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# BMJ Open

## A meta-analytic review of positive psychotherapy

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-046017
Article Type:	Original research
Date Submitted by the Author:	19-Oct-2020
Complete List of Authors:	Hoppen, Thole; University of Münster, Clinical Psychology and Psychotherapy Morina, Nexhmedin ; University of Münster, Psychology
Keywords:	Depression & mood disorders < PSYCHIATRY, Schizophrenia & psychotic disorders < PSYCHIATRY, Cancer pain < ONCOLOGY, Adult psychiatry < PSYCHIATRY, PSYCHIATRY

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# A meta-analytic review of positive psychotherapy

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Short title: Meta-analytic review of positive psychotherapy

*Keywords:* depression, meta-analysis, positive psychotherapy, randomized controlled trial, well-being

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Number of Tables: 3

Number of Figures: 2

Word count: 3,989

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### 4 Abstract

5 **Objective:** Positive Psychotherapy (PPT) aims at increasing positive affect, meaning and  
6 engagement. We aimed to synthesize the available evidence on PPT efficacy.  
7

8 **Design:** We conducted a pre-registered systematic literature search and meta-analysis of  
9 randomized controlled trials examining the efficacy of PPT for increasing positive (e.g.,  
10 satisfaction with life) or decreasing negative psychological outcomes (e.g., depression).  
11  
12

13 **Data sources:** We systematically searched Medline, PsycINFO, and Web of Science from 2006  
14 (i.e., inception of PPT) to Feb 2020 as well as related systematic reviews and meta-analyses.  
15

16 **Results:** We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were  
17 found for increasing positive outcomes ( $g = -0.72$ ,  $95\%CI: -1.31; -0.14$ ,  $k = 10$ ,  $NNT = 2.55$ ) and  
18 reducing negative outcomes ( $g = 0.48$ ,  $95\%CI: 0.18; 0.78$ ,  $k = 8$ ,  $NNT = 3.76$ ) when PPT was  
19 compared to waitlist control conditions at post-treatment. A sub-analysis on decreasing  
20 depression yielded similar results ( $g = 0.57$ ,  $95\%CI: 0.21; 0.92$ ,  $k = 6$ ,  $NNT = 3.22$ ). PPT yielded  
21 large effect sizes at post-treatment for increasing positive outcomes ( $g = -0.92$ ,  $95\%CI: -1.74; -$   
22  $0.11$ ,  $k = 6$ ,  $NNT = 2.05$ ) and reducing depression ( $g = 0.94$ ,  $95\%CI: 0.18; 1.70$ ,  $k = 6$ ,  $NNT =$   
23  $2.03$ ) when compared to active control conditions. No significant differences in efficacy were  
24 found when compared to established treatments such as cognitive behavioural therapy.  
25  
26 Moderator analyses revealed that trial quality was negatively related with effect sizes for  
27 depression and positively related with effect sizes for positive outcomes. Follow-up assessments,  
28 however, remained too scarce for most planned analyses.  
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31 **Conclusions:** Our findings support the short-term efficacy of PPT. However, results are to be  
32 regarded with due caution due to the low number of trials. More high-quality trials that assess  
33 follow-up efficacy are needed to draw firmer conclusions on long-term efficacy of PPT.  
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## Meta-analytic review of positive psychotherapy

### Strengths and limitations of this study

- This meta-analysis was pre-registered and conducted in line with the PRISMA guidelines
- Data synthesis was based on a broad systematic literature search including broad secondary manual searches
- Potential moderators including trial quality, treatment lengths and alliance were analysed
- Scarcity of available trails precluded many (sub-)analyses and asks for due caution in interpreting the present findings
- Due to lacking data, follow-up efficacy could not be determined

1 Meta-analytic review of positive psychotherapy  
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### 4 **Introduction**

5 Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology  
6 and proposes that psychopathology such as depression can be effectively treated by directly and  
7 primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging  
8 to and serving something greater than the self) and engagement (i.e., active involvement in daily  
9 life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be  
10 successfully dampened. While the founders believed from inception that PPT might be an  
11 effective treatment for various disorders, they started off by investigating its efficacy in treating  
12 depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three*  
13 *Good Things* and the *Gratitude Visit*. In *Using Your Strength*, for instance, participants are asked  
14 to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use  
15 their top five strengths more in daily life. Seligman and colleagues ended up including 26  
16 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on  
17 the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11  
18 mildly to moderately depressed students per group and found that PPT was effective in lowering  
19 depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They  
20 also conducted a second RCT where they offered a 14-session individual PPT over 12 weeks in a  
21 sample of adults suffering from major depressive disorder. Again, PPT was found effective in  
22 decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1]  
23 Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further  
24 research on populations suffering depressive symptoms or depressive disorders, PPT has been  
25 investigated in various other contexts including patients with psychosis[4] and multiple other  
26 mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or  
27 multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe  
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1 Meta-analytic review of positive psychotherapy  
2 summarized the findings of 12 publications (from 9 individuals trials) published before May  
3 2015.[3] The authors conclude that the application of PPT in intervention research is  
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8 heterogenous in terms of both, the modifications of the original manual as well as the conditions  
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10 targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-  
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12 analysis on the efficacy of PPT has been published to this date. Against this background, we  
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14 performed a meta-analysis of randomized controlled trials assessing the efficacy of PPT.  
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## 23 **Methods**

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25 Following the recommendations by the Preferred Reporting Items for Systematic  
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27 Reviews and Meta-analysis (PRISMA) group,[10] we defined the main structured research  
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29 question describing the Population, Intervention, Comparison, Outcome, and Study design  
30  
31 (PICOS) as “In individuals with mental or physical health complaints, does PPT (I), compared to  
32  
33 control conditions (C), improve psychological outcomes (O) in randomized controlled trials  
34  
35 (S)?”.

## 36 **Literature Search Strategy**

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41 Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled  
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43 Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a  
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45 minimum of ten participants per treatment arm at post-treatment with available data on at least  
46  
47 one relevant outcome. No restrictions were placed on age of participants, comparison condition,  
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49 or publication type. Studies that only applied a mixture of PPT with another intervention, such as  
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51 a mixture of PPT and cognitive behavioral therapy in comparison to a control condition,[9] were  
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53 excluded due to our narrow focus on the efficacy of PPT, as founded by Seligman et al.[1]. We  
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1 Meta-analytic review of positive psychotherapy  
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3 searched the following databases: PsycINFO, MEDLINE, and Web of Science from 2006 up to  
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5 13<sup>th</sup> of February 2020. The year 2006 represents the year where the theoretical underpinnings of  
6  
7 the PPT were first published.[1] MeSH terms for Ebscohost (regarding MEDLINE and  
8  
9 PsycINFO) were as follows: “SU positive psychotherapy OR TI positive psychotherapy OR AB  
10  
11 positive psychotherapy”. In Web of Science a similar search string to Ebscohost was chosen to  
12  
13 search for “positive psychotherapy” in titles, abstracts, and keywords. To retrieve additional  
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15 publications, the reference lists of all included papers and relevant (i.e., related) meta-analyses  
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17 and systematic reviews were manually screened.[11–19] Secondary hand searches were  
18  
19 conducted using Google Scholar.  
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### 24 **Coding of Studies**

25  
26 The publications were coded by both authors. From each publication, the following  
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28 study, intervention and participant characteristics were coded and extracted: country the trial was  
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30 conducted in, clinical population targeted (i.e., any physical or mental health condition),  
31  
32 experimental intervention type (i.e., original PPT manual or modified version), intervention  
33  
34 format (i.e., individual or group), comparison group(s), session number and session duration in  
35  
36 minutes, longest follow-up measure on relevant outcome(s) when applicable, number of  
37  
38 participants at post-treatment assessment, age of participants (i.e., mean and standard deviation  
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40 or range), proportion of sample with female sex in percent, applied statistical analysis (i.e.,  
41  
42 completer or intent-to-treat analyses) and relevant outcome(s) targeted by PPT. The post-, and  
43  
44 follow-up (if available) assessment group means, standard deviations and samples sizes for each  
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46 relevant outcome were also extracted. When relevant data was not reported, it was either  
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48 calculated from given data (e.g., standard deviations from standard errors) or the corresponding  
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50 author of the respective publication was contacted via email twice with one month in between. In  
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1 Meta-analytic review of positive psychotherapy

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3 one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and Drikvand  
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5 potentially reported the means and SD for a relevant outcome (i.e., quality of life) in wrong order  
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7 [20]. We contacted the authors twice via Email and were left with no response. Consequently, we  
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9 calculated two analyses; one with changed order of means and SD and one with unchanged  
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11 order.  
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14 We divided control conditions into passive control conditions, which turned out to exclusively  
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16 consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual &  
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18 placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy /  
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20 CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy  
21  
22 / MBCT).  
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## 25 **Quality Assessment**

26  
27 Both authors independently rated the quality of the included trials by using a quality  
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29 assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted  
30  
31 in two subsequent meta-analyses.[21-23] This scale assesses the following nine quality criteria:  
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34 1) Were PTSD symptoms assessed with a semi-structured interview?, 2) Was a treatment manual  
35  
36 used?, 3) Were therapists trained either specifically for the study or in a general training?, 4) Was  
37  
38 treatment integrity checked by supervision and/or recordings and/or standardized instruments?,  
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40 5) Was data analyzed with intent-to-treat analysis?, 6) Was group allocation performed with a  
41  
42 true randomization technique?, 7) Was randomization done by an independent third person (or  
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44 computer or sealed envelopes)?, 8) Were blinded assessors used for interviews?, and 9) Were  
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46 dropouts adequately reported? Items for each of the nine quality criteria were scored on a four-  
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48 point scale, where 3 indicates high quality (e.g., a published treatment manual was used), 2  
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50 indicates limited quality (e.g., an unpublished treatment manual was used), 1 indicates lack of  
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3 required quality (e.g., no treatment manual was used), and 0 indicates unknown (i.e., required  
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5 information not reported). When self-report measures were used to assess outcomes in a given  
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7 trial, a score of 3 was given on the quality item concerning blinded assessments. In case of  
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9 technology-based interventions, a trial received a score of 3 on the quality items concerning  
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11 trained therapists and formal fidelity checks due to the technology-based standardized procedure.  
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13 The nine ratings were then summed up to yield the respective trial quality sum score and used as  
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15 a potential moderator in the analyses.  
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### 18 **Data extraction of outcome measures**

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21 Only one positive and/or negative psychological outcome per trial was chosen to warrant  
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23 independence of included participants in (sub-)analyses. Choice of outcomes was data-driven.  
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25 That is, we first extracted all negative and positive psychological outcomes per trial and then  
26  
27 analyzed across all included trials which positive and negative psychological outcomes were  
28  
29 most assessed and reported. For the negative outcomes, depression was by far the most assessed  
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31 outcome ( $k = 14$ ). Positive outcomes varied more. Satisfaction with life was reported most often  
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33 ( $k = 11$ ), consecutively followed by happiness ( $k = 9$ ), well-being ( $k = 5$ ), hope ( $k = 5$ ), positive  
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35 affect ( $k = 4$ ), quality of life ( $k = 3$ ), self-efficacy ( $k = 2$ ) and meaning in life ( $k = 1$ ). As such,  
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37 we prioritized satisfaction with life first in the data extraction phase when several positive  
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39 outcomes were reported in a given trial, happiness second and so forth.  
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### 44 **Statistical Analysis**

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47 Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-  
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49 effects models given that we expected large heterogeneity in included studies.[24–26] We  
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51 prioritized intent-to-treat (ITT) data when available ( $k = 3$ ) over completer data ( $k = 17$ ,  
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53 including  $k = 3$  with insufficient information on participant flow, see Table 1 for further  
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Meta-analytic review of positive psychotherapy information). To obtain the effect size Hedges's  $g$ , R first calculates the standardized mean difference  $d$  (i.e., control group mean subtracted from the experimental group mean and then divided by the pooled standard deviation). The standardized mean difference is then multiplied by a sample size correction factor  $J = 1 - (3 / (4df - 1))$  to yield Hedges's  $g$ .<sup>[27]</sup> Analyses were conducted if four or more trials were available for a given (sub-)analysis.<sup>[28]</sup> Effect sizes  $g$  may be conservatively interpreted with Cohen's convention of small (0.2), medium (0.5) and large (0.8) effects.<sup>[29]</sup> As a test of homogeneity of effect sizes, we calculated the  $Q$ -statistic and the corresponding  $p$ -value. We also calculated the  $I^2$ -statistic, as a measure of heterogeneity across trials in percent. It has been suggested that  $I^2$ -statistics of 25, 50, and 75% may be interpreted as referring to low, moderate, and high levels of heterogeneity, respectively.<sup>[30]</sup> Because we expected large heterogeneity, we also calculated prediction intervals.<sup>[31]</sup> Prediction intervals, unlike  $I^2$ -statistics, present a heterogeneity estimate in the same metric as the original effect size measure (i.e.,  $g$ ). As such, prediction intervals provide a predicted range for the true treatment effect in similar future trials.<sup>[32]</sup> In other words, when both the confidence interval and the prediction interval for a given (sub-)analysis exclude the null, statistical certainty was found for the hypothesis that similar future trials will also find significant effects for the given comparison. To check for potential effects of outliers on meta-analytic outcomes, we aimed at repeating analyses without identified outliers. Outliers were defined as effect sizes departing 3.3 standard deviations away from the pooled mean effect in both directions.<sup>[33, 34]</sup> However, no outliers were identified in any of the performed analyses. When analyses consisted of at least ten trials,<sup>[35]</sup> we assessed risk of publication bias through visual inspection of funnel plots, Egger's test of asymmetry and number of missing studies using the trim-and fill procedure.<sup>[36]</sup> The trim-and-fill procedure yields an asymmetry-corrected estimate of the effect size (i.e., taking

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3 publication bias into account). We calculated the numbers needed to treat (NNT) as a measure of  
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5 efficacy that is easily interpretable from a clinical perspective. It informs about the numbers of  
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7 patients that need to be treated until one adverse event is prevented.[37] Lastly, we performed  
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9 moderator analyses in R with trial quality sum score and treatment length (in minutes) as  
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11 continuous variables and alliance as a continuous variable (i.e., trials with vs. without the  
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13 involvement of the founders of PPT[1]) to check for potential moderating effects on efficacy  
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15 outcomes. Since too few trials were available to check for alliance, we performed main-analyses  
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17 once more with trials involving the founders omitted.[1]  
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## 24 Results

### 25 Study characteristics

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28 Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a  
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30 total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of  
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32 the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with  
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34 a passive control condition (PCC). All PCC turned out to be WLC. Hence, we will refer to WLC  
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36 instead of PCC. Five trials (25%) compared PPT with an active control condition (e.g.,  
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38 treatment-as-usual, control exercises). Three trials (15%) compared PPT with another  
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40 psychological intervention (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more  
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42 than one control conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and  
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44 the remaining 6 trials in an individual setting. Two of the latter trials described in one publication  
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46 applied an internet-based PPT.[39] Treatment lengths was 917.06 minutes on average  
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48 (unweighted mean across trials reporting on both, number and duration of sessions,  $k = 17$ ) with  
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50 a standard deviation of 374.79 minutes. Average number of sessions was 9.17 ( $SD = 2.71$ ) and  
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Meta-analytic review of positive psychotherapy average session length was 101.76 minutes ( $SD = 22.03$ ). Ten trials (50%) conducted follow-up assessments on relevant outcomes whereas nine trials failed to do so. The remaining study assessed data on a relevant outcome two weeks after the post-treatment-assessment,[40] which we excluded from the follow-up data due to too short amount of time between post- and follow-up-assessment. The average follow-up period was 7.10 months ( $SD = 4.21$ ). Most trials were conducted in Iran ( $k = 10$ ) and the United States of America ( $k = 5$ ). The remaining trials were conducted in Austria ( $k = 1$ ), South Korea ( $k = 1$ ), Canada ( $k = 1$ ), China ( $k = 1$ ) and the United Kingdom ( $k = 1$ ). One publication entailing three trials was a PhD dissertation,[39] whereas the remaining trials constituted articles published in peer-reviewed journals. Study quality was moderate overall with a mean of 17.85 out of the possible range from 0 to 27. Study quality varied considerably across included trials with a standard deviation of 4.69.

### Subject characteristics

Basic characteristics of included subjects per trial can be found in Table 1. A total of 1,360 subjects participated in the included trials. Most of the participants were female (unweighted mean across included trials = 71.75%) with a range from 23.63%[41] to 100%.[42] The patients had a pooled weighted mean age of 39.97 with a pooled standard deviation of 10.18. It is worth noting, however, that several studies did only report age ranges rather than means and standard deviations[43] or did not report on age altogether.[39]

### The Efficacy of PPT in Increasing Positive Outcomes

Results on the efficacy of PPT are displayed in Table 2. In terms of increasing various positive outcomes such as satisfaction with life (SWL) and happiness, PPT was found moderately more effective than WLC at post-treatment ( $g = -0.72$ , 95%CI: -1.31; -0.14,  $k = 10$ ,  $NNT = 2.55$ ). See Figure 2 for the corresponding forest plot. Results remained similar, when the

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2 results of Mohamadi et al.[20] were entered as reported in their publication ( $g = -0.82$ ,  $95\%CI: -$   
3  $1.39; -0.25$ ,  $k = 10$ ,  $NNT = 2.27$ ). Number of available trials allowed for a publication bias check.  
4  
5 While a visual inspection of the funnel plot led to the suspicion of publication bias (i.e., missing  
6 trials to the left) and a potential outlier to the far left (see Fig. A1 in the supplementary material),  
7  
8 no trials were added by the trim and fill method and no statistical outlier (i.e., defined as an  
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10 effect size  $\leq$  or  $\geq 3.3$  SD above pooled effect) was found. No evidence was found for the efficacy  
11  
12 of PPT in increasing positive outcomes compared to WLC at follow-up ( $g = -0.36$ ,  $95\%CI: -$   
13  $0.83; 0.11$ ,  $k = 4$ ,  $NNT = 5.01$ ). See Figure A2 for the corresponding forest plot. Follow-up  
14  
15 results are to be scrutinized with due caution in the light of low number of available trials ( $k = 4$ ),  
16  
17 large heterogeneity in outcomes and the wide range of the prediction interval. Satisfaction with  
18  
19 life was the only positive outcome with enough trials to warrant a meta-analytic sub-analysis. In  
20  
21 comparison to WLC at post-treatment, PPT was not found more effective in increasing  
22  
23 satisfaction with life ( $g = -0.15$ ,  $95\%CI: -0.40; 0.09$ ,  $k = 4$ ,  $NNT = 11.55$ ). See Figure A3 for the  
24  
25 corresponding forest plot. Heterogeneity in outcomes was low. In comparison to active control  
26  
27 conditions (i.e., treatment-as-usual and placebo exercises) at post-treatment, PPT yielded a large  
28  
29 effect size in increasing positive outcomes ( $g = -0.92$ ,  $95\%CI: -1.74; -0.11$ ,  $k = 6$ ,  $NNT = 2.05$ ).  
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31 See Figure A4 for the corresponding forest plot. However, heterogeneity in outcomes was large  
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33 and the prediction interval included the null illustrating large variability in findings. When  
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35 compared to other active treatment conditions (i.e., CBT, DBT, MBCT, & Neurofeedback-aided  
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37 Mediation), no differences in efficacy at post-treatment were found for increasing positive  
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39 outcomes ( $g = -0.29$ ,  $95\%CI: -0.89; 0.32$ ,  $k = 6$ ,  $NNT = 6.24$ ). See Figure A5 for the  
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41 corresponding forest plot. Again, heterogeneity in outcomes was large and the prediction interval  
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43 included the null. Results remained insignificant when results of Mohamadi et al.[20] were  
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1 Meta-analytic review of positive psychotherapy  
2 entered as reported in their publication ( $g = -0.65$ ,  $95\%CI: -1.31; 0.01$ ,  $k = 6$ ). Lastly, when trials  
3 with alliance (i.e., involvement of the founder) were omitted, results for the comparison with  
4 WLC at post-treatment remained similar ( $g = -1.04$ ,  $95\%CI: -1.79; -0.28$ ,  $k = 7$ ,  $NNT = 1.87$ , see  
5 Table 2).  
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### 12 **The Efficacy of PPT in Decreasing Negative Outcomes**

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14 PPT was found moderately more effective in reducing depression, negative affect and  
15 stress than WLC at post-treatment ( $g = 0.48$ ,  $95\%CI: 0.18; 0.78$ ,  $k = 8$ ). See Figure 2 for the  
16 corresponding forest plot. To avoid one adverse event (i.e., depression, negative affect or stress),  
17 a little less than four patients needed to be treated ( $NNT = 3.76$ ). Results on decreasing  
18 depression were similar ( $g = 0.57$ ,  $95\%CI: 0.21; 0.92$ ,  $k = 6$ ,  $NNT = 3.22$ ). See Figure A6 for the  
19 corresponding forest plot. However, prediction intervals for both analyses excluded the null  
20 highlighting substantial levels of heterogeneity in efficacy outcomes and remaining uncertainty  
21 about the true efficacy when similar future trials accumulate. In comparison to active control  
22 conditions (i.e., treatment-as-usual with or without medication and placebo exercises) at post-  
23 treatment, PPT yielded large effect sizes in reducing depression ( $g = 0.94$ ,  $95\%CI: 0.18; 1.70$ ,  $k$   
24  $= 6$ ,  $NNT = 2.03$ ). Please find the corresponding forest plot in Figure A7. Again, heterogeneity  
25 was large and the prediction interval excluded the null. When compared to other active treatment  
26 conditions (i.e., CBT, DBT, MBCT, & Neurofeedback-aided Mediation), no differences in  
27 efficacy at post-treatment were found for decreasing negative ( $g = 0.08$ ,  $95\%CI: -0.48; 0.64$ ,  $k =$   
28  $6$ ,  $NNT = 22.22$ ). Please find the corresponding forest plot in Figure A8. Trials that included  
29 follow-up assessments on the efficacy of PPT in decreasing negative outcomes were too few to  
30 allow for meta-analytic review for all included comparisons ( $k < 4$ ). Lastly, when trials with  
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2 alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at  
3 post-treatment remained similar ( $g = 0.63$ ,  $95\%CI: 0.20; 1.07$ ,  $k = 5$ ,  $NNT = 2.89$ , see Table 2).

### 4 Moderator-Analyses

5 Moderator analyses revealed that trial quality as a continuous variable was associated  
6 with effect sizes in most of the abovementioned analyses. See Table 3 for an overview of results.

7 In terms of increasing positive outcomes, only positive moderations and two non-significant  
8 results were found. For the efficacy of PPT in increasing positive outcomes in comparison to  
9 WLC at post-treatment, trial quality was found to be a significant positive moderator ( $b = 0.17$ ,  $p$   
10  $= .003$ ) with higher trial quality being associated with higher effect sizes. A similar result was  
11 found for the follow-up results ( $b = 0.12$ ,  $p = .036$ ). In terms of the comparison with active  
12 control conditions at post-treatment, trial quality was also found to moderate effect sizes  
13 positively ( $b = 0.18$ ,  $p = .015$ ). No significant moderation of trial quality was found for the  
14 comparison with other active treatment conditions ( $b = -0.01$ ,  $p = .907$ ) nor for the sub-analysis  
15 on satisfaction with life only ( $b = -0.01$ ,  $p = .915$ ).

16 In terms of the efficacy of PPT in decreasing negative outcomes in comparison to WLC  
17 at post-treatment, trial quality was found to be a significant moderator ( $b = -0.08$ ,  $p = .003$ ) with  
18 higher trial quality being associated with lower effect sizes. A similar result was found for the  
19 sub-analyses on depression ( $b = -0.11$ ,  $p < .001$ ). Similarly, the sub-analysis on depression for  
20 the comparison of PPT and active control conditions yielded a negative moderation of trial  
21 quality ( $b = -0.17$ ,  $p = .005$ ). However, a positive significant moderation was found for the  
22 comparison with other active treatment conditions ( $b = 0.13$ ,  $p < .001$ ) indicating higher effect  
23 sizes in decreasing negative outcomes for higher quality trials. No evidence was found for a  
24 moderation of treatment length in any of the analyses (see Table 3).

