ-C15-PAL: palliative care questionnaire; T1: time 1; T2: time 2; S1: subsample 1, S2: subsample 2; ex: experimental design; cs: cross-sectional design; lg: longitudinal design; DBP: diastolic blood pressure; SBP: systolic blood pressure; HR: heart rate.

[a]For all listed measures only subscales measuring meaning in life or aspects of physical health, respectively, were considered in this study.

[b]The direction of original correlation coefficients was recoded: positive values of coefficients indicate that higher meaning in life is associated with better health.

[c]Categorisation results encompass moderators' distinction.

*$p < .05$.

**$p < .01$.

***$p < .001$.

****$p < .0001$.

Table 2. Results of meta-analysis of the relationship between meaning in life and health: overall and moderator effects.

	The estimate of the average effect	Range of correlation coefficients (*r*) retrieved from original studies	95% CI for the estimate of the average effect	*N*	*K*[a]	Heterogeneity			Test for moderating effects	
						Q[b]	*p*	I^2%[c]	Q_B	*p*
Overall effect	**.258**	−.040; .677	[.211, .304]	73,546	66	2159.543		96.990		
Moderator analysis for meaning conceptualisation: purpose vs order										
Meaning – order scale	**.195**	.135; .318	[.155, .234]	17,599	9	21.886	.005	63.446		
Meaning –purpose scale	**.205**	.047; .445	[.162, .247]	20,631	22	142.631	<.001	85.277		
									0.106	.744
Moderator analysis: comparisons of meaning in life measures										
PIL (Crumbaugh & Maholic, 1981)	**.240**	.010; .623	[.149, .326]	3399	16	86.836	<.001	82.726		
FACIT-Sp: meaning/peace subscale (Webster et al., 2003)	**.426**	.165; .677	[.241, .582]	1441	6	71.707	<.001	93.027		
									3.243	.072
PIL (Crumbaugh & Maholic, 1981)	**.240**	.010; .623	[.149, .326]	3339	16	86.836	<.001	82.726		
PIL (Ryff, 1989)	**.145**	.047; .440	[.111, .179]	13,891	14	25.943	.017	49.890		
									3.681	.055
PIL (Crumbaugh & Maholic, 1981)	**.240**	.010; .623	[.149, .326]	3399	16	86.836	<.001	82.726		
SWBS:EWBS (Paloutzian & Ellison, 1982)	**.322**	.170; .461	[.194, .439]	1049	5	12.477	.014	67.940		
									1.104	.293
FACIT-Sp: meaning/peace subscale (Webster et al., 2003)	**.426**	.165; .677	[.241, .582]	1441	6	71.707	<.001	93.027		
PIL (Ryff, 1989)	**.145**	.047; .440	[.111, .179]	13,891	14	25.943	.017	49.890		
									8.158	**.004**
FACIT-Sp: meaning/peace subscale (Webster et al., 2003)	**.426**	.165; .677	[.241, .582]	1441	6	71.707	<.001	93.027		
SWBS: EWBS (Paloutzian & Ellison, 1982)	**.322**	.170; .461	[.194, .439]	1049	5	12.477	.014	67.940		
									0.905	0.342
PIL (Ryff, 1989)	**.145**	.047; .440	[.111, .179]	13,891	14	25.943	.017	49.890		
SWBS: EWBS (Paloutzian & Ellison, 1982)	**.322**	.170; .461	[.194, .439]	1049	5	12.477	.014	67.940		
									6.733	**.009**
Moderator analysis: objective vs subjective health indicators										
Objective measures	**.131**	.030; .461	[.087, .174]	14,058	17	51.085	<.001	68.679		
Subjective measures	**.268**	−.040; .677	[.217, .317]	71,016	55	2076.569	<.001	97.400		
									16.050	**0.000**
Moderator analysis: comparisons of health measures										
Mortality	**.099**	.067; .149	[.044, .155]	11,327	3	16.611	<.001	87.960		
All objective measures other than mortality	**.183**	.030; .461	[.106, .257]	2731	14	34.416	.001	62.227		
									3.012	.083
Mortality	**.099**	.067;.149	[.044, .155]	11,327	3	16.611	<.001	87.960		
Disability	**.195**	.090; .336	[.147, .243]	21,164	12	115.188	<.001	90.450		
									6.599	**.010**

(*Continued*)

Table 2. Continued.

