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How strongly related are health status and subjective well-being? Systematic review and meta-analysis

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Abstract

Background: Health status is widely considered to be closely associated with subjective well-being (SWB), yet this assumption has not been tested rigorously. The aims of this first systematic review and meta-analysis are to examine the association between health status and SWB and to test whether any association is affected by key operational and methodological factors.

Methods: A systematic search (January 1980 to April 2017) using Web of Science, Medline, Embase, PsycInfo and Global health was conducted according to Cochrane and PRISMA guidelines. Meta-analyses using a random-effects model were performed.

Results: 29 studies were included and the pooled effect size of the association between health status and SWB was medium, statistically significant and positive (pooled $r = 0.347$, 95% CI = 0.309 to 0.385; Q = 691.51, $I^2 = 94.99$ %, $p < 0.001$). However, the association was significantly stronger: (1) when SWB was operationalized as life satisfaction ($r = 0.365$) as opposed to happiness ($r = 0.307$); (2) among studies conducted in developing countries ($r = 0.423$) than it was in developed countries ($r = 0.336$); and (3) when multiple items were used to assess health status and SWB ($r = 0.353$) as opposed to single items ($r = 0.326$).

Conclusion: Improving people's health status may be one means by which governments can improve the SWB of their citizens. Life satisfaction might be preferred to happiness as a measure of SWB because it better captures the influence of health status.

Keywords: happiness, life satisfaction, subjective well-being, health status, quality of life.

Introduction

One of the fundamental responsibilities of governments and policy makers across the globe is to maximise subjective well-being (SWB) using finite resources [1,2]. Identifying key factors that influence SWB is vital to informing decisions about where best to invest those resources [2,3]. When people are asked to list the key characteristics of a good life, they include health, happiness and life satisfaction [1] and accordingly governments have tried to improve SWB by optimising public health status (e.g., by improving health care). Implicit in these endeavours is the idea that health status and SWB are closely related. Despite this assumption, it is not yet clear what is the magnitude of the association between health status and SWB; meaning that intervening to improve health status alone may not be the optimum means by which SWB can be maximised. In addition to the lack of insight into the magnitude of the association between health status and SWB, the literature suffers a number of methodological and conceptual limitations that can be explored using meta-analysis.

The first major limitation stems from inconsistencies in the definition and measurement of SWB and health status. The terms *happiness* and *life satisfaction* have been used interchangeably to assess SWB. Happiness is most closely associated with emotions, feelings or moods and life satisfaction is concerned with people's cognitive evaluations and judgments about their life when they think about it, which might include evaluations of their work, personal relationships or perception of health status [4]. Evidence suggests that happiness and life satisfaction need to be investigated separately in their association with health status [5]. For example, daily interviews conducted with 1,000 Americans found that married, well-educated people with high income reported greater satisfaction with their lives than the norm, but that the same people did not report being happier than the norm [5]. Similarly, the operationalization of health status has also varied, having been measured via independent objective assessment by medical personnel and/or patients' self-reports [6].

Second, most studies report the results of multivariate statistical analyses but neglect to report univariate analyses. The inclusion of covariates may weaken the observed association between health status and SWB or multivariate techniques might throw up spurious statistically significant associations.

Third, participants have been sampled from patient groups or general population groups and it is likely that the association between health status and SWB is affected by such sampling[1].

Fourth, the majority of studies investigating health status as a driver of SWB are typically conducted in developed nations because these countries have the financial resources to conduct research and participants are accessible in contrast to developing nations with poorer infrastructure. Nevertheless, the question arises as to whether the association between health status and SWB differs across countries at different stages of economic development. Most developing countries are still struggling to tackle poverty. Poverty increases the chances of poor health because very poor people live in poor conditions and struggle to eat, afford the cost of doctors' fees and a course of drugs and transport to reach a health centre. Thus, health status in developing countries might be expected to be more closely associated with SWB than it is in developed nations [7].

Fifth, key operational and methodological factors might affect the association between health status and SWB. For example, while the general consensus is that multiple-item measures (e.g. SF-36, SWLS 5 items) have better psychometric properties than single-item measures, single-item measures may be used due to practical constraints (e.g. respondent burden caused by longer survey) and it would be valuable to gauge the impact of this on the health status-SWB relationship [8].

Finally, the recruitment procedure such as participants were recruited using random or convenience sampling might affect the association between health status and SWB. The

questions arise as to the extent of whether results observed in samples of convenience generalise to the larger population and whether the recruitment procedure affects the size of the relationship between health status and SWB.

