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Analyzing the Effectiveness of Positive Psychology Interventions

The effect of positive psychology interventions on well-being and distress in clinical samples with psychiatric or somatic disorders: a systematic review and meta-analysis

Abstract

Background: Although positive psychology interventions (PPIs) show beneficial effects on mental health in non-clinical populations, the current literature is inconclusive regarding its effectiveness in clinical settings. We aimed to examine the effects of PPIs on well-being (primary outcome), depression, anxiety, and stress (secondary outcomes) in clinical samples with psychiatric or somatic disorders.

Methods: A systematic review and meta-analysis was conducted following PRISMA guidelines. PsycINFO, PubMed, and Scopus were searched for controlled studies of PPIs in clinical samples between Jan 1, 1998 and May 31, 2017. Methodological quality of each study was rated. We used Hedges' adjusted g to calculate effect sizes and pooled results using random-effect models.

Results: Thirty studies were included, representing 1864 patients with clinical disorders. At post-intervention, PPIs showed significant, small effect sizes for well-being (Hedges' $g = 0.24$) and depression ($g = 0.23$) compared to control conditions when omitting outliers. Significant moderate improvements were observed for anxiety ($g = 0.36$). Effect sizes for stress were not significant. Follow-up effects (8–12 weeks), when available, yielded similar effect sizes. Quality of the studies was low to moderate.

Conclusion: These findings indicate that PPIs, wherein the focus is on eliciting positive feelings, cognitions or behaviors, not only have the potential to improve well-being, but can also reduce distress in populations with clinical disorders. Given the growing interest for PPIs in clinical settings, more high quality research is warranted as to determine the effectiveness of PPIs in clinical samples.

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Keywords: Well-being, Distress, Positive psychology, Chronic illness, Meta-analysis, Interventions

Background

Positive psychology is a relatively new field that focuses on enhancing well-being and optimal functioning rather than ameliorating symptoms, and complements rather than replaces traditional psychology [1]. Common themes in positive psychology include savoring, gratitude, kindness, promoting positive relationships, and pursuing hope and meaning [2].

Now that it has been repeatedly shown that well-being and psychopathology are two moderately correlated yet independent constructs of mental health [3–6], well-being receives growing attention in clinical research and practice. Even after successful treatment of psychopathology, low levels of well-being may persist in individuals, which, in turn, form a substantial risk factor for psychological distress [7]. In the light of a substantial body of evidence demonstrating that high levels of well-being buffer against psychological symptomatology, including relapse or recurrence of symptoms, besides enhancing quality of life and longevity [5, 7–14], we anticipate that clinical samples could greatly benefit from positive psychological interventions (PPIs) which explicitly aim to enhance well-being, that is, positive feelings, cognitions or behaviors [15].

Although PPIs have been mostly examined in non-clinical samples [16], some preliminary evidence exist for their efficacy in clinical samples [16, 17]. Independent lines of research have shown that PPIs improved well-being and decreased psychological distress in mildly depressed individuals [18], in patients with mood and depressive disorders [19, 20], in patients with psychotic disorders [21] and improving quality of life and well-being in breast cancer patients [22]. Thus, PPIs may have the potential to be of   value to clinical sam-ples but their effectiveness in these samples is not well established.

To date, two meta-analyses have been published that examined the effectiveness of PPIs in predominantly non-clinical samples. First, Sin and Lyubomirsky [17] included 49 controlled studies with 4235 individuals examining the effectiveness of PPIs on well-being and depression. They found that PPIs were significantly more effective than comparators (i.e. active control or treatment as usual) for enhancing well-being ($r = .29$) and decreasing depression ($r = .31$). Second, to address several methodological issues in Sin and Lyubomirsky's meta-analysis [17] such as lack of methodological quality assessment of the included studies, Bolier and colleagues [16] re-examined the literature. Using more stringent methodological and inclusion criteria, they systematically collected and synthesized the findings of 39 randomized controlled studies with 6139 individuals. Small but significant effects of PPIs on subjective well-being, psychological well-being and depression were found, with Cohen's d effect sizes of 0.34, 0.20 and 0.23, respectively.

However, these previously published meta-analyses are inconclusive regarding the effectiveness of PPIs in improving well-being and alleviating psychological distress in clinical samples. Although both meta-analyses included a number of studies with clinical samples, 12 out of 49 studies [17] and 4 out of 39 studies [16], respectively, these were limited to psychiatric samples with depressive or anxiety symptoms. To our knowledge, no attempt has been made to systematically examine the effects of PPIs in samples with somatic disorders who may benefit from improvements in well-being [23].

Since there is growing interest in the application of PPIs targeting clinical samples, the aim of the study was to add to the existing literature on the effectiveness of PPIs in primarily non-clinical samples [16, 17] through meta-analytically testing the effects of PPIs on well-being and distress across a broad range of clinical samples with psychiatric and somatic disorders.

Methods

This study was prepared and conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines [24] and registered on April 29, 2016 in PROSPERO (#CRD42016037451), an international prospective register for systematic reviews.

Search strategy

The electronic databases PsycINFO, PubMed, and Scopus were searched from 1998 (the start of the positive psychology movement) to March 31, 2016, and an update of the search was conducted on May 31, 2017. For each database, text word search terms, medical subject headings (PubMed) or thesaurus terms (PsycINFO) were relating to 'well-being' and 'positive psychology', in combination with terms related to 'interventions', 'disorders and illness' and 'outcome' (see Additional file 1 for more detailed information on the search terms). Studies cited in the previously published meta-analytic reviews [16, 17, 22] were cross-checked. Additionally, three clinical trial registers (www.clinicaltrialsregister.eu, www.clinicaltrials.gov, www.isrctn.com) were searched on August 31, 2016, to detect trials with unpublished results available.

Selection of studies

Potentially eligible studies were screened on title in the first phase, on abstract in the second phase, and on full paper in the third phase. Studies were included in the meta-analysis if they: 1) examined the effects of an intervention developed in line with the theoretical tradition of positive psychology cfm. Sin and Lyubomirsky (2009), that is, a psychological intervention (i.e. training, exercise, therapy) aimed at raising positive feelings, cognitions or behaviors; 2) included adult participants (18 years or older) with

clinical psychiatric or somatic disorders [according to the International Classification of Diseases and Related Health Problems; [25]; 3) used an outcome measure of social, emotional or psychological well-being; 4) used a control condition; and 5) provided an effect size or sufficient information to calculate an effect size. Studies were excluded if they: 1) were not published in an English language peer-reviewed journal; 2) examined physical exercises aimed at improving well-being; or 3) used an intervention that is primarily based on reminiscence, mindfulness and/or meditation. With regard to the third exclusion criterion, extensive meta-analyses have already been published for these types of interventions [26–30]. Published abstracts and/or study protocols were also excluded.

The first (FC) and second author (JTK) independently conducted the screening of titles. The interrater reliability was high (kappa = 0.84; n = 1000). Disagreements between raters during the screening of abstracts and full texts were discussed until consensus was reached. Any remaining ambiguity was resolved with the third (MSS) and fourth author (ETB).

Data extraction
Data were collected on: 1) population characteristics, including age, gender, disorder, and sample size (per condition); 2) intervention characteristics, including type of PPI, delivery mode, number of sessions, duration in weeks, retention rate, and guidance (i.e. with or without therapist); 3) methodological characteristics, including study design, type of control group, assessment points (i.e. pre, post and/or follow up), and outcome measures. Eight authors were contacted because information regarding study characteristics or to calculate effect sizes was lacking, of whom six provided additional data on request.

Quality assessment
All studies were rated on methodological quality using criteria based on the Cochrane Collaboration's tool for assessing risk of bias [31] and the Jadad scale [32]. This rating consists of seven items that are rated as 0 ("absent") or 1 ("present"), resulting in a maximum quality score of 7 points. Studies were identified as "good" when all seven criteria were met, "fair" when five or six criteria were met, and "poor" when four or less criteria were met [33]. The included items cover: 1) random sequence generation and allocation concealment (i.e. sufficient description of the method used to generate and conceal the allocation sequence); 2) blinding of outcome assessments (i.e. outcome assessments are either administered online or by an independent person who is not involved in

the study), 3) reporting incomplete outcome data (i.e. dropout analysis is conducted or reasons for drop-out are reported), 4) using intention-to-treat analysis, 5) group similarity at baseline regarding prognostic factors (e.g. demographics) or adjustments were made to correct for baseline imbalance, 6) adequate sample size/power analysis (i.e. an adequate power analysis was conducted or the study included 50 or more persons in the analysis), and 7) reliability of the diagnostic assessment (i.e. assessment was conducted by a professional and not based on self-report or screening or there were no diagnostic assessments). The first (FC) and second author (JTK) independently conducted the quality assessment, whereby disagreements were discussed until consensus was reached.

Primary and secondary outcomes
The primary outcome was the mean well-being score at the end of the intervention, assessed with validated measures of social, emotional, and/or psychological well-being. In the absence of well-being measures, measures, constructs related to well-being such as hope, happiness, life satisfaction, personal growth, optimism or positive affect were included if available. If more than one measure for well-being was used, we used the most validated measure, to ensure each study had one primary outcome for the analysis. Secondary outcomes included depression, anxiety and stress.

Statistical analysis
For each study, means and standard deviations were extracted, where possible based on the intention-to-treat method; otherwise, the reported means and standard deviations for the patients that completed the interventions were used. Effect sizes were calculated in three steps. First, standardized pre-post effect sizes were calculated per condition (i.e. PPI or control condition) by subtracting the average pre-intervention score from the average post-intervention score and subsequently dividing this score by the pooled standard deviation. Second, the difference in effect size (Δd) between PPI condition and control condition was computed. Third, Δd was adjusted for small sample bias, indicated as Hedges' g. Where possible, pre-to-follow-up effect sizes were calculated in a similar manner, thereby only using studies with a follow-up period between 8 and 12 weeks.

Using Comprehensive Meta-Analysis version 2.2.064, separate meta-analyses were performed for 1) well-being, 2) depression, 3) anxiety, and 4) stress in which data were pooled using the random-effects model accounting for diversity across studies (e.g. in terms of populations, types of PPIs and outcome measures). Effect sizes of 0.56 to 1.2 can

be considered large, effect sizes of 0.33 to 0.55 moderate, and effect sizes of 0 to 0.32 small [34].

Heterogeneity of effect sizes was examined using Q and I^2 statistics. The Q-test assesses whether the observed effect sizes are significantly more different from one another than would be expected based on chance alone. A significant Q-statistic indicates heterogeneity. The I^2 statistic captures the percentage of the total variance across the included studies attributable to heterogeneity. A value of zero indicates true homogeneity, while values of 25, 50, and 75% indicate low, moderate, and high levels of heterogeneity, respectively [35].

Publication bias was assessed using funnel plots, Egger's Test, Duval and Tweedie's trim-and-fill pro-cedure, and fail-safe N. First, a funnel plot was cre-ated by plotting the overall mean effect size against study size. Whereas a symmetric distribution of stud-ies around the effect size indicates the absence of publication bias, a higher concentration of studies on one side of the effect size than on the other indicates publication bias [36]. Second, Egger's test [37] was used to examine the symmetric distribution of studies around the effect size with a quantitative test statistic (considered significant funnel plot asymmetry if $p < 0.05$). Third, Duval and Tweedie's [38] trim-and-fill procedure was applied. This procedure imputes the effect sizes of missing studies and produces an ad-justed effect size accounting for these missing studies. Adjusted values were only reported for pooled effect sizes when these were statistically significant. Finally, a fail-safe N, a test of funnel plot asymmetry, was cal-culated for each analysis. The fail-safe N indicates the number of unpublished non-significant studies that would be required to lower the overall effect size below significance [37]. The findings were considered robust if the fail-safe $N \geq 5n + 10$, where n is the number of comparisons [39].

Pre-specified exploratory subgroup analyses were performed to examine differences in effect sizes based on: 1) population type: psychiatric vs somatic disor-ders; 2) intervention type: individual vs. group format, with vs. without therapist guidance; and 3) duration of the intervention: short (≤ 8 weeks) vs long (> 8 weeks). Mixed effects analysis was used to tests for differences between subgroups. Additional ad hoc analyses were performed to explore differences in ef-fect sizes based on: 1) type of PPI: PPI therapy pro-grams (e.g. meaning-centered group approach, well-being therapy) vs single PPIs (e.g. three good things/signature strengths); and 2) control group: no intervention (i.e. did not receive any intervention at all)/ waitlist (i.e. did receive the intervention after the experimental group) vs. active/treatment-as-usual.

Finally, meta-regression analysis was performed to in-vestigate if effect sizes were moderated by study quality.

Results

Selection of studies

A total of 10,886 studies were produced in the electronic database searches. After the exclusion of duplicates ($n = 1578$) and the removal of studies at the title screening phase ($n = 9069$), 239 abstracts were reviewed (Fig. 1). Of the 101 articles identified for full text review, 30 con-trolled studies were included. The 30 studies comprised 33 comparisons for well-being, 26 comparisons for de-pression, 14 comparisons for anxiety and 6 comparisons for stress [40–69]. Fourteen studies were conducted in the United States, three each in Iran, Canada, and Spain, two each in the United Kingdom and Italy, and one each in Australia, Germany, and Taiwan. The characteristics of the included studies are presented in Table 1.

Population characteristics

The included studies comprised 1864 adult partici-pants, 960 in the PPI conditions and 904 in the con-trol conditions. The mean age of the participants at pre-intervention was 47.8 years ($SD = 11.5$, range 26.4–68.9), and more than half were women (61.5%). In 16 studies, clinical samples with somatic disorders were included, with cancer being the most prevalent disorder (8 out of 16 studies). Other somatic disor-ders included cardiac diseases ($n = 4$), HIV ($n = 1$), brain injuries ($n = 1$), diabetes ($n = 1$) and chronic pain ($n = 1$). The remaining 14 studies included sam-ples with psychiatric disorders, with depressive dis-order as the most prevalent disorder (7 out of 13 studies), followed by anxiety disorders ($n = 2$), severe emotion dysregulation ($n = 1$), psychotic disorders ($n = 1$), post-traumatic stress syndrome ($n = 1$), and various men-tal health problems ($n = 2$).

Intervention, comparison and outcome characteristics

In 20 studies, PPIs were compared to treatment as usual or an active control condition, such as support-ive psychotherapy [44], cognitive behavioral therapy [47], dialectical behavior therapy [69] or mood moni-toring [57]. Ten studies compared PPIs to a no inter-vention/waitlist condition. The names of the PPIs as provided by the authors of the studies are also dis-played in Table 1. All interventions were explicitly aimed at raising positive feelings, cognitions or behav-iors. The 24 studies used empirically validated PPIs (see [2, 18]) or programs that have incorporated PPIs such as positive psychotherapy [67] or well-being therapy [51]. In 24 studies, therapist guidance was part of the PPI. The intervention duration varied

Fig. 1 Flowchart of the study selection process
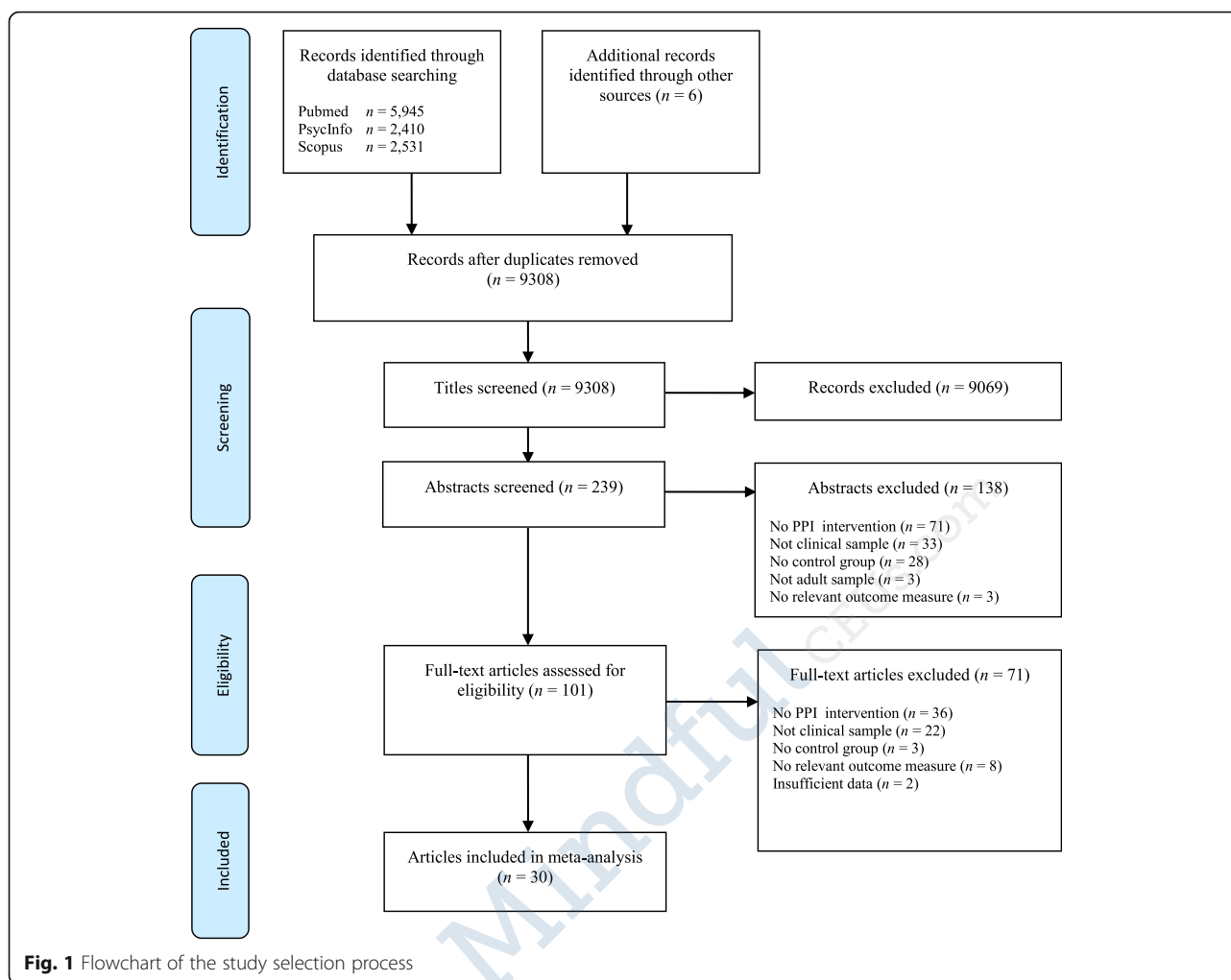
from 3 days to 16 weeks. The mean retention rate, based on dropouts at post-intervention, was 81.4% (available for 26 studies). For the PPI conditions, the mean retention rate was 81.0% and for the control conditions 81.8%. For the 12 studies that included follow-up measurements, the average follow-up time was 12.9 weeks after post-intervention.

Quality of studies

The quality scores of the studies are displayed in Table 2. If a criterion was not reported in the paper, it was labeled "unclear", and the criterion was rated as not met. All studies were either of medium quality ($n = 12$) or of low quality ($n = 18$). None of the included studies met all quality criteria. The use of intention-to-treat analyses was the most poorly rated, with only 11 studies meeting this criterion.

Meta-analyses

Table 3 summarizes findings from the meta-analyses per outcome, i.e. well-being, depression, anxiety, and stress. The meta-analyses were run separately for all studies at post-intervention with the outliers included, with the outliers excluded and with the low quality omitted. The meta-analyses at follow-up were run including outliers and low quality studies. The effect sizes of the individual studies at post-intervention are plotted in Figs. 2, 3, 4 and 5.

Post-intervention effects on well-being

For well-being (33 comparisons), a significant, small effect was observed ($g = 0.28$, 95% CI: 0.07 to 0.48, $p = 0.008$) at post-intervention. The level of heterogeneity was high ($I^2 = 78.20$). Four outliers were detected [41, 46, 52, 61]. After omitting these studies from the analysis, we found a similar effect, with $g = 0.24$ (95% CI: 0.13 to 0.35, $p < 0.001$), and heterogeneity reduced substantially ($I^2 = 20.29$). When studies scored as low quality were excluded from the analysis (including outliers), again a small significant effect size was observed ($g = 0.19$, 95% CI: 0.02 to 0.37, $p = 0.030$), with a moderate level of heterogeneity ($I^2 = 40.88$).