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## Discussion

Our systematic search resulted in 20 randomized controlled trials that assessed the efficacy of PPT. The results of the meta-analysis indicate that PPT can effectively increase positive psychological outcomes and decrease depression at post-treatment. Both comparisons with WLC and active control groups support the short-term efficacy of PPT. Overall, there is too few data on the long-term efficacy of PPT. Additionally, moderator analyses yielded that trial quality was negatively associated with effect sizes for depression and positively related with effect sizes for positive outcomes. However, the low number of available trials, large heterogeneities in outcomes, and wide prediction intervals call for cautious statements on the efficacy.

The findings support the short-term efficacy of PPT in increasing positive psychological outcomes. However, the higher magnitude in effect sizes for comparisons with active control conditions (pooled  $g = -0.92$ ) compared to WLC (pooled  $g = -0.72$ ) is surprising and counterintuitive. Usually the opposite pattern is found in clinical research.[21, 28] Unplanned post-hoc investigations on potential reasons hint towards the effect of an almost outlier in the analysis involving active comparison groups.[7] This trial offered either PPT or treatment-as-usual to cancer patients and yielded a strikingly large effect size at post-treatment favoring PPT ( $g = -2.79$ ) for increasing meaning in life. Furthermore, a second trial on cancer patients also produced a large effect size for increasing happiness ( $g = -1.80$ ) as compared to waitlist at post-treatment.[6] While these two trials on cancer patients suggest that PPT might be highly effective in increasing positive outcomes in this population, two trials remain of course a slim evidence-base. It should be noted, however, that the analysis on passive control conditions (i.e., waitlist

1 Meta-analytic review of positive psychotherapy  
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3 controls) also involved an almost outlier.[40] This study offered PPT to depressed patients and  
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5 yielded a strikingly large effect size at post-treatment ( $g = -2.98$ ) favoring PPT in increasing  
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7 hope. Both almost outlier studies involved a moderate sample size (see Table 1). All this  
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9 suggests that more trials are needed to allow for firmer conclusions.  
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13 When PPT was compared to other established psychological interventions such as CBT,  
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15 current data did not suggest any significant difference in efficacy. Accordingly, the results of the  
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17 six RCTs included in this comparison suggests that PPT is similarly effective in increasing  
18  
19 positive psychological outcomes. However, due to the low number of trials for this comparison  
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21 these findings need to be viewed with due caution.  
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25 The first and foremostly assessed negative outcome in the PPT literature remains  
26  
27 depression. As suggested and intended by its developers, PPT was found moderately to largely  
28  
29 effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with  
30  
31 larger effect sizes in lowering depression for PPT in comparison to active control conditions  
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33 (pooled  $g = 0.94$ ) as opposed to WLC (pooled  $g = 0.57$ ). Once more, unplanned post-hoc  
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35 investigations were performed in an attempt to find potential reasons for the counterintuitive  
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37 finding. Again, we found that an almost outlier might explain the difference. The analysis  
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39 involving active control groups involved an almost outlier with an effect size of  $g = 2.45$ ,[44]  
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41 whereas the analysis involving WLC did not involve such an almost outlier.  
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47 Data on follow-up efficacy altogether were scarce. The only feasible follow-up analysis  
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49 (i.e., efficacy of PPT vs. WLC in increasing positive outcomes) yielded a non-significant effect  
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51 size. The current available literature does not allow for any other valid follow-up analysis and,  
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2 thus, conclusions on the long-term efficacy of PPT cannot not yet be made. This represents  
3 perhaps the main limitation of the literature on the efficacy of PPT.  
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8 Trial quality overall was moderate and, therefore, leaves room for improvement. Results  
9 overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs)  
10 more generally which report moderate effect sizes in increasing positive outcomes and  
11 decreasing negative outcomes.[11-19] A recent meta-analysis on PPIs further also reports on a  
12 significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary  
13 considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not  
14 straightforward.  
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25 This represents the first meta-analysis on the efficacy of PPT. Several limitations need to  
26 be considered. First and foremost, the number of included trials is relatively small and  
27 accordingly more research is needed to draw firmer conclusions. Secondly, depression and SWL  
28 were the only two outcomes with enough trials to warrant sub-analyses. More research is needed  
29 to allow for more homogenous analyses on PPT efficacy for specific outcomes. Thirdly and  
30 related to the second limitation, we clustered positive and negative findings and, thereby,  
31 increased heterogeneity. This decision was based on the overall scarcity of trials. We aimed at  
32 conducting more homogenous sub-analyses were possible which were, as mentioned, only  
33 feasible for depression and SWL. As more trials accumulate, more fine-grained analyses will  
34 become feasible. Fourthly and lastly, the follow-up efficacy of PPT remains uncertain due to lack  
35 of research.  
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## 50 51 **Conclusion** 52 53 54 55 56 57 58 59 60

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3 Our findings indicate that PTT can effectively increase positive outcomes and decrease  
4 negative outcomes at post-treatment. However, there is lack of follow-up data and the number of  
5 available trials altogether remains scarce precluding many of the planned sub-analyses. More  
6 research with high methodological rigor and including follow-up assessments is needed to draw  
7 firmer and more precise conclusions on PPT efficacy.  
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3 **Statements**  
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6 **Competing Interests Statement**  
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8 The authors declare that they have no conflict of interest to declare  
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13 **Funding Sources Statement**  
14

15 This research received no specific grant from any funding agency in the public, commercial or  
16 not-for-profit sectors.  
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22 **Ethics statement**  
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24 Not applicable.  
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28 **Author Contributions Statement**  
29

30 THH and NM conceptualized the meta-analysis conducted the systematic literature search and  
31 coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript.  
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37 **Patient and Public Involvement Statement**  
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39 Not applicable.  
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60 \*indicates that respective trial was included in the present meta-analysis

**Table 1***Basic Characteristics of Included trials*

Study	Country	Health condition	Intervention (treatment manual) <sup>a</sup>	Format	Control group (& format)	Nr. of sessions x Duration in min.	FU <sup>b</sup>	N post	Mean age ± SD, or range	% female	Stat. analysis	Primary outcome(s)	QS
Abdeyan et al.[40]	Iran	Depression	PPT	Group	WLC	8 x 90	n.a. <sup>c</sup>	64	38 ± 6.35	60.90	n.r.	Hope	10
Asgharipoor et al.[45]	Iran	Depression	PPT (Sahebi, 2011)	Indiv.	CBT (group)	12 x 120	n.a.	18	26.44 ± 5.87	72.22	n.r.	Depression & happiness	12
Asl et al.[42]	Iran	Infertility and Depression	PPT (Parks-Sheiner, 2009)	Group	WLC	6 x 90	n.a.	31	30.49 ± 5.68	100	Compl.	SWL	21
Dowlatabadi et al.[6]	Iran	Breast cancer	PPT	Group	WLC	10 x 90	n.a.	33	36.63 ± 5.53	100	Compl.	Depression & happiness	13
Furchtlehner et al.[46]	Austria	Depression	PPT (Rashid & Seligman, 2018)	Group	CBT (group)	14 x 120	6	92	40.66 ± 12.40	64.10	ITT	Depression & happiness	26

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3	Heydari et	Iran	Hemophilia	PPT	Indiv.	WLC	8 x 120	2	56 <sup>c</sup>	10-25	58.93	Compl.	Hope	16
4	al.[43]			(Seligman et										
5				al. 2014)										
6														
7														
8	Hwang et	South	Depression	mPPT (self-	Indiv.	WLC &	10 x 50	4	24	22.77 ± 2.31	75.00	Compl.	Negative	13
9	al.[38]	Korea		developed)		NFB-M							affect & well-	
10						(indiv.)							being	
11														
12	Khayatan et	Iran	Multiple	PPT	Group	WLC	6 x 90	n.a.	30	31.11 ± 6.24	100	n.r.	Depression	13
13	al.[8]		Sclerosis											
14			and											
15			depression											
16														
17	Mohamadi et	Iran	Irritable	PPT (Lee,	Group	DBT	8 x 150	n.a.	73	29.47 ± 3.95	63.01	Compl.	Stress &	17
18	al.[20]		bowel	2015)		(group),							quality of life	
19			syndrome			MBCCT								
20						(group)								
21						and								
22						WLC								
23														
24														
25	Nikrahan et	Iran	Coronary	PPT	Group	TAU	6 x 90	2	27	56.65 ± 8.40	23.63	ITT	Depression	26
26	al.[41]		artery											
27			disease											
28														
29	Parks-Sheiner	USA	Mild to	mPPT	Group	WLC	6 x 90	12	104	n.r.	46.00	Compl.	Depression &	18
30	study 1[39]		moderate										SWL	
31			depression											
32														
33	Parks-Sheiner	USA	Mild to	Online mPPT	Indiv.	Control	n.r.	12	275	46.70 ± 12.43	78.10	Compl.	Depression &	23
34	study 2[39]		moderate			exercise							SWL	
35			depression											
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3	Parks-Sheiner	USA	Mild to moderate depression	Online mPPT	Indiv.	WLC	n.r.	3	140	43.21 ± 11.86	75.70	Compl.	Depression & SWL	23
4	study 3[39]													
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7														
8	Saeedi et al.[7]	Iran	Cancer	PPT	Group	TAU	8 x 90	n.a.	61	47.40 ± 13.10	93.44	Compl.	Meaning in life	14
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11														
12	Schrank et al.[4]	UK	Psychosis	PPT	Group	TAU	11 x 90	n.a.	84	42.50 ± 11.25	40.43	Compl.	Depression & happiness	24
13														
14														
15														
16	Seligman et al. study 1[1]	USA	Mild to moderate depression	PPT	Group	WLC	6 x 120	12	34	Students	42.50	Compl.	Depression & SWL	17
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19														
20	Seligman et al. study 2[1]	USA	Depression	PPT	Indiv.	TAU, TAU-MED	14 x n.r.	12	32	18 – 55 years	68.75	Compl.	Depression & SWL	18
21														
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23														
24	Taghvaienia et al.[47]	Iran	Depression	PPT	Group	WLC	10 x 120	n.a.	52	62.64 ± 12.81	100	Compl.	Depression & happiness	20
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27	Uliaszek et al.[5]	Canada	Psychopathology (trans-diagnostic)	PPT	Group	DBT	12 x 120	n.a.	54	22.17 ± 5.01	77.78	ITT	Depression & happiness	19
28														
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31														
32														
33	Zhang et al.[44]	China	Mild to moderate depression	PPT	Group	TAU	8 x 90	6	76	20.39 ± 1.20	94.90	Compl.	Depression & self-efficacy	14
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Note: CBT = Cognitive Behavioral Therapy; Compl. = Completer analysis; DBT = Dialectical Behavior Therapy; FU = follow-up in months; HLM = Hierarchical Linear Modelling; indiv. = individual; ITT = Intent-To-Treat analysis; MBCT = Mindfulness-Based Cognitive Therapy; mPPT = modified Positive Psychotherapy; n.a. = not applicable; NFB-M = Neurofeedback-aided Meditation therapy; n.r. = not reported; PPT = Positive Psychotherapy as developed by Seligman et al., 2006, unless indicated

# Meta-analytic review of positive psychotherapy

differently; Stat. analysis = Statistical analysis applied; SWL = Satisfaction With Life; TAU = Treatment-As-Usual; WLC = Waitlist Control condition.

<sup>a</sup>PPT = manual as founded by Seligman et al., 2006 [1].

<sup>b</sup>Longest assessed and reported follow-up assessment on relevant outcome(s)

<sup>c</sup>reported but irrelevant, as follow-up was conducted at two weeks post-treatment; <sup>d</sup>no posttreatment assessment available, hence follow-up n reported here.

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**Table 2***Efficacy of PPT for Increasing Positive Outcomes and Decreasing Negative Outcomes*

Comparison groups and timepoint of assessment (post-treatment vs. FU)	<i>k</i>	<i>g</i>	<i>SE</i>	95% CI PI	<i>I</i> <sup>2</sup>	<i>NNT</i>
All trials						
Positive outcomes merged (i.e., SWL, happiness, well-being, hope, positive affect, quality of life, self-efficacy, & meaning in life)						
PPT vs. PCC at post-treatment	10	<b>-0.72*</b>	0.30	-1.31; -0.14 PI -2.55; 1.10	90.37***	2.55
PPT vs. PCC at FU	4	-0.36	0.24	-0.83; 0.11 PI -1.29; 0.57	74.34*	5.01
PPT vs. ACC at post-treatment	6	<b>-0.92*</b>	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. ( <i>k</i> = 2)					
PPT vs. OtherATC at post-treatment	6	-0.29	0.31	-0.89; 0.32 PI -1.71; 1.13	79.57***	6.24
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on SWL						
PPT vs. PCC – SWL at post-treatment	4	-0.15	0.13	-0.40; 0.09 PI -0.45; 0.15	11.20	11.55
PPT vs. PCC – SWL at FU	n.a. ( <i>k</i> = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. PCC at post-treatment	8	<b>0.48**</b>	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. PCC at FU	n.a. ( <i>k</i> = 3)					
PPT vs. ACC at post-treatment	All six trials conducted on depression, see below					
PPT vs. OtherATC at post-treatment	6	0.08	0.29	-0.48; 0.64 PI -1.23; 1.39	76.79***	22.22
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on depression						
PPT vs. PCC – depression at post-treatment	6	<b>0.57**</b>	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. PCC – depression at FU	n.a. ( <i>k</i> = 3)					

## Meta-analytic review of positive psychotherapy

PPT vs. ACC - depression at post-treatment	6	<b>0.94*</b>	0.39	0.18; 1.70 PI -0.96; 2.83	90.28***	2.03
PPT vs. ACC - depression at FU	n.a. ( $k = 3$ )					
PPT vs. OtherATC - depression at post-treatment	n.a. ( $k = 3$ )					
Main-analyses with Seligman et al. [1] and Parks-Sheiner [39] omitted (i.e., alliance)						
Positive outcomes merged						
PPT vs. PCC at post-treatment	7	<b>-1.04**</b>	0.38	-1.79; -0.28 PI -3.04; 0.97	88.21	1.87
PPT vs. ACC at post-treatment	n.a. ( $k = 3$ )					
PPT vs. OtherATC at post-treatment	n.a. (i.e. no trials with alliance)					
Negative outcomes merged						
PPT vs. PCC at post-treatment	5	<b>0.63**</b>	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPT vs. ACC at post-treatment	n.a. ( $k = 3$ )					
PPT vs. OtherATC at post-treatment	n.a. (i.e. no trials with alliance)					

*Note:* ACC = Active Control Conditions, included TAU and placebo;  $k$  = number of trials for the respective comparison; n.a. = not applicable; FU = Follow-up; OtherATC = Other Active Treatment Conditions, included Cognitive Behavioral Therapy, Dialectic Behavioral Therapy, and Mindfulness-Based Cognitive Behavioral Therapy; PCC = Passive Control Conditions; PI = prediction interval; SWL = Satisfaction With Life. **Bold** font indicates statistical significance of respective effect size.

\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

**Table 3***Sub-analyses on Trial Quality and Treatment Length as Potential Moderators*

Comparison	<i>k</i>	Intercept	<i>b</i>	<i>rem. I<sup>2</sup></i>	<i>p</i>
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. PCC at post-treatment	10	-3.60	<b>0.17</b>	79.93***	<b>.003</b>
PPT vs. PCC at follow-up	4	-2.56	<b>0.12</b>	38.01	<b>.036</b>
PPT vs. ACC at post-treatment	6	-4.21	<b>0.18</b>	83.61***	<b>.015</b>
PPT vs. OtherATC at post-treatment	6	-0.13	-0.01	82.40***	.907
Sub-analysis on SWL					
PPT vs. PCC at post-treatment	4	-0.02	-0.01	56.42	.915
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. PCC at post-treatment	8	2.00	<b>-0.08</b>	0	<b>.003</b>
PPT vs. ACC at post-treatment	All six trials conducted on depression, see below				
PPT vs. OtherATC at post-treatment	6	-2.24	<b>0.13</b>	21.28	<b>&lt;.001</b>
Sub-analysis on depression					
PPT vs. PCC at post-treatment	6	2.50	<b>-0.11</b>	0	<b>&lt;.001</b>
PPT vs. ACC at post-treatment	6	4.47	<b>-0.17</b>	76.91***	<b>.005</b>
Potential Moderator: Treatment length <sup>a</sup>					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. PCC at post-treatment	9	-1.19	0.00	89.69	.734
PPT vs. PCC at follow-up	n.a. ( <i>k</i> = 3)				
PPT vs. ACC at post-treatment	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post-treatment	6	1.16	-0.00	74.95	.159
Sub-analysis on SWL					
PPT vs. PCC at post-treatment	n.a. ( <i>k</i> = 3)				
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. PCC at post-treatment	7	0.92	-0.00	16.70	.368
PPT vs. ACC at post-treatment	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post-treatment	6	-0.98	0.00	74.26	.285
Sub-analysis on depression					
PPT vs. PCC at post-treatment	5	0.82	-0.00	21.67	.801

Note. ACC = Active Control Condition; OtherATC = Other Active Treatment Condition; PCC = Passive Control Condition; PPT = Positive Psychotherapy; *rem. I<sup>2</sup>* = remaining amount of unexplained heterogeneity in outcomes; SWL = Satisfaction With Life. **Bold** font indicates statistical significance of moderation.



## Meta-analytic review of positive psychotherapy

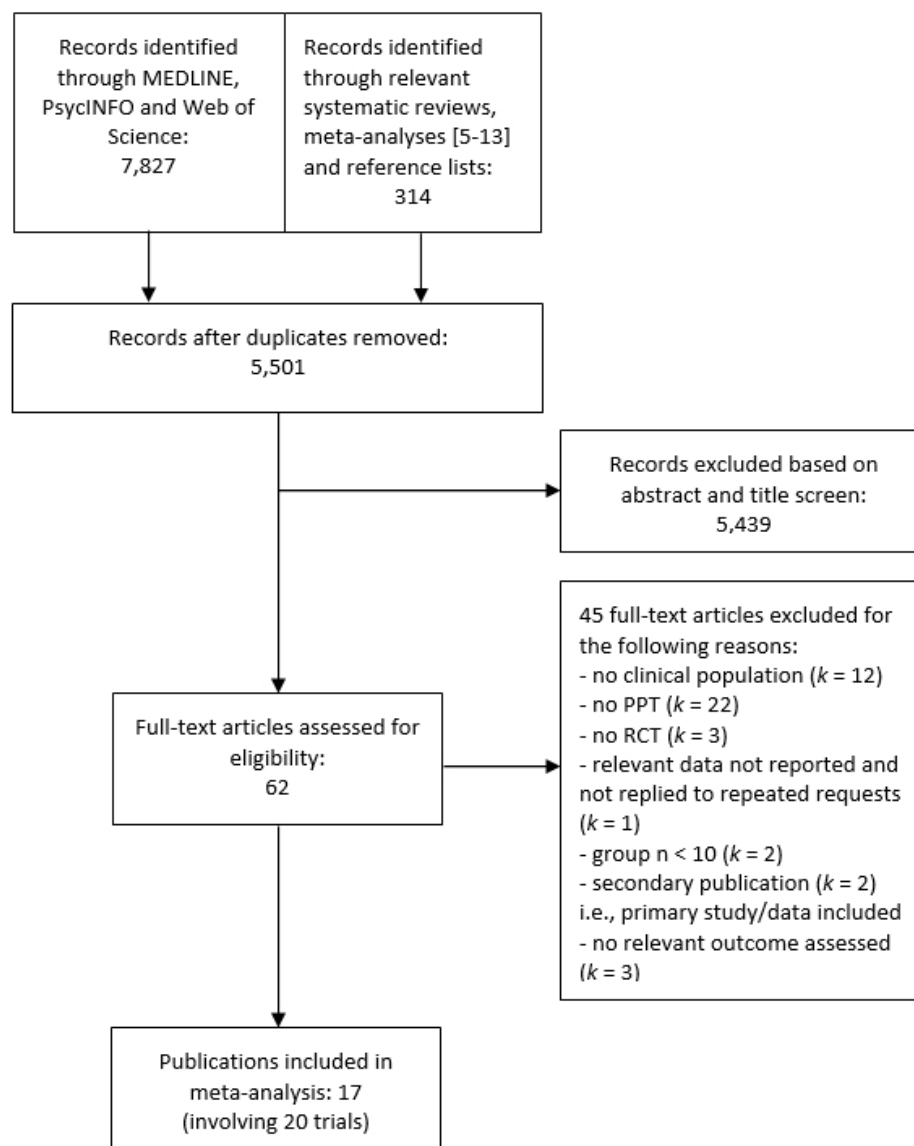
\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

<sup>a</sup>Number of trials differs in comparison to main-analyses since not all publications reported on treatment length as can be witnessed in Table 1.

### Figure Legends

Fig.1 Flow Diagram Depicting Search and Inclusion Process of Randomized Controlled Trials.