The aims of the systematic review and meta-analysis were to: (1) assess the strength of the association between health status and SWB across individual studies using meta-analysis; and (2) test whether the link between health status and SWB is affected by key operational and methodological factors. These key operational and methodological factors are: (a) whether the association varies when the SWB is associated to objective health status or to subjective health status, (b) whether the population is sampled from the general public or from patient groups, (c) the way in which SWB is assessed (e.g., happiness versus life satisfaction), (d) whether the results of the main analysis hold when participants were recruited from developed versus developing countries, (e) whether the results of the main analysis varies accordingly to the way health status and SWB were assessed (multiple items versus single items), and (f) whether the results of the main analysis hold when participants were recruited from random versus convenience sampling.

Methods

The systematic review was conducted and reported according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and Cochrane Handbook recommendations [9].

Search strategy and data sources

A systematic search of the following electronic databases was conducted: Web of Science, Medline, Embase, PsycInfo and Global health. Systematic searches of the literature published between January 1980 and April 2017 was carried out and various combinations of

two key blocks of terms were used: (1) SWB, happiness, life satisfaction, well-being; and (2) state of health, health status, and self-reported health, subjective assessment of health status, quality of life, WHOQOL, diagnosis, disrupted daily functioning, Short-Form SF-36, SF-12, SF-6 D, and EQ-5 D1. We also identified eligible studies by checking the reference lists of the studies meeting the criteria of the systematic review.

Study Selection

The results of the searches of each database were exported to an Endnote database file and merged to identify and delete duplicates. Screening was completed in two stages. Initially, the titles and abstracts of the identified studies were screened for eligibility (see Figure 1). Next, the full-texts of studies initially assessed as "relevant" for the review were retrieved and checked against our inclusion/exclusion criteria. Full-text screening was completed by one researcher and checked by a second researcher independently. Any disagreements were discussed in group meetings until consensus was reached.

Eligibility criteria

Studies were eligible for inclusion if they met the following criteria:

1. Original studies that employed a quantitative research design. Qualitative studies were excluded.

1 Health status captures people's perceptions of how well they are able to function physically, emotionally, and socially; The term 'quality of life' has a different construct to health status and is defined by the World Health Organisation (WHO) as "individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (p.3). In contrast, SWB indicates subjective enjoyment of life and self-evaluation of her/his life-as-a-whole rather than focusing on physical or mental health.

2. Included at least one objective or subjective measure of health status. Objective health status refers to objective clinical assessments of the presence and numbers of chronic medical conditions [10,11]. Subjective measures of health status included either generic self-reported states of health such as "All in all, how would you describe your state of health these days?" or the physical functioning subscales of quality of life measures such as SF-36 [12,13].

3. Included at least one measure of SWB (i.e., happiness or life satisfaction). Measures of happiness included: "Taking all things together, would you say you are (on a scale of 1 to 4): 1=Not at all happy; 2=Not very happy; 3=Quite happy; and 4=Very happy" [14]. Measures of life satisfaction included questions such as; "All things considered, how satisfied are you with your life as a whole these days? On a scale of 1 to 10 if 1=very dissatisfied and 10=very satisfied" [15]. Studies that used outcomes such as personal growth, meaning of life, freedom of choice, or poverty rate were excluded.

4. Provided quantitative data regarding the association between health status and SWB.

5. Were published in a peer-reviewed journal. Academic reports were included; but grey literature was excluded to avoid including data from groups with potential vested interests (e.g., political groups).

Data extraction

An excel file was devised for the purpose of data extraction. This extraction was piloted across five randomly selected studies and changes were made where necessary. Information about the following characteristics of the studies was extracted: first author's name and year of publication, country where the study was conducted and number of participants, health status instrument, happiness/life satisfaction instrument, zero-order

correlation of the association between health status and happiness/life satisfaction, standard error, and quality rating. Countries where studies were conducted included developed and developing countries. Developed countries are defined as industrial, advanced economies with high level of Gross National Income (GNI) per capita of 12,736 US dollars per year (estimated in July 2015). In contrast, developing countries includes countries with low and middle levels of GNI per capita (fewer than 12,736 US dollars per capita) [16].

Data extraction was completed by the first author. A second researcher extracted data from three randomly selected studies.