Table 1 Characteristics of studies included in the systematic review and meta-analysis

First author (Year)	Disorder	% female	Mean age (SD)	PPI name (n)	Format (guidance)	Duration in days or weeks (n sessions)	Control group (n)	Retention rate post-treatment PPI	Retention rate post-treatment Control	Follow-up (in weeks)	Outcome measure WB	DEP	ANX	S
Andrewes (2014) [40]	Brain injury	10%	42.2 (8.5)	Three good things in life / Signature strengths (4)	Individual (Yes)	2w (1–2)	CBT (5)	80%	100%	10	AHI			
Asgharipoor (2012) [41]	Major Depressive Disorder	72%	26.4 (5.9)	Positive psychotherapy (9)	Group (Yes)	12w (12)	CBT (5)	100%	100%	–	EWBS	BDI-II		SUDS
Breitbart (2010) [43]	Advanced cancer	51%	60.1 (11.8)	Meaning-centered group psychotherapy (49)	Group (Yes)	8w (8)	Supportive Psychotherapy (41)	71.4%	48.8%	8	FACIT-SP	HADS-D	HADS-A	
Breitbart (2012) [42]	Advanced cancer	61%	54.4 (11.6)	Meaning-centered group psychotherapy (64)	Individual (Yes)	7w (7)	Massage (56)	64.1%	66.1%	8	FACIT-SP	HADS-D	HADS-A	
Breitbart (2015) [44]	Advanced cancer	70%	58.2 (11.0)	Meaning-centered group psychotherapy (132)	Group (Yes)	8w (8)	Supportive Psychotherapy (121)	52.3%	47.9%	8	FACIT-SP	BDII	HADS-A	
Celano (2016) [55]	Major Depressive Disorder	69%	44 (16.6)	Positive Psychology Intervention (32)	Individual (Yes)	6w (6)	Cognition Focused Intervention (33)	90.6%	87.8%	6	PA	QIDS-SR		
Cerezo (2014) [46]	Breast cancer	100%	50 (9.7)	Positive Psychology Intervention (87)	Group (Yes)	14w (14)	Waitlist (88)	86.1%	83%	–	SWLS			
Chaves (2017) [47]	Depression/Dysthymia	100%	51.7 (10.4)	Positive Psychology Intervention (47)	Group (Yes)	10w (10)	CBT (49)	72.4%	79.6%	–	SWLS	BDI-II	BAI	
Cohn (2014) [48]	Type 2 diabetes	51%	54 (U)	DAHLIA: Developing Affective HeaLth to Improve Adherence (29)	Individual (No)	5w (0)	Emotion reporting (20)	86.2%	85%	–	PA	CES-D		PSS
Coote (2012) [49]	Depression	71%	52.5 (13.4)	Goal-setting and Planning (26)	Individual (No)	5w (0)	Waitlist (29)	92.3%	62.1%	5	PA	CES-D		
Elham (2015) [50]	Cardiovascular diseases	41%	68.9 (8.3)	Need-based spiritual/religious interventions (33)	Individual (Yes)	3 days (3)	No treatment (33)	100%	100%	–	SWBS		STAI	
Fava (1998) [51]	Affective disorders	55%	28.4 (6.6)	Well-being therapy (10)	Group (Yes)	16w (8)	CBT (10)	100%	100%	–	PWB	CID-D	SQ-A	
Fava (2005) [52]	Generalized anxiety disorder	65%	41.9 (11.9)	Well-being therapy (10)	Group (Yes)	16w (8)	CBT (10)	80%	80%	52	PWB	CID-D	CID-A	
Henry (2010) [53]	Stage III or IV ovarian cancer	100%	55 (9.7)	The Meaning-Making intervention (12)	Individual (Yes)	8w (3)	TAU (12)	80%	92.3%	12	FACIT-SP	HADS-D	HADS-A	
Hsiao (2012) [54]	Breast cancer	100%				8w (8)		69.2%	95.4%	32	MLQ	BDII		

Table 1 Characteristics of studies included in the systematic review and meta-analysis (*Continued*)

First author (Year)	Disorder	% female	Mean age (SD)	PPI name (n)	Format (guidance)	Duration in days or weeks (n sessions)	Control group (n)	Retention rate post-treatment PPI	Retention rate post-treatment Control	Follow-up (in weeks)	Outcome measure WB	DEP	ANX	S
			46.2 (8.6)	Body-mind-spirit (BMS) group therapy (26)	Group (Yes)		One psycho-educational session (22)							
Huffman (2016) [55]	Coronary syndrome	40%	62.8 (11.5)	Positive Psychology Interventions (23)	Individual (Yes)	8w (8)	TAU (25)	87%	88%	–	PA	HADS-D	HADS-A	
Kent (2011) [56]	Posttraumatic Stress Disorder	33%	54 (8.34)	Resilience-Oriented Treatment (20)	Group (Yes)	12w (12)	Waitlist (19)	95%	89.5%	–	PWB	BDI-II	STAI	PDS
Kerr (2015) (Group 1 gratitude)	Various mental problems	75%	43 (11.1)	Gratitude Interventions (16)	Individual (No)	2w (14)	Mood monitoring (15)	?	?	–	MLQ	DASS-D	DASS-A	DASS-S
Kerr (2015) (Group 2 Kindness)	Various mental problems	75%	43 (11.1)	Kindness Interventions (16)	Individual (No)	2w (14)	Mood monitoring (15)	?	?	–	MLQ	DASS-D	DASS-A	DASS-S
Krentzman (2015) [58]	Alcohol use disorder	48%	46.3 (10.9)	Web-based gratitude exercise (11)	Individual (No)	2w (14)	Placebo (11)	?	?	8	PA			
Lee (2006) [59]	Breast or colorectal cancer	81%	56.7 (10)	Meaning-making intervention (35)	Individual (Yes)	4.5w (4)	No treatment (39)	85.4%	95.1%	–	LOT-R			
Louro (2016) [60]	Colorectal cancer	34%	(U)	Enhancing Positive Emotions Procedure (31)	Group (Yes)	6w (4)	No treatment (21)	77.4%	95.2%	4	PA			
Mann (2001) [61]	HIV patients	100%	38.5 (8.2)	Future Writing and Optimism (21)	Individual (No)	4w (8)	No treatment (23)	95.2%	87%	–	LOT-R			
Muller (2016) [62]	Physical disability and chronic pain	70%	59.4 (11.8)	Computer-based positive psychology intervention (51)	Individual (No)	8w (0)	Writing exercises (45)	76.5%	74.5%	10	PWI	HADS-D		
Nikrahan (2016) [63] (group 1)	Heart diseases	24%	56.6 (8.7)	Fordyce's positive CBT (15)	Group (Yes)	6w (6)	Waitlist (14)	66.7%	85.7%	–	SWLS	BDI-II		
Nikrahan (2016) [63] (group 2)	Heart diseases	24%	56.6 (8.7)	Lyubomirsky's the how of happiness (13)	Group (Yes)	6w (6)	Waitlist (14)	92.3%	85.7%	–	SWLS	BDI-II		
Nikrahan (2016) [63] (group 3)	Heart diseases	24%	56.6 (8.7)	Seligman's authentic Happiness (13)	Group (Yes)	6w (6)	Waitlist (14)	76.9%	85.7%	–	SWLS	BDI-II		
Pietrowsky (2012) [64]	Depression	53%	38.9 (8.6)	Positive Psychology Interventions (9)	Group (Yes)	4w (3)	TAU (8)	77.8%	75%	–	SWLS	BDI-II		
Sanjuan (2016) [65]	Cardiac diseases	18%	54.4 (9.1)	Program to improve Well-being (57)	Group (Yes)	6w (24)	Relaxation (51)	87.7%	84.3%	–	PA	SCL90-D		
Schrank (2016) [66]	Psychosis	40%	42.5 (11.3)	Positive psychotherapy (47)	Group (Yes)	11w (11)	TAU (47)	91.5%	87.2%	–	WEMWBS	SDHS		

Table 1 Characteristics of studies included in the systematic review and meta-analysis *(Continued)*

First author (Year)	Disorder	% female	Mean age (SD)	PPI name (n)	Format (guidance)	Duration in days or weeks (n sessions)	Control group (n)	Retention rate post-treatment		Follow-up (in weeks)	Outcome measure			
								PPI	Control		WB	DEP	ANX	S
Seligman (2006) [67] (study 2)	Depression	76%	(U)	Positive psychotherapy (11)	Individual (Yes)	12w (14)	TAU (9)	84.6%	60%	–	SWLS	ZSRS		
Taylor (2017) [68]	Depression / Anxiety	62.5%	29.4 (12.1)	Positive Activity Intervention (16)	Individual (Yes)	10w (10)	Waitlist (12)	100%	92.3%	–	SWLS	BDI-II	STAI	
Uliaszek (2016) [69]	Severe emotion dysregulation	78%	22.2 (5.0)	Positive Psychotherapy	Group (Yes)	12w (12)	DBT	55.6%	85.2%	–	PPTI	SCL-90-D	SCL-R-A	DTS

Note. AHI Authentic Happiness Index, *ANX* Anxiety, *BAI* Beck Anxiety Inventory, *BDI-II* Beck Depression Inventory-II, *CES-D* Center for Epidemiologic Studies Depression Scale, *CID-A* Clinical Interview for Depression - Anxiety subscale, *CID-D* Clinical Interview for Depression - Depression subscale, *EWBS* Emotional Well-Being Scale, *DBT* Dialectical Behaviour Therapy, *DEP* Depression, *DTS* Distress Tolerance Scale, *FACIT-SP* Functional Assessment of Chronic Illness Therapy - Spiritual Well-being Scale, *HADS-A* Hospital Anxiety and Depression Scale – Anxiety Scale, *HADS-D* Hospital Anxiety and Depression Scale - Depression Scale, *HS* The Hope Scale, *LOT-R* Life Orientation Test – Revised, *MLQ* The Meaning in Life Questionnaire, *PA* The Positive and Negative Affect Scale - Positive Affect Scale, *PDS* Posttraumatic Stress Diagnostic Scale, *PPI* Positive Psychological Intervention, *PPTI* Positive Psychotherapy Inventory, *PSS* Perceived Stress Scale, *PWB* The Ryff Scales of Psychological Well-Being, *PWBS* Psychological Well-being Scale, *PWI* Personal Well-being Index, *QIDS-SR* Quick Inventory of Depressive Symptomatology, Self-Report, *S* Stress, *SCL-90-A* Symptom Checklist 90 – Anxiety subscale, *SCL-90-D* Symptom Checklist 90 - Depression subscale, *STAI* Spielberger State – Trait Anxiety Inventory, *SQ-A* Symptom Questionnaire - Anxiety subscale, *SUDS* Subjective Units of Distress Scale, *SWB* Subjective Well-Being, *SWBS* Spiritual Well-Being Scale, *SWLS* Satisfaction with Life Scale, *TAU* Treatment-as-Usual, *U* Unknown, *WB* Well-being, *WEMMWB* Warwick-Edinburgh Mental Well-Being Scale

Table 2 Methodological quality of studies included in the meta-analysis

First author (year)	1. Adequate allocation sequence generation and allocation concealment	2. Blinding of main outcome assessments	3. Description of withdrawals/drop-outs	4. Intention-to-treat analysis is performed or there are no drop-outs	5. The sample size is based on an adequate power analysis.	6. The groups are similar on prognostic indicators at baseline (and this was explicitly assessed) or adjustments were made to correct for baseline imbalance (using appropriate covariates).	7. Diagnostic assessment was conducted by a professional, or there were no diagnostic assessments necessary for the recruitment	Score
Andrewes (2014) [40]	Yes	No	Yes	No	No	Yes	Yes	4
Asgharipoor (2012) [41]	Unclear	No	Unclear	Unclear	No	Yes	Yes	2
Breitbart (2010) [43]	Unclear	Unclear	Yes	No	Yes	Yes	Yes	4
Breitbart (2012) [42]	Yes	Unclear	Yes	No	Yes	Yes	Yes	5
Breitbart (2015) [44]	Unclear	Unclear	Yes	No	Yes	Yes	Yes	4
Celano (2016) [55]	Yes	Yes	No	Yes	Yes	Yes	Yes	6
Cerezo (2014) [46]	Yes	Unclear	No	No	Yes	Yes	Yes	4
Chaves (2017) [47]	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6
Cohn (2014) [48]	Yes	Yes	No	No	Yes	Yes	Unclear	4
Coote (2012) [49]	Unclear	Yes	No	No	Yes	Yes	No	3
Elham (2015) [50]	No	No	Yes	Yes	Yes	Yes	Yes	5
Fava (1998) [51]	Unclear	Yes	Yes	Yes	No	Unclear	Yes	4
Fava (2005) [52]	Unclear	Yes	No	No	No	Unclear	Yes	2
Henry (2010) [53]	Yes	Yes	Yes	No	No	Yes	Yes	5
Hsiao (2012) [54]	Yes	Unclear	Yes	No	No	Yes	Yes	4
Huffman (2016) [55]	No	No	Yes	No	No	Yes	Yes	3
Kent (2011) [56]	Unclear	Unclear	Yes	Yes	No	Yes	Yes	4
Kerr (2015)	Unclear	Unclear	Yes	Yes	No	Yes	Yes	4
Krentzman(2015) [58]	Unclear	Yes	No	No	No	Yes	Yes	3
Lee (2006) [59]	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Louro (2016) [60]	No	No	Yes	No	No	Yes	Yes	3
Mann (2001) [61]	Unclear	No	No	No	No	Yes	Yes	2
Muller (2016) [62]	Yes	Yes	Yes	No	Yes	Yes	Yes	6
Nikrahan (2016) [63]	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	5
Pietrowsky (2012) [64]	Unclear	No	No	Yes	No	Yes	Yes	3
Sanjuan 2016 [65]	Yes	Unclear	Yes	No	Yes	Yes	Yes	5
Schrank (2016) [66]	Yes	No	Yes	Yes	Yes	Yes	Yes	6
Seligman (2006) [67] (study 2)	Unclear	Yes	Yes	No	No	Yes	Yes	4
Taylor (2017) [68]	Yes	Unclear	Yes	Yes	No	Yes	Yes	5
Uliaszek (2016) [69]	Yes	No	No	Yes	Yes	Yes	Yes	5

Table 3 Between-group effects

Outcome measures	N_{comp}	Hedges' g	95% CI	Z	Heterogeneity		Fail-safe N
					Q-value	I^2	
All studies post-intervention (including outliers)							
Well-being	33	0.28	0.07–0.48	2.66**	146.81***	78.20	271
Depression	26	0.27	0.09–0.45	2.97**	66.40***	62.34	132
Anxiety	14	0.47	0.23–0.71	3.78***	36.83***	64.71	135
Stress	6	0.00	-0.62–0.62	0.00	25.35***	80.28	0
All studies post-intervention (excluding outliers)[a]							
Well-being	29	0.24	0.13–0.35	4.16***	35.13	20.29	137
Depression	21	0.23	0.11–0.34	3.74***	22.26	10.16	66
Anxiety	13	0.36	0.20–0.53	4.24***	16.96	29.26	81
Stress	5	0.27	−0.19–0.73	1.16	11.02	63.69	0
Medium or high quality studies post-intervention							
Well-being	14	0.19	0.02–0.37	2.17*	21.99	40.88	17
Depression	12	0.07	-0.19–0.32	0.53	32.43	66.08	0
Anxiety	6	0.22	−0.05–0.49	1.57	8.39	40.39	1
Stress	1	−0.32	− 0.85–0.21	−1.19	0.00	0.00	–
Studies with 8–12 week follow up (including outliers)							
Well-being	7	0.41	0.08–0.74	2.46*	19.24**	68.82	28
Depression	5	0.21	0.05–0.37	2.53*	2.55	0.00	4
Anxiety	4	0.35	0.12–0.59	2.91**	4.45	32.54	10
Stress	–	–	–	–	–	–	–

Note. N_{comp}, number of comparisons, CI confidence interval. *$p < 0.05$. ** $p < 0.01$. *** $p < 0.001$. [a] The effect size for well-being ($g = 0.24$) corresponds with a standardized mean difference Cohen's $d = 0.24$ and unweighted mean $r = 0.12$; the effect size for depression ($g = 0.23$) corresponds with $d = 0.23$ and $r = 0.11$; the effect size for anxiety ($g = 0.36$) corresponds with $d = 0.37$ and $r = 0.18$; the effect size for stress ($g = 0.27$) corresponds with $d = 0.28$ and $r = 0.14$

Post-intervention effects on depression
Based on 26 comparisons, we found a significant, small effect of PPIs on depression, with $g = 0.27$ (95% CI: 0.09 to 0.45, $p = 0.003$) at post-intervention. The level of heterogeneity was moderate ($I^2 = 62.34$). Five outliers were detected [45, 51, 56, 68, 69]. After removal of the outliers, a small effect size was observed ($g = 0.23$, 95% CI: 0.11 to 0.34, $p < 0.001$). The level of heterogeneity was low ($I^2 = 10.16$). After removal of low quality studies, the effect size for depression was not significant with $g = 0.07$ (95% CI: -0.19 to 0.32, $p = 0.598$), and heterogeneity was moderate ($I^2 = 66.08$).

Post-intervention effects on anxiety
For anxiety (14 comparisons), a significant, moderate effect was found ($g = 0.47$, 95% CI: 0.23 to 0.71, $p < 0.001$) at post-intervention. Heterogeneity was moderate ($I^2 = 62.34$), and one outlier was detected [52]. After removal of the outlier, the effect size dropped to $g = 0.36$ (95% CI: 0.20 to 0.53, $p < 0.001$), but still remained in the moderate range, and the level of heterogeneity was low ($I^2 = 10.16$). After removal of low quality studies from the analysis, the effect size

for anxiety was small and not significant ($g = 0.22$, 95% CI: -0.05 to 0.49, $p = 0.233$), with moderate heterogeneity ($I^2 = 40.39$).

Post-intervention effects on stress
The overall mean effect size for 5 comparisons on stress was not significant ($g = 0.00$; 95% CI: -0.62 to 0.62, $p = 0.999$) at post-intervention. After the removal of one outlier [41], the effect size increased to the small range ($g = 0.27$; 95% CI: -0.19 to 0.73, $I^2 = 43.89$) but remained non-significant ($p = .247$). Only 1 study that included stress as an outcome had a medium quality rating (see Table 1).