Fig.2 Forest plots – Efficacy of PPT vs. Waitlist Controls in Increasing Positive (left) and Decreasing Negative (right) Outcomes at Post-Treatment

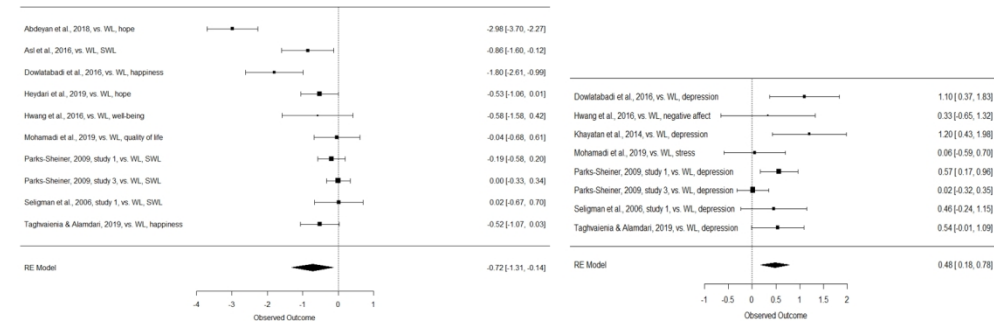


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Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

**Figure 2**

Forest plots – Efficacy of PPT vs. Waitlist Controls in Increasing Positive (left) and Decreasing Negative (right) Outcomes at Post-Treatment

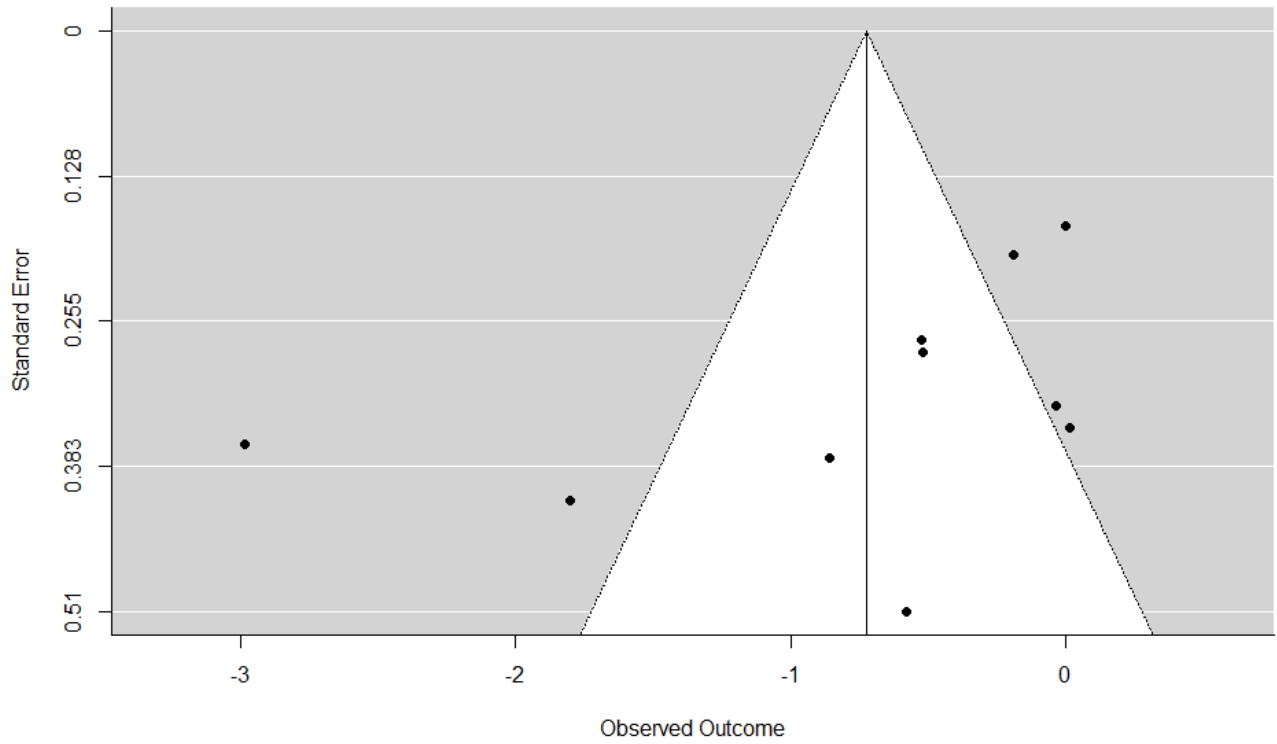


Forest plots Depicting Results on Efficacy of PPT vs. Waitlist Controls in Increasing Positive (left) and Decreasing Negative (right) Outcomes at Post-Treatment

Appendix

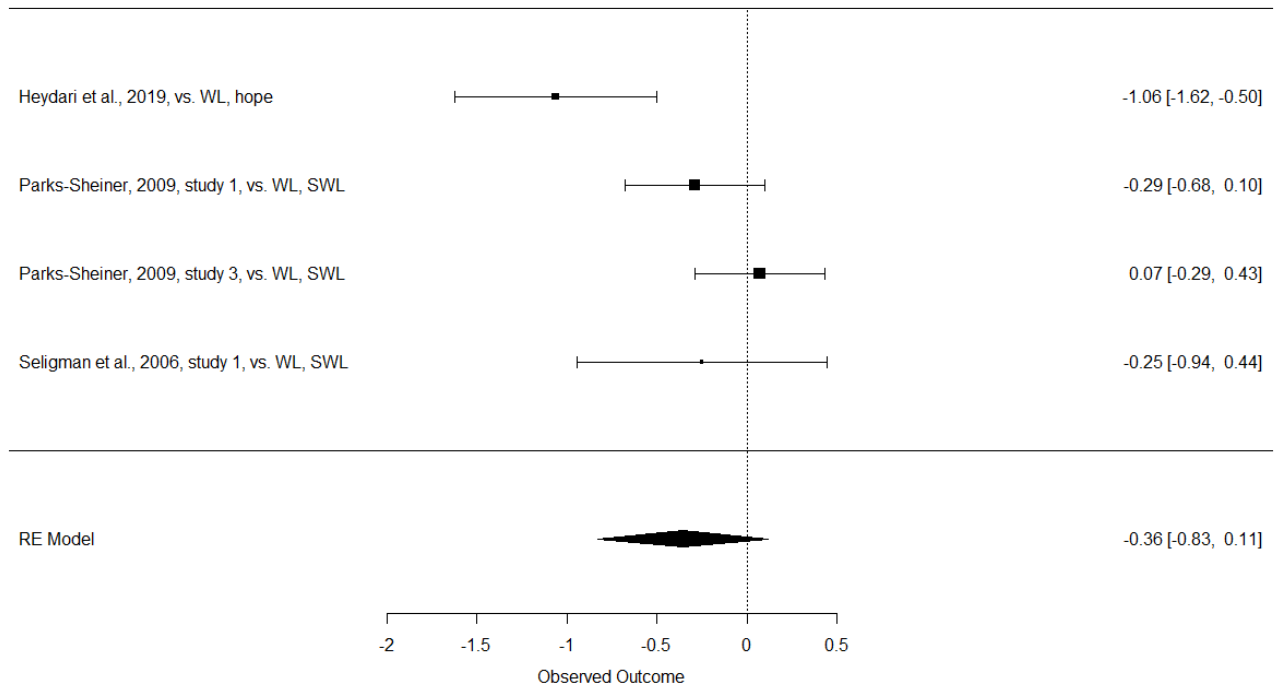
Fig. A1

*Funnel plot – Efficacy of PPT in Increasing Positive Outcomes in Comparison to Passive Control Conditions at Post-Treatment*



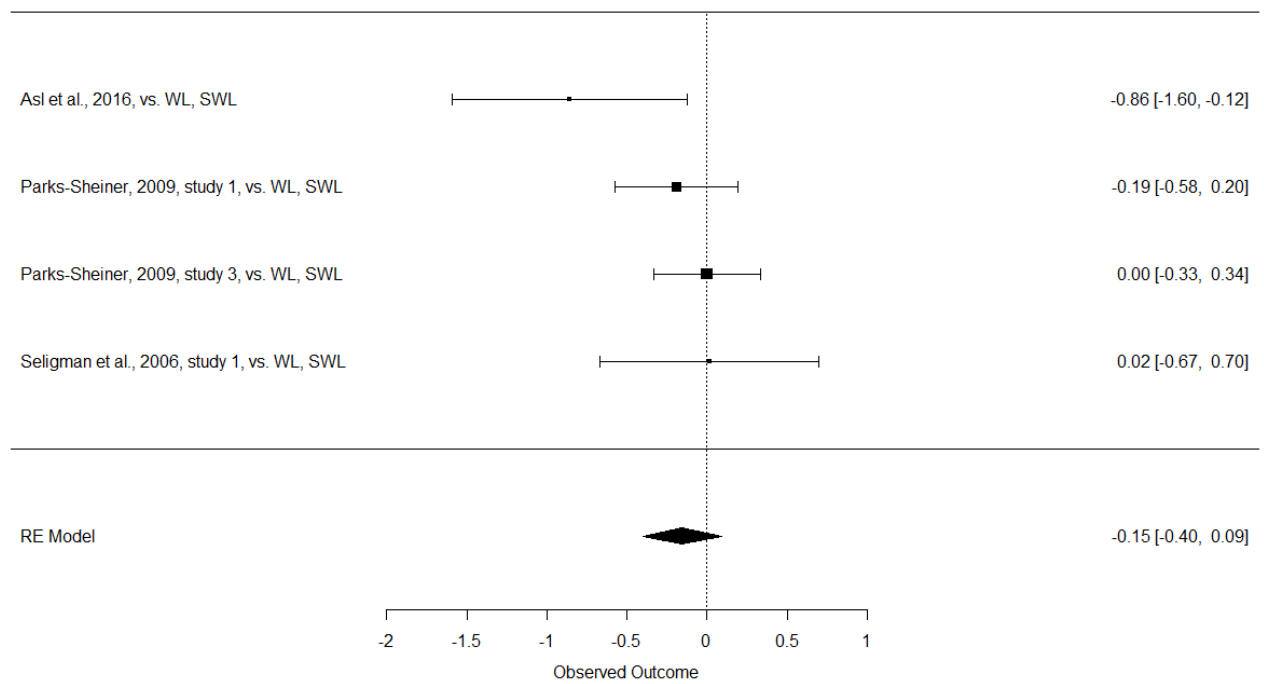
**Fig. A2**

*Forest plot – Efficacy of PPT in Increasing Positive Outcomes in Comparison to Passive Control Conditions at Follow-Up*



**Fig. A3**

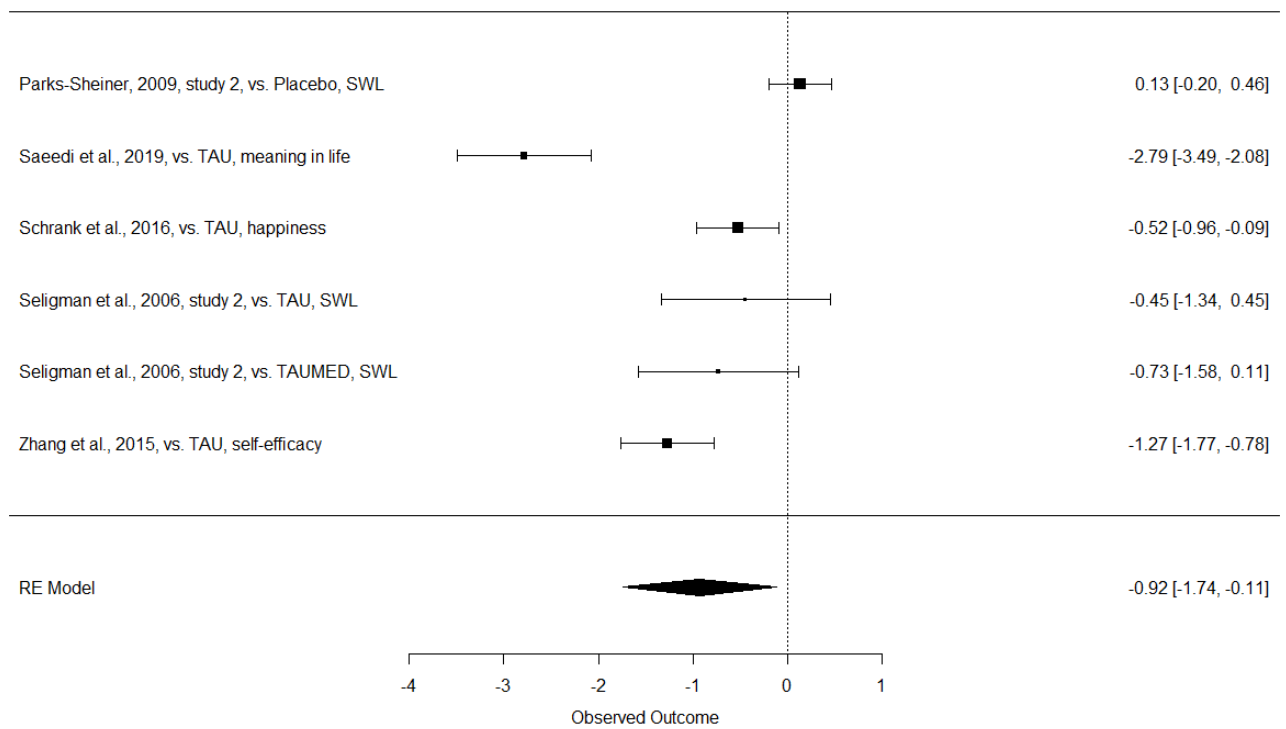
*Forest plot – Efficacy of PPT in Increasing Satisfaction With Life in Comparison to Passive Control Conditions at Post-Treatment*



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**Fig. A4**

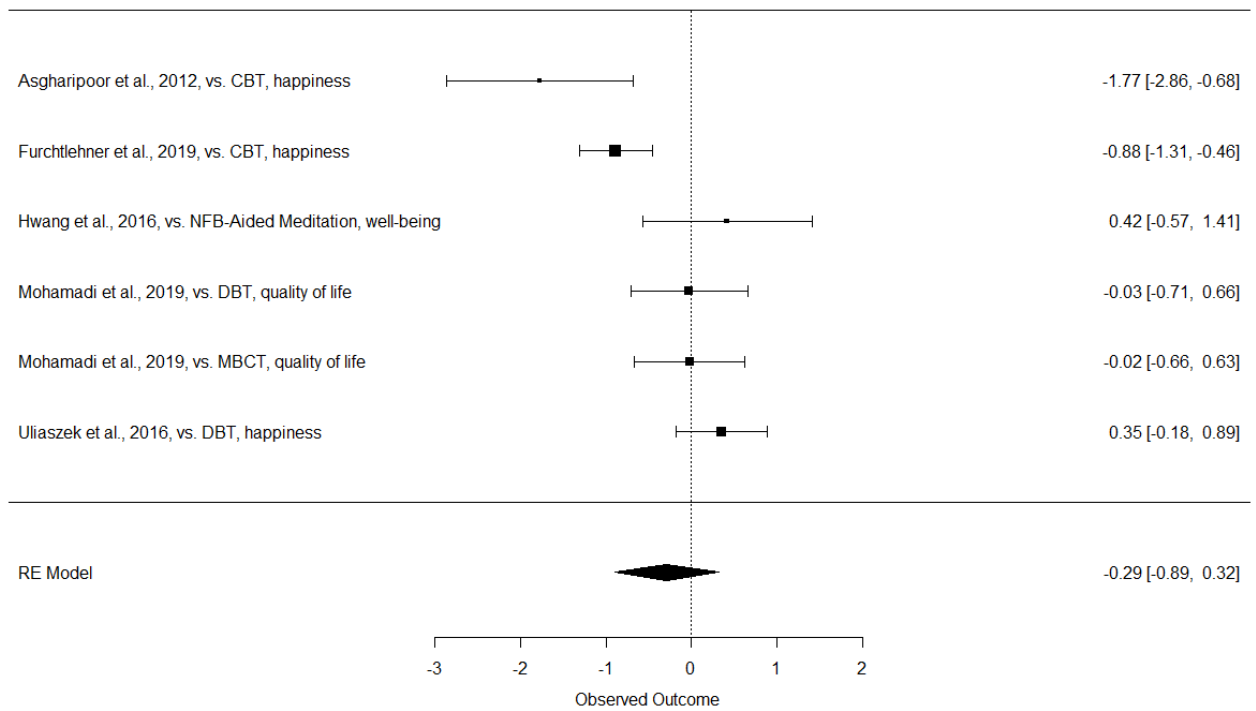
*Forest plot – Efficacy of PPT in Increasing Positive Outcomes in Comparison to Active Control Conditions at Post-Treatment*



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**Fig. A5**

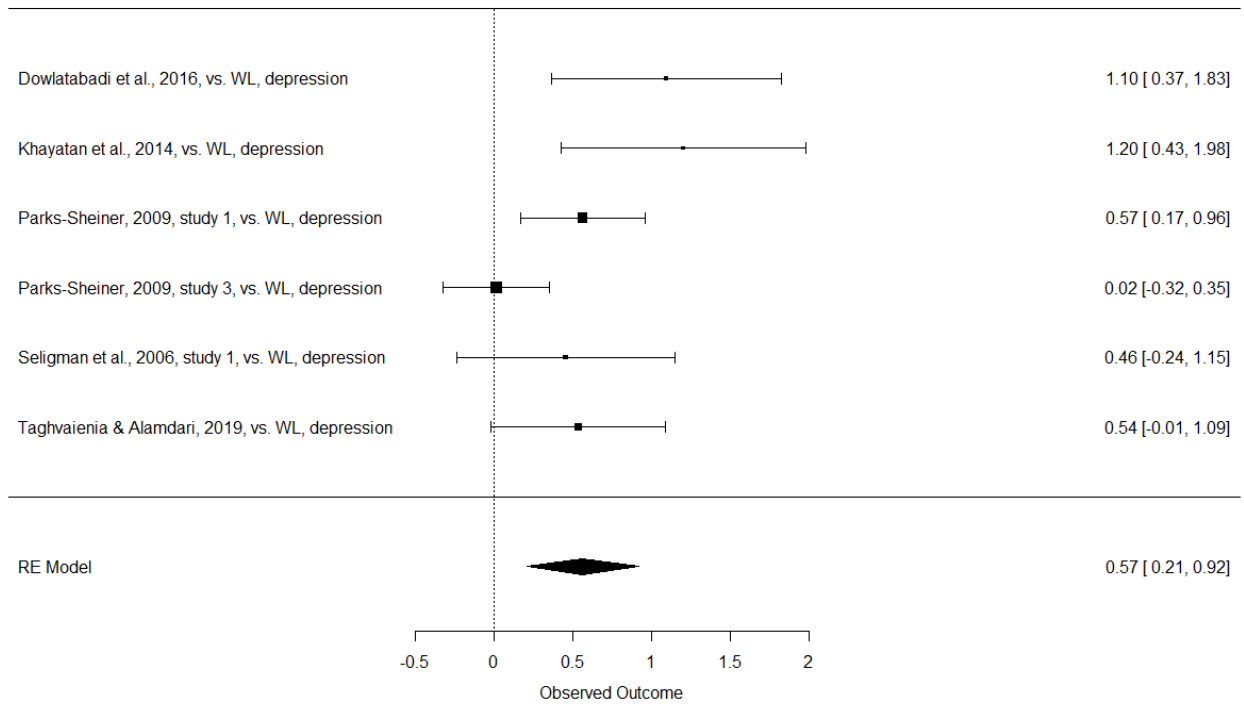
*Forest plot – Efficacy of PPT in Increasing Positive Outcomes in Comparison to Other Active Treatment Conditions at Post-Treatment*





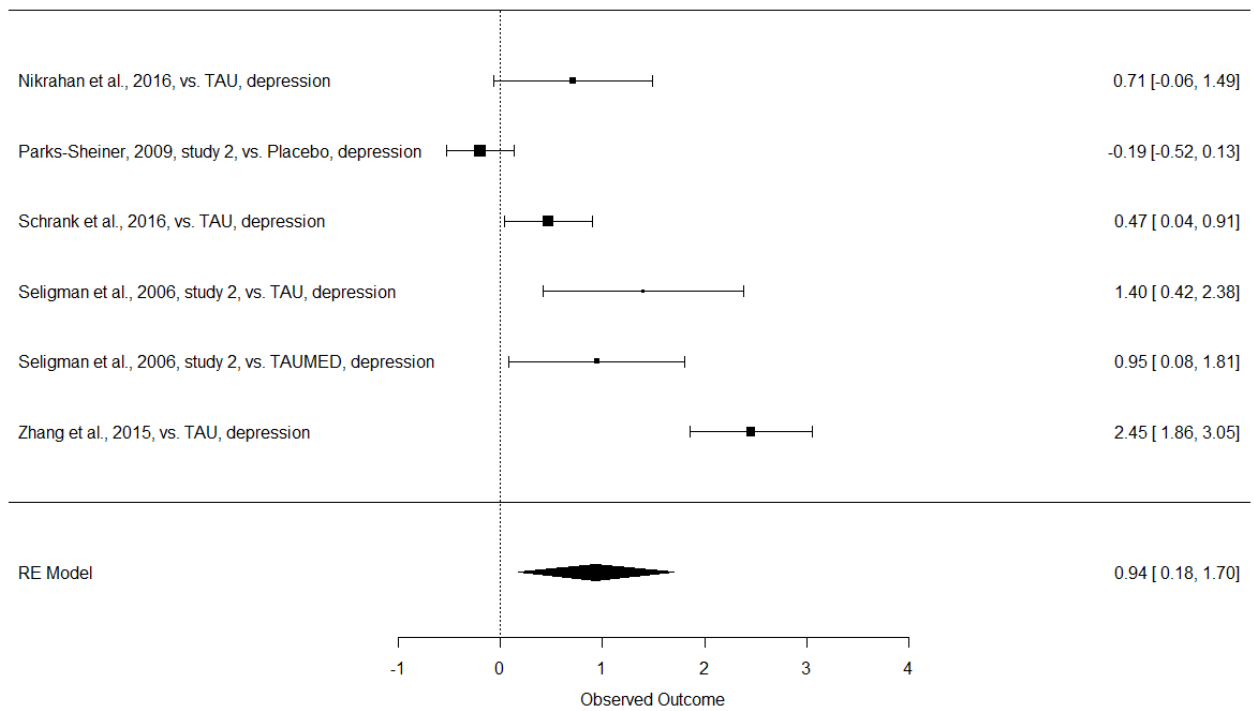
**Fig. A6**

*Forest plot – Efficacy of PPT in Decreasing Depression in Comparison to Passive Control Conditions at Post-Treatment*



**Fig. A7**

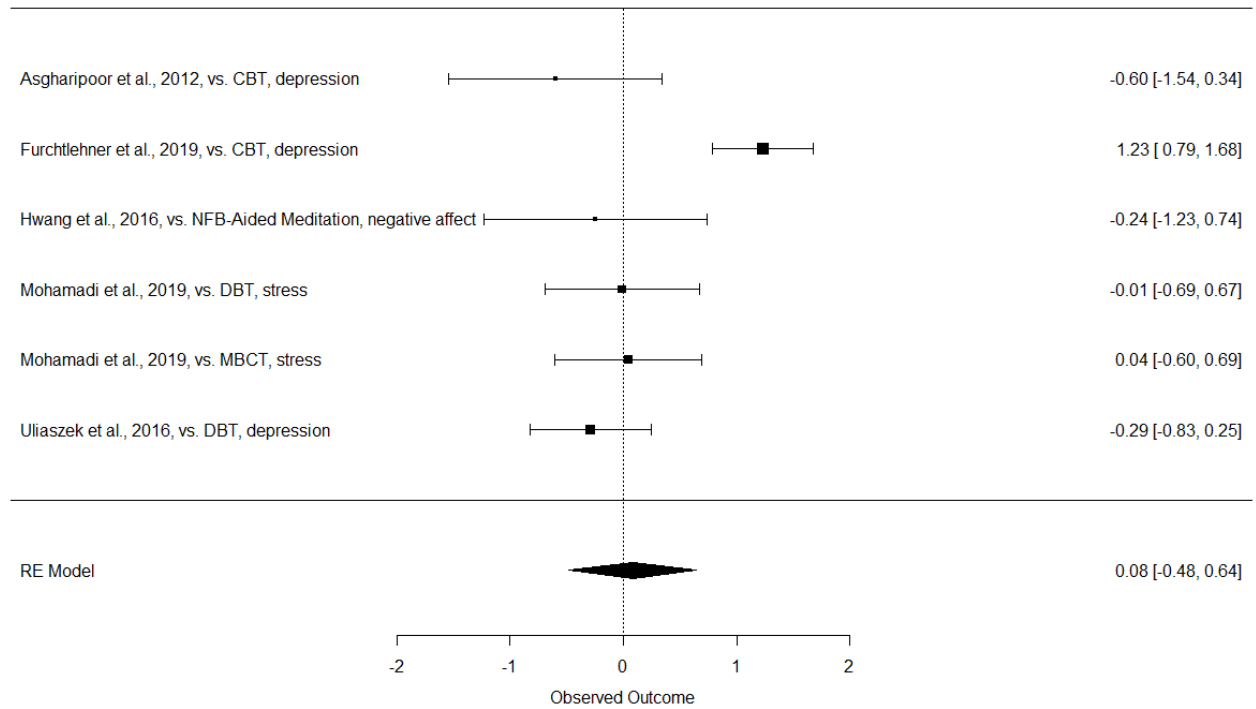
*Forest plot – Efficacy of PPT in Decreasing Negative Outcomes in Comparison to Active Control Conditions at Post-Treatment*



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**Fig. A8**

*Forest plot – Efficacy of PPT in Decreasing Negative Outcomes in Comparison to Other Active Treatment Conditions at Post-Treatment*



**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol\***

Section and topic	Item No	Checklist item	Obeyed?
<b>ADMINISTRATIVE INFORMATION</b>			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	<input checked="" type="checkbox"/>
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	<input checked="" type="checkbox"/>
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	<input checked="" type="checkbox"/>
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	<input checked="" type="checkbox"/>
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	<input checked="" type="checkbox"/>
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	<input checked="" type="checkbox"/>
Support:			
Sources	5a	Indicate sources of financial or other support for the review	<input checked="" type="checkbox"/>
Sponsor	5b	Provide name for the review funder and/or sponsor	<input checked="" type="checkbox"/>
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	<input checked="" type="checkbox"/>
<b>INTRODUCTION</b>			
Rationale	6	Describe the rationale for the review in the context of what is already known	<input checked="" type="checkbox"/>
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	<input checked="" type="checkbox"/>
<b>METHODS</b>			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	<input checked="" type="checkbox"/>
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	<input checked="" type="checkbox"/>
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits such that it could be repeated	<input checked="" type="checkbox"/>

Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	<input checked="" type="checkbox"/>
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	<input checked="" type="checkbox"/>
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently in duplicate), any processes for obtaining and confirming data from investigators	<input checked="" type="checkbox"/>
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	<input checked="" type="checkbox"/>
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	<input checked="" type="checkbox"/>
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	<input checked="" type="checkbox"/>
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	<input checked="" type="checkbox"/>
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I <sup>2</sup> , Kendall's $\tau$ )	<input checked="" type="checkbox"/>
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	<input checked="" type="checkbox"/>
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	<input checked="" type="checkbox"/>
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	<input checked="" type="checkbox"/>
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	<input checked="" type="checkbox"/>

**\* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

*From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.*

# BMJ Open

## The efficacy of positive psychotherapy in reducing negative and enhancing positive psychological outcomes: A meta-analysis

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-046017.R1
Article Type:	Original research
Date Submitted by the Author:	19-May-2021
Complete List of Authors:	Hoppen, Thole; University of Münster, Clinical Psychology and Psychotherapy Morina, Nexhmedin ; University of Münster, Psychology
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health, Evidence based practice
Keywords:	Depression & mood disorders < PSYCHIATRY, Schizophrenia & psychotic disorders < PSYCHIATRY, Cancer pain < ONCOLOGY, Adult psychiatry < PSYCHIATRY, PSYCHIATRY

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11 5 The efficacy of positive psychotherapy in reducing negative and enhancing  
12 positive psychological outcomes: A meta-analysis  
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16 8 Thole H. Hoppen\* & Nexhmedin Morina  
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20 10 Institute of Psychology, University of Münster, Münster, Germany  
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24 12 Short title: Meta-analytic review of positive psychotherapy  
25 13

26 14 *Keywords:* depression, meta-analysis, positive psychotherapy, randomized controlled  
27 15 trial, well-being  
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43 29 Number of Tables: 4

44 30 Number of Figures: 2

45 31 Word count: 4,820 (excl. abstract, key points, statements, references, Tables and Figures)  
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1 Meta-analytic review of positive psychotherapy

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3 32 **Abstract**

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5 33 **Objective:** Positive Psychotherapy (PPT) aims at increasing positive affect, meaning and  
6 34 engagement. We aimed to synthesize the available evidence on PPT efficacy.  
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9 36 **Design:** We conducted a pre-registered systematic literature search and meta-analysis of  
10 37 randomized controlled trials examining the efficacy of PPT for increasing positive (e.g.,  
11 38 satisfaction with life) or decreasing negative psychological outcomes (e.g., depression).  
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14 40 **Data sources:** Medline, PsycINFO, and Web of Science from 2006 (i.e., inception of PPT) to  
15 41 Feb 2020 as well as related systematic reviews and meta-analyses.  
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18 43 **Results:** We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were  
19 44 found for increasing positive outcomes ( $g = -0.72$ , 95%CI: -1.31; -0.14,  $k = 10$ ,  $NNT = 2.55$ ) and  
20 45 reducing negative outcomes ( $g = 0.48$ , 95%CI: 0.18; 0.78,  $k = 8$ ,  $NNT = 3.76$ ) when PPT was  
21 46 compared to waitlist control conditions at post-treatment assessment. When compared to active  
22 47 control conditions, PPT yielded large effect sizes for increasing positive outcomes ( $g = -$   
23 48  $0.92$ , 95%CI: -1.74; -0.11,  $k = 6$ ,  $NNT = 2.05$ ) and reducing depression ( $g = 0.94$ , 95%CI: 0.18;  
24 49 1.70,  $k = 6$ ,  $NNT = 2.03$ ) at post-treatment assessment. No significant differences in efficacy  
25 50 were found when compared to established treatments such as cognitive behavioural therapy.  
26 51 Evidence was found to support an association between trial quality and effect sizes. For positive  
27 52 outcomes, higher trial quality was related with higher effect size. Whereas higher trial quality  
28 53 was related with lower effect size for depression. Follow-up assessments remained too scarce for  
29 54 most planned analyses.  
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32 56 **Conclusions:** Our findings support the short-term efficacy of PPT. However, results are to be  
33 57 regarded with due caution in the light of low number of trials. More high-quality trials that assess  
34 58 efficacy at follow-ups are needed to draw firmer conclusions on the long-term efficacy of PPT.  
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37 60 **PROSPERO registration number:** CRD42020173567  
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Meta-analytic review of positive psychotherapy

61 **Strengths and limitations of this study**

- 62 • This meta-analysis was pre-registered and conducted in line with the PRISMA guidelines
- 63 • Data synthesis was based on a broad systematic literature search including broad  
64 secondary manual searches
- 65 • Potential moderators including trial quality, treatment lengths and alliance were analysed
- 66 • Scarcity of available trials precluded many (sub-)analyses and asks for due caution in  
67 interpreting the present findings
- 68 • Due to lacking follow-up assessment, long-term efficacy could not be determined
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1 Meta-analytic review of positive psychotherapy

2  
3 71 **Introduction**

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5 72 Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology  
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7 73 and proposes that psychopathology such as depression can be effectively treated by directly and  
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9 74 primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging  
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11 75 to and serving something greater than the self) and engagement (i.e., active involvement in daily  
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13 76 life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be  
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15 77 successfully dampened. While the founders believed from inception that PPT might be an  
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17 78 effective treatment for various disorders, they started off by investigating its efficacy in treating  
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19 79 depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three*  
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21 80 *Good Things* and the *Gratitude Visit*. In *Using Your Strength*, for instance, participants are asked  
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23 81 to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use  
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25 82 their top five strengths more in daily life. Seligman and colleagues ended up including 26  
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27 83 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on  
28  
29 84 the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11  
30  
31 85 mildly to moderately depressed students per group and found that PPT was effective in lowering  
32  
33 86 depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They  
34  
35 87 also conducted a second RCT where they offered a 14-session individual PPT over 12 weeks in a  
36  
37 88 sample of adults suffering from major depressive disorder. Again, PPT was found effective in  
38  
39 89 decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1]  
40  
41 90 Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further  
42  
43 91 research on populations suffering depressive symptoms or depressive disorders, PPT has been  
44  
45 92 investigated in various other contexts including patients with psychosis[4] and multiple other  
46  
47 93 mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or  
48  
49 94 multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe  
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1 Meta-analytic review of positive psychotherapy

2  
3 95 summarized the findings of 12 publications (from 9 individuals trials) published before May  
4  
5 96 2015.[3] The authors conclude that the application of PPT in intervention research is  
6  
7  
8 97 heterogenous in terms of both, the modifications of the original manual as well as the conditions  
9  
10 98 targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-  
11  
12 99 analysis with an exclusive focus on the efficacy of PPT has been published to this date. Against  
13  
14  
15 100 this background, we performed a systematic literature review and meta-analysis of randomized  
16  
17 101 controlled trials assessing the efficacy of PPT.  
18

## 19 102 20 103 **Methods**

21  
22 104 Following the recommendations by the Preferred Reporting Items for Systematic  
23  
24 105 Reviews and Meta-analysis (PRISMA) group,[10] we defined the main structured research  
25  
26 106 question describing the Population, Intervention, Comparison, Outcome, and Study design  
27  
28 107 (PICOS) as “In individuals with mental or physical health complaints, does PPT (I), compared to  
29  
30 108 control conditions (C), improve psychological outcomes (O) in randomized controlled trials  
31  
32 109 (S)?”. We pre-registered the present meta-analysis in the PROSPERO database (ID:  
33  
34  
35 110 CRD42020173567).  
36  
37

## 38 111 **Patient and Public Involvement**

39  
40  
41 112 Not applicable. We performed a meta-analysis on published data.  
42

## 43 113 **Literature Search Strategy**

44  
45 114 Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled  
46  
47 115 Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a  
48  
49 116 minimum of ten participants per treatment arm at post-treatment assessment with available data  
50  
51 117 on at least one relevant outcome. No restrictions were placed on age of participants, comparison  
52  
53 118 condition, or publication type. Studies that only applied a mixture of PPT with another  
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1 Meta-analytic review of positive psychotherapy  
2  
3 119 intervention, such as a mixture of PPT and cognitive behavioral therapy in comparison to a  
4  
5 120 control condition,[9] were excluded due to our narrow focus on the efficacy of PPT, as founded  
6  
7  
8 121 by Seligman et al.[1]. We searched the following databases: PsycINFO, MEDLINE, and Web of  
9  
10 122 Science from 2006 up to 13<sup>th</sup> of February 2020. The year 2006 represents the year where the  
11  
12 123 theoretical underpinnings of the PPT were first published.[1] No other limits or filters were  
13  
14 124 applied. MeSH terms for Ebscohost (regarding MEDLINE and PsycINFO) were as follows: “SU  
15  
16 125 positive psychotherapy OR TI positive psychotherapy OR AB positive psychotherapy” (see also  
17  
18 126 eList 1 in the supplementary materials). In Web of Science a similar search string to Ebscohost  
19  
20 127 was chosen to search for “positive psychotherapy” in titles, abstracts, and keywords. To retrieve  
21  
22 128 additional publications, the reference lists of all included papers and relevant (i.e., related) meta-  
23  
24 129 analyses and systematic reviews were manually screened.[11–19] Secondary hand searches were  
25  
26 130 conducted using Google Scholar. The study synthesis was performed independently by both  
27  
28  
29  
30  
31 131 authors.

### 32 33 132 **Coding of Studies**

34  
35 133 The publications were independently coded by both authors. From each publication, the  
36  
37 134 following study, intervention and participant characteristics were coded and extracted: country  
38  
39 135 the trial was conducted in, clinical population targeted (i.e., any physical or mental health  
40  
41 136 condition), experimental intervention type (i.e., original PPT manual or modified version),  
42  
43 137 intervention format (i.e., individual or group), comparison group(s), session number and session  
44  
45 138 duration in minutes, follow-up duration in months for the longest reported follow-up assessment  
46  
47 139 of the relevant outcome(s), number of participants at post-treatment assessment, age of  
48  
49 140 participants (i.e., mean and standard deviation or range), proportion of sample with female sex in  
50  
51 141 percent, applied statistical analysis (i.e., completer or intent-to-treat analyses) and relevant  
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1 Meta-analytic review of positive psychotherapy

2  
3 142 outcome(s) targeted by PPT. The post-treatment assessment experimental group and control  
4  
5 143 group means, standard deviations and sample sizes on the relevant outcome(s) (see in more detail  
6  
7  
8 144 below) were extracted. When reported, follow-up assessment data on relevant outcomes per  
9  
10 145 group were also extracted. When multiple follow-up assessments were reported, the data from  
11  
12 146 the longest follow-up assessment were retrieved. When relevant data was not reported, it was  
13  
14 147 either calculated from given data (e.g., standard deviations from standard errors) or the  
15  
16 148 corresponding author of the respective publication was contacted via email twice with one month  
17  
18 149 in between. In one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and  
19  
20 150 Drikvand potentially reported the means and SDs for a relevant outcome (i.e., quality of life) in  
21  
22 151 wrong order (i.e., means where SDs should be placed and vice versa) [20]. We contacted the  
23  
24 152 authors twice via Email and were left with no response. Consequently, we calculated two  
25  
26 153 analyses; one with changed order of means and SD and one with unchanged order.  
27  
28 154 We divided control conditions into passive control conditions, which turned out to exclusively  
29  
30 155 consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual &  
31  
32 156 placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy /  
33  
34 157 CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy  
35  
36 158 / MBCT). Note that included trials included different physical or mental health conditions and,  
37  
38 159 therefore, TAU may involve various different treatment regimens.  
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43

#### 44 160 **Quality Assessment**

45  
46  
47 161 Both authors independently rated the quality of the included trials by using a quality  
48  
49 162 assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted  
50  
51 163 in two subsequent meta-analyses.[21-23] After independent rating, regular digital meetings were  
52  
53 164 held to discuss disagreements. This scale assesses the following nine quality criteria: 1) Were  
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1 Meta-analytic review of positive psychotherapy  
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3 165 symptoms/diagnoses assessed with a semi-structured diagnostic interview?, 2) Was a treatment  
4  
5 166 manual used?, 3) Were therapists trained either specifically for the study or in a general  
6  
7 167 training?, 4) Was treatment integrity checked by supervision and/or recordings and/or  
8  
9 168 standardized instruments?, 5) Was data analyzed with intent-to-treat analysis?, 6) Was group  
10  
11 169 allocation performed with a true randomization technique?, 7) Was randomization done by an  
12  
13 170 independent third person (or computer or sealed envelopes)?, 8) Were blinded assessors used for  
14  
15 171 interviews?, and 9) Were dropouts adequately reported? Items for each of the nine quality  
16  
17 172 criteria were scored on a four-point scale, where 3 indicates high quality (e.g., a published  
18  
19 173 treatment manual was used), 2 indicates limited quality (e.g., an unpublished treatment manual  
20  
21 174 was used), 1 indicates lack of required quality (e.g., no treatment manual was used), and 0  
22  
23 175 indicates unknown (i.e., required information not reported). When self-report measures were  
24  
25 176 used to assess outcomes in a given trial, a score of 3 was given on the quality item concerning  
26  
27 177 blinded assessments. In case of technology-based interventions, a trial received a score of 3 on  
28  
29 178 the quality items concerning trained therapists and formal fidelity checks due to the technology-  
30  
31 179 based standardized procedure. The nine ratings were then summed up to yield the respective trial  
32  
33 180 quality sum score and used as a potential moderator in meta-regressions.

#### 181 **Data extraction of outcome measures**

182 For each study, a maximum of two outcomes were selected, one positive psychological outcome  
183 (if available) and one negative (if available). Choice of extracted positive and/or negative  
184 psychological outcome(s) was data-driven. That is, we first extracted all negative and positive  
185 psychological outcomes per trial and then analyzed across all included trials which positive and  
186 negative psychological outcomes were most frequently assessed and reported in the PPT trial  
187 literature. For the negative outcomes, depression was by far the most frequently assessed



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188 outcome ( $k = 14$ ) and the sole negative outcome extracted. Assessment of positive outcomes was  
189 more heterogenous. Satisfaction with life was assessed most often ( $k = 11$ ), consecutively  
190 followed by happiness ( $k = 9$ ), well-being ( $k = 5$ ), hope ( $k = 5$ ), positive affect ( $k = 4$ ), quality of  
191 life ( $k = 3$ ), self-efficacy ( $k = 2$ ) and meaning in life ( $k = 1$ ). As such, we prioritized satisfaction  
192 with life first in the data extraction phase when several positive outcomes were reported in a  
193 given trial, happiness second and so forth. We planned to conduct two overarching analyses  
194 across included negative and positive outcomes, respectively, as well as sub-analyses on all  
195 individual outcomes with a sufficient number of independent trials (i.e.,  $k \geq 4$ ). Data was  
196 extracted by both authors and regular digital meetings were held to discuss disagreements.

### 197 **Statistical Analysis**

198 Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-  
199 effects models given that we expected large heterogeneity in reported effect sizes .[24–26] We  
200 prioritized intent-to-treat (ITT) data when available ( $k = 3$ ) over completer data ( $k = 17$ ,  
201 including  $k = 3$  with insufficient information on participant flow, see Table 1 for further  
202 information). To obtain the effect size Hedges's  $g$ , R first calculates the standardized mean  
203 difference  $d$  (i.e., control group mean subtracted from the experimental group mean and then  
204 divided by the pooled standard deviation). The standardized mean difference is then multiplied  
205 by a sample size correction factor  $J = 1 - (3 / (4df - 1))$  to yield Hedges's  $g$ . [27] Analyses were  
206 conducted if four or more trials were available for a given (sub-)analysis. [28] Effect sizes  $g$  may  
207 be conservatively interpreted with Cohen's convention of small ( $\pm 0.2$ ), medium ( $\pm 0.5$ ) and large  
208 ( $\pm 0.8$ ) effects. [29] As a test of homogeneity of effect sizes, we calculated the Q-statistic and the  
209 corresponding p-value. We also calculated the  $I^2$ -statistic, as a measure of heterogeneity of effect  
210 sizes across trials in percent. It has been suggested that  $I^2$ -statistics of 25, 50, and 75% may be



1 Meta-analytic review of positive psychotherapy  
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3 211 interpreted as referring to low, moderate, and high levels of heterogeneity, respectively.[30]  
4  
5 212 Because we expected large heterogeneity, we also calculated prediction intervals.[31] Prediction  
6  
7 213 intervals, unlike  $I^2$ -statistics, present a heterogeneity estimate in the same metric as the original  
8  
9 214 effect size measure (i.e.,  $g$ ). As such, prediction intervals provide a predicted range for the true  
10  
11 215 treatment effect in similar future trials.[32] In other words, when both the confidence interval  
12  
13 216 and the prediction interval for a given (sub-)analysis exclude the null, statistical certainty was  
14  
15 217 found for the hypothesis that similar future trials will also find significant effects for the given  
16  
17 218 comparison. To check for potential effects of outliers on meta-analytic outcomes, we aimed at  
18  
19 219 repeating analyses without identified outliers. Outliers were defined as effect sizes departing 3.3  
20  
21 220 standard deviations away from the pooled mean effect in both directions.[33, 34] However, no  
22  
23 221 outliers were identified in any of the performed analyses. When analyses consisted of at least ten  
24  
25 222 trials,[35] we assessed risk of publication bias through visual inspection of funnel plots, Egger's  
26  
27 223 test of asymmetry and number of missing studies using the trim-and fill procedure.[36] The trim-  
28  
29 224 and-fill procedure yields an asymmetry-corrected estimate of the effect size (i.e., taking  
30  
31 225 publication bias into account). We calculated the numbers needed to treat (NNT) as a measure of  
32  
33 226 efficacy that is easily interpretable from a clinical perspective. It informs about the numbers of  
34  
35 227 patients that need to be treated until one adverse event is prevented.[37] NNT were calculated  
36  
37 228 with the NNT function of the dmetar package and are based on the pooled effect sizes (i.e.,  
38  
39 229 Hedges'  $g$ ). Lastly, we performed moderator analyses in R with trial quality sum score and  
40  
41 230 treatment length (in minutes) as continuous variables (i.e., meta-regressions) and alliance as a  
42  
43 231 dichotomous variable (i.e., trials with vs. without the involvement of the founders of PPT[1]) to  
44  
45 232 check for potential moderating effects on efficacy outcomes. Since too few trials were available  
46  
47 233 to check for alliance, we performed sensitivity analyses with trials involving the founders  
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234 omitted.[1] Moreover, we performed more general sensitivity analyses with the leaving1out  
235 function of the metafor package.

236

237

## Results

### 238 Study characteristics

239 Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a  
240 total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of  
241 the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with  
242 WLC. Five trials (25%) compared PPT with an active control condition (e.g., treatment-as-usual,  
243 control exercises). Three trials (15%) compared PPT with another psychological intervention  
244 (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more than one control  
245 conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and the remaining 6  
246 trials in an individual setting. Two of the latter trials described in one publication applied an  
247 internet-based PPT.[39] Treatment lengths was 917.06 minutes on average (unweighted mean  
248 across trials reporting on both, number and duration of sessions,  $k = 17$ ) with a standard  
249 deviation of 374.79 minutes. Note that the pioneering manual of Seligman et al.[1] constitutes of  
250 a 720 minutes (i.e., 12 sessions á 60 minutes). Average number of sessions was 9.17 ( $SD = 2.71$ )  
251 and average session length was 101.76 minutes ( $SD = 22.03$ ). Ten trials (50%) conducted follow-  
252 up assessments on relevant outcomes whereas nine trials failed to do so. The remaining study  
253 assessed data on a relevant outcome two weeks after the post-treatment-assessment,[40] which  
254 we excluded from the follow-up data due to too short amount of time between post- and follow-  
255 up assessment. The average follow-up period was 7.10 months ( $SD = 4.21$ ). Most trials were  
256 conducted in Iran ( $k = 10$ ) and the United States of America ( $k = 5$ ). The remaining trials were

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2  
3 257 conducted in Austria (k = 1), South Korea (k = 1), Canada (k = 1), China (k = 1) and the United  
4  
5 258 Kingdom (k = 1). One publication entailing three trials was a PhD dissertation,[39] whereas the  
6  
7 259 remaining trials constituted articles published in peer-reviewed journals. Study quality was  
8  
9  
10 260 moderate overall with a mean of 17.85 out of the possible range from 0 to 27. Study quality  
11  
12 261 varied considerably across included trials with a standard deviation of 4.69. The detailed quality  
13  
14 262 assessment per trial can be found in Table 2.  
15  
16  
17 263  
18  
19 264

20 **-Table 1 here-**

### 21 265

### 22 266 **Participant characteristics**

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24  
25  
26 267 Basic characteristics of included participants per trial can be found in Table 1. A total of  
27  
28 268 1,360 participants participated in the included trials. Most of the participants were female  
29  
30 269 (unweighted mean across included trials = 71.75%) with a range from 23.63%[41] to 100%.[42]  
31  
32  
33 270 The patients had a pooled weighted mean age of 39.97 with a pooled standard deviation of 10.18.  
34  
35 271 It is worth noting, however, that several studies did only report age ranges rather than means and  
36  
37 272 standard deviations[43] or did not report on age altogether.[39]  
38  
39

### 40 273 **The Efficacy of PPT in Increasing Positive Outcomes**

41  
42 274 Results on the efficacy of PPT are displayed in Table 3. In terms of increasing various  
43  
44 275 positive outcomes such as satisfaction with life (SWL) and happiness, PPT was found  
45  
46 276 moderately more effective than WLC at post-treatment assessment ( $g = -0.72$ ,  $95\%CI: -1.31; -$   
47  
48 277  $0.14$ ,  $k = 10$ ,  $NNT = 2.55$ ). See Figure 2 for the corresponding forest plot. Results remained  
49  
50 278 similar, when the results of Mohamadi et al.[20] were entered as reported in their publication ( $g$   
51  
52 279  $= -0.82$ ,  $95\%CI: -1.39; -0.25$ ,  $k = 10$ ,  $NNT = 2.27$ ). Number of available trials allowed for a  
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2  
3 280 publication bias check. While a visual inspection of the funnel plot led to the suspicion of  
4  
5 281 publication bias (i.e., missing trials to the left and a potential outlier to the far left, see eFig. 1 in  
6  
7 282 the supplement), Egger's test did not indicate significant asymmetry ( $t = -1.91$ ,  $p = .093$ ). The  
8  
9 283 sensitivity analysis yielded that one trial had particular influence on the pooled effect size. When  
10  
11 284 Abdeyan et al., 2018 (i.e., assessed positive outcome = hope) was omitted, pooled effect size  
12  
13 285 decreased to  $g = -0.44$  (see eTable 1 in the supplement). No evidence was found for the efficacy  
14  
15 286 of PPT in increasing positive outcomes compared to WLC at follow-up assessment ( $g = -0.36$ ,  
16  
17 287  $95\%CI: -0.83; 0.11$ ,  $k = 4$ ,  $NNT = 5.01$ ). See eFigure 2 in the supplement for the corresponding  
18  
19 288 forest plot. Follow-up assessment results are to be scrutinized with due caution in the light of low  
20  
21 289 number of available trials ( $k = 4$ ), large heterogeneity in effect sizes ( $I^2 = 74.34$ ) and the wide  
22  
23 290 range of the prediction interval ( $PI = -1.29; 0.57$ ). Satisfaction with life was the only positive  
24  
25 291 outcome with enough trials to warrant a meta-analytic sub-analysis. In comparison to WLC at  
26  
27 292 post-treatment assessment, PPT was not found more effective in increasing satisfaction with life  
28  
29 293 ( $g = -0.15$ ,  $95\%CI: -0.40; 0.09$ ,  $k = 4$ ,  $NNT = 11.55$ ). See eFigure 3 in the supplement for the  
30  
31 294 corresponding forest plot. Heterogeneity in outcomes was low ( $I^2 = 11.20$ ). The sensitivity  
32  
33 295 analysis did not yield that one of the four studies was particularly influential on the pooled effect  
34  
35 296 with all leaving out analyses yielding a non-significant pooled  $g$  (see eTable 1 in the  
36  
37 297 supplement). In comparison to active control conditions (i.e., treatment-as-usual and placebo  
38  
39 298 exercises) at post-treatment assessment, PPT yielded a large effect size in increasing positive  
40  
41 299 outcomes ( $g = -0.92$ ,  $95\%CI: -1.74; -0.11$ ,  $k = 6$ ,  $NNT = 2.05$ ). See eFigure 4 in the supplement  
42  
43 300 for the corresponding forest plot. However, heterogeneity in outcomes was large ( $I^2 = 92.51$ ) and  
44  
45 301 the prediction interval included the null ( $PI = -2.98; 1.13$ ) illustrating large variability in  
46  
47 302 findings. When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, &  
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2  
3 303 Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were  
4  
5 304 found for increasing positive outcomes ( $g = -0.29$ ,  $95\%CI: -0.89; 0.32$ ,  $k = 6$ ,  $NNT = 6.24$ ). See  
6  
7  
8 305 eFigure 5 in the supplement for the corresponding forest plot. Again, heterogeneity in outcomes  
9  
10 306 was large ( $I^2 = 79.57$ ) and the prediction interval included the null ( $PI = -1.71; 1.13$ ). Results  
11  
12 307 remained insignificant when results of Mohamadi et al.[20] were entered as reported in their  
13  
14 308 publication ( $g = -0.65$ ,  $95\%CI: -1.31; 0.01$ ,  $k = 6$ ). Lastly, when trials with alliance (i.e.,  
15  
16 309 involvement of the founder) were omitted, results for the comparison with WLC at post-  
17  
18 310 treatment assessment remained similar ( $g = -1.04$ ,  $95\%CI: -1.79; -0.28$ ,  $k = 7$ ,  $NNT = 1.87$ , see  
19  
20 311 Table 3).