Assessment of methodological quality

Studies were rated for their quality by one researcher and verified by another researcher using criteria adapted from guidance on the quality assessment tools for quantitative studies [9]. Any disagreements were resolved by discussion. The quality review included assessment of the quality of the research design, population and recruitment methods, verified if the choice of the health status measure and SWB measures were valid and reliable, determined if the outcome variable was clearly identified and if the analysis reported the association between health status and SWB. These included assessments of the quality of the research (see Table 1).

Meta-analysis procedures

The associated Confidence Intervals (CI) of the zero-order correlations were calculated in STATA 13.1. The analysis was conducted using the *metan* command. The pooled zero-order correlation as well as the forest plots was computed using STATA 13.1. Then five subgroup analyses were conducted. We focus our interpretation of the results in terms of effect sizes [17]. Thus, $r = 0.10$ was a "small" effect size ("not so small as to be

trivial", p. 159 [17]), $r = 0.30$ was a "medium" effect size ("likely to be visible to the naked eye of a careful observer", p. 159 [17]), and $r = 0.50$ was a "large" effect size ("the same distance above medium as small was below it", p.159 [17]).To test whether the association between health status and SWB varies across sub-groups, we used Cohen's q Fisher's z transformation of *r*. By convention, if z score values is greater than or equal to 1.96 or less than or equal to -1.96, the two correlations coefficients are significantly different at the .05 level of significance (suggesting difference of correlation coefficients between two population groups) [18].

Results

We retrieved 394 studies and after removing duplicates ($n = 141$), 253 studies were assessed for eligibility. Following abstract and full-text screening 29 studies were included in the review. The flowchart of the screening and selection process is shown in Figure 1.

[Figure 1 near here]

Descriptive characteristics of the studies

Table 1 presents the main characteristics of the 29 studies included in the review. All studies were cross-sectional. Four studies were conducted in the USA, 13 in Europe and 12 studies were conducted elsewhere (see Table 1 for more details). All studies were published between 2002 and 2017. Participants were adults ranged from 16 to 99 years old. The sample sizes varied from 67 to 350,000. Eighteen studies recruited participants from the general population [20] and eleven studies recruited people with chronic medical conditions [11]. People with chronic medical conditions included people with cystic fibrosis, traumatic brain injuries, infertility, systemic lupus erythematosus, breast cancer survivors, patients with multiple sclerosis, low back pain or patients with orthopaedic diseases [10,21].

Studies used data from a range of surveys such as US General Social Survey (GSS) [22], China Health and Nutrition Survey (CHNS) [23], National Health Interview Survey and the Behavioural Risk Factor Surveillance [20]. Most well-known surveys such as GSS used reliable recruitment procedures (e.g. stratified random sampling). Nevertheless, twelve studies used opportunistic sampling to target specific groups of people [24].

Multiple instruments were used to measure health status and happiness /life satisfaction. For health status, single items with 4 point Likert scales tended to be used in studies targeting general population at the national [15] or regional level [25-27].

Most studies used multiple items to target specific groups of people such as older adults [12] or survival of illness [11,28]. For example, in terms of health status, 22 studies used multiple items and the remaining studies (n = 7) used a single item. With regard to SWB, the majority of studies (n = 16) used multiple items and the remaining studies (n = 13) used single items to measure happiness/life satisfaction. The meta-analyses were based on high quality rating studies scoring 5 or the maximum of 6 and sub-groups were used as moderators in the association between health status and SWB (see Table 1).

[Table 1 near here]

Meta-analysis of the association between health status and SWB

Main meta-analysis: The overall association between health status and SWB.

Figure 2 presents the forest plot of the main analysis that examined the overall relationship between health status and SWB across 29 studies. The pooled effect size was medium, significant and positive but the heterogeneity was high (pooled $r = 0.347$, 95% CI = 0.309 to 0.385; Q = 691.51, $I^2 = 94.99$ %, $p < 0.001$). This result indicates that better health is moderately associated with greater SWB. As shown in Figure 2, the effect sizes across all the studies were positive but varied significantly in magnitude (from $r = 0.16$ to $r = 0.73$).

[Figure 2 near here]

Subgroups analyses

Retrieved studies were grouped into six sub-groups: objective health status (n = 8) versus subjective health status (n = 21), general population (n = 18) versus people with chronic illness (n = 11), happiness (n = 9) versus life satisfaction (n = 20), developed (n = 23) versus developing countries (n = 4), two studies were conducted worldwide, multiple items measures (n = 23) versus single item measures (n = 6) and random sampling (n = 17) versus convenience (n = 12).