Effects at follow-up
At follow-up, a significant, moderate effect was observed for well-being ($g = 0.41$, 95% CI: 0.08 to 0.74, $p = 0.014$), a significant, small effect for depression ($g = 0.21$, 95% CI: 0.05 to 0.37, $p = 0.011$), and a significant, moderate effect for anxiety ($g = 0.35$, 95% CI: 0.12 to 0.59, $p = 0.004$). There were no follow-up assessments conducted between 8 to 12 weeks with stress as outcome.
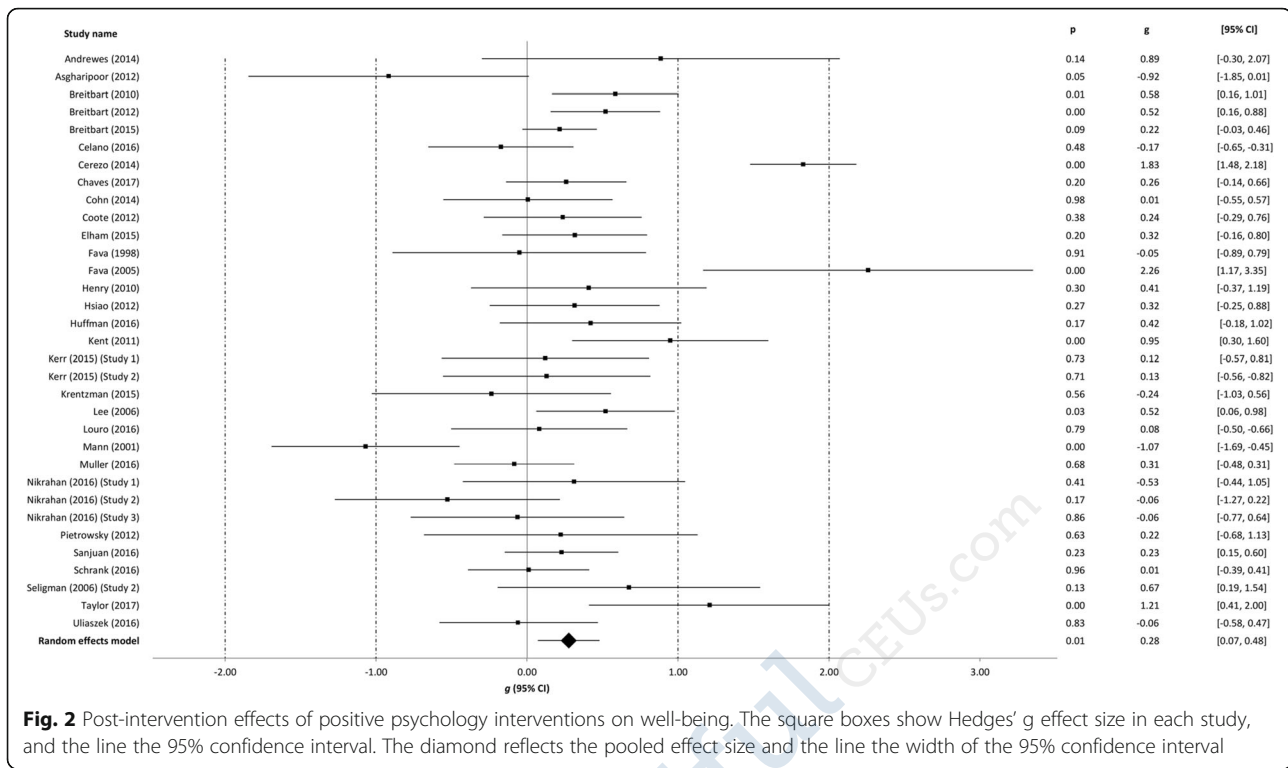
Fig. 2 Post-intervention effects of positive psychology interventions on well-being. The square boxes show Hedges' g effect size in each study, and the line the 95% confidence interval. The diamond reflects the pooled effect size and the line the width of the 95% confidence interval

Subgroup analyses

Exploratory subgroup analyses are presented in Table 4. For well-being ($Q = 6.412$, $df = 1$, $p = 0.011$) a significantly higher effect size was found for PPIs with therapist guidance ($g = 0.39$) than for PPIs without therapist guidance ($g = -0.12$). For stress, PPIs were found significantly more effective in studies using a no intervention/waitlist control condition ($g = 1.12$ vs $g = -0.21$; $Q = 8.283$, $df = 1$, $p = 0.004$) than in studies using an active or treatment-as-usual control condition. Effect sizes did not significantly vary based on population type (i.e. psychiatric vs somatic disorders), intervention format (i.e. individual vs group), intervention duration (i.e. shorter vs longer than 8 weeks) and/or type of PPI (i.e. PPI therapy programs vs single PPIs). For depression and anxiety, no significant differences between subgroups were found.

Meta-regression analysis

Using meta-regression analysis, we found no evidence that effect sizes for well-being and stress were moderated by study quality. The study quality had a significant negative influence on the effect size for depression and anxiety, with lower study quality scores resulting in lower effect sizes for depression (slope: -0.17, $Z = -3.23$, $p = 0.001$) and anxiety (slope: -0.28, $Z = -3.25$, $p = 0.001$).

Publication bias

First, inspection of the funnel plots showed that only for stress the funnel plot was skewed in favor of studies with a positive outcome at post-intervention. Second, Egger's test statistic showed no significant funnel plot asymmetry for all analyses (all p-values > .05). Third, after adjusting for potential publication bias with Duval and Tweedie's trim-and-fill procedure, the effect sizes for well-being and stress remained the same. However, for depression, four studies were trimmed and the adjusted effect size was $g = 0.15$ (95% CI: 0.05 to 0.25). Also for anxiety, four studies were trimmed and the adjusted effect size was $g = 0.27$ (95% CI: 0.14 to 0.39). Finally, the fail-safe N indicated that the findings for well-being and anxiety were robust, whereas the fail-safe numbers for depression (132) and stress (0) were lower than required (140 and 35, respectively). After omitting outliers, the findings for anxiety remained robust. The fail-safe N for well-being (137), depression (66) and stress (0) were lower than required (respectively 155, 115 and 35). At follow-up, the fail-safe N for well-being (28), depression (4) and anxiety (10) were lower than required (respectively 45, 35, and 30).

Discussion

To our knowledge, this is the first meta-analysis examining the effects of PPIs on well-being and distress in clinical samples with psychiatric and somatic disorders. When

Study name	p	g	[95% CI]
Asgharipoor (2012)	0.05	-0.92	[-1.07, 0.70]
Breitbart (2010)	0.01	0.58	[-0.23, 0.59]
Breitbart (2012)	0.00	0.52	[0.17, 0.89]
Breitbart (2015)	0.09	0.22	[-0.04, 0.53]
Celano (2016)	0.48	-0.17	[-0.98, 0.00]
Chaves (2017)	0.20	0.26	[-0.53, 0.27]
Cohn (2014)	0.98	0.01	[-0.21, 0.92]
Coote (2012)	0.38	0.24	[-0.16, 0.89]
Fava (1998)	0.91	-0.05	[0.90, 2.96]
Fava (2005)	0.00	2.26	[-0.20, 1.53]
Henry (2010)	0.30	0.41	[-0.59, 0.96]
Hsiao (2012)	0.27	0.32	[-0.10, 1.03]
Huffman (2016)	0.17	0.42	[-0.06, 1.15]
Kent (2011)	0.00	0.95	[0.47, 1.79]
Kerr (2015) (Study 1)	0.73	0.12	[-0.65, 0.73]
Kerr (2015) (Study 2)	0.71	0.13	[-0.83, 0.54]
Muller (2016)	0.68	-0.08	[-0.23, 0.57]
Nikrahan (2016) (Study 1)	0.41	0.31	[-0.74, 0.73]
Nikrahan (2016) (Study 2)	0.17	-0.53	[-1.17, 0.31]
Nikrahan (2016) (Study 3)	0.86	-0.06	[-0.40, 1.03]
Pietrowsky (2012)	0.63	0.22	[0.03, 1.95]
Sanjuan (2016)	0.23	0.23	[-0.35, 0.40]
Schrank (2016)	0.96	0.01	[-0.28, 0.52]
Seligman (2006) (Study 2)	0.13	0.67	[0.17, 1.99]
Taylor (2017)	0.00	1.21	[0.68, 2.34]
Uliaszek (2016)	0.83	-0.06	[-1.14, -0.06]
Random effects model	0.00	0.27	[0.09, 0.45]

Fig. 3 Post-intervention effects of positive psychology interventions on depression. The square boxes show Hedges' g effect size in each study, and the line the 95% confidence interval. The diamond reflects the pooled effect size and the line the width of the 95% confidence interval

excluding outliers, our analyses suggest that PPIs have a small but significant effect on well-being compared to control conditions. At follow-up, a significant moderate effect size of PPIs on well-being was observed. For the secondary outcomes, a small but significant effect size was found for depression at post-intervention and follow-up and moderate significant effect sizes for anxiety at post-intervention and follow-up. Effect sizes for stress were not significant. These findings suggest that PPIs not only have the potential to improve well-being, but can also reduce distress in populations with clinical disorders.

The effect sizes at post-intervention and follow-up for well-being and distress were comparable with those found in Bolier et al's meta-analysis of controlled PPIs studies in predominantly non-clinical samples [16], but were lower than those in the earlier meta-analysis of Sin and Lyubomirsky [17]. However, in the meta-analysis conducted by Sin and Lyubomirsky [17] less stringent inclusion criteria were used and other interventions such as mindfulness and life-review were included that are commonly not regarded as PPIs [2, 16]. Nonetheless, our findings show promise for PPIs in samples with psychiatric and somatic disorders, and suggest that PPIs, wherein the focus is on eliciting positive feelings, cognitions or behaviors, may also be relevant for clinical populations.

In the field of psychology, especially clinical psychology, the focus lies primarily on examining distress-reducing treatment approaches. As PPIs explicitly aim to improve well-being, the findings of the current study are important because well-being is often impaired in individuals with clinical disorders [23] and low levels of well-being form a substantial risk for relapse or recurrence of symptoms [5, 7]. More importantly, recent studies suggest that well-being and psychological distress are two separate constructs, and that the treatment of symptoms does not necessarily result in improved well-being (e.g., [6, 14]). In the light of these findings, we encourage researchers to further establish the effectiveness of well-being enhancing approaches including PPIs.

Explorative subgroup analyses suggest that guided PPIs are more effective in improving well-being compared to unguided PPIs, such as self-help. Similar findings were found in earlier meta-analytic reviews [16, 17] regarding PPIs in predominantly nonclinical samples, where larger effect sizes were found in therapist-guided interventions (compared with unguided self-help), when the interventions were offered to people with mental health problems. This is also in line with findings regarding supported versus unsupported conventional psychological treatments, such as cognitive behavioral therapy (e.g., [70, 71]) where significant larger effect sizes are observed for supported psychological treatments. Therapist guidance may potentially improve outcomes of PPIs on well-being in samples with psychiatric and/or somatic disorders. However, based on the explorative nature of the subgroup analyses, these
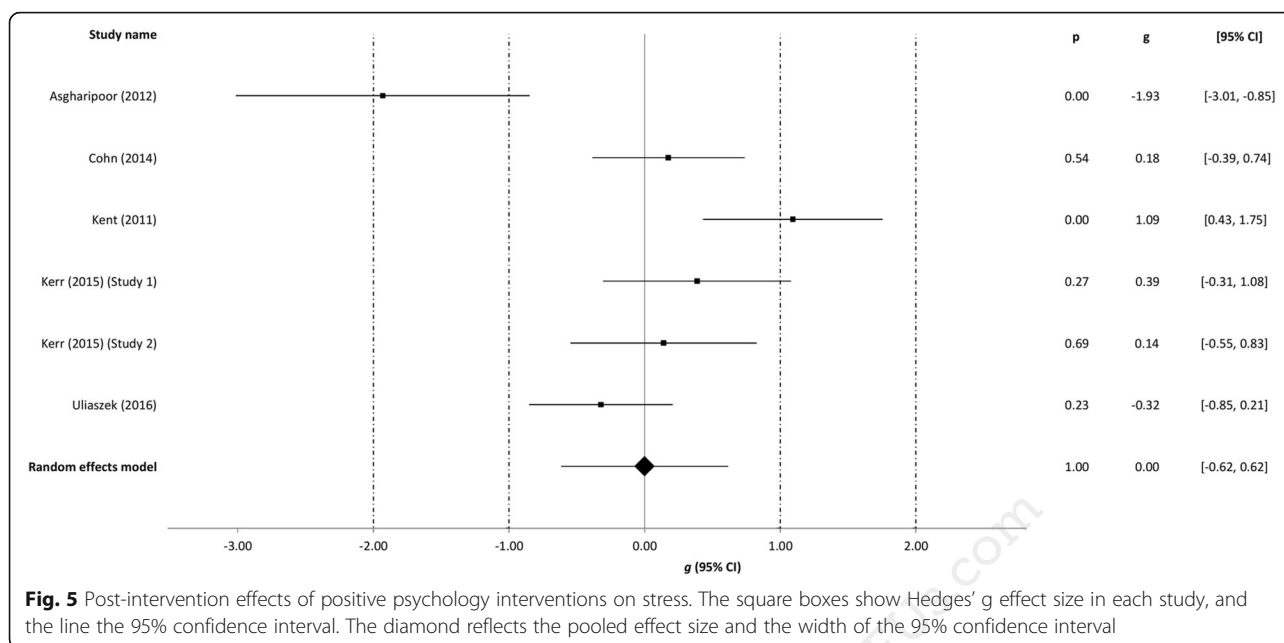
Fig. 4 Post-intervention effects of positive psychology interventions on anxiety. The square boxes show Hedges' g effect size in each study, and the line the 95% confidence interval. The diamond reflects the pooled effect size and the width of the 95% confidence interval
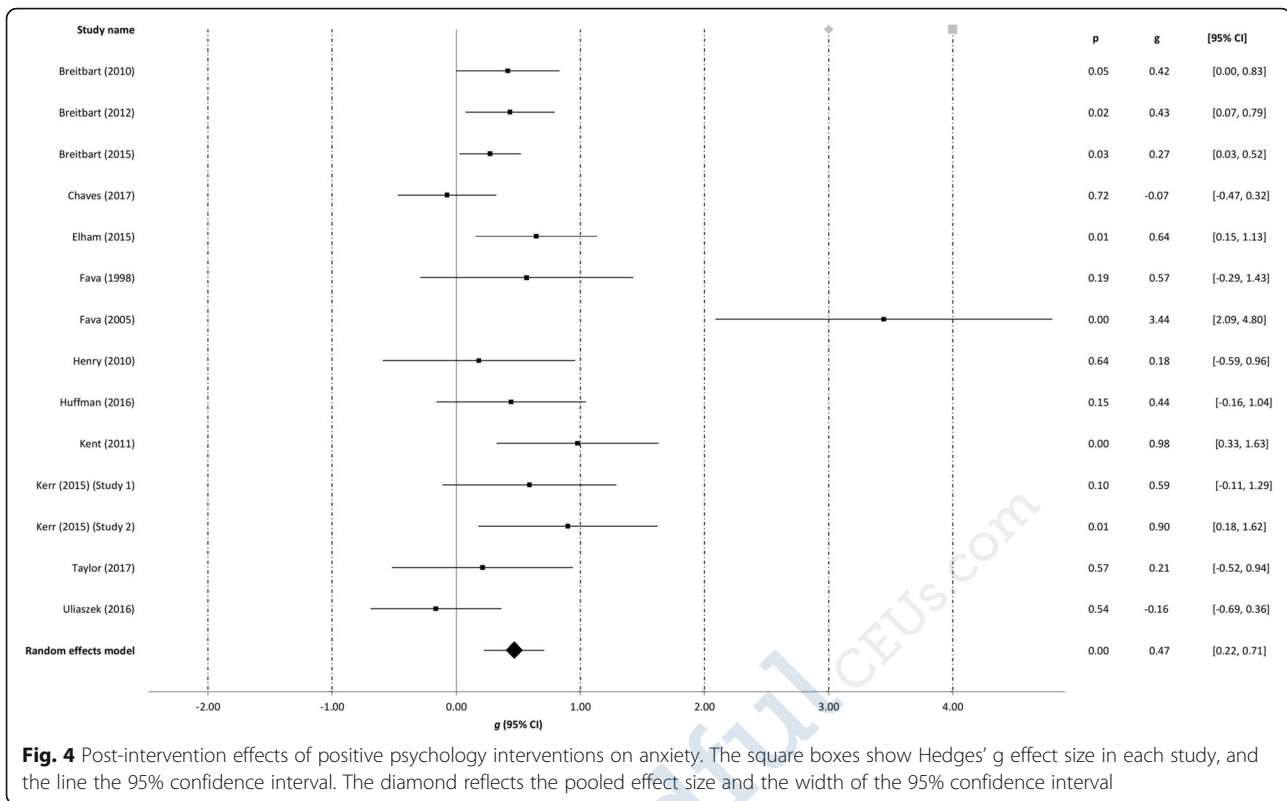
findings should be treated with caution and future re-search should examine the effect of therapist guidance compared to self-help in controlled studies.

No other significant pre-specified moderators of outcome were observed. There was no significant ef-fect of disorder type (i.e. psychiatric vs somatic disor-ders) and intervention format (i.e. individual vs group). Although, the moderating effect of interven-tion duration was not significant, the results showed that PPIs with a shorter duration than 8 weeks did not have a significant effect on well-being whereas PPIs with a longer duration had a significant effect on well-being. This finding is in line with earlier meta-analytic reviews [4, 5] and suggests that PPIs are more effective when offered during a longer period of time (more than 8 weeks). In the additional moderator analyses, no significant differences in effect sizes were found for empirically validated PPIs vs other PPIs. For stress, a significantly higher effect size was found for PPIs that had no intervention/waitlist as control condition than for PPIs that had an active control condition or treatment-as-usual as control condition. However, the sample sizes were relatively small in the exploratory subgroup analyses, which limits the interpretation of the differences between groups, and the results should therefore be consid-ered with caution.

The current systematic review and meta-analysis high-lights the need to improve the research methodology and reporting within the field of PPIs. The quality of the included studies was low to medium. Although the qual-ity of the studies may have been underestimated since we rated a criterion as not met if it was not reported in the paper, it seems that the methodological quality of studies in this field could be considerably improved if authors routinely report on sequence generation, alloca-tion concealment and blinding of assessors. Further-more, only one third of the included studies reported using the intention-to-treat principle to analyze the re-sults and almost half of the included studies did not re-port using a power analysis to determine the sample size. Inadequate statistical power and not adhering to the intention-to-treat principle introduces bias into the results of individual studies, and distorts the results from meta-analyses [72]. This was reflected in the meta-regression analysis which indicated that the effects of PPIs on depression and anxiety were moderated by the methodological quality of the studies, with a lower study quality resulting in smaller effect sizes. Therefore, we recommend researchers conducting studies on PPIs in clinical samples to comply with the quality criteria when designing studies, in order to perform more high quality research to accurately determine the effectiveness of PPIs in clinical samples with psychiatric and somatic

Fig. 5 Post-intervention effects of positive psychology interventions on stress. The square boxes show Hedges' g effect size in each study, and the line the 95% confidence interval. The diamond reflects the pooled effect size and the width of the 95% confidence interval

disorders. Moreover, the number of studies including post-treatment follow-up measures is relatively low (12 out of 30). We encourage researchers in the field to include follow-up measurements as to determine whether possible favorable effects of PPIs can be sustained in the long run.

Our systematic review and meta-analysis focused on controlled studies of PPIs in clinical samples. We identified a number of studies in different clinical disorders, age groups and settings. Drawing upon these findings in one place has generated the first evidence-based overview of the effectiveness of PPIs in clinical populations. However, several limitations should be noted. One important limitation is that well-being was not always the primary outcome in the included studies. Also, different definitions of well-being were used across the included studies. Incorporating validated measures of well-being, preferably ones that encompass emotional, psychological, and social dimensions of well-being [73], in future studies of PPIs is recommended. Second, the effects of the PPIs may also have been overestimated due to publication bias. Although the results of this meta-analysis point at significant but small effects of PPIs, after adjustment for publication bias, caution is needed. Third, our conclusions are based on the overall effect after the exclusion of outliers, including studies of low quality. When considering only studies of at least medium quality, the effects of PPIs are substantially lower but the sample size of the studies also decreases substantially. Since this is the first study meta-analyzing the effects of PPIs in clinical samples, we based our conclusions on the analyses (i.e. after excluding outliers) with the largest sample size to present a more

comprehensive representation of the field. Fourth, we observed a broad range of PPIs in our meta-analysis that varied in delivery mode and intensity. Future research should examine which clinical populations may benefit from PPIs, in terms of type, delivery mode and intensity, and whether there are differential mediators of outcome. Still, this is one of the first meta-analyses in this field providing an overview of PPIs in clinical samples.

Conclusions

In conclusion, this systematic review and meta-analysis provides evidence that PPIs are effective in improving well-being as well as in alleviating common psychological symptoms, including depression and anxiety, in clinical samples with psychiatric and somatic disorders. At present, the most promising PPIs seem to be those that are guided. Given the growing interest for PPIs in clinical settings [15, 16], it is timely and important to further establish the potential of PPIs in the context of clinical populations using large-scale and methodologically sound trials.