	The estimate of the average effect	Range of correlation coefficients (*r*) retrieved from original studies	95% CI for the estimate of the average effect	*N*	*K*[a]	Heterogeneity			Test for moderating effects	
						Q[b]	*p*	I^2%[c]	Q_B	*p*
Mortality	**.099**	.067; .149	[.044, .155]	11,327	3	16.611	<.001	87.960		
Self-report measures developed for the purpose of the original study	**.231**	.010; .450	[.187, .275]	22,990	26	174.409	<.001	85.666		
									13.375	**.000**
Mortality	**.099**	.067; .149	[.044, .155]	11,327	3	16.611	<.001	87.960		
Self-report standardised measures	**.310**	−.040; .677	[.232, .384]	35,179	24	513.640	<.001	95.522		
									18.274	**.000**
All objective measures other than mortality	**.183**	.030; .461	[.106, .257]	2731	14	34.416	.001	62.227		
Disability	**.195**	0.90; .336	[.147, .243]	21,164	12	115.188	<.001	90.450		
									0.078	.779
All objective measures other than mortality	**.183**	.030; .461	[.106, .257]	2731	14	34.416	.001	62.227		
Self-report measures developed for the purpose of the original study	**.231**	.010; .450	[.187, .275]	22,990	26	174.409	<.001	85.666		
									1.201	.273
All objective measures other than mortality	**.183**	.030; .461	[.106, .257]	2731	14	34.416	.001	62.227		
Self-report standardised measures	**.310**	−.040; .677	[.232, .384]	35,179	24	513.640	<.001	95.522		
									5.345	**.021**
Disability	**.195**	0.90; .336	[.147, .243]	21,164	12	115.188	<.001	90.450		
Self-report measures developed for the purpose of the original study	**.231**	.010; .450	[.187, .275]	22,990	26	174.409	<.001	85.666		
									1.169	.280
Disability	**.195**	0.90; .336	[.147, .243]	21,164	12	115.188	<.001	90.450		
Self-report standardised measures	**.310**	−.040; .677	[.232, .384]	35,179	24	513.640	<.001	95.522		
									5.997	**.014**
Self-report measures developed for the purpose of the original study	**.231**	.010; .450	[.187, .275]	22,990	26	174.409	<.001	85.666		
Self-report standardised measures	**.310**	−.040; .677	[.232, .384]	35,179	24	513.640	<.001	95.522		
									2.975	.085
Moderator analysis: comparisons of groups with different health status										
Healthy	**.233**	.047;.623	[.173, .292]	66,143	39	1753.755	<.001	97.833		
With cancer	**.341**	−.040;.677	[.135, .519]	1447	9	120.512	<.001	93.632		
									1.025	.311
With cancer	**.341**	−.040;.677	[.135, .519]	1447	9	120.512	<.001	93.632		
Other illnesses	**.260**	.010;.459	[.191, .327]	5956	18	98.226	<.001	82.693		
									0.566	.452
Healthy	**.233**	.047;.623	[.173, .292]	66,143	39	1753.755	<.001	97.833		
Other illnesses	**.260**	.010;.459	[.191, .327]	5956	18	98.226	<.001	82.693		
									0.348	.556
Moderator analysis: age groups comparisons										
Younger than 35	**.344**	.150;.623	[.056, .580]	576	3	25.360	<.001	92.113		
Older than 55	**.212**	.105;.383	[.177, .247]	20,000	27	104.958	<.001	75.228		