Measure of health status: The pooled effect size for the association between SWB and subjective health status was slightly higher, pooled $r = 0.355$, 95% CI = 0.311 to 0.399, Q = 297.14, $I^2 = 94.11$ %, $p < 0.001$, than the pooled effect size for the association between SWB and objective health status: pooled $r = 0.327$, 95% CI = 0.246 to 0.409, Q = 273.90, $I^2 = 95.63$ %, $p < 0.001$. Cohen's q revealed no statistically significant difference in the magnitude of the correlations between these two sub-groups, Cohen's q = 0.652, p = 0.51.

Population: The association between health status and SWB did not vary amongst studies based on people with chronic conditions versus studies based on general population samples: pooled $r = 0.331$, 95% CI = 0.273 to 0.389, Q = 305.22, $I^2 = 94.01$ %, $p < 0.001$; studies based on general population samples: pooled $r = 0.357$, 95% CI = 0.306 to 0.410, Q = 295.21, $I^2 = 95.06$ %, $p < 0.001$. Cohen's q showed no statistically significant difference between these two sub-groups: Cohen's q = 0.551, p = 0.58.

Measure of SWB: The pooled effect size for the association between health status and happiness was lower, pooled $r = 0.307$, 95% CI = 0.245 to 0.370, Q = 114.08, $I^2 = 93.28$ %, $p < 0.001$ compared with the pooled effect size for the association between health status and life satisfaction: pooled $r = 0.365$, 95% CI = 0.319 to 0.413, Q = 575.77, $I^2 = 94.70$ %, $p <$

0.001. This observation was confirmed by the Cohen's q test, which showed that the correlation between health status and life satisfaction was significantly stronger than it was between health status and happiness: Cohen's q = 3.778, p<0.05.

Country level of development: The pooled effect size for the link between health status and SWB in developed countries was lower, pooled *r* = 0.336, 95% CI = 0.292 to 0.380; Q = 553.08, I^2 = 94.37 %, *p* < 0.001 compared to studies conducted in developing countries, pooled *r* = 0.423, 95% CI = 0.329 to 0.519; Q = 84.54, I^2 = 93.67 %, *p* < 0.001, respectively. The magnitude of the correlation was significantly stronger among studies conducted in developing countries than it was in developed countries: Cohen's q = 7.344, p<0.05.

Multiple items versus single item measures on the health status-SWB relationship: The pooled effect sizes of the association between SWB and health status was higher when multiple items were used to assess the health status and SWB than when single item measures were used: pooled r = 0.353, 95% CI = 0.309 to 0.397, Q = 599.23, I^2 = 95.23 %, *p* < 0.001; single item measures: pooled *r* = 0.326, 95% CI = 0.239 to 0.412, Q = 89.27, I^2 = 93.27 %, *p* < 0.001. The magnitude of the correlation was significantly stronger among studies using multiple items measures than it was in studies using single item measures: Cohen's q = 3.757, p<0.05.

Recruitment procedure: The pooled effect size for the association between health status and SWB was slightly higher among studies that recruited their participants using convenience sampling, pooled *r* = 0.376, 95% CI = 0.314 to 0.437, Q = 204.36, I^2 = 93.81 %, *p* < 0.001, than the pooled effect size among studies that recruited their participants using random sampling: pooled *r* = 0.329, 95% CI = 0.284 to 0.375, Q = 416.46, I^2 = 94.52 %, *p* < 0.001. Cohen's q showed no statistically significant difference in the magnitude of the correlations between these two sub-groups, Cohen's q = 0.994, p = 0.32.

Discussion

The principal finding of the present systematic review and meta-analysis is that health status has a medium-sized positive association with SWB [26,36]. Moreover, the link between health status and SWB does not differ significantly: (a) when objective health status or subjective health status was used to assess people's health status; or (b) across people with chronic medical conditions and general population samples. However, the association between health status and SWB was significantly stronger: (1) when SWB was operationalized as life satisfaction as opposed to happiness; (2) among studies conducted in developing countries than it was in developed countries; and (3) significantly stronger among studies using multiple items measures than it was in studies using single item measures.