Additional files

Additional file 1: Search strategy. Full search strategies for Scopus, Pubmed, and PsycINFO (DOCX 13 kb)

Additional file 2: Figure S1. Flowchart of the study selection process. PRISMA Flowchart of the study selection process (DOCX 26 kb)

Outcome measure	Criterion	Subgroup	N_{comp}	Hedges' g	95% CI	I^2	Z
Well-being	Duration	<= 8 weeks	22	0.15	0.00–0.30	42.23	1.95
		> 8 weeks	11	0.59	0.06–1.11	88.74	2.19*
	Format	Group	17	0.33	0.01–0.66	84.87	2.01*
		Individual	16	0.20	−0.03–0.43	58.89	1.74
	Guidance	Therapist	26	0.39	0.16–0.62	78.63	3.30***
		Without therapist	7	−0.12	−0.43–0.20	49.96	−0.73
	Disorder	Psychiatric	15	0.26	−0.02–0.53	62.56	1.83
		Somatic	18	0.28	−0.01–0.57	83.99	1.91
Depression	Duration	<= 8 weeks	16	0.18	0.03–0.33	27.56	2.38*
		> 8 weeks	10	0.54	0.08–0.99	80.02	2.31*
	Format	Group	15	0.23	−0.01–0.47	64.37	1.91
		Individual	11	0.33	0.04–0.61	61.60	2.26*
	Guidance	Therapist	21	0.31	0.09–0.52	68.95	2.74**
		Without therapist	5	0.19	−0.05–0.43	0.00	1.55
	Disorder	Psychiatric	14	0.37	0.01–0.73	76.94	2.03*
		Somatic	12	0.26	0.13–0.39	0.00	3.86***
Anxiety	Duration	<= 8 weeks	7	0.41	0.25–0.57	0.00	5.02***
		> 8 weeks	7	0.59	0.03–1.16	81.11	2.05*
	Format	Group	7	0.52	0.08–0.96	81.15	2.31**
		Individual	7	0.49	0.28–0.70	0.00	4.53***
	Guidance	Therapist	12	0.43	0.17–0.70	67.87	3.21**
		Without therapist	2	0.74	0.24–1.24	0.00	2.89**
	Disorder	Psychiatric	8	0.65	0.12–1.18	79.75	2.41**
		Somatic	6	0.38	0.21–0.54	0.00	4.56***
Stress	Duration	<= 8 weeks	3	0.23	−0.14–0.59	0.00	1.20
		> 8 weeks	3	−0.33	−1.77–1.11	91.69	−0.45
	Format	Group	3	−0.33	−1.77–1.11	91.69	−0.45
		Individual	3	0.23	−0.14–0.59	0.00	1.20
	Guidance	Therapist	3	−0.33	−1.77–1.11	91.69	−0.45
		Without therapist	3	0.23	−0.14–0.59	0.00	1.20
	Disorder	Psychiatric	5	−0.06	−0.84–0.73	84.16	−0.14
		Somatic	1	0.18	−0.39–0.74	0.00	0.61

Note. N_{comp}, number of comparisons; *CI* confidence interval. *$p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

depression subscale; DBT: Dialectical behaviour therapy; DEP: Depression; DTS: Distress tolerance scale; EWBS: Emotional well-being scale; FACIT-SP: Functional assessment of chronic illness therapy - spiritual well-being scale; HADS: Hospital anxiety and depression scale; HADS-A: Hospital anxiety and depression scale – anxiety scale; HADS-D: Hospital anxiety and depression scale - depression scale; HS: The hope scale; LOT-R: Life orientation test – revised; MLQ: The meaning in life questionnaire; N_{comp}: Number of comparisons; PA: The positive and negative affect scale - positive affect scale; PDS: Posttraumatic stress diagnostic scale; PPI: Positive psychological intervention; PPTI: Positive psychotherapy inventory; PRISMA: Preferred reporting items for systematic reviews and meta-analyses; PSS: Perceived stress scale; PWB: The Ryff scales of psychological well-being; PWBS: Psychological Well-Being Scale; PWI: Personal well-being index; QIDS-SR: Quick inventory of depressive symptomatology, self-report; S: Stress; SCL-90-A: Symptom checklist 90 – anxiety subscale; SCL-90-D: Symptom checklist 90 - depression subscale; SQ-A: Symptom questionnaire - anxiety subscale; STAI: Spielberger state – trait anxiety inventory; SUDS: Subjective units of

distress scale; SWB: Subjective well-being; SWBS: Spiritual well-being scale; SWLS: Satisfaction with Life Scale; TAU: Treatment-as-usual; U: Unknown; WB: Well-being; WEMMWB: Warwick-Edinburgh mental well-being scale

Availability of data and materials
The data are included within the article (and its Additional files 1 and 2.

Authors' contributions
FC, JTK, MSS and ETB designed the study. JTK conducted the literature searches. Selection of studies and data extraction: FC and JTK. Disagreements were resolved by discussion or arbitration by MSS and ETB. Statistical analysis: FC, MSS and ETB. FC drafted the manuscript. FC, JTK, MSS and ETB critically revised the manuscript and approved the final version.

Competing interests

The authors declare that they have no competing interests.

References

1. Duckworth AL, Steen TA, Seligman ME. Positive psychology in clinical practice. Annu Rev Clin Psychol. 2005;1:629–51.
2. Schueller SM, Parks AC. The science of self-help. Eur Psychol. 2014;19(2):145–55.
3. Huppert FA, Whittington JE. Evidence for the independence of positive and negative well-being: implications for quality of life assessment. Br J Health Psychol. 2003;8(Pt 1):107–22.
4. Keyes CL. Mental illness and/or mental health? Investigating axioms of the complete state model of health. J Consult Clin Psychol. 2005;73(3):539–48.
5. Lamers S, Westerhof GJ, Glas CA, Bohlmeijer ET. The bidirectional relation between positive mental health and psychopathology in a longitudinal representative panel study. J Posit Psychol. 2015;10(6):553–60.
6. Westerhof GJ, Keyes CL. Mental illness and mental health: the two continua model across the lifespan. J Adult Dev. 2010;17(2):110–9.
7. Wood AM, Joseph S. The absence of positive psychological (eudemonic) well-being as a risk factor for depression: a ten year cohort study. J Affect Disord. 2010;122(3):213–7.
8. Chida Y, Steptoe A. Positive psychological well-being and mortality: a quantitative review of prospective observational studies. Psychosom Med. 2008;70(7):741–56.
9. Diener E, Ryan K. Subjective well-being: a general overview. South African Journal of Psychology. 2009;39(4):391–406.
10. Howell RT, Kern ML, Lyubomirsky S. Health benefits: meta-analytically determining the impact of well-being on objective health outcomes. Health Psychol Rev. 2007;1(1):83–136.
11. Keyes CL, Dhingra SS, Simoes EJ. Change in level of positive mental health as a predictor of future risk of mental illness. Am J Public Health. 2010; 100(12):2366–71.
12. Lamers SM, Bolier L, Westerhof GJ, Smit F, Bohlmeijer ET. The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis. J Behav Med. 2012;35(5):538–47.
13. Ryff CD. Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychother Psychosom. 2014;83(1):10–28.
14. Trompetter H, Lamers S, Westerhof G, Fledderus M, Bohlmeijer E. Both positive mental health and psychopathology should be monitored in psychotherapy: confirmation for the dual-factor model in acceptance and commitment therapy. Behav Res Ther. 2017;91:58–63.
15. Wood AM, Tarrier N. Positive clinical psychology: a new vision and strategy for integrated research and practice. Clin Psychol Rev. 2010;30(7):819–29.
16. Bolier L, Haverman M, Westerhof GJ, Riper H, Smit F, Bohlmeijer E. Positive psychology interventions: a meta-analysis of randomized controlled studies. BMC Public Health. 2013;13(1):119.
17. Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. J Clin Psychol. 2009;65(5):467–87.
18. Seligman ME, Steen TA, Park N, Peterson C. Positive psychology progress: empirical validation of interventions. Am Psychol. 2005;60(5):410–21.
19. Fava GA, Ruini C. Development and characteristics of a well-being enhancing psychotherapeutic strategy: well-being therapy. J Behav Ther Exp Psychiatry. 2003;34(1):45–63.
20. Rashid T. Positive psychotherapy: a strength-based approach. J Posit Psychol. 2015;10(1):25–40.
21. Meyer PS, Johnson DP, Parks A, Iwanski C, Penn DL. Positive living: a pilot study of group positive psychotherapy for people with schizophrenia. J Posit Psychol. 2012;7(3):239–48.
22. Casellas-Grau A, Font A, Vives J. Positive psychology interventions in breast cancer. A systematic review. Psychooncology. 2014;23(1):9–19.
23. de Ridder D, Geenen R, Kuijer R, van Middendorp H. Psychological adjustment to chronic disease. Lancet. 2008;372(9634):246–55.
24. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med. 2009;151(4):264–9.
25. World Health Organization. International statistical classification of diseases and health related problems, 10th revision. Geneva: WHO; 1992.
26. Bohlmeijer E, Prenger R, Taal E, Cuijpers P. The effects of mindfulness-based stress reduction therapy on mental health of adults with a chronic medical disease: a meta-analysis. J Psychosom Res. 2010;68(6):539–44.
27. Bohlmeijer E, Roemer M, Cuijpers P, Smit F. The effects of reminiscence on psychological well-being in older adults: a meta-analysis. Aging Ment Health. 2007;11(3):291–300.
28. Gotink RA, Chu P, Busschbach JJ, Benson H, Fricchione GL, Hunink MG. Standardised mindfulness-based interventions in healthcare: an overview of systematic reviews and meta-analyses of RCTs. PLoS One. 2015;10(4):e0124344.
29. Khoury B, Lecomte T, Fortin G, Masse M, Therien P, Bouchard V, Chapleau MA, Paquin K, Hofmann SG. Mindfulness-based therapy: a comprehensive meta-analysis. Clin Psychol Rev. 2013;33(6):763–71.
30. Strauss C, Cavanagh K, Oliver A, Pettman D. Mindfulness-based interventions for people diagnosed with a current episode of an anxiety or depressive disorder: a meta-analysis of randomised controlled trials. PLoS One. 2014;9(4):e96110.
31. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, Savović J, Schulz KF, Weeks L, Sterne JA. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ. 2011;343:d5928.
32. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, McQuay HJ. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Control Clin Trials. 1996;17(1):1–12.
33. Spijkerman MPJ, Pots WTM, Bohlmeijer ET. Effectiveness of online mindfulness-based interventions in improving mental health: a review and meta-analysis of randomised controlled trials. Clin Psychol Rev. 2016;45:102–14.
34. Lipsey MW, Wilson DB. The efficacy of psychological, educational, and behavioral treatment. Confirmation from meta-analysis. Am Psychol. 1993; 48(12):1181–209.
35. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. Stat Med. 2002;21(11):1539–58.
36. Sterne JA, Egger M, Moher D. Addressing reporting biases. Cochrane handbook for systematic reviews of interventions; 2008. p. 297–333.
37. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629–34.
38. Duval S, Tweedie R. Trim and fill: a simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. Biometrics. 2000;56(2):455–63.
39. Rosenberg MS. The file-drawer problem revisited: a general weighted method for calculating fail-safe numbers in meta-analysis. Evolution. 2005;59(2):464–8.
40. Andrewes HE, Walker V, O'Neill B. Exploring the use of positive psychology interventions in brain injury survivors with challenging behaviour. Brain Inj. 2014;28(7):965–71.
41. Asgharipoor N, Asgharnejad FA, Arshadi H, Sahebi A. A comparative study on the effectiveness of positive psychotherapy and group cognitive-behavioral therapy for the patients suffering from major depressive disorder. Iran J Psychiatry Behav Sci. 2012;6(2):33–41.
42. Breitbart W, Poppito S, Rosenfeld B, Vickers AJ, Li Y, Abbey J, Olden M, Pessin H, Lichtenthal W, Sjoberg D, et al. Pilot randomized controlled trial of individual meaning-centered psychotherapy for patients with advanced cancer. J Clin Oncol. 2012;30(12):1304–9.
43. Breitbart W, Rosenfeld B, Gibson C, Pessin H, Poppito S, Nelson C, Tomarken A, Timm AK, Berg A, Jacobson C, et al. Meaning-centered group psychotherapy for patients with advanced cancer: a pilot randomized controlled trial. Psychooncology. 2010;19(1):21–8.
44. Breitbart W, Rosenfeld B, Pessin H, Applebaum A, Kulikowski J, Lichtenthal WG. Meaning-centered group psychotherapy: an effective intervention for improving psychological well-being in patients with advanced cancer. J Clin Oncol. 2015;33(7):749–54.
45. Celano C, Beale E, Mastromauro C, Stewart J, Millstein R, Auerbach R, Bedoya C, Huffman J. Psychological interventions to reduce suicidality in high-risk patients with major depression: a randomized controlled trial. Psychol Med. 2017;47(5):810–21.
46. Cerezo MV, Ortiz-Tallo M, Cardenal V, De La Torre-Luque A. Positive psychology group intervention for breast cancer patients: a randomised trial. Psychol Rep. 2014;115(1):44–64.

47. Chaves C, Lopez-Gomez I, Hervas G, Vazquez C. A comparative study on the efficacy of a positive psychology intervention and a cognitive behavioral therapy for clinical depression. Cognit Ther Res. 2017;41(3):417–33.

48. Cohn MA, Pietrucha ME, Saslow LR, Hult JR, Moskowitz JT. An online positive affect skills intervention reduces depression in adults with type 2 diabetes. J Posit Psychol. 2014;9(6):523–34.

49. Coote HM, MacLeod AK. A self-help, positive goal-focused intervention to increase well-being in people with depression. Clin Psychol Psychother. 2012;19(4):305–15.

50. Elham H, Hazrati M, Momennasab M, Sareh K. The effect of need-based spiritual/religious intervention on spiritual well-being and anxiety of elderly people. Holist Nurs Pract. 2015;29(3):136–43.

51. Fava GA, Rafanelli C, Cazzaro M, Conti S, Grandi S. Well-being therapy. A novel psychotherapeutic approach for residual symptoms of affective disorders. Psychol Med. 1998;28(2):475–80.

52. Fava GA, Ruini C, Rafanelli C, Finos L, Salmaso L, Mangelli L, Sirigatti S. Well-being therapy of generalized anxiety disorder. Psychother Psychosom. 2005;74(1):26–30.

53. Henry M, Cohen SR, Lee V, Sauthier P, Provencher D, Drouin P, Gauthier P, Gotlieb W, Lau S, Drummond N, et al. The meaning-making intervention (MMi) appears to increase meaning in life in advanced ovarian cancer: a randomized controlled pilot study. Psychooncology. 2010;19(12):1340–7.

54. Hsiao FH, Jow GM, Kuo WH, Chang KJ, Liu YF, Ho RT, Ng SM, Chan CL, Lai YM, Chen YT. The effects of psychotherapy on psychological well-being and diurnal cortisol patterns in breast cancer survivors. Psychother Psychosom. 2012;81(3):173–82.

55. Huffman JC, Millstein RA, Mastromauro CA, Moore SV, Celano CM, Bedoya CA, Suarez L, Boehm JK, Januzzi JL. A positive psychology intervention for patients with an acute coronary syndrome: treatment development and proof-of-concept trial. J Happiness Stud. 2016;17(5):1985–2006.

56. Kent M, Davis MC, Stark SL, Stewart LA. A resilience-oriented treatment for posttraumatic stress disorder: results of a preliminary randomized clinical trial. J Trauma Stress. 2011;24(5):591–5.

57. Kerr SL, O'Donovan A, Pepping CA. Can gratitude and kindness interventions enhance well-being in a clinical sample? J Happiness Stud. 2015;16(1):17–36.

58. Krentzman AR, Mannella KA, Hassett AL, Barnett NP, Cranford JA, Brower KJ, Higgins MM, Meyer PS. Feasibility, acceptability, and impact of a web-based gratitude exercise among individuals in outpatient treatment for alcohol use disorder. J Posit Psychol. 2015;10(6):477–88.

59. Lee V, Robin Cohen S, Edgar L, Laizner AM, Gagnon AJ. Meaning-making intervention during breast or colorectal cancer treatment improves self-esteem, optimism, and self-efficacy. Soc Sci Med. 2006;62(12):3133–45.

60. Louro AC, Fernández-Castro J, Blasco T. Effects of a positive emotion-based adjuvant psychological therapy in colorectal cancer patients: a pilot study. Psicooncología. 2016;13(1):113.

61. Mann T. Effects of future writing and optimism on health behaviors in HIV-infected women. Ann Behav Med. 2001;23(1):26–33.

62. Muller R, Gertz KJ, Molton IR, Terrill AL, Bombardier CH, Ehde DM, Jensen MP. Effects of a tailored positive psychology intervention on well-being and pain in individuals with chronic pain and a physical disability: a feasibility trial. Clin J Pain. 2016;32(1):32–44.

63. Nikrahan GR, Suarez L, Asgari K, Beach SR, Celano CM, Kalantari M, Abedi MR, Etesampour A, Abbas R, Huffman JC. Positive psychology interventions for patients with heart disease: a preliminary randomized trial. Psychosomatics. 2016;57(4):348–58.

64. Pietrowsky R, Mikutta J. Effects of positive psychology interventions in depressive patients—a randomized control study. Psychology. 2012;03(12):1067–73.

65. Sanjuan P, Montalbetti T, Perez-Garcia AM, Bermudez J, Arranz H, Castro A. A randomised trial of a positive intervention to promote well-being in cardiac patients. Appl Psychol Health Well Being. 2016;8(1):64–84.

66. Schrank B, Brownell T, Jakaite Z, Larkin C, Pesola F, Riches S, Tylee A, Slade M. Evaluation of a positive psychotherapy group intervention for people with psychosis: pilot randomised controlled trial. Epidemiol Psychiatr Sci. 2016;25(3):235–46.

67. Seligman ME, Rashid T, Parks AC. Positive psychotherapy. Am Psychol. 2006;61(8):774–88.

68. Taylor CT, Lyubomirsky S, Stein MB. Upregulating the positive affect system in anxiety and depression: outcomes of a positive activity intervention. Depress Anxiety. 2017;34(3):267–80.

69. Uliaszek AA, Rashid T, Williams GE, Gulamani T. Group therapy for university students: a randomized control trial of dialectical behavior therapy and positive psychotherapy. Behav Res Ther. 2016;77:78–85.

70. Andersson G, Cuijpers P. Internet-based and other computerized psychological treatments for adult depression: a meta-analysis. Cogn Behav Ther. 2009;38(4):196–205.

71. Richards D, Richardson T. Computer-based psychological treatments for depression: a systematic review and meta-analysis. Clin Psychol Rev. 2012;32(4):329–42.

72. Juni P, Altman DG, Egger M. Systematic reviews in health care: assessing the quality of controlled clinical trials. BMJ. 2001;323(7303):42–6.

73. Lamers SM, Westerhof GJ, Bohlmeijer ET, ten Klooster PM, Keyes CL. Evaluating the psychometric properties of the mental health continuum-short form (MHC-SF). J Clin Psychol. 2011;67(1):99–110.

Towards sustainable mental health promotion: trial-based health-economic evaluation of a positive psychology intervention versus usual care

Abstract

Background: Mental well-being could be promoted and protected by positive psychology (PP) based interventions. Such interventions may be appealing for people at risk of anxiety and depressive disorders, but health-economic evaluations are scarce. The aim was to examine the cost-effectiveness of a PP intervention.

Methods: Participants with suboptimal levels of mental well-being were randomly assigned to an email guided PP-intervention ($n = 137$) or a wait-list control group ($n = 138$) with access to usual care (UC). At baseline and 6 months follow-up, data were collected on health care costs. Outcomes of interest were flourishing mental health and treatment response on anxiety and depressive symptoms.

Results: Bootstrapped mean incremental cost-effectiveness ratios were €2359 ($2899) for flourishing, €2959 ($3637) for anxiety and €2578 ($3168) for depression, suggesting appreciable health gains for low additional costs. At a willingness to pay ceiling of €10,000 ($12,290) for a treatment response, the probability that the intervention is deemed cost-effective ranged between 90 and 93%.