									0.849	.357
Older than 55	**.212**	.105;.383	[.177, .247]	20,000	27	104.958	<.001	75.228		
Mixed age	**.281**	−.040; .677	[.211, .349]	52,970	36	1581.405	<.001	97.787		
									2.972	.085
Younger than 35	**.344**	.150;.623	[.056, .580]	576	3	25.360	<.001	92.113		
Mixed age	**.281**	−.040; .677	[.211, .349]	52,970	36	1581.405	<.001	97.787		
									0.193	.660
Moderator analysis: effects of study design										
Cross-sectional	**.243**	−.040; .677	[.206, .280]	37,333	50	509.551	<.001	90.384		
Experimental	**.381**	.089; .570	[.209, .530]	299	5	9.824	.043	59.284		
									2.415	.120
Experimental	**.381**	.089; .570	[.209, .530]	299	5	9.824	.043	59.284		
Longitudinal	**.306**	.067; .670	[.168, .432]	36,018	12	802.511	<.001	98.629		
									0.495	.482
Cross-sectional	**.243**	−.040; .677	[.206, .280]	37,333	50	509.551	<.001	90.384		
Longitudinal	**.306**	.067; .670	[.168, .432]	36,018	12	802.511	<.001	98.629		
									0.758	.384
Moderator analysis: effects of region of data collection										
North American-Australian region	**.259**	−.040; .677	[.212, .306]	23,829	42	483.288	<.001	91.516		
European region	**.207**	.130; .623	[.156, .258]	17,568	14	48.682	<.001	73.296		
									2.161	.142
European region	**.207**	.130; .623	[.156, .258]	17,568	14	48.682	<.001	73.296		
Asian region	**.264**	.067; .445	[.134, .384]	32,149	10	343.273	<.001	97.378		
									0.647	.421
North American-Australian region	**.259**	−.040; .677	[.212, .306]	23,829	42	483.288	<.001	91.516		
Asian region	**.264**	.067; .445	[.134, .384]	32,149	10	343.273	<.001	97.378		
									0.004	.951

Notes: Significant effects are indicated in bold font. CI: confidence interval; PIL: The Purpose in Life Test; FACIT-Sp: The Functional Assessment of Chronic Illness Therapy – Spiritual Well-Being Scale; SWBS: Spiritual Well-Being Scale; EWBS: Existential Well-being Subscale.

[a]Number of studies.

[b]A significant *Q*-value indicates that the data are heterogeneous, suggesting that the variability among studies was not due to sampling error.

[c]Value indicates the percentage of variance due to heterogeneity among studies.

To examine the moderating role of the type of health operationalisation and measurement, studies were divided into two groups: (a) research applying subjective measures (76.5% of studies) and research applying objective measures (23.5% of studies). The moderation analysis showed that there was a significant difference in the estimates of the average effect: significantly stronger estimates of the average effect were found for studies using the subjective measures (see Table 2). The estimates of average effects using objective indices of health pointed to weaker, but still significant, associations.

To test the moderating role of the type of health operationalisation and measurement, studies were divided into five groups: research applying subjective measures such as (1) self-report measures developed for the purpose of the original study (33% of studies), (2) self-report standardised measures (30% of studies), (3) disability measures (15% of studies), and research applying objective measure such as (4) mortality (4% of studies), and (5) any objective measures other than mortality (18% of studies). The moderation analysis showed that significantly weaker estimates of the average effect were found for studies using mortality rates compared to research applying any self-report measures. There were further significant differences in the estimates of the average effect: significantly stronger estimates of the average effect were found for research applying standardised self-report measures of health compared to studies using either disability measures or any objective measures other than mortality.

The original studies were divided into three categories on the basis of the health status of participants. They included (a) healthy individuals (59% of studies) or those suffering from (b) cancer (14% of studies) and (c) other illnesses (27% of studies) (see Table 2). The results of the moderation analysis showed that there were no significant differences between groups (i.e. healthy vs. patients with cancer, healthy vs. with illness other than cancer or patients with cancer vs. those with other illness) (see Table 2).

Next, the moderating effect of age was investigated. Studies were divided into three groups: (a) with younger participants (i.e., under 35 years old; 4.5% of studies), (b) with older participants (i.e., over 55 years old; 41% of studies), and (c) mixed age samples, consisting of adults from various age groups (54.5% of studies) (Table 2). Results of the moderation analysis showed that there were no significant between-groups differences in estimates of the average effect.

Additional analyses tested effects of the region of the world and study design. The original studies were divided into three categories on the basis of the region where studies were conducted: (a) North American-Australian region, including USA, Canada, and Australia (64% of studies), (b) European region (21% of studies), (c) and Asian region (15% of studies) (see Table 2). Results of the moderation analysis showed that there were no significant between-groups differences in estimates of the average effect. Finally, the effect of the study design employed in original studies was tested. To examine the effect of study designs on the estimate of the average effect size, studies were divided into three groups: (a) applying cross-sectional correlational design (75% of studies), (b) applying correlational longitudinal design (18% of studies), and (c) applying experimental design (7% of studies). Results of the moderation analysis showed a lack of significant differences by study design in the estimates of the average effect calculated for associations between meaning in life and health indicators.