The following discussion considers the practical and theoretical issues arising from these findings. Policy makers with responsibilities for allocating scarce resources need information that helps to identify the key determinants of SWB. The present research helps in this regard, but also shows that health status is moderately associated with SWB. The implication is that there are other determinants of SWB beyond health status and that improving health status is not the only route to improving SWB. Further research is required to see how closely associated are other potential determinants of SWB (e.g., inequalities, financial satisfaction) compared with SWB.

Despite the fact that health status is only moderately associated with greater SWB, the relationship is robust and does not vary across whether respondents were people with chronic medical conditions or from the general population. This suggests that policy makers should seek to improve the health status of the general population rather than focusing on people with chronic medical conditions as a means to improve SWB.

Another important finding is that the association between health status and SWB was

significantly stronger when SWB was operationalized as life satisfaction as opposed to happiness. This is consistent with research showing that health status has an impact on life satisfaction [3]. While a large number of studies continue to operationalize SWB solely in terms of people's happiness [5,12], studies show that life satisfaction is more stable over time than happiness [3,44]. Moreover, life satisfaction scores correlate significantly with physiological variables that are thought to track positive moods [3,44]. Life satisfaction might be preferred to happiness as a measure of SWB because it better captures the influence of health status.

The present study found that the magnitude of the association between health status and SWB was higher in developing countries than it was in developed nations. The majority of developing countries are still struggling to tackle poverty. Poverty increases the chances of poor health because very poor people live in poor conditions and struggle to eat, afford the cost of doctors' fees and a course of drugs. In contrast, developed countries tend to have sophisticated and relatively accessible health care and so future population gains in SWB through improving health status further are likely to diminish as health care improves further[7]. The implication is that domains other than health status may take on increasing importance in driving SWB in the future.

Moreover, the present study found that the association between health status and SWB does vary across studies using multiple items versus single item measures to assess health status and SWB. One implication is that multiple item measures should be used as the first option because of their better psychometric properties.

Although the present findings take the literature on SWB forward in some important respects, it is worthwhile highlighting some potential limitations. First, most studies investigating the association between health status and SWB have been conducted in

unrepresentative samples of largely "developed" nations such as USA, European countries, South Korea, and Japan. Of 29 studies included in the present meta-analysis, only one study has been conducted in Sub-Saharan Africa (i.e., Rwanda) and one study has been conducted in Latin America (i.e., Brazil). This is problematic in terms of the representativeness for the purpose of global decision making and further high quality cross-cultural research is required. Second, all studies included in the present research were cross-sectional and it would be valuable to conduct a prospective cohort study to confirm the link between SWB and health status and investigate the variability of that association across subgroups (e.g. people with chronic medical conditions versus general population samples). Third, grey literature was excluded to avoid including data from groups with potential vested interests (e.g., political groups). Nevertheless, the delay between research and published literature may create publication bias. Thus, we have included academic report amongst our eligibility criteria.

Conclusion

Health status is positively associated with higher SWB and improving people's health status is one means by which governments across the globe can improve the SWB of their citizens. The association between health status and SWB is medium and further research is required to identify other key drivers of SWB.

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Competing interests: None declared

Ethical approval: Not required (Because it is a systematic review of studies that already had ethical approval).

Key points

- Improving SWB is fundamental to the roles of many governments across the globe and so identifying the key factors that influence SWB is vital to informing government policy including public health.
- Health status is positively associated with higher SWB
- Improving people's health status is one means by which governments across the globe can improve the SWB of their citizens.
- The association between health status and SWB is medium and further research is required to identify the key drivers of SWB.