### 24 312 **The Efficacy of PPT in Decreasing Negative Outcomes**

26 313 PPT was found moderately more effective in reducing depression, negative affect and  
27  
28 314 stress than WLC at post-treatment assessment ( $g = 0.48$ ,  $95\%CI: 0.18; 0.78$ ,  $k = 8$ ). See Figure 2  
29  
30 315 for the corresponding forest plot. To avoid one adverse event (i.e., depression, negative affect or  
31  
32 316 stress), a little less than four patients needed to be treated ( $NNT = 3.76$ ). The sensitivity analysis  
33  
34 317 did not yield that one of the eight studies was particularly influential on the pooled effect with all  
35  
36 318 leaving1out analyses yielding moderate pooled effect sizes between 0.40 and 0.58 (see eTable 1  
37  
38 319 in the supplement). Results on decreasing depression were similar ( $g = 0.57$ ,  $95\%CI: 0.21; 0.92$ ,  
39  
40 320  $k = 6$ ,  $NNT = 3.22$ ). See eFigure 6 in the supplement for the corresponding forest plot. Again, the  
41  
42 321 sensitivity analysis did not yield that one of the six studies was particularly influential with  
43  
44 322 moderate pooled effect sizes between 0.47 and 0.68 for the leaving1out analyses (see eTable 1 in  
45  
46 323 the supplement). Prediction intervals for both analyses (i.e., all negative outcomes and  
47  
48 324 depression only) excluded the null ( $PI = -0.17; 1.13$ ;  $PI = -0.18; 1.31$ , respectively) highlighting  
49  
50  
51 325 substantial levels of heterogeneity in efficacy outcomes and remaining uncertainty about the true  
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3 326 efficacy when similar future trials accumulate. In comparison to active control conditions (i.e.,  
4  
5 327 treatment-as-usual with or without medication and placebo exercises) at post-treatment  
6  
7 328 assessment, PPT yielded large effect sizes in reducing depression ( $g = 0.94$ ,  $95\%CI$ : 0.18; 1.70,  $k$   
8  
9  
10 329 = 6,  $NNT = 2.03$ ). Please find the corresponding forest plot in eFigure 7 in the supplementary  
11  
12 330 materials. Again, heterogeneity was large ( $I^2 = 90.28$ ) and the prediction interval excluded the  
13  
14 331 null ( $PI = -0.96$ ; 2.83). When compared to other active treatment conditions (i.e., CBT, DBT,  
15  
16 332 MBCT, & Neurofeedback-aided Meditation), no differences in efficacy at post-treatment  
17  
18 333 assessment were found for decreasing negative outcomes ( $g = 0.08$ ,  $95\%CI$ : -0.48; 0.64,  $k = 6$ ,  
19  
20 334  $NNT = 22.22$ ). Please find the corresponding forest plot in eFigure 8 in the supplement. Trials  
21  
22 335 that included follow-up assessments on the efficacy of PPT in decreasing negative outcomes  
23  
24 336 were too few to allow for meta-analytic review for all included comparisons ( $k < 4$ ). Lastly,  
25  
26 337 when trials with alliance (i.e., involvement of the founder) were omitted, results for the  
27  
28 338 comparison with WLC at post-treatment assessment remained similar ( $g = 0.63$ ,  $95\%CI$ : 0.20;  
29  
30 339 1.07,  $k = 5$ ,  $NNT = 2.89$ , see Table 3).

#### 340 **Moderator Analyses**

341 Moderator analyses revealed that trial quality as a continuous variable was associated  
342 with effect sizes in most of the abovementioned analyses. See Table 4 for an overview of results.  
343 In terms of increasing positive outcomes, only significant moderations and two non-significant  
344 results were found. With regards to the efficacy of PPT in increasing positive outcomes in  
345 comparison to WLC at post-treatment assessment, trial quality was found to be a significant  
346 moderator with higher trial quality being associated with higher effect sizes ( $b = 0.17$ ,  $p = .003$ ).  
347 A similar result was found for the follow-up assessment results ( $b = 0.12$ ,  $p = .036$ ). In terms of  
348 the comparison with active control conditions at post-treatment assessment, trial quality was also



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2  
3 349 found to moderate effect sizes with higher trial quality being associated with higher effect sizes  
4  
5 350 ( $b = 0.18$ ,  $p = .015$ ). No significant moderation of trial quality was found for the comparison with  
6  
7 351 other active treatment conditions ( $b = -0.01$ ,  $p = .907$ ) nor for the sub-analysis on satisfaction  
8  
9  
10 352 with life ( $b = -0.01$ ,  $p = .915$ ).

11  
12 353 In terms of the efficacy of PPT in decreasing negative outcomes in comparison to WLC  
13  
14 354 at post-treatment assessment, trial quality was found to be a significant moderator with higher  
15  
16 355 trial quality being associated with lower effect sizes ( $b = -0.08$ ,  $p = .003$ ). A similar result was  
17  
18 356 found for the sub-analyses on depression ( $b = -0.11$ ,  $p < .001$ ). Similarly, the sub-analysis on  
19  
20 357 depression for the comparison of PPT and active control conditions yielded a significant  
21  
22 358 moderation of trial quality with higher trial quality being associated with lower effect sizes ( $b = -$   
23  
24 359  $0.17$ ,  $p = .005$ ). However, a significant moderation was found for the comparison with other  
25  
26 360 active treatment conditions with higher trial quality being related to higher effect sizes in  
27  
28 361 decreasing negative outcomes ( $b = 0.13$ ,  $p < .001$ ). No evidence was found for a moderation of  
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30 362 treatment length in any of the analyses (see Table 4).

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## 34 364 Discussion

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37 365 Our systematic search resulted in 20 randomized controlled trials that assessed the  
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39 366 efficacy of PPT. The results of the meta-analysis indicate that PPT can effectively increase  
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41 367 positive psychological outcomes and decrease depression at post-treatment assessment. Both  
42  
43 368 comparisons with WLC and active control groups support the short-term efficacy of PPT.  
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45 369 Overall, there is too few data on the long-term efficacy of PPT. Additionally, moderator analyses  
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47 370 yielded that trial quality was significantly associated with effect size. For positive outcomes,  
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49 371 higher quality of trials was related to higher effect sizes. Whereas for depression, higher quality  
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3 372 of trials was related to lower effect sizes. However, the low number of available trials, large  
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5 373 heterogeneities, identification of some influential single trials in the sensitivity analyses and wide  
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7 374 prediction intervals call for cautious statements on the efficacy.  
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10  
11 375 The findings support the short-term efficacy of PPT in increasing positive psychological  
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13 376 outcomes. However, the higher magnitude in effect sizes for comparisons with active control  
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15 377 conditions (pooled  $g = -0.92$ ) compared to WLC (pooled  $g = -0.72$ ) is surprising and  
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17 378 counterintuitive. Usually the opposite pattern is found in clinical research.[21, 28] Unplanned  
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19 379 post-hoc investigations on potential reasons hint towards the effect of an almost outlier in the  
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21 380 analysis involving active comparison groups.[7] This trial offered either PPT or treatment-as-  
22  
23 381 usual to cancer patients and yielded a strikingly large effect size at post-treatment assessment  
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25 382 favoring PPT ( $g = -2.79$ ) for increasing meaning in life. Furthermore, a second trial on cancer  
26  
27 383 patients also produced a large effect size for increasing happiness ( $g = -1.80$ ) as compared to  
28  
29 384 waitlist at post-treatment assessment.[6] While these two trials on cancer patients suggest that  
30  
31 385 PPT might be highly effective in increasing positive outcomes in this population, two trials  
32  
33 386 remain of course a slim evidence-base. It should be noted, however, that the analysis on passive  
34  
35 387 control conditions (i.e., waitlist controls) also involved an almost outlier.[40] This study offered  
36  
37 388 PPT to depressed patients and yielded a strikingly large effect size at post-treatment assessment  
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39 389 ( $g = -2.98$ ) favoring PPT in increasing hope. Both almost outlier studies involved a moderate  
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41 390 sample size (see Table 1). All this suggests that more trials are needed to allow for firmer  
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43 391 conclusions.  
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51 392 When PPT was compared to other established psychological interventions such as CBT,  
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53 393 current data did not suggest any significant difference in efficacy. Accordingly, the results of the  
54  
55 394 six RCTs included in this comparison suggests that PPT is similarly effective in increasing  
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2  
3 395 positive psychological outcomes. However, due to the low number of trials for this comparison  
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5 396 these findings need to be viewed with due caution.  
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9 397 The first and foremostly assessed negative outcome in the PPT literature remains  
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11 398 depression. As suggested and intended by its developers, PPT was found moderately to largely  
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13 399 effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with  
14  
15 400 larger effect sizes in lowering depression for PPT in comparison to active control conditions  
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17 401 (pooled  $g = 0.94$ ) as opposed to WLC (pooled  $g = 0.57$ ). Once more, unplanned post-hoc  
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19 402 investigations were performed in an attempt to find potential reasons for the counterintuitive  
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21 403 finding. Again, we found that an almost outlier might explain the difference. The analysis  
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23 404 involving active control groups involved an almost outlier with an effect size of  $g = 2.45$ ,<sup>[44]</sup>  
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25 405 whereas the analysis involving WLC did not involve such an almost outlier.  
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30 406 Data on the efficacy at follow-up assessments altogether were scarce. The only feasible  
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32 407 analysis on follow-up assessment data (i.e., PPT vs. WLC in increasing positive outcomes)  
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34 408 yielded a non-significant effect size. The current available literature does not allow for any other  
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36 409 valid follow-up analyses and, thus, conclusions on the long-term efficacy of PPT cannot not yet  
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38 410 be made. This represents perhaps the main limitation of the literature on the efficacy of PPT. For  
39  
40 411 the same reason, additional sensitivity analyses (e.g., group vs. individual PPT, or PPT efficacy  
41  
42 412 by health condition vs. mental health condition) were not feasible.  
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47 413 Trial quality overall was moderate and, therefore, leaves room for improvement. Results  
48  
49 414 overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs)  
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51 415 more generally which report moderate effect sizes in increasing positive outcomes and  
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53 416 decreasing negative outcomes.<sup>[11-19]</sup> A recent meta-analysis on PPIs further also reports on a  
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3 417 significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary  
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5 418 considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not  
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8 419 straightforward.

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11 420 This represents the first meta-analysis with an exclusive focus on the efficacy of PPT.

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13 421 Several limitations need to be considered. First and foremost, the number of included trials is  
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15 422 relatively small and accordingly more research is needed to draw firmer conclusions. Secondly,  
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17 423 depression and SWL were the only two outcomes with enough trials to warrant sub-analyses.  
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19 424 More research is needed to allow for more homogenous analyses on PPT efficacy for specific  
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21 425 outcomes. Thirdly and related to the second limitation, the two overarching analyses on various  
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23 426 positive and negative outcomes involved large heterogeneity, respectively. The decision to  
24  
25 427 conduct such overarching analyses on heterogenous outcomes was based on the overall scarcity  
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27 428 of trials. We aimed at conducting more homogenous sub-analyses were possible which were, as  
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29 429 mentioned, only feasible for depression and SWL. As more trials accumulate, more fine-grained  
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31 430 analyses will become feasible. Fourthly and lastly, the long-term efficacy of PPT remains  
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33 431 uncertain due to lack of follow-up assessments.  
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### 39 **Conclusion**

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41 432 Our findings indicate that PPT can effectively increase positive outcomes and decrease  
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43 433 negative outcomes at post-treatment assessment. However, there is lack of follow-up data and  
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45 434 the number of available trials altogether remains scarce precluding many of the planned sub-  
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47 435 analyses. More research with high methodological rigor and including follow-up assessments is  
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49 436 needed to draw firmer and more precise conclusions on PPT efficacy.  
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2  
3 440 **Statements**

4  
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6 441 **Acknowledgments**

7  
8 442 None.

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14 444 **Data Availability Statement**

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16  
17 445 We performed a meta-analysis on published und publicly accessible data. No additional data  
18  
19 446 available.

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24 448 **Competing Interests Statement**

25  
26 449 The authors declare that they have no conflict of interest to declare

27  
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30  
31 451 **Funding Sources Statement**

32  
33 452 This research received no specific grant from any funding agency in the public, commercial or  
34  
35 453 not-for-profit sectors.

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40 455 **Ethics statement**

41 456 Not applicable. We performed a meta-analysis on published data.

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46 458 **Author Contributions Statement**

47  
48 459 THH and NM conceptualized the meta-analysis conducted the systematic literature search and  
49  
50 460 coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript  
51  
52 461 and agreed to be accountable for all aspects of the work.

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\*indicates that trial was included in the present meta-analysis



**Table 1**

Basic characteristics of included trials

Study	Country	Health condition	Intervention (treatment manual) <sup>a</sup>	Format	Control group (& format)	Nr. of sessions x Duration in min.	FU <sup>b</sup>	N post	Mean age ± SD, or range	% female	Stat. analysis	Negative and/or positive psychological outcome analysed in the meta-analysis (utilized instrument)	QS
Abdeyan et al.[40]	Iran	Depression	PPT	Group	WLC	8 x 90	n.a. <sup>c</sup>	64	38 ± 6.35	60.90	n.r.	Hope (SHQ)	10
Asgharipoor et al.[45]	Iran	Depression	PPT (Sahebi, 2011)	Indiv.	CBT (group)	12 x 120	n.a.	18	26.44 ± 5.87	72.22	n.r.	Depression (BDI-II) & happiness (OHQ)	12
Asl et al.[42]	Iran	Infertility and Depression	PPT (Parks-Sheiner, 2009)	Group	WLC	6 x 90	n.a.	31	30.49 ± 5.68	100	Compl.	SWL (SWLS)	21
Dowlatabadi et al.[6]	Iran	Breast cancer	PPT	Group	WLC	10 x 90	n.a.	33	36.63 ± 5.53	100	Compl.	Depression (BDI-II) & happiness (OHQ)	13
Furchtlehner et al.[46]	Austria	Depression	PPT (Rashid & Seligman, 2018)	Group	CBT (group)	14 x 120	6	92	40.66 ± 12.40	64.10	ITT	Depression (BDI-II) & happiness (DHS)	26

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Heydari et al.[43]	Iran	Hemophilia	PPT (Seligman et al. 2014)	Indiv.	WLC	8 x 120	2	56 <sup>c</sup>	10-25	58.93	Compl.	Hope (SHQ-C)	16
Hwang et al.[38]	South Korea	Depression	mPPT (self-developed)	Indiv.	WLC & NFB-M (indiv.)	10 x 50	4	24	22.77 ± 2.31	75.00	Compl.	Negative affect (SPANE) & well-being (FS)	13
Khayatan et al.[8]	Iran	Multiple Sclerosis and depression	PPT	Group	WLC	6 x 90	n.a.	30	31.11 ± 6.24	100	n.r.	Depression (BDI-II)	13
Mohamadi et al.[20]	Iran	Irritable bowel syndrome	PPT (Lee, 2015)	Group	DBT (group), MBCT (group) and WLC	8 x 150	n.a.	73	29.47 ± 3.95	63.01	Compl.	Stress (PSS) & quality of life (IBS-QOL)	17
Nikrahan et al.[41]	Iran	Coronary artery disease	PPT	Group	TAU	6 x 90	2	27	56.65 ± 8.40	23.63	ITT	Depression (BDI-II)	26
Parks-Sheiner study 1[39]	USA	Mild to moderate depression	mPPT	Group	WLC	6 x 90	12	104	n.r.	46.00	Compl.	Depression (BDI-II) & SWL (SWLS)	18
Parks-Sheiner study 2[39]	USA	Mild to moderate depression	Online mPPT	Indiv.	Control exercise	n.r.	12	275	46.70 ± 12.43	78.10	Compl.	Depression (BDI-II) & SWL (SWLS)	23



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1														
2														
3	Parks-Sheiner	USA	Mild to moderate depression	Online mPPT	Indiv.	WLC	n.r.	3	140	43.21 ± 11.86	75.70	Compl.	Depression (BDI-II) & SWL (SWLS)	23
4	study 3[39]													
5														
6														
7														
8	Saedi et al.[7]	Iran	Cancer	PPT	Group	TAU	8 x 90	n.a.	61	47.40 ± 13.10	93.44	Compl.	Meaning in life (LAP)	14
9														
10														
11														
12	Schrank et al.[4]	UK	Psychosis	PPT	Group	TAU	11 x 90	n.a.	84	42.50 ± 11.25	40.43	Compl.	Depression (DHS-S) & happiness (PPTI)	24
13														
14														
15														
16														
17														
18	Seligman et al. study 1[1]	USA	Mild to moderate depression	PPT	Group	WLC	6 x 120	12	34	Students	42.50	Compl.	Depression (BDI-II) & SWL (SWLS)	17
19														
20														
21														
22	Seligman et al. study 2[1]	USA	Depression	PPT	Indiv.	TAU, TAU-MED	14 x n.r.	12	32	18 – 55 years	68.75	Compl.	Depression (BDI-II) & SWL (SWLS)	18
23														
24														
25														
26	Taghvaenia et al.[47]	Iran	Depression	PPT	Group	WLC	10 x 120	n.a.	52	62.64 ± 12.81	100	Compl.	Depression (BDI-II) & happiness (OHQ)	20
27														
28														
29														
30														
31	Uliaszek et al.[5]	Canada	Psychopathology (trans-diagnostic)	PPT	Group	DBT	12 x 120	n.a.	54	22.17 ± 5.01	77.78	ITT	Depression & happiness (PPTI)	19
32														
33														
34														
35														
36	Zhang et al.[44]	China	Mild to moderate depression	PPT	Group	TAU	8 x 90	6	76	20.39 ± 1.20	94.90	Compl.	Depression (BDI-II) &	14
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self-efficacy  
(GSE)

BDI-II, Beck Depression Inventory 2<sup>nd</sup> edition; CBT, Cognitive Behavioral Therapy; Compl., Completer analysis; DBT, Dialectical Behavior Therapy; DHS, Depression-Happiness Scale; DHS-S, Depression-Happiness Scale – Short; FS, Flourishing Scale; FU, follow-up period in months (i.e., longest reported follow-up assessment); GSE, General Self Efficacy scale; HLM, Hierarchical Linear Modelling; IBS-QOL, Irritable Bowl Syndrome – Quality Of Life; indiv., individual; ITT, Intent-To-Treat analysis; LAP, Life Attitude Profile; MBCT, Mindfulness-Based Cognitive Therapy; mPPT, modified Positive Psychotherapy; n.a., not applicable; NFB-M, Neurofeedback-aided Meditation; N post, number of participants (experimental group + comparison group) at post-treatment assessment; n.r., not reported; OHQ, Oxford Happiness Questionnaire; PPT, Positive Psychotherapy as developed by Seligman et al., 2006,[1] unless indicated differently; PPI, Positive Psychotherapy Inventory; PPTI, Positive Psychotherapy Inventory; PSS, Perceived Stress Scale; SHQ, Snyders' Hope Questionnaire; SHQ-C, Snyders' Hope Questionnaire – Child version; SPANE, Scale of Positive and Negative Experience; Stat. analysis, Statistical analysis applied; SWL, Satisfaction With Life; SWLS, Satisfaction With Life Scale; TAU, Treatment-As-Usual; TAU-MED, Treatment-As-Usual plus antidepressant medication; WLC, Waitlist Control condition.

<sup>a</sup>PPT, positive psychotherapy manual as founded by Seligman et al., 2006 [1].

<sup>b</sup>Longest reported follow-up assessment on relevant outcome(s) in months, FU assessment used in the meta-analysis.

<sup>c</sup>reported but irrelevant, as follow-up assessment was conducted at two weeks post-treatment; <sup>d</sup>no post-treatment assessment available, hence follow-up assessment n reported.

**Table 2.** Quality assessment of included trials

Trial	Q1 - interview-based diagnostics	Q2 - manual-based treatment	Q3 - trained therapists	Q4 - integrity check	Q5 - ITT	Q6 - RCT	Q7 - independent randomisation	Q8 - blind assessments	Q9 - dropouts reported	Q sum
Abdeyan et al. (2018)	1	3	0	0	0	3	0	3	0	10
Asgharipoor et al. (2012)	3	3	0	0	0	3	0	3	0	12
Asl et al. (2016)	3	3	3	2	1	3	0	3	3	21
Dowlatabadi et al. (2016)	3	0	0	0	1	3	0	3	3	13
Furchtlehner et al. (2019)	3	3	2	3	3	3	3	3	3	26
Heydari et al. (2019)	3	3	0	0	1	3	0	3	3	16
Hwang et al. (2016)	1	0	0	2	1	3	0	3	3	13
Khayatan et al. (2014)	1	3	3	0	0	3	0	3	0	13
Mohamadi et al. (2019)	1	3	3	0	1	3	0	3	3	17
Nikrahan et al. (2016)	3	3	3	2	3	3	3	3	3	26
Parks-Sheiner (2009, study 1)	1	3	3	0	1	3	1	3	3	18
Parks-Sheiner (2009, study 2)	1	3	3	3	1	3	3	3	3	23
Parks-Sheiner (2009, study 3)	1	3	3	3	1	3	3	3	3	23
Saeedi et al. (2019)	1	3	0	0	1	3	0	3	3	14
Schrank et al. (2016)	3	3	3	2	1	3	3	3	3	24
Seligman et al. (2006, study 1)	1	3	3	0	1	3	0	3	3	17
Seligman et al. (2006, study 2)	0	3	3	2	1	3	0	3	3	18
Taghvaenia et al. (2019)	1	3	3	0	1	3	3	3	3	20
Uliaszek et al. (2016)	3	3	0	1	3	3	0	3	3	19
Zhang et al. (2015)	1	3	0	0	1	3	0	3	3	14

Q = quality criterion; Q sum = quality sum score. See paragraph on quality assessment in the method section for more details on the quality criteria and their scoring.