Discussion

This meta-analysis aimed to define the strength of associations between meaning in life and health indicators, measured subjectively or objectively. We tested the relationships found in 66 studies enrolling healthy individuals and those with various illnesses. The overall associations between health indicators and meaning in life were of small-to-moderate size (the estimate of the average effect: .26, 95% CI [.211, .304]), and similar in experimental, longitudinal, and correlational studies. Estimates of the average effects were significant across studies using different conceptualisations of meaning in life, across samples differing in terms of health status or age, and in research using objective and subjective indicators of health.

We found that self-reported indicators of health formed stronger associations with meaning in life compared to mortality rates or other investigated objective physiological indicators of health.

Importantly, associations between objective indicators and meaning were weaker, but still significant (the estimates of the average effect: .10 for mortality; .13 for other investigated objective health indicators). To our knowledge, the present study is the first to provide a synthesis of research showing a significant association between meaning in life and objective indicators of better health and lower mortality. Overall, the meta-analysis suggests that meaning in life emerges as a relevant determinant or correlate of a number of indicators of health, though in line with our expectations the effects are more pronounced for self-reported health. Importantly, stronger estimates of the average effect were found for studies using standardised self-report measures, which might result from established reliability and validity of these forms of assessment. Self-reports of health may depend more strongly on personal goals, appraisals of self, one's own life and relationships, and coping processes and people may attempt to achieve coherent self-presentation of one's own beliefs, actions, and their outcomes (Schlenker & Leary, 1982). Thus, self-reports of meaning in life may form stronger associations with self-evaluations of health evaluations but weaker associations with objective health indices. On the other hand, stronger weighted effects found for self-report measures of health (compared to the objective indices) may result from common method variance, which may have inflated the associations. Moreover, although we analysed data collected with instruments concerning meaning, some measures include items that may be assessing both meaning and well-being and thus confounding these two constructs (e.g., an item from the FACIT-Sp, 'I feel a sense of harmony within myself' may assess inner order and well-being). Future research should take care to use measures of meaning not confounded with well-being.

The associations between meaning and health were similar across studies where meaning was conceptualised accentuating such aspects as order or purpose (Park & Folkman, 1997). These findings are in line with the original assumptions formed by Park and Folkman (1997) who did not suggest that the two aspects of meaning would produce substantially different effects on outcomes. Although the two types of meaning may produce effects of similar size, the underlying processes of their effects may be different. For example, the effects of goal or purpose-related constructs may be explained by motivational mechanisms related to goal formation (cf., Bandura, 1997). On the other hand, effects of 'meaning-order' may be explained by a broader set of attitudes or beliefs referring to the comprehensibility and coherence of the world, self, and relationships between self and the world. The two distinct mechanisms (motivational processes and comprehensibility) have also been proposed as distinct determinants of meaning in life (Park, 2007). As suggested by Park (2007), the associations between meaning and health may be explained by health behaviours, adherence to treatment or coping with illness (Park, 2007). However, the association between meaning and health behaviours, adherence to treatment, or coping with illness may be influenced by goal formation (in the case of developing 'meaning-purpose') or they may be influenced by attitudes or beliefs referring to self, world and others (in the case of developing 'meaning-order'). Future research needs to investigate the differences in the mechanisms through which different aspects of meaning may operate. In particular, intervention studies using techniques enhancing meaning in life should address both types of meaning and evaluate whether they operate through distinct pathways.

Future research need to carefully consider the choice of the measurement of meaning in life. Significantly stronger estimates of the average effect were found for studies using measures assessing meaning defined as a broader concept encompassing meaning in life but also a sense of harmony and peace of mind (see FACIT-Sp meaning/peace, SWBS-EWBS subscale), compared to research applying Purpose in Life subscale (Ryff, 1989), which explicitly concerns meaning in life but does not measure well-being. Meaning-related sense of harmony, peace, and well-being may represent an outcome of effective searching for or finding meaning in life and therefore, the observed relationships with physical health outcomes may be stronger when the measure of meaning in life tapped a construct accounting for both purpose-related peace and harmony.