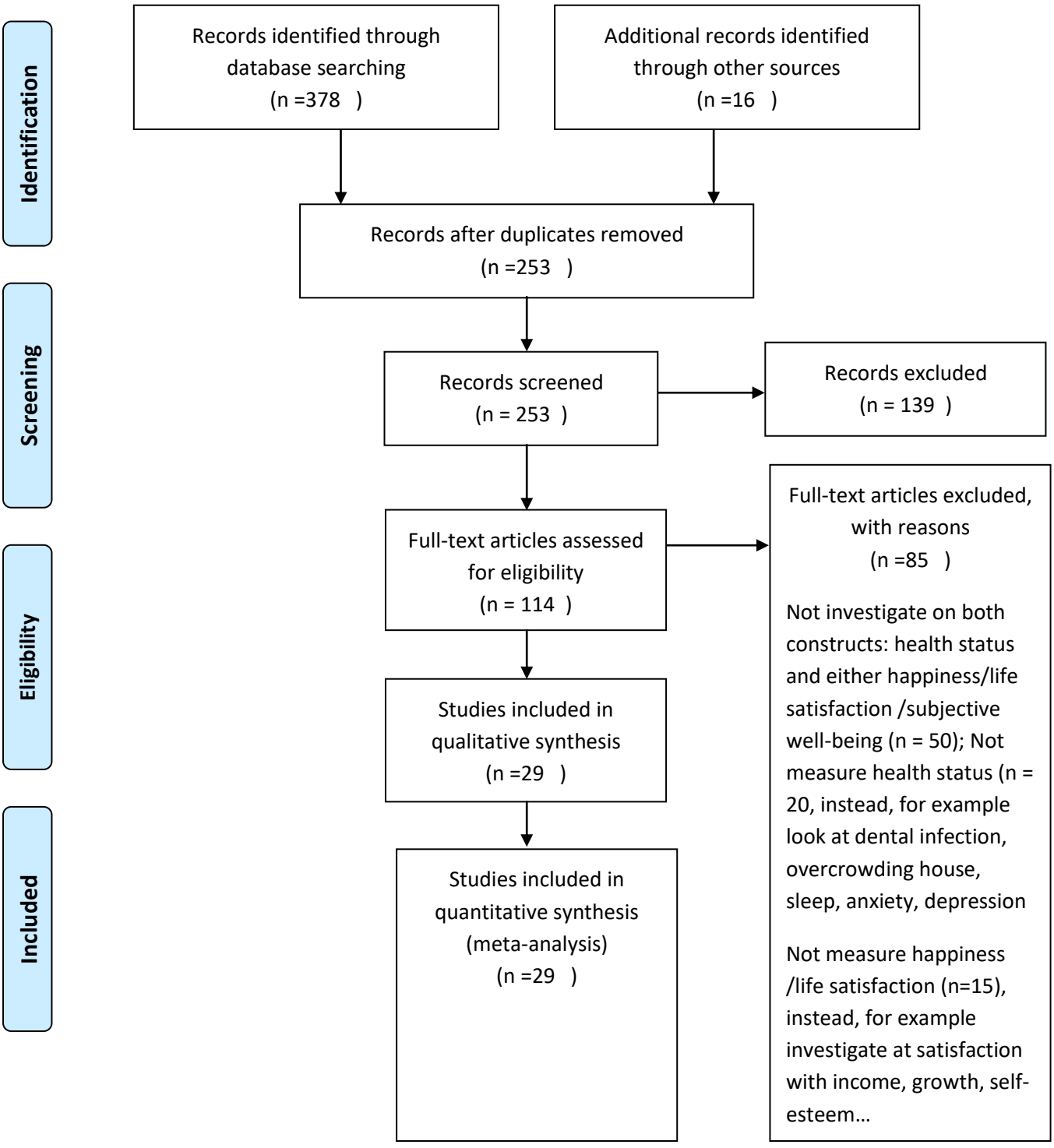

Figure 1. PRISMA Flow Diagram [19]

Study	ES	[95%	CI]	% Weight
An, 2008	0.620	0.573	0.667	3.60
Angner, 2013	0.372	0.274	0.470	3.00
Barger, 2009	0.290	0.243	0.337	3.60
Doherty, 2013	0.333	0.286	0.380	3.60
Dubrovina, 2012	0.730	0.318	1.142	0.65
Fisher, 2010	0.405	0.358	0.452	3.60
Gana, 2013	0.292	0.245	0.339	3.60
Garrido, 2013	0.388	0.341	0.435	3.60
Goldbeck, 2001	0.360	0.313	0.407	3.60
Jacobsson, 2010	0.308	0.261	0.355	3.60
Kim, 2012	0.350	0.303	0.397	3.60
Koots-Ausmees, 2015	0.340	0.297	0.383	3.63
Kulczycka, 2010	0.420	0.373	0.467	3.60
Lacruz, 2012	0.190	0.053	0.327	2.49
Liang, 2014	0.490	0.443	0.537	3.60
Matthews, 2002	0.470	0.423	0.517	3.60
Mukuria, 2013	0.294	0.247	0.341	3.60
Mukuria, 2015	0.390	0.343	0.437	3.60
Ngamaba, 2016	0.498	0.455	0.541	3.63
Ngamaba, 2017	0.290	0.247	0.333	3.63
Patten, 2010	0.160	0.140	0.180	3.78
Sabatini, 2014	0.220	0.161	0.279	3.48
Takeyachi, 2003	0.202	0.155	0.249	3.60
Tuchtenhagen, 2015	0.290	0.243	0.337	3.60
Wang, 2002	0.320	0.273	0.367	3.60
Wang, 2015	0.320	0.300	0.340	3.78
Yildirim, 2013	0.390	0.343	0.437	3.60
Zajacova, 2014	0.244	0.197	0.291	3.60
Zagorski, 2013	0.360	0.313	0.407	3.60
Overall effect (pl)	0.347	0.309	0.385	100.00