**Table 3**

Efficacy of PPT for increasing positive outcomes and decreasing negative outcomes

Comparison groups and timepoint of assessment (i.e., post vs. FU)	<i>k</i>	<i>g<sup>a</sup></i>	<i>SE</i>	95% CI PI	<i>I<sup>2</sup></i>	<i>NNT</i>
All trials						
Positive outcomes merged (i.e., SWL, happiness, well-being, hope, positive affect, quality of life, self-efficacy, & meaning in life)						
PPT vs. WLC at post	10	<b>-0.72*</b>	0.30	-1.31; -0.14 PI -2.55; 1.10	90.37***	2.55
PPT vs. WLC at FU	4	-0.36	0.24	-0.83; 0.11 PI -1.29; 0.57	74.34*	5.01
PPT vs. ACC at post	6	<b>-0.92*</b>	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. ( <i>k</i> = 2)					
PPT vs. OtherATC at post	6	-0.29	0.31	-0.89; 0.32 PI -1.71; 1.13	79.57***	6.24
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on SWL						
PPT vs. WLC – SWL at post	4	-0.15	0.13	-0.40; 0.09 PI -0.45; 0.15	11.20	11.55
PPT vs. WLC – SWL at FU	n.a. ( <i>k</i> = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. WLC at post	8	<b>0.48**</b>	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. WLC at FU	n.a. ( <i>k</i> = 3)					
PPT vs. ACC at post	All six trials conducted on depression, see below					
PPT vs. OtherATC at post	6	0.08	0.29	-0.48; 0.64 PI -1.23; 1.39	76.79***	22.22
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on depression						
PPT vs. WLC – depression at post	6	<b>0.57**</b>	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. WLC – depression at FU	n.a. ( <i>k</i> = 3)					

## Meta-analytic review of positive psychotherapy

PPT vs. ACC - depression at post	6	<b>0.94*</b>	0.39	0.18; 1.70 PI -0.96; 2.83	90.28***	2.03
PPT vs. ACC - depression at FU	n.a. ( <i>k</i> = 3)					
PPT vs. OtherATC - depression at post	n.a. ( <i>k</i> = 3)					
Main-analyses with Seligman et al. [1] and Parks-Sheiner [39] omitted (i.e., alliance)						
Positive outcomes merged						
PPT vs. WLC at post	7	<b>-1.04**</b>	0.38	-1.79; -0.28 PI -3.04; 0.97	88.21	1.87
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)					
PPT vs. OtherATC at post	n.a. (i.e. no trials with alliance)					
Negative outcomes merged						
PPT vs. WLC at post	5	<b>0.63**</b>	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)					
PPT vs. OtherATC at post	n.a. (i.e. no trials with alliance)					

ACC, Active Control Conditions, included TAU and placebo; *k*, number of trials for the respective comparison; n.a., not applicable; FU, Follow-Up assessment;  $I^2$ , measure of heterogeneity in % including the p-value of the Q-statistic as indicated by asterisks; OtherATC, Other Active Treatment Conditions (included Cognitive Behavioral Therapy, Dialectic Behavioral Therapy, and Mindfulness-Based Cognitive Behavioral Therapy); PI, prediction interval; post, post-treatment assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of respective effect size.

<sup>a</sup>A negative Hedges' *g* for positive outcomes indicates efficacy in favor of PPT over control conditions (and vice versa). A positive Hedges' *g* for negative outcomes indicates efficacy in favor of PPT over control conditions (and vice versa).

\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

**Table 4**

Sub-analyses on trial quality and treatment length as potential moderators

Comparison groups and timepoint of assessment	<i>k</i>	Intercept	<i>b</i>	<i>rem. I<sup>2</sup></i>	<i>p</i>
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	10	-3.60	<b>0.17</b>	79.93***	<b>.003</b>
PPT vs. WLC at follow-up	4	-2.56	<b>0.12</b>	38.01	<b>.036</b>
PPT vs. ACC at post	6	-4.21	<b>0.18</b>	83.61***	<b>.015</b>
PPT vs. OtherATC at post	6	-0.13	-0.01	82.40***	.907
Sub-analysis on SWL					
PPT vs. WLC at post	4	-0.02	-0.01	56.42	.915
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. WLC at post	8	2.00	<b>-0.08</b>	0	<b>.003</b>
PPT vs. ACC at post	All six trials conducted on depression, see below				
PPT vs. OtherATC at post	6	-2.24	<b>0.13</b>	21.28	<b>&lt;.001</b>
Sub-analysis on depression					
PPT vs. WLC at post	6	2.50	<b>-0.11</b>	0	<b>&lt;.001</b>
PPT vs. ACC at post	6	4.47	<b>-0.17</b>	76.91***	<b>.005</b>
Potential Moderator: Treatment length <sup>a</sup>					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	9	-1.19	0.00	89.69	.734
PPT vs. WLC at follow-up	n.a. ( <i>k</i> = 3)				
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post	6	1.16	-0.00	74.95	.159
Sub-analysis on SWL					
PPT vs. WLC at post	n.a. ( <i>k</i> = 3)				
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. WLC at post	7	0.92	-0.00	16.70	.368
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post	6	-0.98	0.00	74.26	.285
Sub-analysis on depression					
PPT vs. WLC at post	5	0.82	-0.00	21.67	.801

ACC, Active Control Condition; *b*, refers to the interaction term between treatment and covariate (in Hedges' *g*); OtherATC, Other Active Treatment Condition; PPT, Positive Psychotherapy; *rem. I<sup>2</sup>*, remaining amount of unexplained heterogeneity including the *p*-value of the *Q*-statistic as indicated by asterisks; post, post-treatment

## Meta-analytic review of positive psychotherapy

assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of moderation.

\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

<sup>a</sup>Number of trials differs in comparison to main-analyses since not all publications reported on treatment length as can be witnessed in Table 1.

### Figure Legends

Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

Fig.2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment

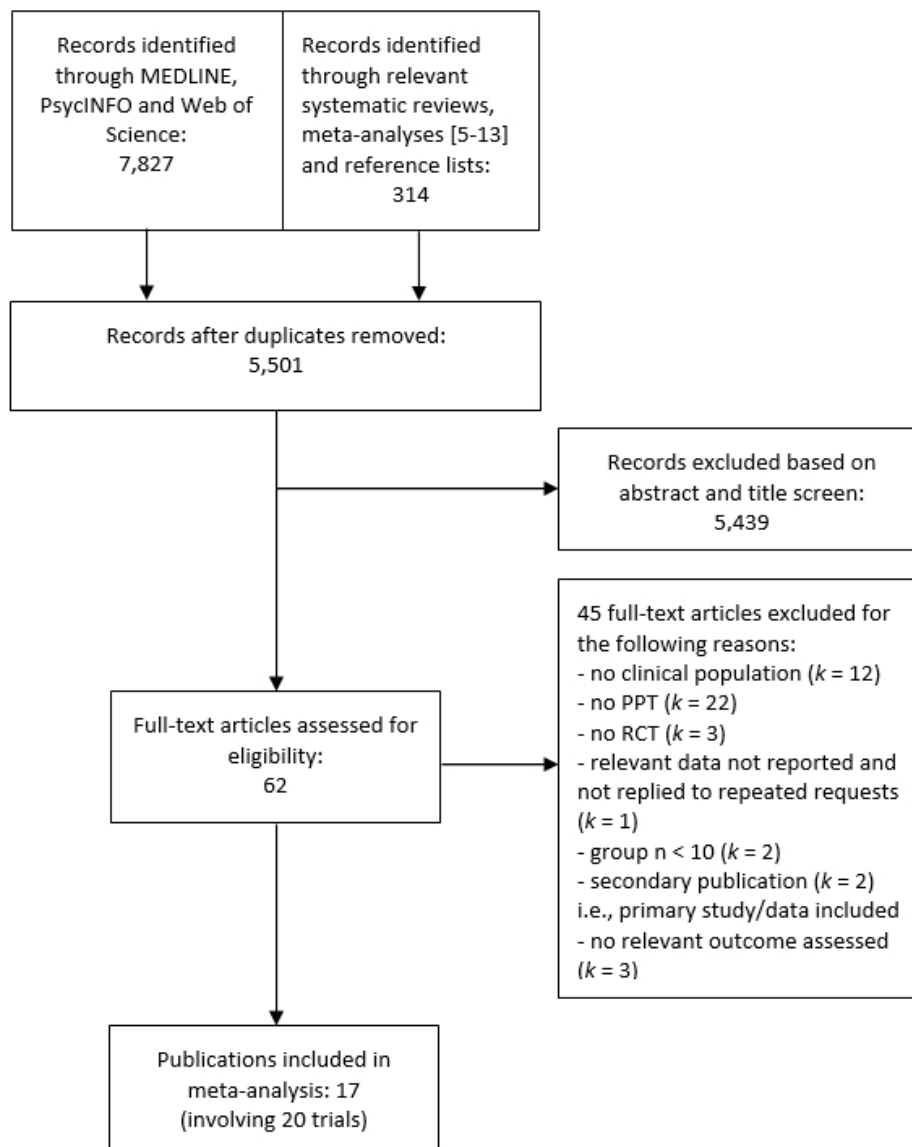
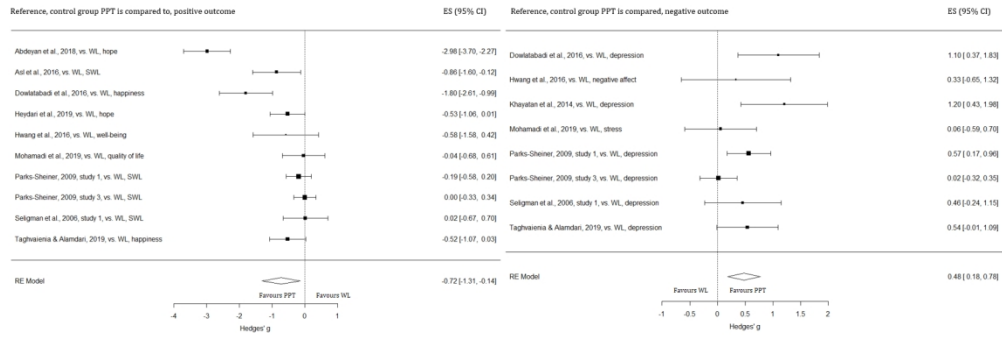


Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials



Figure 2

Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment



CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control conditions. Size of squares indicates size of trial (i.e., N). Width of diamonds indicates the 95% confidence interval of pooled effect sizes.

Fig. 2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment

## Supplementary materials

**eList 1.** Search strategy (PsycINFO and MEDLINE)

**eFig. 1.** Funnel plot – Efficacy of PPT in increasing positive outcomes in comparison to passive control conditions at post-treatment

**eFig. 2.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to passive control conditions at follow-up

**eFig. 3.** Forest plot – Efficacy of PPT in increasing satisfaction with life in comparison to passive control conditions at post-treatment

**eFig. 4.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to active control conditions at post-treatment

**eFig. 5.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to other active treatment conditions at post-treatment

**eFig. 6.** Forest plot – Efficacy of PPT in decreasing depression in comparison to passive control conditions at post-treatment

**eFig. 7.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to active control conditions at post-treatment

**eFig. 8.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to other active treatment conditions at post-treatment

**eTable 1.** Leave1out sensitivity analyses for main-analyses (PPT vs. PCC at post assessment)

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2  
3 **eList 1.** Search strategy (PsycINFO and MEDLINE)  
4

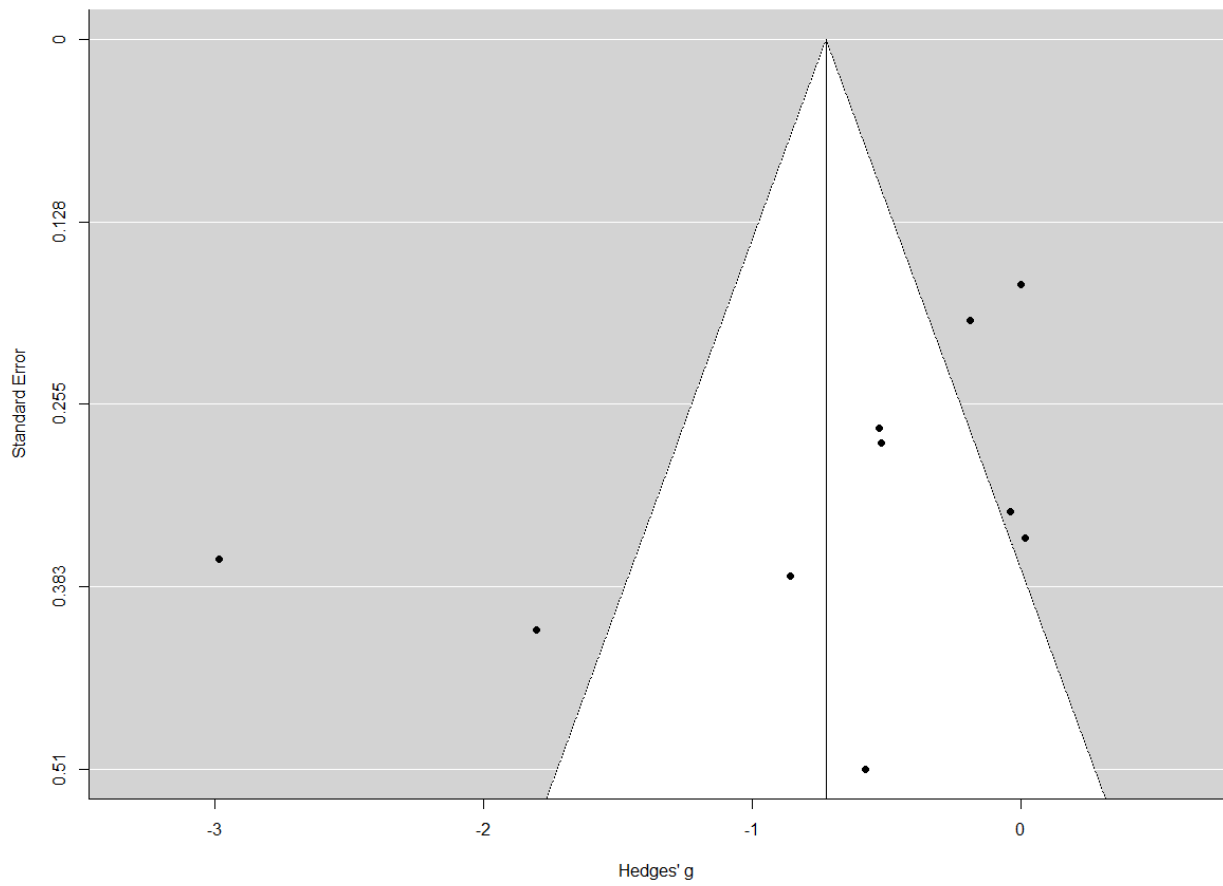
5 **Search terms and strategy:** "TI positive psychotherapy OR AB positive psychotherapy OR  
6 SU positive psychotherapy".  
7

8 **Time limit:** Jan 1 2006 to Feb 13 2020.  
9

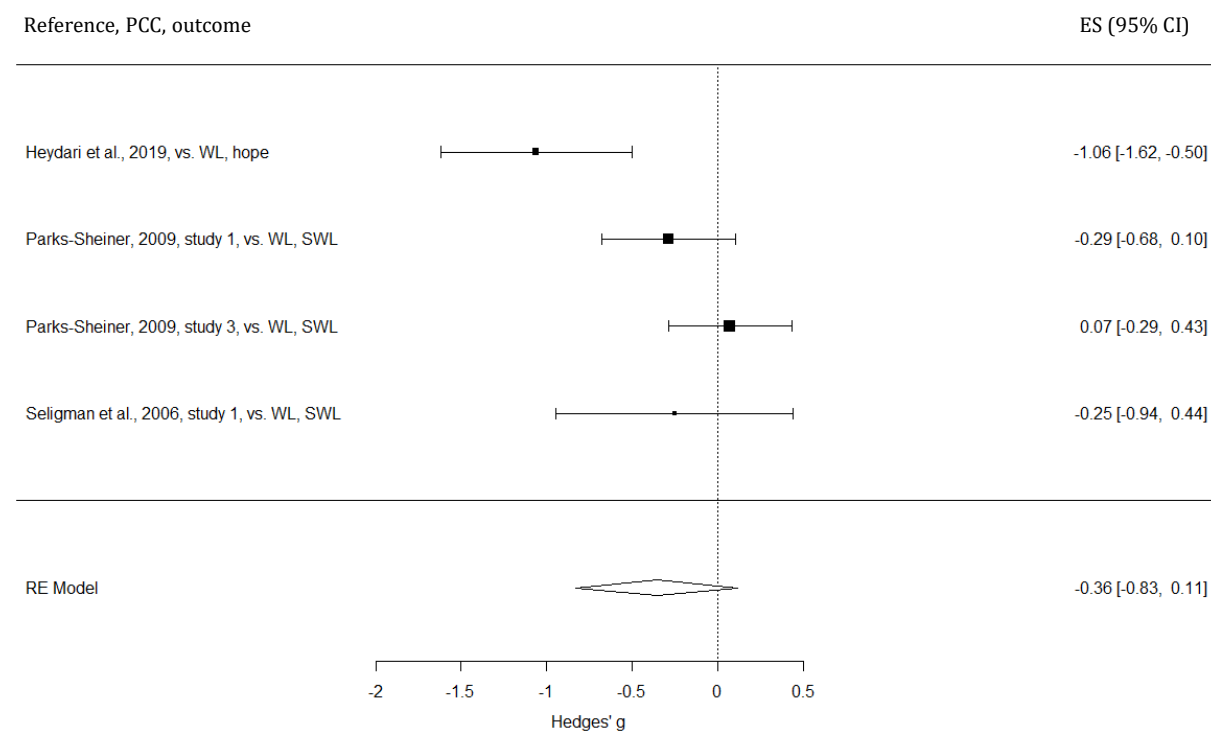
10 **Other limits and filters:** None.  
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**eFig. 1.** Funnel plot – Efficacy of PPT in increasing positive outcomes in comparison to passive control conditions at post-treatment

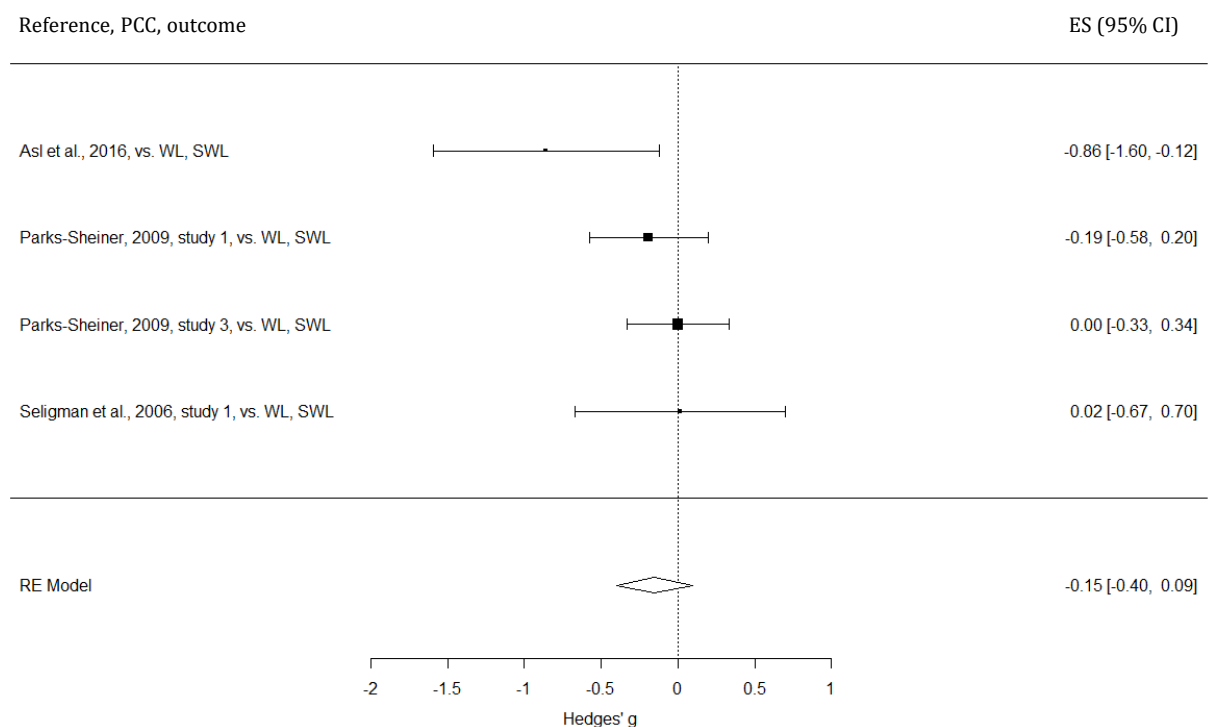


**eFig. 2.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to passive control conditions at follow-up



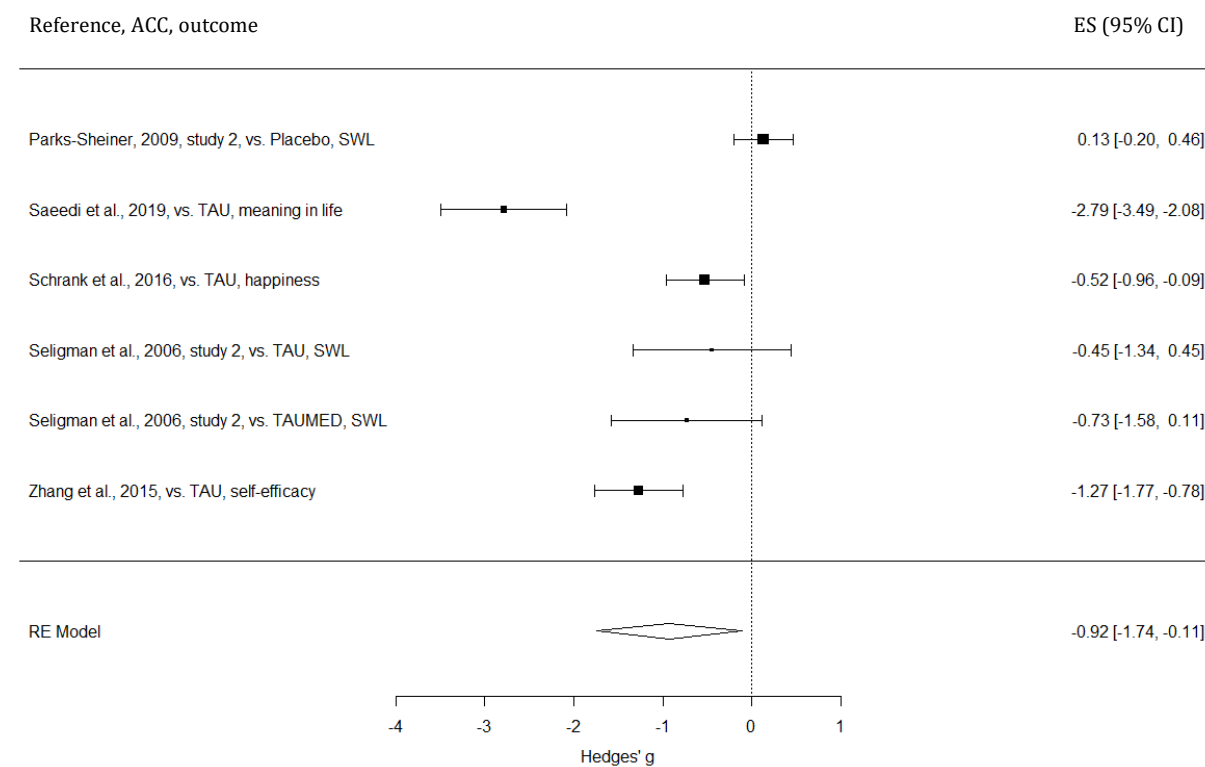
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 3.** Forest plot – Efficacy of PPT in increasing satisfaction with life (SWL) in comparison to passive control conditions at post-treatment