Conclusions: The guided PP intervention appears to be a promising strategy as seen from both a public health and a health-economic perspective, especially when there is some willingness to pay. When the PP-intervention is scaled up, then outcome monitoring is recommended to better guarantee the longer term cost-effectiveness of the intervention.

Trial registration: The Netherlands National Trial Register NTR4297. Registered on 29 November 2013. The NTR is part of the WHO Primary Registries.

Keywords: Cost-effectiveness, Mental well-being, Guided self-help, Prevention, Positive psychology, Randomized controlled trial

Background

A new cost-effective strategy for the prevention of anxiety and depressive disorders might be to promote a flourishing mental health state in people with low or moderate levels of mental well-being [1, 2]. Earlier studies demonstrated that these people have an increased health care use[3] with concomitant health care costs and productivity losses [3–5]. Flourishing is defined as the presence of *high levels* of emotional well-being (e.g. life-satisfaction, positive affect) in combination with *high levels* of social and psychological well-being (e.g. social contribution, positive relationships, self-acceptance, purpose in life) [6, 7].

Longitudinal studies have shown that flourishing helps to protect against first-onset and recurrence of diagnosed mood and anxiety disorders [8, 9]. Other promising results stem from two of our randomized controlled trials demonstrating that individuals are able to improve their well-being up to flourishing levels using email guided bibliotherapy based on a positive

psychology or related framework [10, 11]. The same stud-ies also found beneficial effects on anxiety and depressive symptoms, suggesting that deteriorating mental health could be prevented by such self-help interventions. Self-help books are widely available and have the purpose to reach the lay public [12]. However, it is yet unknown whether positive psychology (PP) based bibliotherapy pro-grams are cost-effective [13].

To our knowledge, only one prior study evaluated the cost-effectiveness of a positive psychology intervention, which was an online multicomponent intervention for people with mild to moderate depressive symptoms [14]. This non-guided web-based intervention contained psycho-education and practical exercises about goal set-ting, positive emotions, positive relations, mindfulness, optimism and mastery. Participants in the experimental condition could independently select modules and exer-cises to tailor the intervention to their needs. At six months follow-up, the intervention was not effective in improving the primary outcome of mental well-being, but it was effective in reducing depressive symptoms com-pared to a wait-list (usual care) control group. However, the online intervention was not found to be cost-effective from a societal cost-effective perspective on any outcome measure [14]. According to the authors, these somewhat disappointing findings might be partly attributed to the lack of compliance, since only 10% of the participants completed at least one module as recommended [14, 15]. Therefore, a more cost-effective self-help format for posi-tive interventions might include some therapist inv-olvement to increase adherence. The present economic evaluation uses our trial data of an early bibliotherapy intervention for people with suboptimal levels of mental well-being [11]. We hypothesized that this PP-based self-help intervention with some guidance over the Inter-net was also cost-effective relative to usual care alone.

Methods

Design and participants

The non-blinded randomized controlled trial was con-ducted in two parallel groups, with computerized randomization using Excel (1:1 allocation) and stratified for gender and education (low, medium, high) per-formed by the first author. For each group, a contact list was created in Qualtrics, making it possible to send per-sonal emails to participants (e.g. including the result of the randomized assignment) without interference of the researcher. A sample size of 132 participants per condi-tion was required to provide a statistical power of 80%, two-sided with α of 5% and compensating for a 25% drop-out rate, to detect a small to medium effect size (Cohen's d of 0.40) on the main outcome i.e. mental well-being (a continuous measure) [16, 17]. Although the primary outcome of the current study was the binary

measure of mental well-being, a similar sample size was needed when the power calculation was adjusted to a χ^2 test and intention-to-treat data ($n = 126$ per group). Par-ticipants aged 18 years or older were recruited from the general Dutch population in January 2014 via national advertisements calling for people who were motivated to actively work on their "well-being and resilience". The participants were willing to invest an average time of 4 h per week for 9 weeks and had access to email and the Internet. Interested participants completed a contact form via a research website, and received an online in-formed consent procedure per email before they could access the online screening survey. Eligible participants were excluded when they were younger than 18 years of age, already possessed a flourishing mental health status as measured with the Mental Health Continuum-Short Form (MHC-SF); scoring 4 or 5 on at least one emo-tional well-being item together with a score of 4 or 5 on at least 6 of the 11 social and psychological well-being items [7, 18] or when they presented scores above 10 on at least one subscale of the Hospital Anxiety and Depression Scale (HADS), indicating moderate to severe anxiety or depressive symptoms [19]. Also, participants had to complete the screening and baseline question-naire because randomization took place after baseline.

In total, 518 participants were interested in participat-ing in the study, of which 243 participants had to be ex-cluded [11]. The final sample of 275 participants were allocated to the intervention group ($n = 137$) or the wait-list control group ($n = 138$). The trial protocol was approved by the Ethics Committee of the University of Twente (no. 13212) and registered at The Netherlands Trial Register (NTR4297). The design of the study [20] and its main findings [11] are published elsewhere.

Interventions

Participants in the intervention group received (1) the self-help book *This is Your Life* [21], (2) a 9-week time schedule for reading the book with recommended exer-cises, and (3) weekly email support from a personal counselor. The book consists of eight chapters containing psycho-education, theoretical background information, and a variety of evidence-based exercises from positive psychology, but also from mindfulness and acceptance and commitment therapy. The purpose of the book is to improve an individual's capacity to savor positive emo-tions, discover and use character strengths, encourage flow and an optimistic attributional style, develop self-ac-ceptance and compassion, learn to cope with adversity (re-silience), and encourage to share and connect with others [20]. The chapter about discovering and using character strengths was spread out over 2 weeks in the time sched-ule. Participants had 8 to 12 weeks to complete the

program. A full description of each chapter and recommended exercises can be found elsewhere [20].

Once a week, participants emailed their personal counselor with their experiences about the chapter and corresponding exercises. Five positive psychology students each guided 25 participants and the first author guided the remaining participants. The counselors were trained in providing email support during a study course plus a one-day workshop. In addition, they attended weekly supervision meetings. The email correspondence was aimed at increasing adherence. On average, participants reported that they had completed 6.4 (out of the 8) chapters (SD = 2.4) and had sent 6.4 extensive emails (SD = 3.62), indicating adequate adherence to the protocol [11].

Participants in the wait-list control group received the self-help book *This is Your Life* and the 9-week time schedule after completing the 6 months assessment. Participants in both conditions had unrestricted access to usual care.

Health related outcomes
The primary outcome was flourishing mental health and the secondary outcomes were anxiety and depressive symptoms. Self-reported data were obtained from online questionnaires at baseline and 6 months follow-up.

Flourishing
The 14-item MHC-SF measures mental well-being on a continuous scale but can also classify people into (1) flourishing mental health, (2) moderate mental health or (3) languishing mental health [18, 22], although we put the latter two categories together because there were few people with languishing mental health in the current sample at baseline (4.4%). In a cost-effectiveness study, hard currency (measured at the interval level) cannot be meaningfully related to health benefits that are measured at the ("elastic") ordinal measurement scale. It is economically more meaningful to relate hard currency to a binary outcome such as treatment response, where treatment response is clearly defined as reliable change [23] or as a transition from one health state (e.g. languishing or moderate mental health) to another (e.g. flourishing mental health).

The first three items of the MHC-SF measure emotional well-being (i.e. happiness, interest, life-satisfaction), the next five items measure social well-being (i.e. social contribution, social integration, social actualization, social acceptance, social coherence) and the last six items tap into psychological well-being (i.e. self-acceptance, mastery, positive relations, personal growth, autonomy, purpose in life). Each item was scored on a 6-point scale from 0 (never) to 5 (almost always). Flourishing is theoretically operationalized as scoring 4 or 5 on at least one emotional well-being item together with a score of 4 or 5 on at least 6 of the 11 remaining items, which parallels the DSM-IV

approach to diagnose a major depression [7, 18, 24]. The Dutch version of the MHC-SF has shown good psychometric properties [22] and showed good internal consistency in the current study (α = 0.88).

Anxiety and depressive symptoms
Anxiety and depressive symptoms were measured with the HADS-A and HADS-D respectively. Each subscale has 7 items with scores ranging from 0 to 3. Total summed scores range from 0 to 21, with higher scores indicating greater anxiety or depressive symptom severity. The HADS has shown good psychometric properties in the Dutch population [25, 26] and showed good internal consistency in the current sample (α = 0.76 for both subscales). To measure treatment response on these scales, Jacobson and Truax' method [23] was applied to obtain the reliable change index to distinguish between treatment responders and non-responders. The reliable change index was calculated as $x_2 - x_1 / S_{diff}$, where x_2 is the post-test score and x_1 is the baseline score. S_{diff} is the standard error of difference between the pre- and post-test scores which is calculated as $\sqrt{2(S_E)^2}$, where the standard error of measurement (S_E) is calculated as $SD\sqrt{1 - r_{xx}}$. r_{xx} is the test-retest reliability of the measure, which was 0.89 for the HADS-A and 0.86 for the HADS-D [26]. A treatment responder was estimated to be a pre-post change of at least 2.22 points on the anxiety subscale and 2.55 points on the depression subscale, taking the 95% criterion into account ($z = 1.96$).

Resource use and costing
The current study adopts a health sector perspective in accordance with national UK and US guidelines [27, 28]. Therefore, direct medical costs (health service use), direct non-medical costs (travel costs to health services) and intervention costs were included and not productivity losses. Resource use was measured with the Medical Consumption Questionnaire (MCQ) for three periods: 3 months before baseline (T0), baseline to 3 months follow-up (T1) and 3 to 6 months follow-up (T2) [29]. All costs are expressed in euros (€) for the reference year 2014. The main results are also expressed in US dollars ($). The general purchasing power parity (PPP) was used for conversion of the € to $ for 2014 (US$1.00 = NL€0.814) [30].

Direct medical and non-medical costs
Table 1 displays an overview of health service units (contacts or hours) and their standard unit cost price as reported in the Dutch guidelines for health-economic evaluations [31]. Health service costs per participant were calculated by multiplying the utilized health service units of each participant in the past 3 months with the standard unit cost price of that service. Travel costs for each health service visit were calculated by multiplying the average distance to that service according to the

Table 1 Unit cost price for direct medical and direct non-medical costs by the reference year 2014

Health service type	Direct medical costs		Direct non-medical costs	
	Unit	Unit cost price	km	Unit cost price
Family doctor – standard consult	Contact	33	1,1	3.21
Family doctor – mental health	Contact	66	1,1	3.21
Family doctor – home visit	Contact	50	NA	NA
Company doctor	Contact	33	17,6	6.34
Social worker	Contact	65	5	3.95
Regional mental health center	Contact	112	10	4.90
Regional addiction center	Contact	112	10	4.90
Independent psychologist, psychotherapist, psychiatrist	Contact	94	7	4.33
Psychologist, psychotherapist, psychiatrist in hospital[a]	Contact	91	7	4.33
Self-help group	Hour	14	7	4.33
Alternative healer[b]	Contact	55	5	3.95

[a]Unit cost price was based on a weighted mean of a general and academic hospital
[b]Unit cost price was based on own calculation as weighted average of homeopath and acupuncturist

Dutch guidelines (see Table 1) with the costs per km (€0.19). Parking costs were added to the travel costs which amounted to €3 per visit. Other costs of participants or its family members outside formal health care (e.g. informal care) which might have had a direct relation with an illness were not included in this health-economic evaluation because no severe (chronic) disorders were investigated and the sum of these costs would be limited.

Intervention costs

Each participant in the intervention group received the self-help book *This is Your Life* which was valued at €25 in 2014 as found in a large and representative online bookstore in The Netherlands. Each participant also received personal email support. Although the current study used students as counselors, in real-life health care settings these will be replaced by the family doctor's mental health nurse at €17 per consult [31]. We assume an average of nine email contacts, which puts the costs at €17*9 contacts = €153 per participant. Additional costs were incurred for recruitment, screening and training costs for the mental health nurse at €44 per participant in a real-world setting. In total, the estimated intervention costs were €222 ($273) per participant.

Analysis
Statistical analyses
Analyses of the health related outcomes were carried out in accordance with the intention-to-treat principle. Missing data on the MHC-SF, HADS-A and HADS-D at T2 were imputed using the expectation maximization (EM) algorithm in SPSS (IBM, Chicago, Ill., USA) version 22.0. The results of these health effects were also reported in our prior trial but repeated here for clarity [11].

Cost-effectiveness analyses
The Consolidated Health Economic Evaluation Reporting Standards (CHEERS) were followed [27]. Therefore, the intention-to-treat principle was also applied to the cost data and these were imputed using EM. In order to compare our results with other cost-effectiveness studies, costs were annualized by multiplying the costs of three months by 4. No discounting of costs and effects was applied because the study's follow-up did not exceed one year [27]. Furthermore, the conditions were compared as if operating under steady-state conditions. This means that it is assumed that the health care costs in the past 3 months (as well as the health gains in the past 4 weeks) as measured at the 6 month follow-up are representative for a whole year with the proviso that there were no significant baseline differences between the conditions. Therefore, only the annualized 6 months health care costs (including the intervention costs in the intervention condition) were used for calculating the incremental cost-effectiveness ratio (ICER). The ICER is calculated as $(C_1-C_0)/(E_1-E_0)$, where C is the average annualized per-participant health care costs in the experimental and control condition (i.e. incremental costs) and E is the proportion of flourishers or treatment responders on the HADS (i.e. incremental effects). The subscripts 1 and 0 refer to the intervention and control condition, respectively. The ICERs represent the incremental costs per additional treatment responder in the intervention as compared to the control group.

A Microsoft Excel macro was used to simulate 2500 ICERs in a non-parametric bootstrap procedure. With this resampling procedure, each estimated ICER was plotted in a cost-effectiveness plane. In this plane, the costs are presented on the x-axis and the health outcomes (i.e. flourishing, anxiety, depression) on the y-axis. When the dots

are mainly plotted in the northwest (NW) quadrant (higher costs, less health) or southeast (SE) quadrant (lower costs, health gains), this means that a clear decision can be made from a cost-effective perspective; i.e. the intervention is unacceptable (dominated by usual care) in the NW quadrant and acceptable (dominant) in the SE quadrant compared to the control group. However, the northeast (NE) quadrant (higher costs, health gains) and southwest (SW) quadrant (lower costs, less health) require a more advanced decision-making to balance higher or lower costs against greater or lesser health gains, for which a cost-effectiveness acceptability curve is being used. This curve provides insight into the probability of accepting an intervention relative to a control condition. In the present study, this curve displays hypothetical willingness to pay (WTP) ceilings (€0 - €30,000) for gaining one additional treatment responder on flourishing, anxiety and depressive symptoms respectively (on the x-axis) and graphs the likelihood that the PP intervention is deemed to be of acceptable cost-effectiveness (on the y-axis).

Sensitivity analysis
The analyses were repeated for three different scenarios to examine the robustness of the results. In scenario A, the intervention costs were based on the actual number of emails sent by the personal counselor to the participant (not the assumed maximum of 9 emails) and then multiplied by the costs for consulting a family's doctor mental health nurse (€17). In scenario B, the intervention costs were raised by including the time investment of participants (valued at 3 h*9 weeks*€14) amounted to a total of €600 per participant. In scenario C, completers-only analyses were performed, using data of the 112 participants in the intervention condition and 125 participants in the control condition who completed all measurements at T2.

Results
Sample characteristics
Participants were predominantly female (85.8%), higher educated (74.5%) and in paid employment (68.4%). Mean age was 47.8 years (SD = 10.9). The mean score of the total sample for mental well-being was 2.57 (SD = 0.63), for anxiety symptoms 7.28 (SD = 2.41) and for depressive symptoms 5.80 (SD = 2.47). There were no significant between-group differences regarding participant characteristics, main outcome measures and resource costs.

Health effects
At 6 months, there were 42 participants (30.7%) with flourishing mental health in the intervention condition and 16 participants (11.6%) in the control condition ($\chi^2 = 15.01$, $df = 1$, $P = <0.001$), as has also been reported previously [11]. The incremental effect (i.e. the proportion of flourishers in the experimental group minus

the proportion of flourishers in the control group) was 0.31–0.12 = 0.19. Similar effects were found for anxiety and depressive symptoms. For the HADS-A, 57 participants (41.6%) in the intervention group met the criteria for treatment response compared to 27 participants (19.6%) in the control group ($\chi^2 = 15.74$, $df = 1$, $P = <0.001$). For the HADS-D, these number of participants were 59 (43.1%) in the intervention group and 30 (21.7%) in the control group ($\chi^2 = 14.29$, $df = 1$, $P = <0.001$). The incremental effects were 0.42–0.20 = 0.22 for anxiety symptoms and 0.43–0.22 = 0.21 for depressive symptoms.

Costs
At baseline, total average annualized direct medical and direct non-medical costs were €581 (SD = €1190) in the intervention condition and €675 (SD = €1246) in the control condition (Table 2). At T1, these costs were €432 (SD = €983) and €658 (SD = €1224) respectively. At T2, these costs were €506 (SD = €1001) for the guided self-help intervention and €488 (SD = €1190) for usual care. These T2 annualized costs were used for the cost-effectiveness analyses, adding the intervention costs of €222 to the intervention condition. Therefore, the annualized incremental costs at the trial's follow-up were €728–€488 = €240 ($295).

Cost-effectiveness: Flourishing
The bootstrapped mean ICER shows that additional costs of €2359 ($2899) had to be paid to improve one person from low or moderate well-being to flourishing mental health. The bootstrapped median ICER showed additional costs of €1245 ($1530; Table 3). The majority of the plotted ICERs (92%) occurred in the northeast quadrant, indicating that the intervention produced health gains at additional costs (Fig. 1). All other plotted ICERs occurred in the southeast quadrant (8%), which implies health gains at lower costs. When there is no WTP, there is a 12% probability that the guided self-help intervention is more cost-effective relative to usual care (Fig. 2). This probability increases to 93% with a WTP ceiling for a favorable treatment outcome of €10,000 ($12,290). Conversely, with a probability of 80% the WTP is approximately €8000 ($9832).

Cost-effectiveness: Anxiety and depressive symptoms
The bootstrapped mean and median ICERs for treatment response on anxiety symptoms were €2959 ($3637) and €1095 ($1346) respectively, and for depressive symptoms €2578 ($3168) and €1189 ($1461; Table 4). The distribution of the 2500 bootstrapped ICERs on the cost-effectiveness plane as well as the WTP curve show similar results as has been found for flourishing: 91 and 90% of the ICERs were plotted in the northeast quadrant for anxiety and depressive symptoms respectively. The probability of accepting the intervention in favor of

Table 2 Per participant annualized costs in Euros (€) by condition, for 3 months prior to baseline, 0–3 months during intervention (t0-t1) and 3–6 months after intervention (t1-t2)

	Baseline Mean (SD)	0–3 months Mean (SD)	3–6 months Mean (SD)
Wait-list control group (*n* = 138)			
Direct medical costs	637.16 (1185.66)	620.49 (1167.22)	462.97 (1137.84)
Direct non-medical costs	38.14 (61.87)	37.50 (59.61)	25.36 (52.71)
Intervention costs	NA	NA	NA
Total costs	675.30 (1245.89)	657.99 (1223.89)	488.33 (1189.92)
Self-help with email support (*n* = 137)			
Direct medical costs	546.83 (1128.45)	408.09 (939.50)	478.05 (956.73)
Direct non-medical costs	34.07 (63.50)	23.58 (44.69)	27.77 (45.94)
Intervention costs	NA	222	NA
Total costs	580.90 (1190.07)	653.66 (982.97)	505.82 (1001.27)[a]

[a]For further analyses, these annualized costs were included plus the intervention costs of €222. The total mean costs amounted to 727.82 (SD = 1001.27) at 6 months

usual care with no WTP was 13% for both outcomes. At a WTP of €10,000, the probability of accepting the intervention had risen to 92 and 93% respectively.