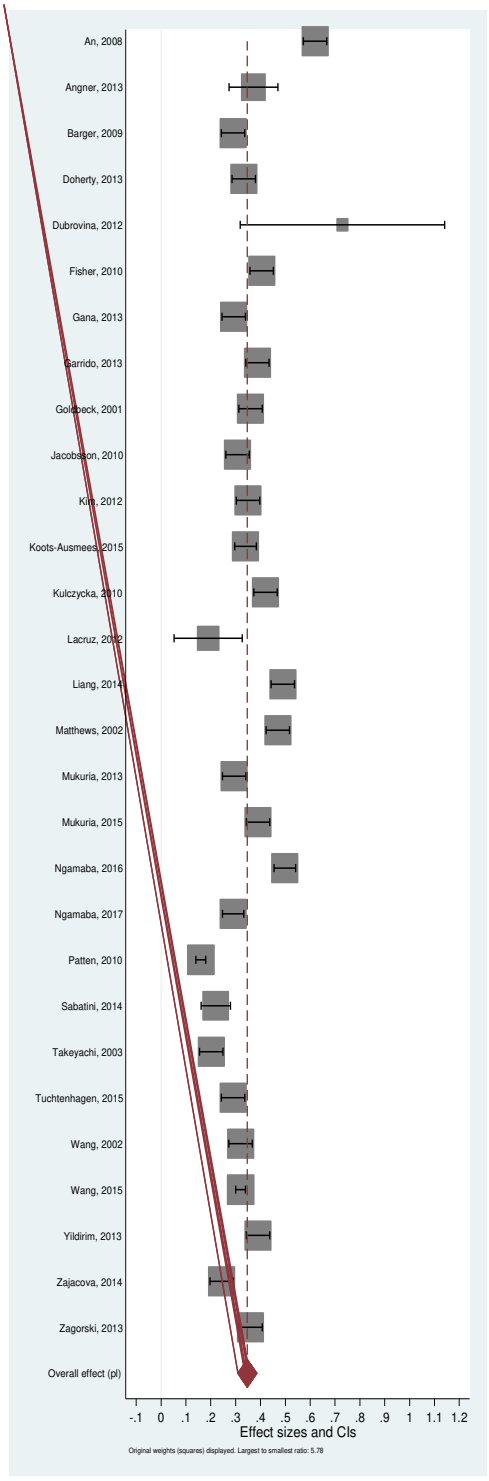

Figure 2. Forest plot displaying meta-analysis of the correlations between health status and subjective well-being across 29 independent samples. Note: Weights are from random effects analysis.