We found that the effects of meaning in life on health were equally strong among healthy individuals and those with chronic illnesses, among younger and older participants, and across the

regions of world. A lack of significant moderator effects of health status might be caused by the effects of illness-specific variables that could have a pronounced effect on the meaning in life–health relationship. Such variables may include the stage of illness (early vs. advanced), time elapsed since diagnosis, a manageable versus life-threatening condition, mild versus highly debilitating symptoms, and aggressive versus less invasive treatment procedures. Unfortunately, not all studies conducted among people with a chronic illness provided sufficient information to consider the effects of such potential moderators. Future research should carefully investigate the illness characteristics or more specific age groups (e.g., young, middle-aged, and older adults) that may determine the strengths of the associations between meaning in life and health.

Finally, the present findings suggest a lack of cultural differences in the associations between meaning in life and health. Previous research indicated some cross-cultural differences in associations between meaning and psychological well-being (Steger, Kawabata, Shimai, & Otake, 2008), but also highlighted that these differences are particularly salient when the construct of meaning in life is further divided into searching for meaning and finding meaning (or perceiving presence of meaning in one's life). Such findings are in line with a proposal made by Park (2010), suggesting major differences in processes and outcomes of searching for meaning and finding meaning in life. Unfortunately, the data obtained from the original studies analysed in the present meta-analysis did not allow for a clear-cut categorisation into either searching for meaning or finding meaning (e.g., due to using an index combining these two categories). To further clarify the cross-cultural differences in associations between meaning in life and health, research may need to use separate indices for possessing, finding, and searching for meaning.

This study relied on research predominantly using correlational designs; therefore no causal conclusions may be drawn. It is possible that healthier people would rate their meaning in life higher, as they lead more active, less burdensome, and more controllable lives. It is also possible that people who rate their meaning in life as higher are able to recover or adjust more easily; therefore, their health indicators are better (subjectively or objectively assessed). Furthermore, other variables that are strong determinants of both meaning and health, such as appraisals of stressful events as threatening and uncontrollable (Park, 2010), may be responsible for the consistent associations between meaning in life and health indicators.

Our study has several limitations. The majority of analysed studies enrolled healthy people and focused on self-reports of physical health. The conclusions referring to objective indicators and people with an illness are based on a limited number of studies, which were heterogeneous in terms of applied indices and populations. Thus, the findings indicating moderating effects of the type of health index (objective vs. subjective) are preliminary. Other moderator analyses might suffer from relatively low power, which affected the precision of the estimate and limited the likelihood of detecting significant differences (Borenstein et al., 2011). Thus, it is possible that moderating effects exist, but were not detected. Furthermore, although we were able to test the moderating role of the aspects of operationalisation and conceptualisation of meaning (order vs. purpose), we were unable to investigate whether effects of searching for meaning differ from those of finding or possessing meaning. As only one study included in this review clearly referred to situational meaning (Bower et al., 1998), we were unable to test the moderating effects of the conceptualisation of meaning in life as global or situation-specific.

Our search strategy assumed that our selected keywords should be included in the title, abstract, or original keywords proposed by the authors of the study. Therefore, we might have missed studies that actually examined the associations between meaning and health indicators but did not use these terms in either the title or abstract or used terms other than our keywords to refer to these associations. Future research should broaden the search for terms related to meaning by, for example, using keywords referring to the measures that include the subscale assessing meaning in life (e.g. FACIT-Sp). It should be noted that the findings of a meta-analysis almost always have certain limitations related to search and selection biases (Walker, Hernandez, & Kattan, 2008). No meta-analysis can exhaust a subject, since new data are always appearing.

In spite of its limitations, our study offers novel evidence for the relationship between meaning in life and physical health. Significant associations between these two variables were observed for various indices of health, various indices of meaning in life, across countries, age groups, among healthy individuals, and those with chronic illnesses. Importantly, the associations were similar regardless of the design of the study. Although the estimates of average effects are weaker for the objective indices, they remain significant, highlighting the consistent associations between meaning in life and physical health indicators.

Disclosure statement

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