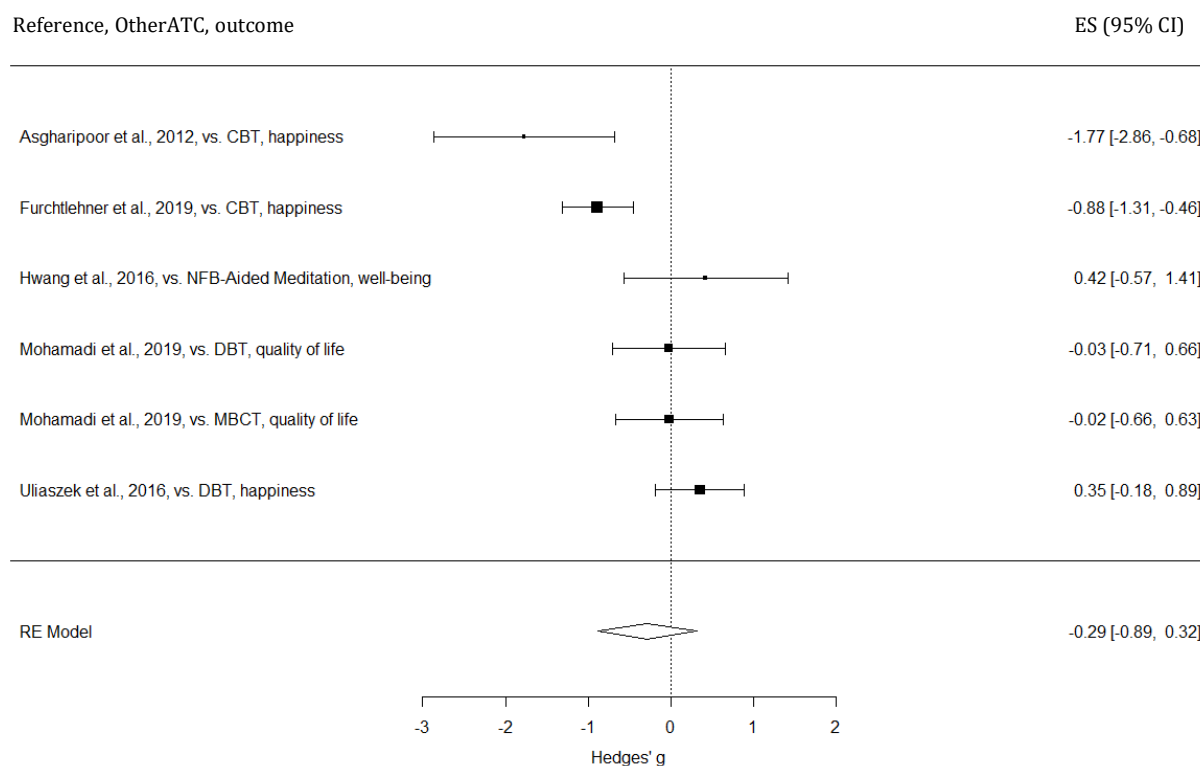
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 4.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to active control conditions at post-treatment



ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); Placebo, pill Placebo; RE Model, Random Effects Model; SWL, Satisfaction With Life; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

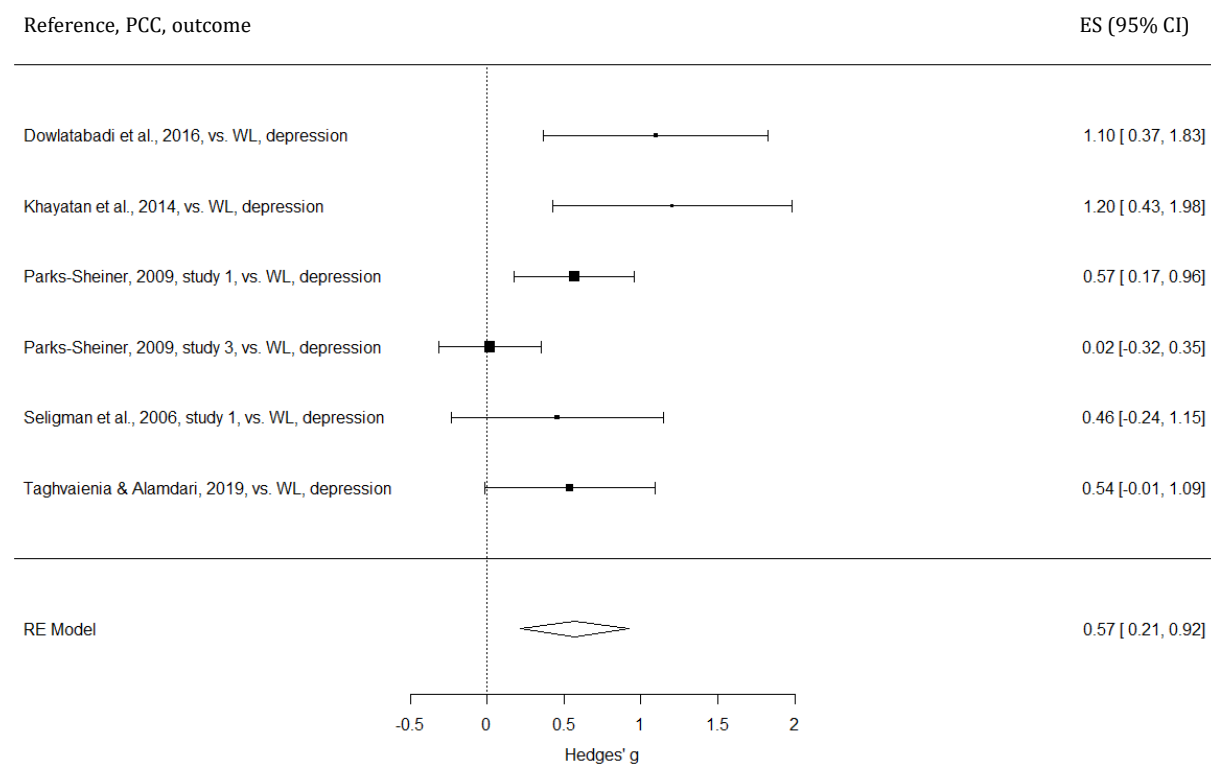
**eFig. 5.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to other active treatment conditions (OtherATC) at post-treatment



CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

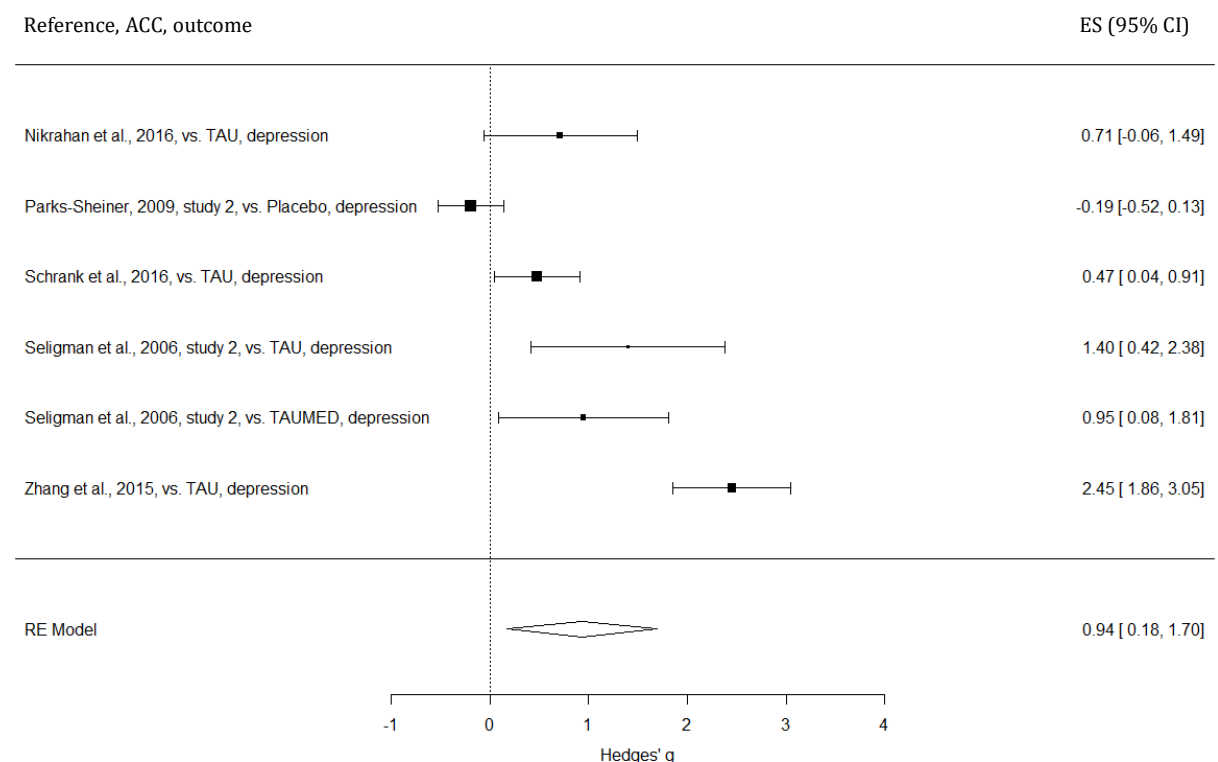


**eFig. 6.** Forest plot – Efficacy of PPT in decreasing depression in comparison to passive control conditions at post-treatment



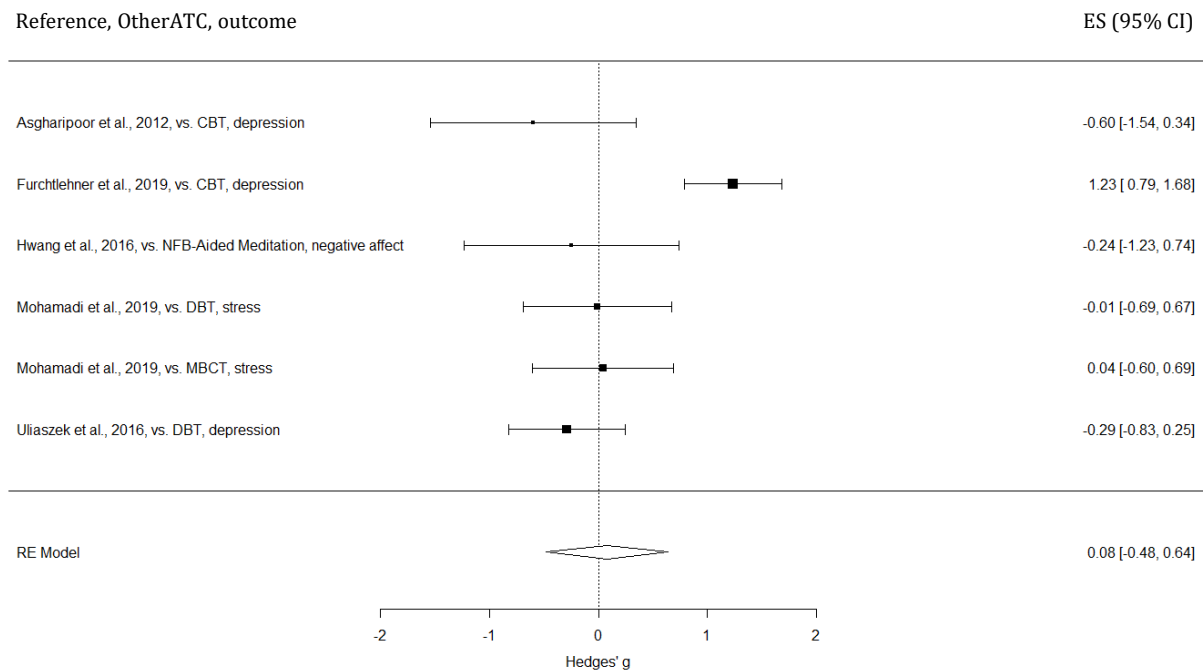
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 7.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to active control conditions at post-treatment



ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 8.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to other active treatment conditions (OtherATC) at post-treatment



CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eTable 1.** Leave1out sensitivity analyses for main-analyses (PPT vs. PCC at post assessment)

<b>Trial omitted (negative outcome assessed)</b>	<b>Corrected <i>g</i></b>	<b><i>SE</i></b>	<b><i>Z</i></b>	<b><i>Q</i></b>
Dowlatabadi et al., 2016 (depression)	0.40	0.15	2.76**	10.90
Hwang et al., 2016 (negative affect)	0.50	0.16	3.03**	14.63*
Khayatan et al., 2014 (depression)	0.40	0.14	2.79**	10.28
Mohamadi et al., 2019 (stress)	0.54	0.16	3.28**	13.46*
Parks-Sheiner, 2009, study 1 (depression)	0.47	0.18	2.61**	13.74*
Parks-Sheiner, 2009, study 3 (depression)	0.58	0.12	4.93***	7.30
Seligman et al., 2006, study 1 (depression)	0.49	0.17	2.86**	14.62*
Taghvaenia & Alamdari, 2019 (depression)	0.48	0.18	2.73**	14.37*
<b>Trial omitted (sub-analysis on depression only)</b>				
Dowlatabadi et al., 2016	0.48	0.18	2.64**	10.02*
Khayatan et al., 2014	0.47	0.17	2.68**	9.41
Parks-Sheiner, 2009, study 1	0.59	0.23	2.55*	12.84*
Parks-Sheiner, 2009, study 3	0.68	0.13	5.21***	3.96
Seligman et al., 2006, study 1	0.60	0.21	2.79**	13.41**
Taghvaenia & Alamdari, 2019	0.59	0.22	2.66**	13.27*
<b>Trial omitted (positive outcome assessed)</b>				
Abdeyan et al., 2018 (hope)	-0.44	0.17	-2.55*	21.89**
Asl et al., 2016 (SWL)	-0.71	0.33	-2.14*	71.62***
Dowlatabadi et al., 2016 (happiness)	-0.61	0.31	2.00*	61.85***
Heydari et al., 2019 (hope)	-0.75	0.33	-2.24*	72.70***
Hwang et al., 2016 (well-being)	-0.74	0.33	-2.25*	72.70***
Mohamadi et al., 2019 (quality of life)	0.80	0.32	-2.48*	70.88***
Parks-Sheiner, 2009, study 1 (SWL)	-0.79	0.33	-2.40*	70.19***
Parks-Sheiner, 2009, study 3 (SWL)	-0.82	0.32	-2.53*	62.36***
Seligman et al., 2006, study 1 (SWL)	-0.81	0.32	-2.51*	70.66***
Taghvaenia & Alamdari, 2019 (happiness)	-0.75	0.33	-2.25*	72.71***
<b>Trial omitted (sub-analysis on SLW only)</b>				
Asl et al., 2016	-0.07	0.12	-0.57	0.60
Parks-Sheiner, 2009, study 1	-0.22	0.26	-0.85	4.53
Parks-Sheiner, 2009, study 3	-0.29	0.20	-1.42	3.30
Seligman et al., 2006, study 1	-0.24	0.20	-1.20	4.37

Corrected *g*, pooled Hedges' *g* effect size when given trial was omitted from the random effects analysis; *SE*, standard error; SWL, Satisfaction With Life; *Z*, standardized z-score for pooled effect size including statistical significance level as indicated below.

\*  $p < .05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < .001$

## PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol

Section and topic	Item No	Checklist item	Obeyed?	Where? page/line number
<b>ADMINISTRATIVE INFORMATION</b>				
Title:		The efficacy of positive psychotherapy in reducing negative and enhancing positive psychological outcomes: A meta-analysis		
Identification	1a	Identify the report as a protocol of a systematic review	<input checked="" type="checkbox"/>	5/101-103
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	n.a.	n.a.
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	<input checked="" type="checkbox"/>	2/60; 5/113-114
Authors:				
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	<input checked="" type="checkbox"/>	1/8-30
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	<input checked="" type="checkbox"/>	20/450-453
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	n.a.	n.a.
Support:				
Sources	5a	Indicate sources of financial or other support for the review	<input checked="" type="checkbox"/>	20/443-445
Sponsor	5b	Provide name for the review funder and/or sponsor	n.a.	n.a.
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	n.a.	n.a.
<b>INTRODUCTION</b>				
Rationale	6	Describe the rationale for the review in the context of what is already known	<input checked="" type="checkbox"/>	5/100-103
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	<input checked="" type="checkbox"/>	5/108-113
<b>METHODS</b>				
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	<input checked="" type="checkbox"/>	5/108-6/126

Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	<input checked="" type="checkbox"/>	6/123-125; 6/131-133; 7/148-155
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	<input checked="" type="checkbox"/>	6/126-127; eList 1 (supplement)
Study records:				
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	<input checked="" type="checkbox"/>	5/108-109; 6/135
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	<input checked="" type="checkbox"/>	6/135
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	<input checked="" type="checkbox"/>	6/135-7/155
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any planned data assumptions and simplifications	<input checked="" type="checkbox"/>	6/135-7/161; 8/184-9/198
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	<input checked="" type="checkbox"/>	6/134-7/161; 8/184-9/198
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	<input checked="" type="checkbox"/>	7/162-8/182
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	<input checked="" type="checkbox"/>	7/144-155; 8/183-9/198
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$ , Kendall's $\tau$ )	<input checked="" type="checkbox"/>	9/199-11/236
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	<input checked="" type="checkbox"/>	10/229-11/236
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	n.a.	n.a.
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	<input checked="" type="checkbox"/>	10/229-11/236
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	<input checked="" type="checkbox"/>	9/208-10/220

# BMJ Open

## The efficacy of positive psychotherapy in reducing negative and enhancing positive psychological outcomes: A meta-analysis of randomized controlled trials

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-046017.R2
Article Type:	Original research
Date Submitted by the Author:	02-Aug-2021
Complete List of Authors:	Hoppen, Thole; University of Münster, Clinical Psychology and Psychotherapy Morina, Nexhmedin ; University of Münster, Psychology
<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health, Evidence based practice
Keywords:	Depression & mood disorders < PSYCHIATRY, Schizophrenia & psychotic disorders < PSYCHIATRY, Cancer pain < ONCOLOGY, Adult psychiatry < PSYCHIATRY, PSYCHIATRY

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11 5 The efficacy of positive psychotherapy in reducing negative and enhancing  
12 positive psychological outcomes: A meta-analysis of randomized controlled trials  
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24 12 Short title: Meta-analytic review of positive psychotherapy  
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26 14 *Keywords:* depression, meta-analysis, positive psychotherapy, randomized controlled  
27 15 trial, well-being  
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43 29 Number of Tables: 4

44 30 Number of Figures: 2

45 31 Word count: 4,784 (excl. abstract, key points, statements, references, Tables and Figures)  
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1 Meta-analytic review of positive psychotherapy

2  
3 32 **Abstract**

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5 33 **Objective:** Positive Psychotherapy (PPT) aims at increasing positive affect, meaning and  
6 34 engagement. We aimed to synthesize the available evidence on PPT efficacy.  
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9 36 **Design:** We conducted a pre-registered systematic literature search and meta-analysis of  
10 37 randomized controlled trials examining the efficacy of PPT for increasing positive (e.g.,  
11 38 satisfaction with life) or decreasing negative psychological outcomes (e.g., depression).  
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13  
14 40 **Data sources:** Medline, PsycINFO, and Web of Science from 2006 (i.e., inception of PPT) to  
15 41 Feb 2020 as well as related systematic reviews and meta-analyses.  
16 42

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18 43 **Results:** We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were  
19 44 found for increasing positive outcomes ( $g = -0.72$ , 95%CI: -1.31; -0.14,  $k = 10$ ,  $NNT = 2.55$ ) and  
20 45 reducing negative outcomes ( $g = 0.48$ , 95%CI: 0.18; 0.78,  $k = 8$ ,  $NNT = 3.76$ ) when PPT was  
21 46 compared to waitlist control conditions at post-treatment assessment. When compared to active  
22 47 control conditions, PPT yielded large effect sizes for increasing positive outcomes ( $g = -$   
23 48  $0.92$ , 95%CI: -1.74; -0.11,  $k = 6$ ,  $NNT = 2.05$ ) and reducing depression ( $g = 0.94$ , 95%CI: 0.18;  
24 49 1.70,  $k = 6$ ,  $NNT = 2.03$ ) at post-treatment assessment. No significant differences in efficacy  
25 50 were found when compared to established treatments such as cognitive behavioural therapy.  
26 51 Evidence was found to support an association between trial quality and effect sizes. For positive  
27 52 outcomes, higher trial quality was related to larger effect size. Whereas higher trial quality was  
28 53 associated with smaller effect size for depression. Follow-up assessments remained too  
29 54 scarce for most planned analyses.  
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31  
32 56 **Conclusions:** Our findings support the short-term efficacy of PPT. However, results are to be  
33 57 regarded with due caution in the light of low number of trials. More high-quality trials that assess  
34 58 efficacy at follow-ups are needed to draw firmer conclusions on the long-term efficacy of PPT.  
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36  
37 60 **PROSPERO registration number:** CRD42020173567  
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Meta-analytic review of positive psychotherapy

61 **Strengths and limitations of this study**

- 62 • This meta-analysis was pre-registered and conducted in line with the PRISMA guidelines
- 63 • Data synthesis was based on a broad systematic literature search including broad  
64 secondary manual searches
- 65 • Potential moderators including trial quality, treatment lengths and alliance were analysed
- 66 • Scarcity of available trials precluded many (sub-)analyses and asks for due caution in  
67 interpreting the present findings
- 68 • Due to lacking follow-up assessment, long-term efficacy could not be determined
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1 Meta-analytic review of positive psychotherapy

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3 71 **Introduction**

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5 72 Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology  
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7 73 and proposes that psychopathology such as depression can be effectively treated by directly and  
8  
9 74 primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging  
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11 75 to and serving something greater than the self) and engagement (i.e., active involvement in daily  
12  
13 76 life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be  
14  
15 77 successfully dampened. While the founders believed from inception that PPT might be an  
16  
17 78 effective treatment for various disorders, they started off by investigating its efficacy in treating  
18  
19 79 depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three*  
20  
21 80 *Good Things* and the *Gratitude Visit*. In *Using Your Strength*, for instance, participants are asked  
22  
23 81 to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use  
24  
25 82 their top five strengths more in daily life. Seligman and colleagues ended up including 26  
26  
27 83 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on  
28  
29 84 the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11  
30  
31 85 mildly to moderately depressed students per group and found that PPT was effective in lowering  
32  
33 86 depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They  
34  
35 87 also conducted a second RCT where they offered a 14-session individual PPT over 12 weeks in a  
36  
37 88 sample of adults suffering from major depressive disorder. Again, PPT was found effective in  
38  
39 89 decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1]  
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41 90 Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further  
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43 91 research on populations suffering depressive symptoms or depressive disorders, PPT has been  
44  
45 92 investigated in various other contexts including patients with psychosis[4] and multiple other  
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47 93 mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or  
48  
49 94 multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe  
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3 95 summarized the findings of 12 publications (from 9 individuals trials) published before May  
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5 96 2015.[3] The authors conclude that the application of PPT in intervention research is  
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7  
8 97 heterogenous in terms of both, the modifications of the original manual as well as the conditions  
9  
10 98 targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-  
11  
12 99 analysis with an exclusive focus on the efficacy of PPT has been published to this date. Against  
13  
14 100 this background, we performed a systematic literature review and meta-analysis of randomized  
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17 101 controlled trials assessing the efficacy of PPT.  
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## 19 102 20 103 **Methods**

21  
22 104 Following the recommendations by the Preferred Reporting Items for Systematic  
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24 105 Reviews and Meta-analysis (PRISMA) group,[10] we defined the main structured research  
25  
26 106 question describing the Population, Intervention, Comparison, Outcome, and Study design  
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28 107 (PICOS) as “In individuals with mental or physical health complaints, does PPT (I), compared to  
29  
30 108 control conditions (C), improve psychological outcomes (O) in randomized controlled trials  
31  
32 109 (S)?”. We pre-registered the present meta-analysis in the PROSPERO database (ID:  
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34 110 CRD42020173567).  
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## 38 111 **Patient and Public Involvement**

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41 112 Not applicable. We performed a meta-analysis on published data.  
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## 43 113 **Literature Search Strategy**

44  
45 114 Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled  
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47 115 Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a  
48  
49 116 minimum of ten participants per treatment arm at post-treatment assessment with available data  
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51 117 on at least one relevant outcome. No restrictions were placed on age of participants, comparison  
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53 118 condition, or publication type. Studies that only applied a mixture of PPT with another  
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3 119 intervention, such as a mixture of PPT and cognitive behavioral therapy in comparison to a  
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5 120 control condition,[9] were excluded due to our narrow focus on the efficacy of PPT, as founded  
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8 121 by Seligman et al.[1]. We searched the following databases: PsycINFO, MEDLINE, and Web of  
9  
10 122 Science from 2006 up to 13<sup>th</sup> of February 2020. The year 2006 represents the year where the  
11  
12 123 theoretical underpinnings of the PPT were first published.[1] No other limits or filters were  
13  
14 124 applied. MeSH terms for Ebscohost (regarding MEDLINE and PsycINFO) were as follows: “SU  
15  
16 125 positive psychotherapy OR TI positive psychotherapy OR AB positive psychotherapy” (see also  
17  
18 126 eList 1 in the supplementary materials). In Web of Science a similar search string to Ebscohost  
19  
20 127 was chosen to search for “positive psychotherapy” in titles, abstracts, and keywords. To retrieve  
21  
22 128 additional publications, the reference lists of all included papers and relevant (i.e., related) meta-  
23  
24 129 analyses and systematic reviews were manually screened.[11–19] Secondary hand searches were  
25  
26 130 conducted using Google Scholar. The study synthesis was performed independently by both  
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31 131 authors.