Table 1: Characteristics of included studies and quality ratings

Study 1st author & year of publication	Country	Particip.	Populat category	Health measures	Health instruments	SWB Measures	LS/Hap instruments	Effect size	SE	Quality Rating*
An, 2008 [24]	South Korea	121	GenPop	HealthMulti	20 items (1-3)	SWBMulti	LS (1-3)	0.62	0.024	6
Angner, 2013 [12]	USA	383	Chronic condit.	HealthMulti	SF-12 (1-5)	SWBMulti	Hap 4 items (1-7)	0.372	0.05	6
Barger, 2009 [20]	USA	350,000	GenPop	HealthMulti	BRFSS (1-5)	SWBSingle	LS (1-4)	0.29	0.024	6
Doherty, 2013 [29]	Ireland	1764	GenPop	HealthMulti	Multi (1-5)	SWBSingle	Hap (0-10)	0.333	0.024	6
Dubrovina, 2012 [25]	Poland	42331	GenPop	HealthMulti	Multi (1-4)	SWBSingle	LS (1-4)	0.73	0.21	5
Fisher, 2010 [30]	Australia	112	Chronic condit.	HealthMulti	SF-12	SWBMulti	LS SWLS 5 items	0.405	0.024	6
Gana, 2013 [31]	France	899	GenPop	Healthsingle	SRH (1-5)	SWBMulti	LS 5 items (1-7)	0.292	0.024	6
Garrido, 2013 [32]	Spain	870	GenPop	HealthMulti	SF-36	SWBMulti	LS SWLS (1-5)	0.388	0.024	6
Goldbeck, 2001 [33]	Germany	70	Chronic condit.	HealthMulti	SF-36	SWBMulti	LS 16 items	0.36	0.024	5
Jacobsson, 2010 [10]	Sweden	67	Chronic condit.	HealthMulti	SF-36	SWBMulti	LS SWLS (1-7)	0.308	0.024	6
Kim, 2012 [34]	South Korea	246	Chronic condit.	HealthMulti	31 items (1-4)	SWBMulti	LS 20 items (1-5)	0.35	0.024	6
Koots-Ausmees, 2015[35]	32 countries (28 EU + Israel, Russia, Turkey & Ukraine)	285086	GenPop	Healthsingle	1 item (1-5)	SWBSingle	LS (0-10)	0.34	0.022	6
Kulczycka, 2010 [28]	Poland	83	Chronic condit.	HealthMulti	SF-36	SWBMulti	LS 5 items	0.42	0.024	6

Lacruz, 2012 [36]	Germany	2,675	GenPop	HealthMulti	7 items	SWBSingle	LS (0-5)	0.19	0.07	5
Liang, 2014 [23]	China	19000	GenPop	HealthMulti	2 items (0-1)	SWBSingle	LS (0-1)	0.49	0.024	5
Matthews, 2002 [11]	USA	612	Chronic condit.	HealthMulti	SF-36	SWBMulti	LS 17 items (1-7)	0.47	0.024	6
Mukuria, 2013 [37]	UK, Wales	15,184	GenPop	HealthMulti	EQ-5D	SWBMulti	Hap SF-30	0.294	0.024	6
Mukuria, 2015 [38]	UK	6,808	GenPop	HealthMulti	SF-6D	SWBMulti	LS	0.39	0.024	6
Ngamaba, 2016[39]	Rwanda	3030	GenPop	Healthsingle	1 item (1-4)	SWBSingle	Hap (1-4)	0.498	0.022	6
Ngamaba, 2017[40]	Worldwide 59 countries	85070	GenPop	Healthsingle	1 item (1-4)	SWBSingle	LS (1-10)	0.29	0.022	6
Patten, 2010 [15]	Canada	245	Chronic condit.	HealthMulti	Multi (1-5)	SWBSingle	LS (1-10)	0.16	0.01	6
Sabatini, 2014 [26]	Italy	817	GenPop	Healthsingle	1 item (1-4)	SWBSingle	Hap (1-10)	0.22	0.03	5
Takeyachi, 2003 [21]	Japan	816	Chronic condit.	HealthMulti	SF-12	SWBMulti	Hap multi	0.202	0.024	5
Tuchtenhagen, 2015 [41]	Brazil	1,134	Chronic condit.	HealthMulti	OHRQoL	SWBMulti	Hap multi	0.29	0.024	5
Wang, 2002 [42]	Japan	142	Chronic condit.	HealthMulti	SF-36	SWBMulti	LS 9 items	0.32	0.024	5
Wang, 2015 [14]	China	5854	GenPop	HealthMulti	EQ-5D	SWBSingle	Hap (1-4)	0.32	0.01	5
Yildirim, 2013 [43]	Turkey	396	GenPop	HealthMulti	QoL 26 items	SWBMulti	LS 5 items (1-7)	0.39	0.024	6
Zajacova, 2014 [22]	USA	3722	GenPop	Healthsingle	1 item (1-3)	SWBSingle	Hap (1-3)	0.244	0.024	6
Zagorski, 2013 [27]	28 Europ. Nations	26,257	GenPop	Healthsingle	1 item (1-10)	SWBSingle	LS (1-10)	0.36	0.024	6

Note: GenPop: Participants from General population; Chronic condit.: Participants with chronic medical conditions; SWB: subjective well-being; LS: life satisfaction; Hap: happiness; *The quality rating score was calculated by awarding 1 point for each of the criteria: 1 for valid recruitment procedure, 1 for research design, 1 for health status measures, 1 for subjective well-being measures, 1 if multiple items were used to assess SWB and health status, and 1 if the correlation coefficient of the association was reported.

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Appendix 1. Screening Process