Sensitivity analyses
The results from the alternative scenarios show similar patterns for all three outcomes (see Table 3 for flourishing and Table 4 for anxiety and depression). Most mean and median bootstrapped ICERs were lowest in scenario A based on the actual intervention costs with mean ICERs between €1848 ($2271) and €2109 ($2592). Scenario B (intervention costs including the opportunity costs of the participants loss of leisure time) revealed the highest mean

and median ICERs, while the completers-only analysis of scenario C was more comparable to scenario A. The percentage of ICERs on the cost-effectiveness planes for treatment response lies between 86% (scenario A) and 100% (scenario B). Furthermore, the probability of accepting the intervention over the control condition at no WTP lies between 4% (scenario B) and 18% (scenario A). In sum, these sensitivity analyses provide support for the robustness of the main analyses.

Discussion
This health-economic evaluation is the first of its kind evaluating the cost-effectiveness of bibliotherapy based

Table 3 Cost-effectiveness analysis and sensitivity analysis with flourishing as health outcome

Flourishing	Total sample	Alternative scenarios		
		A	B	C
Costs, €[a]	239	196	617	223
Effect	0.19	0.19	0.19	0.20
ICER, €[b]	1245	1058	3240	1099
Distribution on the cost-effectiveness plane				
1st quadrant (northeast)	92	86	100	89
2nd quadrant (inferior: northwest)	0	0	0	0
3rd quadrant (southwest)	0	0	0	0
4th quadrant (superior: southeast)	8	14	0	11
WTP ceiling, %				
€ 0	12	18	4	14
€ 10,000	93	92	91	93
€ 20,000	97	97	96	97
€ 30,000	100	100	100	100

Scenario A = adjustment of the per participant intervention costs, based on actual costs for counseling (the number of extensive emails sent by each participant multiplied by €17); scenario B = intervention costs raised from €222 to €600; scenario C = completers only analysis (*n* = 112 intervention group and *n* = 125 control group)
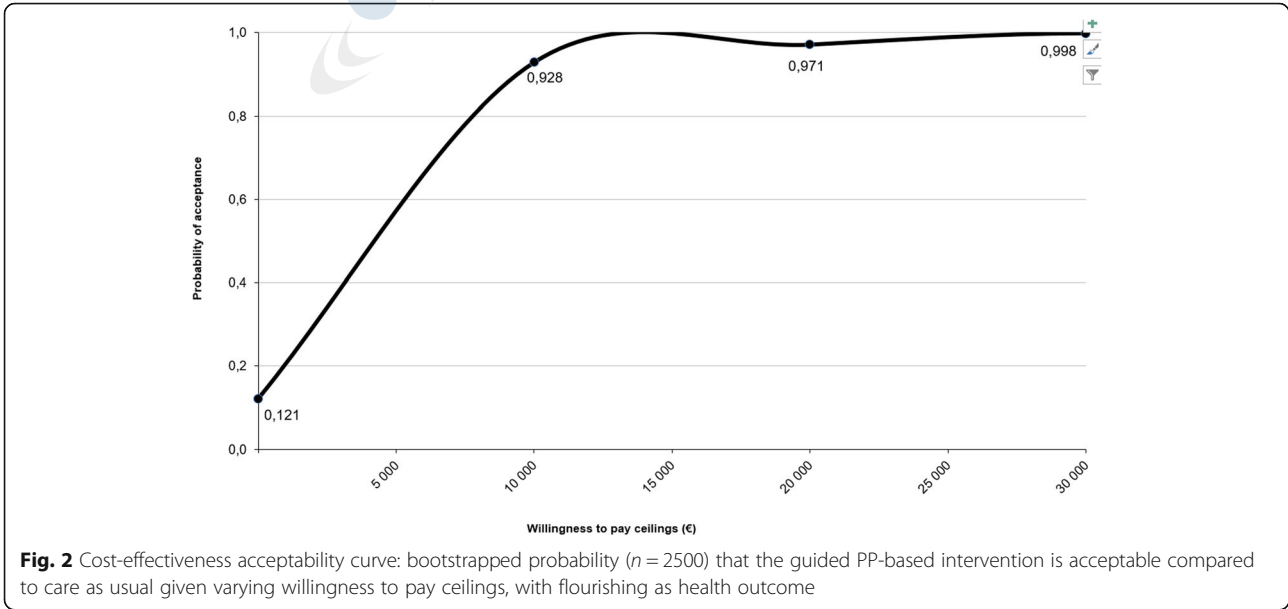[a]Costs per 'disease-free' year (i.e. one year in flourishing mental health) at 2014 prices
[b]Bootstrapped median, which is the 50th percentile of 2500 replications of the ICER

Fig. 1 Cost-effectiveness plane of 2500 bootstrapped incremental cost-effectiveness ratios (ICERs) for flourishing, primary analysis
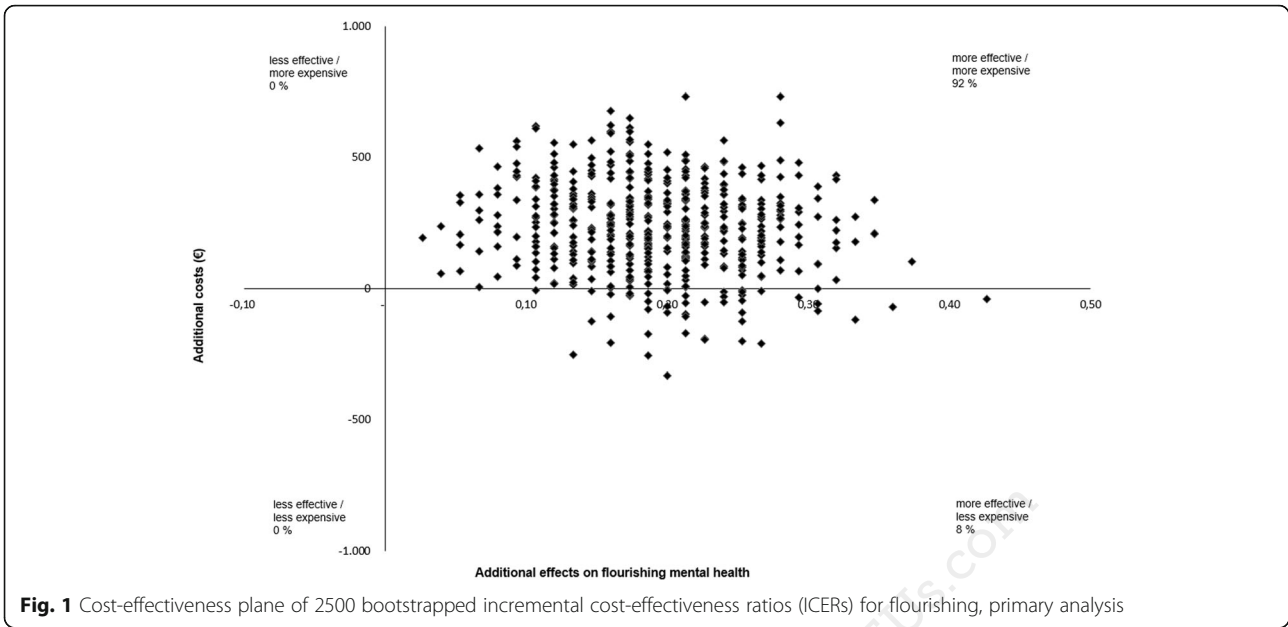
on a positive psychology framework. Participants with low or moderate levels of mental well-being received the book *This is Your Life* with email support or were placed on a wait-list (with full access to usual care). Results demonstrated that the intervention was effective at 6 months, showing significant improvements in mental well-being (from non-flourishing to flourishing mental health) while also decreasing both anxiety and depressive symptom severity [11]. However, owing to the intervention costs, the health care costs at 6 months were higher in the intervention group than the control group. The intervention costs were varied in sensitivity analyses, but all findings pointed in the same direction: substantial

health gains can be expected from the intervention against an increase in health care costs of some €883~ €4534 ($1085~$5572). From a decision-making point of view it might be worthwhile to note that the probability of regarding the intervention as cost-effective exceeds 90% at a willingness to pay of €10,000 ($12,290) per treatment responder.

These findings corroborate prior findings from cost-effectiveness analyses of (guided) bibliotherapy for depression [32, 33] and binge-eating disorder [34], although these interventions were based on cognitive behavioral therapy (CBT). Economic evaluations of web-based self-help interventions (mostly CBT-based)

Fig. 2 Cost-effectiveness acceptability curve: bootstrapped probability (*n* = 2500) that the guided PP-based intervention is acceptable compared to care as usual given varying willingness to pay ceilings, with flourishing as health outcome

Table 4 Cost-effectiveness analysis and sensitivity analysis with anxiety and depressive symptoms as health outcomes

	Total sample		Alternative scenarios					
			A		B		C	
	Anxiety	Depression	Anxiety	Depression	Anxiety	Depression	Anxiety	Depression
Costs, €[a]	239	239	196	196	617	617	223	223
Effect	0.22	0.21	0.22	0.21	0.22	0.21	0.26	0.23
ICER, €[b]	1095	1189	883	940	2785	2897	904	968
Distribution on the cost-effectiveness plane								
1st quadrant (northeast)	91	90	86	86	100	100	89	89
2nd quadrant (inferior: northwest)	0	0	0	0	0	0	0	0
3rd quadrant (southwest)	0	0	0	0	0	0	0	0
4th quadrant (dominant: southeast)	9	10	14	14	0	0	11	11
WTP ceiling, %								
€ 0	13	13	18	18	4	4	15	15
€ 10,000	92	93	93	93	91	90	92	92
€ 20,000	97	97	97	97	97	96	97	97
€ 30,000	100	100	100	100	100	100	100	100

Scenario A = adjustment of the per participant intervention costs, based on actual costs for counseling (the number of extensive emails sent by each participant multiplied by €17); scenario B = intervention costs raised from €222 to €600; scenario C = completers only analysis (*n* = 112 intervention group and *n* = 125 control group)

[a]Costs per 'disease-free' year (i.e. one year reliable improvement in depressive symptoms) at 2014 prices

[b]Bootstrapped median, which is the 50th percentile of 2500 replications of the ICER

for mental health are more abundant [35]. To our knowledge, only one prior study evaluated the cost-effectiveness of a PP-based intervention or therapy [14]. This unguided web-based self-help intervention for people with mild to moderate depressive symptoms revealed substantially higher mean ICERs for mental well-being (€21,319) and depression (€9807) compared to the current study (€2359 and €2578 respectively). However, direct comparison of the ICERs is hindered by differences between both studies (e.g. outcome measures, societal vs. health care perspective, unguided web-based vs. guided bibliotherapy) despite some similarities in study design (e.g. recruitment strategy via newspapers in The Netherlands, mainly higher educated females and non-flourishers, a multicomponent PP structure, type of control condition). In addition, there are no known or generally accepted willingness-to-pay ceilings available for making a transition to a flourishing mental health state. Nonetheless, the cost-effectiveness acceptability curve indicates that a decision-maker has an 80% certainty that the intervention is deemed cost-effective at a WTP ceiling of roughly €8000 ($9832) and this likelihood increases to above 90% at the WTP ceiling of €10,000 ($12,290). Thus, the current study indicates that if there is a willingness to pay of at least €8000 for reaching a flourishing mental health state and avoiding anxiety and depression, guided PP-based bibliotherapy has a high likelihood to be seen as a cost-effective approach compared to usual care.

Strengths and limitations

Main strengths of the study were its well-powered and randomized controlled design, the high adherence rates and results that appeared robust under sensitivity analyses. Also, as the self-selected sample of "well-being-seekers" recruited in the general Dutch population is congruent with usual recruitment strategies for self-help interventions in The Netherlands, the sample is representative for future applications of this intervention. However, we cannot generalize to the (unselected) general population because our sample overrepresented well-educated women in their late forties with paid jobs. An important limitation of the current study relates to the lack of an active control group wherein the self-help book could have been offered without email support, as was planned [20] but not feasible [11]. Prior studies demonstrated larger effects of guided CBT-based self-help than its unguided counterpart in improving mental well-being, anxiety and depression [13, 35, 36]. Hence, we cannot rule out the influence of adding email support to the PP-based bibliotherapy. Other limitations include the relatively short follow-up of 6 months and using this time-point for the extrapolation to an entire year (i.e. assuming a steady-state of the annualized costs and effects), the use of a wait-list control group (rather than usual care alone), unblinded participants, and the absence of assessing quality-adjusted life years (QALY's) [27]. An advantage of using QALY's is that a cost-utility analysis could have been added to the

analyses to obtain the costs per QALY gained which is a *generic* health-related outcome that can be used across diseases and disorders. However, a strength of the current study was to use a *specific* health-related outcome that fit-ted well with the target group (people with languishing or moderate mental health) and the intervention aim (to es-tablish the transition to flourishing mental health). In addition, the MHC-SF measuring mental well-being seems more sensitive to change [22] then the EQ-5D measuring QALY's [37], although more research is needed to validate the theoretical cut-off scores for categorizing people into flourishing or not.

Public health implications

A valuable approach for public mental health seems to enhance flourishing mental health because this status has been related to reduced risk of developing anxiety and depressive symptoms and mortality [8, 9, 38, 39]. The results of the present study demonstrated that an early intervention based on PP principles has the potential to promote a flourishing mental health status and substantially reduce anxiety and depressive symptom severity at some additional costs. The intervention could offer good value for money when there is a WTP of around €8000 ($9832), which corresponds to a probability of 80% that the intervention is more cost-effective compared to usual care. Even when the intervention costs are tripled by including the time costs of the participants, the WTP for a probability of 80% falls around €8000 ($9832). The economic costs of the intervention would rise from €2359 ($2899) for one additional person to improve from suboptimal well-being to flourishing in the main analysis to €4534 ($5572) when intervention costs are tripled. However, when there is no WTP for a treatment response, there is only a 12–13% probability that the intervention is more cost-effective relative to usual care. Thus, it remains a challenge to further optimize the cost-effectiveness of PP-based self-help interventions. Perhaps this can be achieved by shortening and refining the current program and focus on its most efficacious processes: enhancing positive relations, self-compassion and optimism [40]. In addition, it remains a great challenge to reach people with a lower socio-economic status, also with PP-based interventions.

Future research should replicate our findings and examine longer-term costs and benefits of PP interventions to promote flourishing. In this regard, we recommend large-scale implementation of the guided bibliotherapy program in public mental health or primary care wherein the intervention costs and effects are carefully monitored for more than one year. It is also of utmost importance to conduct economic evaluations of a guided versus unguided PP-based intervention which could shed light on the added value of therapist involvement. Furthermore, a cost-effectiveness study wherein a self-help intervention based on CBT is compared with a self-help intervention based on PP would be interesting because a prior study found that both CBT and PP where efficacious in ameliorating mental well-being and depression, but that the PP-based intervention was significantly more preferred, thus, having an impact on a larger population [41]. Overall, a PP-based self-help intervention with some guidance over the Internet has the potential to reach large groups of people via public mental health services, primary care and as additional service in mental health institutions. Also, a PP-based self-help intervention might hold promise as a worthwhile alternative to the predominant CBT-based self-help interventions. We hope the current study inspires researchers to plan and conduct economic evaluations alongside their trials to address this gap in the mental health promotion literature [13, 42].

Conclusions

The results of this large randomized controlled trial demonstrated that a multicomponent positive psychology intervention was cost-effective on a reliable improvement in mental well-being as well as a reliable reduction in anxiety and depressive symptoms. The current study adds to prior knowledge because it is the first study worldwide demonstrating that mental health and flourishing can be substantially and cost-effectively improved via a positive psychology self-help intervention. This intervention is of great importance for public mental health and clinical practice because it has the potential to reach large groups of people through public mental health services and primary care with minimal investment.

References

1. Forsman AK, Wahlbeck K, Aaro LE, Alonso J, Barry MM, Brunn M, Cardoso G, Cattan M, de Girolamo G, Eberhard-Gran M, et al. Research priorities for public mental health in Europe: recommendations of the ROAMER project. Eur J Pub Health. 2015;25(2):249–54.

2. Kobau R, Seligman ME, Peterson C, Diener E, Zack MM, Chapman D, Thompson W. Mental health promotion in public health: perspectives and strategies from positive psychology. Am J Public Health. 2011;101(8):e1–9.

3. Kim ES, Park N, Sun JK, Smith J, Peterson C. Life satisfaction and frequency of doctor visits. Psychosom Med. 2014;76(1):86–93.

4. Hamar B, Coberley C, Pope JE, Rula EY. Well-being improvement in a midsize employer: changes in well-being, productivity, health risk, and perceived employer support after implementation of a well-being improvement strategy. J Occup Environ Med. 2015;57(4):367–73.

5. Keyes CLM, Grzywacz JG. Health as a complete state: the added value in work performance and healthcare costs. J Occup Environ Med. 2005; 47(5):523–32.

6. Hone LC, Jarden A, Schofield GM, Duncan S. Measuring flourishing: the impact of operational definitions on the prevalence of high levels of wellbeing. Int J Wellbeing. 2014;4(1):62–90.

7. Keyes CL. Mental health in adolescence: is America's youth flourishing? Am J Orthop. 2006;76(3):395–402.

8. Keyes CLM, Dhingra SS, Simoes EJ. Change in level of positive mental health as a predictor of future risk of mental illness. Am J Public Health. 2010; 100(12):2366–71.

9. Schotanus-Dijkstra M, ten Have M, Lamers S, de Graaf R, Bohlmeijer ET. The longitudinal relationship between flourishing mental health and incident mood, anxiety and substance use disorders. Eur J Pub Health. 2017;27(3):563–8.

10. Bohlmeijer ET, Lamers SMA, Fledderus M. Flourishing in people with depressive symptomatology increases with acceptance and commitment therapy. Post-hoc analyses of a randomized controlled trial. Behav Res Ther. 2015;65:101–6.

11. Schotanus-Dijkstra M, Drossaert CHC, Pieterse ME, Boon B, Walburg JA, Bohlmeijer ET. An early intervention to promote well-being and flourishing and reduce anxiety and depression: A randomized controlled trial. Internet Interventions. 2017;9(Supplement C):15–24.

12. Schueller SM, Parks AC. The science of self-help: translating positive psychology research into increased individual happiness. Eur Psychol. 2014; 19(2):145–55.

13. Cavanagh K, Strauss C, Forder L, Jones F. Can mindfulness and acceptance be learnt by self-help?: a systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. Clin Psychol Rev. 2014;34(2):118–29.

14. Bolier L, Majo C, Smit F, Westerhof GJ, Haverman M, Walburg JA, Riper H, Bohlmeijer E. Cost-effectiveness of online positive psychology: randomized controlled trial. J Posit Psychol. 2014;9(5):460–71.

15. Bolier L, Haverman M, Kramer J, Westerhof GJ, Riper H, Walburg JA, Boon B, Bohlmeijer E. An internet-based intervention to promote mental fitness for mildly depressed adults: randomized controlled trial. J Med Internet Res. 2013;15(9):e200.

16. Bolier L, Haverman M, Westerhof GJ, Riper H, Smit F, Bohlmeijer E. Positive psychology interventions: a meta-analysis of randomized controlled studies. BMC Public Health. 2013;13:119.

17. Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. J Clin Psychol. 2009;65(5):467–87.

18. Keyes CL, Wissing M, Potgieter JP, Temane M, Kruger A, van Rooy S. Evaluation of the mental health continuum-short form (MHC-SF) in setswana-speaking south Africans. Clin Psychol Psychother. 2008;15(3):181–92.

19. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand. 1983;67(6):361–70.

20. Schotanus-Dijkstra M, Drossaert CHC, Pieterse ME, Walburg JA, Bohlmeijer ET. Efficacy of a Multicomponent Positive Psychology Self-Help Intervention: Study Protocol of a Randomized Controlled Trial. Journal of Medical Internet Research, Research Protocols. 2015;4(3):e105.

21. Bohlmeijer E, Hulsbergen M. Dit is jouw leven. Ervaar de effecten van de positieve psychologie (this is your life. Exerpience the effects of positive psychology). Uitgeverij Boom: Amsterdam, The Netherlands; 2013.

22. Lamers SMA, Westerhof GJ, Bohlmeijer ET, ten Klooster PM, Keyes CLM. Evaluating the psychometric properties of the mental health continuum-short form (MHC-SF). J Clin Psychol. 2011;67(1):99–110.

23. Jacobson NS, Truax P. Clinical significance: a statistical approach to defining meaningful change in psychotherapy research. J Consult Clin Psychol. 1991; 59(1):12–9.

24. Keyes CL. The mental health continuum: from languishing to flourishing in life. J Health Soc Behav. 2002;43(2):207–22.

25. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the hospital anxiety and depression scale: an updated literature review. J Psychosom Res. 2002;52(2):69–77.

26. Spinhoven P, Ormel J, Sloekers PP, Kempen GI, Speckens AE, Van Hemert AM. A validation study of the hospital anxiety and depression scale (HADS) in different groups of Dutch subjects. Psychol Med. 1997;27(2):363–70.

27. Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E, et al. Consolidated health economic evaluation reporting standards (CHEERS)--explanation and elaboration: a report of the ISPOR health economic evaluation publication guidelines good reporting practices task force. Value Health. 2013;16(2):231–50.

28. Guide to the methods of technology appraisal 2013. [https://www.nice.org.uk/article/pmg9/chapter/Foreword].

29. Bouwmans C, Hakkaart-van Roijen L, Koopmanschap M, Krol M, Severens H, Brouwer W. Medical Consumption Questionnaire. In. Rotterdam: Institute for Medical Technology Assessment, Erasmus Universiteit Rotterdam; 2013.

30. PPPs and exchange rates (http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP).

31. ZorginstituutNederland. Kostenhandleiding: Methodologie van kostenonderzoek en referentieprijzen voor economische evaluaties in de gezondheidszorg. In. Diemen: Zorginstituut Nederland; 2015.

32. Smit F, Willemse G, Koopmanschap M, Onrust S, Cuijpers P, Beekman A. Cost-effectiveness of preventing depression in primary care patients: Randomised trial. Br J Psychiatry. 2006;188(APR.):330–336.

33. Vos T, Corry J, Haby MM, Carter R, Andrews G. Cost-effectiveness of cognitive-behavioural therapy and drug interventions for major depression. Aust N Z J Psychiatry. 2005;39(8):683–92.

34. Lynch FL, Striegel-Moore RH, Dickerson JF, Perrin N, Debar L, Wilson GT, Kraemer HC. Cost-effectiveness of guided self-help treatment for recurrent binge eating. J Consult Clin Psychol. 2010;78(3):322–33.

35. Donker T, Blankers M, Hedman E, Ljotsson B, Petrie K, Christensen H. Economic evaluations of internet interventions for mental health: a systematic review. Psychol Med. 2015;45(16):3357–76.

36. Beshai S, Wallace LM, McDougall KH, Waldmann K, Stea JN. Reduced contact cognitive-behavioral interventions for adult depression: a review. The Journal of Psychology. 2016;150(2):252–79.

37. Payakachat N, Ali MM, Tilford JM. Can the EQ-5D detect meaningful change? A Systematic Review Pharmacoeconomics. 2015;33(11):1137–54.

38. Keyes CL, Eisenberg D, Perry GS, Dube SR, Kroenke K, Dhingra SS. The relationship of level of positive mental health with current mental disorders

in predicting suicidal behavior and academic impairment in college students. J Am Coll Heal. 2012;60(2):126–33.

39. Keyes CL, Simoes EJ. To flourish or not: positive mental health and all-cause mortality. Am J Public Health. 2012;102(11):2164–72.

40. Schotanus-Dijkstra M, Pieterse ME, Drossaert CHC, Walburg JA, Bohlmeijer ET. Possible mechanisms in a multicomponent positive psychology self-help intervention to improve mental well-being, anxiety and depression: A multiple mediation model. In press.

41. Parks AC, Szanto RK. Assessing the efficacy and effectiveness of a positive psychology-based self-help book. Terapia psicológica. 2013;31:141–9.

42. Lewis C, Pearce J, Bisson JI. Efficacy, cost-effectiveness and acceptability of self-help interventions for anxiety disorders: systematic review. Br J Psychiatry. 2012;200(1):15–21.

The acceptability of an online intervention using positive psychology for depression: A qualitative study

A B S T R A C T

Background: Positive psychology interventions may usefully treat depression and can be delivered online to reduce the treatment gap. However, little is known about how acceptable patients find this approach. To address this, the present study interviewed recent users of a positive psychology self-help website.

Methods: In-depth semi-structured interviews explored the experiences of twenty-three participants from a larger feasibility study. A stratified purposive sampling strategy selected participants with varying intervention experience according to their intervention logins, as well as varying age, gender and depressive symptoms. Framework analysis was used to explore patterns and linkages within and between participants' accounts.

Results: Acceptability varied between participants. Those who found it more acceptable felt it was relevant to their depression and reported feeling empowered by a self-help approach. Conversely, participants for whom it was less acceptable perceived the positive focus irrelevant to their depression and found the emphasis on self-action unsupportive.

Conclusions: The acceptability of an online positive psychology intervention may be facilitated by a patients' preference for a psychological focus on the positive. However, patients may also have distinct preferences for online self-help. Future research should investigate the importance of the therapeutic orientation of online self-help interventions and whether patients' preferences for these can be reliably identified. This could help to target online self-help in clinical practice.

1. Introduction

Positive psychology interventions are brief cognitive and behavioural exercises that aim to increase positive feelings, behaviours, and thoughts. Evidence suggests that such interventions may improve wellbeing and reduce symptoms of depression (Bolier et al., 2013b; Sin and Lyubomirsky, 2009). Increasingly online means, e.g. smartphones and websites, are used to disseminated packages of positive psychology interventions as self-help for people with clinical and subclinical depression (Bolier et al., 2013a; Roepke et al., 2015; Schueller and Parks, 2012). Such online dissemination is a strategy to sustainably improve access to mental health interventions (Bolier et al., 2013a; Bolier and Abello, 2014) in response to the vast numbers of people globally experiencing depression (World Health Organization, 2009). It reflects a general trend in the use of online means to make low-intensity psychological interventions more available to help bridge the treatment

gap (Department of Health, 2014; Hollis et al., 2015; Mental Health Network NHS Confederation, 2014; Mental Health Taskforce, 2016).

A second reason positive psychology interventions are deemed suitable for online dissemination is that they are viewed as inherently more appealing and may have fewer barriers to entry, compared to accessing traditional forms of therapy, or so-called problem-focused approaches (Layous et al., 2011; Schueller and Parks, 2012; Seligman et al., 2006). Anecdotal reports suggest such interventions generate overwhelmingly positive feedback even with patients with clinical depression (Seligman et al., 2006). However, others have suggested that people with depression may find positive psychology interventions inappropriate or unattractive (Kaczmarek et al., 2013) as, by its nature, depression is associated with reduced interest in previously enjoyable activities and deficits in motivation (Bylsma et al., 2008). It has also been argued that for people experiencing psychosocial difficulties a focus on the positive might be exhausting and stressful (La Torre, 2007)

and may not help people cope with the real and complex issues they face (Moskowitz et al., 2012).

To date however, few studies have investigated the acceptability of delivering positive psychology online. One study reported that almost 60% of participants with depression were indifferent to, or dissatisfied with, an online intervention using components of positive psychology however, this study did not collect data on reasons for dissatisfaction (Bolier et al., 2013a). These researchers suggested that participants might have been dissatisfied with the intervention content, and felt unable to complete it, or that the intervention website may have lacked suitably attractive design. The lack of acceptability data limits the development, evaluation and implementation of potentially effective interventions for people with depression.

Qualitative studies are a useful way of exploring patient experiences of interventions and have often be used to understand acceptability of and engagement with other therapeutically oriented online interventions (Knowles et al., 2014). The aim of this study was to explore the views of participants who had recently used an online positive psychology intervention within a feasibility study, to address the research question: What is the acceptability of an online positive psychology intervention for depression?

2. Method

2.1. Design

In an exploratory qualitative study purposely selected participants were interviewed about the acceptability of online positive psychology. The study conduct and reporting adheres to the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007).

2.2. Sampling

Participants were sampled from a feasibility study evaluating the delivery of an online positive psychology intervention to patients self-identifying as depressed (ISRCTN96366571). The feasibility study recruitment was self-referral in response to adverts in GPs, mental health services, counselling services and online. Eligibility for participation was checked during a brief telephone call with a researcher to ensure participants were aged ≥18, had regular internet access, sufficient command of English and endorsed of one of the Whooley screening items (Whooley et al., 1997). Following online consent and baseline questionnaire completion, participants were provided with intervention access for six weeks. They were invited to log in and practice any component once per week for six weeks, receiving weekly reminders of this, with the option of more frequent practice.

Table 1 summarises the intervention content, which adapted components from positive psychotherapy (Seligman et al., 2006).

Participants were.

Fig. 1 summarises the stratified purposive sampling strategy (Ritchie et al., 2014) used to select feasibility study completers according to their age, gender and number of intervention logins. The sampling criteria were based on the emergent feasibility study sample. When sampling, attention was also paid to participant's baseline depression symptom severity, measured via the PHQ-9 during the feasibility study (Kroenke et al., 2001) Participants were selected until the authors felt that data saturation was reached, i.e. that further interviews may not provide new insights (O'Reilly and Parker, 2013).

2.3. Study procedure

Following informed consent, participants were interviewed in-person (n = 16) or via video call software (i.e. FaceTime or Skype) (n = 7), according to participants' preference. Interviews were semistructured (Yeo et al., 2014) and based on a refined topic guide, provided in supplement A, which included key questions and suggested probes regarding the helpfulness of the intervention and factors helping and hindering its use.

Interviews were completed on average within two weeks of feasibility study completion (range 1–44 days). To aid recall and/or elaboration participants often accessed the intervention website prior to, or during, the interview (n = 15, 65%). Interviews lasted on average 50 min (range 34–85 min). Participants received remuneration to the value of £20 in cash or as an electronic Amazon voucher, depending on interview modality. Local research governance and national ethics approvals were received for the study (North West - Manchester National Research Ethics Committee 16/NW/0447).

2.4. Analysis

Interviews were audio-recorded and transcribed, omitting any identifiable information. The transcripts were then analysed using framework analysis, a pattern based approach using a framework matrix to display summarised data and explore linkages between participants accounts (Ritchie and Spencer, 1994).

Data were approached with a realist viewpoint, whereby participants accounts were viewed as grounded in reality, whilst acknowledging the role of social context (McEvoy and Richards, 2003).

The study team was multidisciplinary. The first author and lead analyst and second author who supported the analysis were health service researchers, whilst a psychiatrist specialising in psychotherapy and a general practitioner provided supervision and oversight of the analysis. The credentials and possible influences of the authors on the study conduct and analysis are provided in detail in Supplementary Table B.1.

An organising framework, shown in Table 2, was created to index

Table 1
Positive psychology components used in self-help website.

Positive psychology component	Description	Component adapted from Seligman et al. (2006)
Strengths quiz	Participants select five character strengths from 24 statements	Values in Action Inventory of Strengths (VIA-IS)
Strengths plan	Based on selected strengths the website provides a tailored suggestion of how to use a selected strength and provides a space to record a plan	Cultivation of signature strengths
Good things	The website gives space for participants to record good things that happen and why	Blessings journal
Enjoy	Audio instructions guide participants on using their five senses to enjoy physical sensations and give a space to record enjoyable moments	Savouring
Connect	Tips are provided on having positive conversations with others and space is given to record these connections	Active constructive responding
Saying thanks	The participant is encouraged to say, text or email thanks to someone who has helped him or her and record it online	Gratitude letter
Sharing strengths	Based on selected strengths the website provides a tailored suggestion of how to share their strength to help others and provides a space to record a plan	Gift of time

Age and gender / Intervention logins	Females aged ≤35	Females aged ≥36	Males aged ≤35	Males aged ≥36
Below average (<4)	2	2	1	1
Average logins (=4)	2	3	1	1
Above average (>4)	3	2	1	1

Fig. 1. Final sampling frame for sample target (n = 20)

Table 2
Organising framework developed to index qualitative data.

Category	Subcategory
1.Effects of intervention	1.1 Management of thoughts and feelings
	1.2 Behaviour changes
	1.3 Seeing progression
	1.4 Rewards for intervention use
2. Nature of self-help	2.1 Patient taking action
	2.2 Understanding the why and how of activities
	2.3 Feeling valued
	2.4 Responsiveness to individual needs
3. Feeling connected	3.1 Direct social networking with other users
	3.2 Indirect social support
	3.3 External support services
4. Person-intervention fit	4.1 Familiarity with depression
	4.2 Current treatment context
	4.3 Familiarity with intervention content
	4.4 Mental health app/website familiarity
	4.5 Digital literacy
	4.6 Perceived usefulness of online writing
	4.7 Personality
5. Fit with depression	5.1 Depression affecting intervention access
	5.2 Depression affecting benefitting from intervention
	5.3 Activities understand/acknowledge depression
	5.4 Resources about depression

the transcript data. Its development was partly inductive, e.g. based on factors observed during initial familiarisation, and partly deductive, e.g. based on prior knowledge and existing literature (Gale et al., 2013). The framework was checked and refined by the second author to ensure no categories were omitted or overlapping.

Once indexed, data summaries were created that reduced the data whilst keeping the participants' voice (Gale et al., 2013), using the NVivo 10 framework tool (QSR International Pty Ltd., 2012). The second author reviewed a selection of 20% (n = 5) transcripts to ensure the credibility of the indexing and summaries (Morse et al., 2002).

Mapping and interpretation involved reading across the framework (by participant), reading down (by subcategory), detecting elements, organising these into dimensions and combing findings into higher-level themes. The framework tool enabled analysts to identify and compare explanatory factors between participants. This process of abstraction and interpretation involved moving back and forth between the transcripts, the framework and the emerging themes (Ritchie and Spencer, 1994). Throughout this stage the authors met regularly to discuss the emerging patterns, linkages, and explanations to ensure these were distinct, credible, and trustworthy (Morse et al., 2002).

3. Results

3.1. Sample

Twenty-three participants, of 43 that were approached, took part. Reasons for not participating included actively (n = 4) or passively declining, i.e. not responding to requests for interviews (n = 10), or not attending arranged interviews due to mental health (n = 4), or other practical issues (n = 2).

Participants were predominantly female (70%), were on average

36 years of age (range 18–58) and reported moderately severe symptoms of depression, according to their median score of 18 on the PHQ-9, measured at baseline as part of the feasibility study (range 5–25).

The sample included sufficient participants of the required age, gender and range of depression severity in those with below average (n = 9) and above average logins (n = 12). However, the sampling frame target of seven participants with average logins was not achieved (n = 2). Non-completers of the interviews had slightly lower use of the intervention compared to those who completed it but there were no other demographic differences between completers and non-completers. Full details of participants are Supplementary Table B.2 and a comparison to non-completers in Table B.3.

3.2. Overview of findings

In the analysis two subgroups of participants were identified with differing perceptions of acceptability: those who perceived some benefit from the intervention and those who perceived no benefit. These differing perceptions could be explained by two factors depicted in Fig. 2; the extent to which participants perceived the intervention to be relevant to their depression and the extent to which they found the intervention supportive and empowering.

The differing perceptions of benefit appeared unrelated to participants' depression profile (e.g. symptom severity, treatment history, and treatment context) or to how much participants used the intervention. For example, there were participants with mild and moderate depression in both subgroups. Further, it did not appear related to participants' digital literacy (e.g. daily experience with technology, its use for

Some benefit	No benefit
Recognising small achievements, pleasures, awareness of strengths, new activities. Shorter and longer term benefits	Unhelpful and unable to benefit from. Highlighted depression and low functioning
Factor 1: Relevance to depression	
Tone of positivity OK, credible intervention components	Positivity overwhelming and disconnected from experiences, exercises unrealistic and 'typical' advice
Factor 2: Feeling empowered vs. unsupported	
Appreciate invitation to take action and gain sense of autonomy and value	Struggle to motivate self to take action and have sense of isolation

Fig. 2. Explanatory factors of differing perceptions of the benefit online positive psychology intervention.

health management). For example, participants in both subgroups discussed that they had a range of experience with technology both in their day-to-day life, but also for managing their health.

3.3. Subgroups

3.3.1. Some benefit

Participants who perceived some benefit from the intervention described that it helped them to recognise and acknowledge small day-to-day achievements that they would have otherwise discounted. Participants reported being more aware of daily pleasures and subsequently feeling calmer or more joyful. The intervention helped to interrupt the downward spiral of negative thinking or overthinking typifying depression, and improved participants' frame of mind.

> "It kind of gets you thinking about what's going on in your experience at that point in time, rather than um, just wondering around letting it all go past you basically, because you're caught in your own head with your own thoughts. So it was nice to sort of like someone saying like 'kind of pay attention to this'. It kind of brings you to the present really."
>
> (Participant 188, M, above average logins)

The strengths focus was appreciated as it helped participants to recognise personal strengths, provided a confidence boost and made participants feel more hopeful.

> "I did like the one a lot about finding a strength and sharing a strength 'cos I think when you feel really low you tend to think you haven't got any strengths. So that's really positive to think about a strength and share it with someone."
>
> (Participant 132, F, above average logins)

Participants in this subgroup varied in how long they felt the intervention benefits lasted. One view was that whilst the impact was positive, it was brief.

> "I'd do the exercise and [...] I'd see some positivity and stuff but then 'cos of my mood it fluctuate so much it's hard to regulate my mood, then maybe like even an hour later I could go downhill bit by bit."
>
> (Participant 260, F, above average logins)

Despite the limited impact, participants recognised it was still useful to have the positive experience. For others, intervention benefits lasted longer. Participants noticed behavioural changes, such as being more social, being more aware of others' needs and completing a greater range of activities,

> "I think it made me a bit more *active* again, because [...] like just going for a walk round the park and then that made me want to do sport again [...]. So I guess it could have been recording that doing, going for a walk was a good thing to see that I had *done* something then made me want to go for another *walk*, and that made me want to do some *sport* and then doing exercise in *itself* is a little bit of good isn't it? So [0.5] I guess it opened up a chain."
>
> (Participant 198, M, above average logins)

3.3.2. No benefit

In contrast, other participants perceived no benefit from the intervention and described how it did not resonate with them.

> "I have been going through quite a bad time the last few months, so um, [0.4] I didn't, agh [sighs[...] I didn't really find it particularly helpful. I kind of went on it now and again [...] but I didn't really feel [0.3 sighs heavily] sort of totally connected to [...] I think a lot's been going on so it was kind of...I'm not seeing a lot of positive thinking really."
>
> (Participant 159, M, average logins)

This idea that this particular intervention was not suitable was not a particular concern for some.

> "I had different types of help: like group therapy or one-to-one therapy or body therapy – you know, like I had a few things, so it was a bit like it's not the therapy is shit; it's just like this just didn't work, like this wasn't for me"
>
> (Participant 253, F, below average logins)

Others found it more concerning that the intervention did not benefit them and reported that it highlighted their depression and confronted them with it. Participants described already feeling less capable when depressed and that not finding the intervention beneficial felt like another failure.

> "There was only one activity that I did, I think twice, which was about changing the way, like writing down the positives out of something rather than thinking of it in a negative way[...] I liked the activity but then it also made me feel as if: um, why am I not thinking this way for example – if that makes sense. [...]. like why... um, if they're basically suggesting that you should think this way why is that everybody else does think that way but not myself."
>
> (Participant 179, F, below average logins)

Participants who did not perceive the intervention as beneficial responded negatively to the idea of keeping a written record of the exercises online. Participants described feeling like they were being asked to write 'essays' and that this was not useful.

> "I can write my Strengths on my own piece of paper you know, and throw away. I can write some Good Things on there and throw away. And the only thing you have on there that I couldn't do on paper is 'Connect' you know? That's the only thing. But I can go to Facebook and connect with people with depression on there. It doesn't appeal to me you know to be really honest it's just a generic website where I type things on there you know."
>
> (Participant 258, M, below average logins)

3.4. Factor 1 explaining acceptability: Relevance to depression

The first factor that seemed to explain the differing perceptions of intervention benefit was the extent to which the intervention was perceived to be relevant to depression.

3.4.1. Extent of feeling understood and relevant to needs

Those who perceived some benefit from the intervention broadly reported that they found the tone of the intervention accepting of depression. They mentioned that although the components might appear difficult in the face of depression, such as finding a good thing when you feel negative, they nevertheless found at least one relevant component.

> "It can actually be quite challenging because you might think *nothing* good has happened, everything in my life is bad or whatever, you know you might have that sort of catastrophising feeling, but I think it's good because you're really having to focus and *find* something um, that was good. And of course there are good things that happen. You know, however small it is."
>
> (Participant 102, F, above average logins)

Participants differed in which intervention component they found most relevant. For some the 'strengths plan' and 'sharing strengths' exercises were less relevant as they required a big change in thinking.

> "I just felt um, you know 'cos it was asking you to think about the good things about yourself, initially when I read that I thought 'oh shut up, there's noth[ing], I don't have anything good about myself [laughter]'. So I can't use this site. Er, [0.5] I am quite used to thinking that, so I guess that didn't affect me that much but it wasn't...[0.8] it was hard to think the opposite to what I think about

myself"

<div align="right">(Participant 177, F, below average logins)</div>

For others, the strengths aspect was a useful source of ideas and helped reinforce one's positive actions.

Despite finding some intervention components relevant participants discussed how their depression affected their ability to make full use of the intervention. Participants discussed that that when feeling low they had less mental energy to give. Also as a consequence of not being very active, participants reported having few 'good things' or moments they had enjoyed to add to the site. Consequently, participants recognised they might have had more benefit had they been feeling a little better.

In contrast, the subgroup of participants who perceived no benefit reported that the intervention content appeared irrelevant to their needs, which was an insurmountable issue. The intervention was experienced as too positive, seemed to 'mask' their feelings and thus felt disconnected from their experience.

"I think it just mentioned all the good points and it makes you feel you can't *achieve*; […] to me it's not acknowledging the depression, it's just saying these are all the positive things, but where is about your illness, so maybe more understanding that when you feel *down*, just linking it rather than saying 'this will make you happy' – because even happy things don't get rid of the depression – they can help and it's not…it didn't feel it was acknowledging that kind of thing"

<div align="right">(Participant 160, F, above average logins)</div>

These participants reported that it was overwhelming to receive suggestions that seemed unrealistic for their situation.

"I guess something I found difficult is that it was…it's difficult to describe; it was all these kind of like positive things, rather than feeling like I was being kind of met where I was *at*, and kind of working from there and moving up? I think that was something that kind of overwhelmed me, was like how I needed to think of all these 'good things' and things that I 'enjoy' and it didn't really feel *doable*."

<div align="right">(Participant 170, F, below average logins)</div>

Participants who perceived no benefit described feeling unable to complete the intervention components. They described how they were unable to think of a single 'good thing' to add, nor were they experiencing pleasurable sensations to add to 'enjoy'. Participants mentioned feeling isolated from friends and so could not complete the 'connect' components and as they were not seeing themselves in a positive light they could not identify, let alone share, their strengths.

3.4.2. Familiarity with intervention components

Whilst participants in both subgroups reported that the intervention content was somewhat familiar (e.g. they had heard it previously), participants responded differently to this. In those who perceived some benefit from the intervention, familiarity with the content fostered the intervention's credibility and reinforced techniques for managing their depression.

"I used to try to do that ['enjoy'] as well – try and focus on thing[s] – but this is…motivates you more because it's actually not you doing it; there's somebody else who's actually thought of this, so […] it is a valid thing that I can do and it's more guided than your own thing: so it's still quite useful."

<div align="right">(Participant 157, F, above average logins)</div>

Yet, not all participants who experienced benefit were familiar with the positive psychology content, for some it was new.

In contrast, all participants in the subgroup who reported no intervention benefit were familiar with the intervention content and felt it was standard advice. Consequently, the intervention provided did not add to what they already knew. In part, an issue was that participants had tried and not benefited from the activities.

"*Part* of the reason I didn't use it so much was that it was already similar to stuff that I was already *doing*? Um, and part of it 'cos the stuff that I was already doing didn't seem to be helping anyway [laughs] so I thought not much point in doing *more* of it"

<div align="right">(Participant 152, M, below average logins)</div>

For others, there was a sense that they had heard it all before and therefore did not see the intervention offering anything relevant or novel.

3.5. Factor 2 explaining acceptability: Feeling empowered vs. feeling unsupported

The second factor that differed between participants was the extent to which the intervention was perceived as empowering. Participants had differing viewpoints of the emphasis on the person themselves taking action. They also had different experiences of feeling valued by the intervention.

3.5.1. Patient taking action

The subgroup of participants who benefited found comfort and a sense of achievement came with being in control of the intervention. They appreciated having a private space to document feelings and activities. This appeared related to personal preferences for independently getting on with things. Participants appreciated that the intervention was 'self-generating', i.e. based on them taking responsibility for taking action for themselves.

"That's definitely one of the um, big advantages of that: that it's interactive and you can have your input and not just reading, receiving or, you know?"

<div align="right">(Participant 217, M, below average logins)</div>

This idea of being motivated to take action was clearly contrasting in those who perceived no benefit from the intervention. For these participants, being invited to take action was difficult, as they struggled to motivate themselves when left to get on with something and to generate answers for the intervention components. For some, being asked to take action was perceived as though they were to being told what to do, almost like a child being given homework activities. They saw themselves as being both the input and output of the intervention and being asked to give without receiving a helpful response.

"I feel it was quite sort of limited – I don't know really why – but then it's kind of like you're just left on your own; so in a way there's no real input other than what you're putting in and so it's just like a bit of a one-way *process*? So you're not…you're still not really getting [0.4] the *help*."

<div align="right">(Participant 159, M, average logins)</div>

3.5.2. Feeling valued

Those who found some benefit experienced a sense of value from the intervention.

"I felt like supported by something – even if it's not like a person [laughs]. So maybe just like a little bit less *alone*"

<div align="right">(Participant 145 F, above average logins)</div>

The site was described as a 'friend in the corner'. Some related this sense of supportiveness to the reminders received as part of the research study, which felt like someone was thinking of them. Participants also felt that indirectly the researcher was 'there' in the site as it had the appearance of a live site that someone was taking care of, even if their activity on the site was not being monitored.

In contrast, those who did not find a benefit discussed how it did not seem to value them. They described feeling unable to relate to others in wider society and so coming to the intervention looking for help and to feel less alone, but instead were still talking to themselves. In part this

was to do with the site being automated.

> "Some might feel really comfortable with doing it all remotely and not really having a face in front of them and that made them feel safe. But for me it's already quite robotic and quite impersonal and it felt like oh no, it…I felt *worse*. Er, it just kind of accentuated the, the loneliness."

(Participant 253, F, below average logins)

4. Discussion

4.1. Main findings

This study developed an understanding of what makes online positive psychology interventions acceptable and potentially beneficial to patients with depression. Acceptability was facilitated by participants' perception of the positive psychology content as relevant to their depression and the extent to which they perceived the self-help format as empowering. Conversely, participants who experienced the positive psychology content as disconnected from their depression, and the self-help format as unsupportive reported a lack of acceptability and perceived benefit. The differing perceptions appeared unrelated to measurable factors, such as number of intervention logins or depression profile (e.g. symptom severity, treatment history, and treatment context) but appear to be attitudinal differences. The findings suggest that matching patients to the psychological content of an online intervention may facilitate acceptability. Secondly, the findings indicate that there need to be different formats of online interventions including varying levels of support to meet patients' differing needs.

4.2. Strengths and limitations

The main strength of this study is the purposive sampling, which enabled a diverse sample with a range of experiences and viewpoints on the online positive psychology intervention. A second strength is that, to the authors' knowledge, this is the first qualitative study of patient experiences of online positive psychology, thus enabling a systematic analysis of patients' experiences. However, the study is limited by the fact that participants often required access to the intervention during, or prior to, their interview to refresh their memory of it. This sometimes led to discussions of the appearance and design of the intervention rather than the impact of its psychological content, data that had limited utility for understanding acceptability. A second limitation is that above average users of the intervention were overrepresented in the sample as those who used the intervention less did not agree to participate in the interviews. This may limit the extent to which this paper understands those who may have had less favourable perceptions. A further limitation is that the researcher who developed the online intervention conducted all interviews. This may have led to social desirability bias, e.g. over-reporting acceptability or under-reporting negative perceptions. However, the data indicates that participants reported a range of experiences and a multidisciplinary team conducted the analysis, with excerpts provided to support authors' interpretations.

4.3. Clinical and research implications of findings

Previously researchers disagreed on the acceptability of positive psychology interventions to those experiencing depression. The current findings suggest that this disagreement may be a consequence of the fact that patients have varying preferences for positive psychology interventions. This suggests that whilst some do indeed find positive psychology acceptable, as has been reported (Layous et al., 2011; Schueller and Parks, 2012; Seligman et al., 2006), others find the ideas overwhelming and irrelevant to helping them cope with their depression, as has also been suggested (La Torre, 2007; Moskowitz et al., 2012). This would suggest that patients might need to be matched to

psychological content of online interventions in order to increase their acceptability and potentially effectiveness. It has previously been suggested that responsiveness to personal needs and sensitivity to patients' identity is a key facilitator of acceptability in other therapeutically oriented interventions (Knowles et al., 2014). This is understandable given the context of online interventions if patients are unguided, there is likely a need to feel the intervention is designed for them, rather than just a generic one-size fits all approach.

The second finding that some patients liked and perceived value from the self-help intervention, whilst others found this a somewhat isolating experience, supports previous research suggesting it is difficult to balance the levels of collaboration and connectedness in online interventions. Knowles et al. (2014) argue that online interventions with a low level of collaboration (e.g. without contact between experts and peers) can feel empowering, but can also be perceived as burdensome. Similarly, those with a low level of connectedness (e.g. without actual interaction or identification) can enable privacy and safety yet can feel isolating. It has been suggested that increasing the level of collaboration and connectedness may improve how supported and empowered patients feel but risks promoting passivity and increasing burden (Knowles et al., 2014). The implication is that online interventions should include varying levels of support to meet patients' differing needs, since it is unlikely to be possible to balance these varying demands within a single intervention.

If further research is to investigate whether online interventions should be matched to patient preferences for psychological content and collaboration and connection with others, several aspects ought to be addressed.

Firstly, it is unclear how one can reliably ascertain patient preferences. There has been much research and debate regarding how to measure treatment expectancy in face-to-face psychological treatment, which would indicate that this is a difficult task (Constantino et al., 2012). Setting that aside, if it were possible to find out what patients want, the question then becomes how to direct patients towards an appropriate online intervention, without using up resources. Previous research has used administrative staff or therapists to guide users towards relevant content, in order to tailor their experience of the intervention, which is thought to facilitate engagement (Carlbring et al., 2011; Richards and Richardson, 2012). However, this limits the scalability of interventions and undermines the apparent benefit of online interventions that once developed, they require little further resource to disseminate (Muñoz, 2010). Instead, this tailoring process could be automated with a use of a short questionnaire, the results of which could help identify an appropriate intervention. However, care must be taken to ensure this does not create a barrier to entry, as again an apparent benefit of online interventions is that they are easily accessible for patients (Hill et al., 2017; Hollis et al., 2015). In future, research must therefore focus on whether it is possible to match patients to interventions, whilst also investigating technological solutions to this. Throughout these stages of research there should be continual consultation with potential users to assess and ensure acceptability, as recommended in the person-based approach to developing digital interventions (Yardley et al., 2015).

The above suggestions are based on the assumption that it is problematic for patients to engage in an intervention for which they are unsuited, i.e. find unacceptable or perceive it not to be beneficial. It has been argued that there may be opportunity costs for patients engaging in online interventions that they perceive to be ineffective; not only does it prevent them from accessing another intervention with a greater chance of success, it may in future prevent patients from engaging in treatment as they become pessimistic about their likelihood of benefit (Murray et al., 2009). Future research is needed to investigate these assumptions, as it is possible that there is no long term consequence for patients who find an online intervention unacceptable, they simply stop logging in and move on. Rather than waste further resource on developing the aforementioned solutions, the consequences of a lack of

acceptability must be checked.

4.4. Conclusion

The findings suggest that the acceptability of online positive psychology is influenced by patients' perception of the relevance of the positive in the context of depression. Acceptability was also influenced by patients' perception of self-help, either as empowering or unsupportive. Future research should investigate the importance of the therapeutic orientation of online interventions and the role of support and whether patients' preferences for these can be reliably identified. This could help to target online self-help in clinical practice.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.invent.2018.07.003.

References

Bolier, L., Abello, K.M., 2014. State of the art and future directions. In: Parks, A.C., Schueller, S.M. (Eds.), The Wiley-Blackwell Handbook of Positive Psychological Interventions. Wiley Blackwell, Chichester, West Sussex, pp. 286–309.

Bolier, L., Haverman, M., Kramer, J., Westerhof, G.J., Riper, H., Walburg, J.A., ...

Bohlmeijer, E., 2013a. An internet-based intervention to promote mental fitness for mildly depressed adults: randomized controlled trial. J. Med. Internet Res. 15, e200.

Bolier, L., Haverman, M., Westerhof, G.J., Riper, H., Smit, F., Bohlmeijer, E., 2013b. Positive psychology interventions: a meta-analysis of randomized controlled studies. BMC Public Health 13, 119.

Bylsma, L.M., Morris, B.H., Rottenberg, J., 2008. A meta-analysis of emotional reactivity in major depressive disorder. Clin. Psychol. Rev. 28, 676–691.

Carlbring, P., Maurin, L., Törngren, C., Linna, E., Eriksson, T., Sparthan, E., ... Andersson, G., 2011. Individually-tailored, Internet-based treatment for anxiety disorders: a randomized controlled trial. Behav. Res. Ther. 49, 18–24.

Constantino, M.J., Ametrano, R.M., Greenberg, R.P., 2012. Clinician interventions and participant characteristics that foster adaptive patient expectations for psychotherapy and psychotherapeutic change. Psychotherapy 49, 557–569.

Department of Health, 2014. Chief Medical Officer (CMO) Annual Report: Public Mental Health. (D. of Health, Ed.). Retrieved from. https://www.gov.uk/government/publications/chief-medical-officer-cmo-annual-report-public-mental-health.

Gale, N.K., Heath, G., Cameron, E., Rashid, S., Redwood, S., 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC Med. Res. Methodol. 13, 117.

Hill, C., Martin, J.L., Thomson, S., Scott-Ram, N., Penfold, H., Creswell, C., 2017. Navigating the challenges of digital health innovation: considerations and solutions in developing online and smartphone-application-based interventions for mental health disorders. Br. J. Psychiatry 211, 65–69.

Hollis, C., Morriss, R., Martin, J., Amani, S., Cotton, R., Denis, M., Lewis, S., 2015. Technological innovations in mental healthcare: harnessing the digital revolution. Br. J. Psychiatry 206, 263–265.

Kaczmarek, L.D., Kashdan, T.B., Kleiman, E.M., Baczkowski, B., Enko, J., Siebers, A., ...

Baran, B., 2013. Who self-initiates gratitude interventions in daily life? An examination of intentions, curiosity, depressive symptoms, and life satisfaction. Personal. Individ. Differ. 55, 805–810.

Knowles, S.E., Toms, G., Sanders, C., Bee, P., Lovell, K., Rennick-Egglestone, S., ... Bower, P., 2014. Qualitative meta-synthesis of user experience of computerised therapy for depression and anxiety. PLoS One 9, e84323.

Kroenke, K., Spitzer, R.L., Williams, J.B.W., 2001. The PHQ-9: validity of a brief depression severity measure. J. Gen. Intern. Med. 16, 606–613.

La Torre, M.A., 2007. Positive psychology: is there too much of a push? Perspect. Psychiatr. Care 43, 151–153.

Layous, K., Chancellor, J., Lyubomirsky, S., Wang, L., Doraiswamy, P.M., 2011. Delivering happiness: translating positive psychology intervention research for treating major and minor depressive disorders. J. Altern. Complement. Med. 17, 675–683.

McEvoy, P., Richards, D., 2003. Critical realism: a way forward for evaluation research in nursing? J. Adv. Nurs. 43, 411–420.

Mental Health Network NHS Confederation, 2014. The future's digital. In: Mental Health and Technology. NHS Confederation. Retrieved from, London. http://www.nhsconfed.org/resources/2014/09/the-future-s-digital-mental-health-and-technology.

Mental Health Taskforce. (2016). The Five Year Forward View for Mental Health. Retrieved from https://www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-Taskforce-FYFV-final.pdf.

Morse, J.M., Barrett, M., Mayan, M., Olson, K., Spiers, J., 2002. Verification strategies for establishing reliability and validity in qualitative research. Int J Qual Methods 1, 13–22.

Moskowitz, J.T., Hult, J.R., Duncan, L.G., Cohn, M.A., Maurer, S., Bussolari, C., Acree, M., 2012. A positive affect intervention for people experiencing health-related stress: development and non-randomized pilot test. J. Health Psychol. 17, 676–692.

Muñoz, R.F., 2010. Using evidence-based Internet interventions to reduce health disparities worldwide. J. Med. Internet Res. 12, e60.

Murray, E., Khadjesari, Z., White, I.R., Kalaitzaki, E., Godfrey, C., McCambridge, J., ... Wallace, P., 2009. Methodological challenges in online trials. J. Med. Internet Res. 11, e9.

O'Reilly, M., Parker, N., 2013. "Unsatisfactory saturation": a critical exploration of the notion of saturated sample sizes in qualitative research. Qual. Res. 13, 190–197.

QSR International Pty Ltd, 2012. NVivo Qualitative Data Analysis Software.

Richards, D., Richardson, T., 2012. Computer-based psychological treatments for depression: a systematic review and meta-analysis. Clin. Psychol. Rev. 32, 329–342.

Ritchie, J., Spencer, L., 1994. Qualitative Data Analysis for Applied Policy Research. In: Bryman, A., Burgess, R.G. (Eds.), Analysing qualitative data. Routledge, London, pp. 173–194.

Ritchie, J., Lewis, J., Elam, G., Tennant, R., Rahim, N., 2014. Designing and selecting samples. In: Ritchie, J., Lewis, J., Nicholls McNaughton, C., Ormston, R. (Eds.), Qualitative Research Practices: A Guide for Social Science Students and Researchers. SAGE Publications, London, pp. 111–145.

Roepke, M.A., Jaffee, S.R., Riffle, O.M., McGonigal, J., Broome, R., Maxwell, B., 2015. Randomized controlled trial of Superbetter, a smartphone-based/internet-based self-help tool to reduce depressive symptoms. Games Health J. 4, 235–246.

Schueller, S.M., Parks, A.C., 2012. Disseminating self-help: positive psychology exercises in an online trial. J. Med. Internet Res. 14 (e63).

Seligman, M.E.P., Rashid, T., Parks, A.C., 2006. Positive psychotherapy. Am. Psychol. 61, 774–788.

Sin, N.L., Lyubomirsky, S., 2009. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. J. Clin. Psychol. 65, 467–487.

Tong, A., Sainsbury, P., Craig, J., 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32- item checklist for interviews and focus group. Int. J. Qual. Health Care 19, 349–357.

Whooley, M.A., Avins, A.L., Miranda, J., Browner, W.S., 1997. Case-finding instruments for depression. Two questions are as good as many. J. Gen. Intern. Med. 12, 439–445.

World Health Organization, 2009. Global Health risks: mortality and burden of disease attributable to selected major risks. Bull. World Health Organ. 87, 646.

Yardley, L., Morrison, L., Bradbury, K., Muller, I., 2015. The person-based approach to intervention development: application to digital health-related behavior change interventions. J. Med. Internet Res. 17, e30.

Yeo, A., Legard, R., Keegan, J., Ward, K., Nicholls McNaughton, C., Lewis, J., 2014. In-depth interviews. In: Ritchie, R., Lewis, J., McNaughton, N., Ormston, C. (Eds.), Qualitative Research in Practice. SAGE Publications, London, pp. 177–210.