### 32 33 132 **Coding of Studies**

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35 133 The publications were independently coded by both authors. From each publication, the  
36  
37 134 following study, intervention and participant characteristics were coded and extracted: country  
38  
39 135 the trial was conducted in, clinical population targeted (i.e., any physical or mental health  
40  
41 136 condition), experimental intervention type (i.e., original PPT manual or modified version),  
42  
43 137 intervention format (i.e., individual or group), comparison group(s), session number and session  
44  
45 138 duration in minutes, follow-up duration in months for the longest reported follow-up assessment  
46  
47 139 of the relevant outcome(s), number of participants at post-treatment assessment, age of  
48  
49 140 participants (i.e., mean and standard deviation or range), proportion of sample with female sex in  
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51 141 percent, applied statistical analysis (i.e., completer or intent-to-treat analyses) and relevant  
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3 142 outcome(s) targeted by PPT. The post-treatment assessment experimental group and control  
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5 143 group means, standard deviations and sample sizes on the relevant outcome(s) (see in more detail  
6  
7 144 below) were extracted. When reported, follow-up assessment data on relevant outcomes per  
8  
9 145 group were also extracted. When multiple follow-up assessments were reported, the data from  
10  
11 146 the longest follow-up assessment were retrieved. When relevant data was not reported, it was  
12  
13 147 either calculated from given data (e.g., standard deviations from standard errors) or the  
14  
15 148 corresponding author of the respective publication was contacted via email twice with one month  
16  
17 149 in between. In one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and  
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19 150 Drikvand potentially reported the means and SDs for a relevant outcome (i.e., quality of life) in  
20  
21 151 wrong order (i.e., means where SDs should be placed and vice versa) [20]. We contacted the  
22  
23 152 authors twice via Email and were left with no response. Consequently, we calculated two  
24  
25 153 analyses; one with changed order of means and SD and one with unchanged order.  
26  
27 154 We divided control conditions into passive control conditions, which turned out to exclusively  
28  
29 155 consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual &  
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31 156 placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy /  
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33 157 CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy  
34  
35 158 / MBCT). Note that included trials included different physical or mental health conditions and,  
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37 159 therefore, TAU may involve various different treatment regimens.  
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#### 44 160 **Quality Assessment**

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47 161 Both authors independently rated the quality of the included trials by using a quality  
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49 162 assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted  
50  
51 163 in two subsequent meta-analyses.[21-23] After independent rating, regular digital meetings were  
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53 164 held to discuss disagreements. This scale assesses the following nine quality criteria: 1) Were  
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3 165 symptoms/diagnoses assessed with a semi-structured diagnostic interview?, 2) Was a treatment  
4  
5 166 manual used?, 3) Were therapists trained either specifically for the study or in a general  
6  
7 167 training?, 4) Was treatment integrity checked by supervision and/or recordings and/or  
8  
9 168 standardized instruments?, 5) Was data analyzed with intent-to-treat analysis?, 6) Was group  
10  
11 169 allocation performed with a true randomization technique?, 7) Was randomization done by an  
12  
13 170 independent third person (or computer or sealed envelopes)?, 8) Were blinded assessors used for  
14  
15 171 interviews?, and 9) Were dropouts adequately reported? Items for each of the nine quality  
16  
17 172 criteria were scored on a four-point scale, where 3 indicates high quality (e.g., a published  
18  
19 173 treatment manual was used), 2 indicates limited quality (e.g., an unpublished treatment manual  
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21 174 was used), 1 indicates lack of required quality (e.g., no treatment manual was used), and 0  
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23 175 indicates unknown (i.e., required information not reported). When self-report measures were  
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25 176 used to assess outcomes in a given trial, a score of 3 was given on the quality item concerning  
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27 177 blinded assessments. In case of technology-based interventions, a trial received a score of 3 on  
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29 178 the quality items concerning trained therapists and formal fidelity checks due to the technology-  
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31 179 based standardized procedure. The nine ratings were then summed up to yield the respective trial  
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33 180 quality sum score and used as a potential moderator in meta-regressions.

#### 181 **Data extraction of outcome measures**

182 For each study, a maximum of two outcomes were selected, one positive psychological outcome  
183 (if available) and one negative (if available). Choice of extracted positive and/or negative  
184 psychological outcome(s) was data-driven. That is, we first extracted all negative and positive  
185 psychological outcomes per trial and then analyzed across all included trials which positive and  
186 negative psychological outcomes were most frequently assessed and reported in the PPT trial  
187 literature. For the negative outcomes, depression was by far the most frequently assessed



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188 outcome ( $k = 14$ ) and the sole negative outcome extracted. Assessment of positive outcomes was  
189 more heterogenous. Satisfaction with life was assessed most often ( $k = 11$ ), consecutively  
190 followed by happiness ( $k = 9$ ), well-being ( $k = 5$ ), hope ( $k = 5$ ), positive affect ( $k = 4$ ), quality of  
191 life ( $k = 3$ ), self-efficacy ( $k = 2$ ) and meaning in life ( $k = 1$ ). As such, we prioritized satisfaction  
192 with life first in the data extraction phase when several positive outcomes were reported in a  
193 given trial, happiness second and so forth. We planned to conduct two overarching analyses  
194 across included negative and positive outcomes, respectively, as well as sub-analyses on all  
195 individual outcomes with a sufficient number of independent trials (i.e.,  $k \geq 4$ ). Data was  
196 extracted by both authors and regular digital meetings were held to discuss disagreements.

### 197 **Statistical Analysis**

198 Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-  
199 effects models given that we expected large heterogeneity in reported effect sizes .[24–26] We  
200 prioritized intent-to-treat (ITT) data when available ( $k = 3$ ) over completer data ( $k = 17$ ,  
201 including  $k = 3$  with insufficient information on participant flow, see Table 1 for further  
202 information). To obtain the effect size Hedges's  $g$ , R first calculates the standardized mean  
203 difference  $d$  (i.e., control group mean subtracted from the experimental group mean and then  
204 divided by the pooled standard deviation). The standardized mean difference is then multiplied  
205 by a sample size correction factor  $J = 1 - (3 / (4df - 1))$  to yield Hedges's  $g$ . [27] Analyses were  
206 conducted if four or more trials were available for a given (sub-)analysis. [28] Effect sizes  $g$  may  
207 be conservatively interpreted with Cohen's convention of small ( $\pm 0.2$ ), medium ( $\pm 0.5$ ) and large  
208 ( $\pm 0.8$ ) effects. [29] As a test of homogeneity of effect sizes, we calculated the Q-statistic and the  
209 corresponding p-value. We also calculated the  $I^2$ -statistic, as a measure of heterogeneity of effect  
210 sizes across trials in percent. It has been suggested that  $I^2$ -statistics of 25, 50, and 75% may be

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3 211 interpreted as referring to low, moderate, and high levels of heterogeneity, respectively.[30]  
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5 212 Because we expected large heterogeneity, we also calculated prediction intervals.[31] Prediction  
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7 213 intervals, unlike  $I^2$ -statistics, present a heterogeneity estimate in the same metric as the original  
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9 214 effect size measure (i.e.,  $g$ ). As such, prediction intervals provide a predicted range for the true  
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11 215 treatment effect in similar future trials.[32] When the prediction interval excludes the null, it is  
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13 216 likely that similar future trials will also find significant effects. To check for potential effects of  
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15 217 outliers on meta-analytic outcomes, we aimed at repeating analyses without identified outliers.  
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17 218 Outliers were defined as effect sizes departing 3.3 standard deviations away from the pooled  
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19 219 mean effect in both directions.[33, 34] However, no outliers were identified in any of the  
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21 220 performed analyses. When analyses consisted of at least ten trials,[35] we assessed risk of  
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23 221 publication bias through visual inspection of funnel plots, Egger's test of asymmetry and number  
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25 222 of missing studies using the trim-and fill procedure.[36] The trim-and-fill procedure yields an  
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27 223 asymmetry-corrected estimate of the effect size (i.e., taking publication bias into account). We  
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29 224 calculated the numbers needed to treat (NNT) as a measure of efficacy that is easily interpretable  
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31 225 from a clinical perspective. It informs about the numbers of patients that need to be treated until  
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33 226 one adverse event is prevented.[37] NNT were calculated with the NNT function of the `dmatar`  
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35 227 package and are based on the pooled effect sizes (i.e., Hedges'  $g$ ). Lastly, we performed  
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37 228 moderator analyses in R with trial quality sum score and treatment length (in minutes) as  
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39 229 continuous variables (i.e., meta-regressions) and alliance as a dichotomous variable (i.e., trials  
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41 230 with vs. without the involvement of the founders of PPT[1]) to check for potential moderating  
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43 231 effects on efficacy outcomes. Since too few trials were available to check for alliance, we  
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45 232 performed sensitivity analyses with trials involving the founders omitted.[1] Moreover, we  
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3 233 performed more general sensitivity analyses with the leaving1out function of the metafor  
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5 234 package.

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## Results

### 237 Study characteristics

14 238 Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a  
15 239 total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of  
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17 240 the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with  
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19 241 WLC. Five trials (25%) compared PPT with an active control condition (e.g., treatment-as-usual,  
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21 242 control exercises). Three trials (15%) compared PPT with another psychological intervention  
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23 243 (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more than one control  
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25 244 conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and the remaining 6  
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27 245 trials in an individual setting. Two of the latter trials described in one publication applied an  
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29 246 internet-based PPT.[39] Treatment lengths was 917.06 minutes on average (unweighted mean  
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31 247 across trials reporting on both, number and duration of sessions,  $k = 17$ ) with a standard  
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33 248 deviation of 374.79 minutes. Note that the pioneering manual of Seligman et al.[1] constitutes of  
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35 249 a 720 minutes (i.e., 12 sessions á 60 minutes). Average number of sessions was 9.17 ( $SD = 2.71$ )  
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37 250 and average session length was 101.76 minutes ( $SD = 22.03$ ). Ten trials (50%) conducted follow-  
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39 251 up assessments on relevant outcomes whereas nine trials failed to do so. The remaining study  
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41 252 assessed data on a relevant outcome two weeks after the post-treatment-assessment,[40] which  
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43 253 we excluded from the follow-up data due to too short amount of time between post- and follow-  
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45 254 up assessment. The average follow-up period was 7.10 months ( $SD = 4.21$ ). Most trials were  
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54 255 conducted in Iran ( $k = 10$ ) and the United States of America ( $k = 5$ ). The remaining trials were

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3 256 conducted in Austria ( $k = 1$ ), South Korea ( $k = 1$ ), Canada ( $k = 1$ ), China ( $k = 1$ ) and the United  
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5 257 Kingdom ( $k = 1$ ). One publication entailing three trials was a PhD dissertation,[39] whereas the  
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7 258 remaining trials constituted articles published in peer-reviewed journals. Study quality was  
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10 259 moderate overall with a mean of 17.85 out of the possible range from 0 to 27. Study quality  
11  
12 260 varied considerably across included trials with a standard deviation of 4.69. The detailed quality  
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14 261 assessment per trial can be found in Table 2.  
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17 262  
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19 263 **-Table 1 here-**  
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### 22 265 **Participant characteristics**

23  
24 266 Basic characteristics of included participants per trial can be found in Table 1. A total of  
25  
26 267 1,360 participants participated in the included trials. Most of the participants were female  
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28 268 (unweighted mean across included trials = 71.75%) with a range from 23.63%[41] to 100%.[42]  
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30 269 The patients had a pooled weighted mean age of 39.97 with a pooled standard deviation of 10.18.  
31  
32 270 It is worth noting, however, that several studies only reported age ranges rather than means and  
33  
34 271 standard deviations[43] or did not report on age altogether.[39]  
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### 37 272 **The Efficacy of PPT in Increasing Positive Outcomes**

38 273 Results on the efficacy of PPT are displayed in Table 3. In terms of increasing various  
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40 274 positive outcomes such as satisfaction with life (SWL) and happiness, PPT was found  
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42 275 moderately more effective than WLC at post-treatment assessment ( $g = -0.72$ ,  $95\%CI: -1.31; -$   
43  
44 276  $0.14$ ,  $k = 10$ ,  $NNT = 2.55$ ). See Figure 2 for the corresponding forest plot. Results remained  
45  
46 277 similar, when the results of Mohamadi et al.[20] were entered as reported in their publication ( $g$   
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48 278  $= -0.82$ ,  $95\%CI: -1.39; -0.25$ ,  $k = 10$ ,  $NNT = 2.27$ ). Number of available trials allowed for a  
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3 279 publication bias check. While a visual inspection of the funnel plot led to the suspicion of  
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5 280 publication bias (i.e., missing trials to the left and a potential outlier to the far left, see eFig. 1 in  
6  
7 281 the supplement), Egger's test did not indicate significant asymmetry ( $t = -1.91$ ,  $p = .093$ ). The  
8  
9 282 sensitivity analysis yielded that one trial had particular influence on the pooled effect size. When  
10  
11 283 Abdeyan et al., 2018 (i.e., assessed positive outcome = hope) was omitted, pooled effect size  
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13 284 decreased to  $g = -0.44$  (see eTable 1 in the supplement). No evidence was found for the efficacy  
14  
15 285 of PPT in increasing positive outcomes compared to WLC at follow-up assessment ( $g = -0.36$ ,  
16  
17 286  $95\%CI: -0.83; 0.11$ ,  $k = 4$ ,  $NNT = 5.01$ ). See eFigure 2 in the supplement for the corresponding  
18  
19 287 forest plot. Follow-up assessment results are to be scrutinized with due caution in the light of low  
20  
21 288 number of available trials ( $k = 4$ ), large heterogeneity in effect sizes ( $I^2 = 74.34$ ) and the wide  
22  
23 289 range of the prediction interval ( $PI = -1.29; 0.57$ ). Satisfaction with life was the only positive  
24  
25 290 outcome with enough trials to warrant a meta-analytic sub-analysis. In comparison to WLC at  
26  
27 291 post-treatment assessment, PPT was not found more effective in increasing satisfaction with life  
28  
29 292 ( $g = -0.15$ ,  $95\%CI: -0.40; 0.09$ ,  $k = 4$ ,  $NNT = 11.55$ ). See eFigure 3 in the supplement for the  
30  
31 293 corresponding forest plot. Heterogeneity in outcomes was low ( $I^2 = 11.20$ ). The sensitivity  
32  
33 294 analysis did not yield that one of the four studies was particularly influential on the pooled effect  
34  
35 295 with all leaving out analyses yielding a non-significant pooled  $g$  (see eTable 1 in the  
36  
37 296 supplement). In comparison to active control conditions (i.e., treatment-as-usual and placebo  
38  
39 297 exercises) at post-treatment assessment, PPT yielded a large effect size in increasing positive  
40  
41 298 outcomes ( $g = -0.92$ ,  $95\%CI: -1.74; -0.11$ ,  $k = 6$ ,  $NNT = 2.05$ ). See eFigure 4 in the supplement  
42  
43 299 for the corresponding forest plot. However, heterogeneity in outcomes was large ( $I^2 = 92.51$ ) and  
44  
45 300 the prediction interval included the null ( $PI = -2.98; 1.13$ ) illustrating large variability in  
46  
47 301 findings. When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, &  
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3 302 Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were  
4  
5 303 found for increasing positive outcomes ( $g = -0.29$ ,  $95\%CI: -0.89; 0.32$ ,  $k = 6$ ,  $NNT = 6.24$ ). See  
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7  
8 304 eFigure 5 in the supplement for the corresponding forest plot. Again, heterogeneity in outcomes  
9  
10 305 was large ( $I^2 = 79.57$ ) and the prediction interval included the null ( $PI = -1.71; 1.13$ ). Results  
11  
12 306 remained insignificant when results of Mohamadi et al.[20] were entered as reported in their  
13  
14 307 publication ( $g = -0.65$ ,  $95\%CI: -1.31; 0.01$ ,  $k = 6$ ). Lastly, when trials with alliance (i.e.,  
15  
16 308 involvement of the founder) were omitted, results for the comparison with WLC at post-  
17  
18 309 treatment assessment remained similar ( $g = -1.04$ ,  $95\%CI: -1.79; -0.28$ ,  $k = 7$ ,  $NNT = 1.87$ , see  
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21 310 Table 3).

### 24 311 **The Efficacy of PPT in Decreasing Negative Outcomes**

26 312 PPT was found moderately more effective in reducing depression, negative affect and  
27  
28 313 stress than WLC at post-treatment assessment ( $g = 0.48$ ,  $95\%CI: 0.18; 0.78$ ,  $k = 8$ ). See Figure 2  
29  
30 314 for the corresponding forest plot. To avoid one adverse event (i.e., depression, negative affect or  
31  
32 315 stress), a little less than four patients needed to be treated ( $NNT = 3.76$ ). The sensitivity analysis  
33  
34 316 did not yield that one of the eight studies was particularly influential on the pooled effect with all  
35  
36 317 leaving1out analyses yielding moderate pooled effect sizes between 0.40 and 0.58 (see eTable 1  
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38 318 in the supplement). Results on decreasing depression were similar ( $g = 0.57$ ,  $95\%CI: 0.21; 0.92$ ,  
39  
40 319  $k = 6$ ,  $NNT = 3.22$ ). See eFigure 6 in the supplement for the corresponding forest plot. Again, the  
41  
42 320 sensitivity analysis did not yield that one of the six studies was particularly influential with  
43  
44 321 moderate pooled effect sizes between 0.47 and 0.68 for the leaving1out analyses (see eTable 1 in  
45  
46 322 the supplement). Prediction intervals for both analyses (i.e., all negative outcomes and  
47  
48 323 depression only) excluded the null ( $PI = -0.17; 1.13$ ;  $PI = -0.18; 1.31$ , respectively) highlighting  
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50 324 substantial levels of heterogeneity in efficacy outcomes and remaining uncertainty about the true  
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1 Meta-analytic review of positive psychotherapy  
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3 325 efficacy when similar future trials accumulate. In comparison to active control conditions (i.e.,  
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5 326 treatment-as-usual with or without medication and placebo exercises) at post-treatment  
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7 327 assessment, PPT yielded large effect sizes in reducing depression ( $g = 0.94$ ,  $95\%CI$ : 0.18; 1.70,  $k$   
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9 = 6,  $NNT = 2.03$ ). Please find the corresponding forest plot in eFigure 7 in the supplementary  
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11 328 = 6,  $NNT = 2.03$ ). Please find the corresponding forest plot in eFigure 7 in the supplementary  
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13 329 materials. Again, heterogeneity was large ( $I^2 = 90.28$ ) and the prediction interval excluded the  
14  
15 330 null ( $PI = -0.96$ ; 2.83). When compared to other active treatment conditions (i.e., CBT, DBT,  
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17 331 MBCT, & Neurofeedback-aided Meditation), no differences in efficacy at post-treatment  
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19 332 assessment were found for decreasing negative outcomes ( $g = 0.08$ ,  $95\%CI$ : -0.48; 0.64,  $k = 6$ ,  
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21 333  $NNT = 22.22$ ). Please find the corresponding forest plot in eFigure 8 in the supplement. Trials  
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23 334 that included follow-up assessments on the efficacy of PPT in decreasing negative outcomes  
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25 335 were too few to allow for meta-analytic review for all included comparisons ( $k < 4$ ). Lastly,  
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27 336 when trials with alliance (i.e., involvement of the founder) were omitted, results for the  
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29 337 comparison with WLC at post-treatment assessment remained similar ( $g = 0.63$ ,  $95\%CI$ : 0.20;  
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31 338 1.07,  $k = 5$ ,  $NNT = 2.89$ , see Table 3).

### 339 Moderator Analyses

340 Moderator analyses revealed that trial quality as a continuous variable was associated  
341 with effect sizes in most of the abovementioned analyses. See Table 4 for an overview of results.  
342 With regards to the efficacy of PPT in increasing positive outcomes in comparison to WLC at  
343 post-treatment assessment, trial quality was found to be a significant moderator with higher trial  
344 quality being associated with larger effect sizes ( $b = 0.17$ ,  $p = .003$ ). A similar result was found  
345 for the follow-up assessment results ( $b = 0.12$ ,  $p = .036$ ). In terms of the comparison with active  
346 control conditions at post-treatment assessment, trial quality was also found to moderate effect  
347 sizes with higher trial quality being associated with larger effect sizes ( $b = 0.18$ ,  $p = .015$ ). No

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3 348 significant moderation of trial quality was found for the comparison with other active treatment  
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5 349 conditions ( $b = -0.01$ ,  $p = .907$ ) nor for the sub-analysis on satisfaction with life ( $b = -0.01$ ,  $p =$   
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7  
8 350  $.915$ ).

9  
10 351 In terms of the efficacy of PPT in decreasing negative outcomes in comparison to WLC  
11  
12 352 at post-treatment assessment, trial quality was found to be a significant moderator with higher  
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14 353 trial quality being associated with smaller effect sizes ( $b = -0.08$ ,  $p = .003$ ). A similar result was  
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16  
17 354 found for the sub-analyses on depression ( $b = -0.11$ ,  $p < .001$ ). Similarly, the sub-analysis on  
18  
19 355 depression for the comparison of PPT and active control conditions yielded a significant  
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21 356 moderation of trial quality with higher trial quality being associated with smaller effect sizes ( $b =$   
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23  
24 357  $-0.17$ ,  $p = .005$ ). However, a significant moderation was found for the comparison with other  
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26 358 active treatment conditions with higher trial quality being related to larger effect sizes in  
27  
28 359 decreasing negative outcomes ( $b = 0.13$ ,  $p < .001$ ). No evidence was found for a moderation of  
29  
30 360 treatment length in any of the analyses (see Table 4).

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## 34 35 362 Discussion

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37 363 Our systematic search resulted in 20 randomized controlled trials that assessed the  
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39 364 efficacy of PPT. The results of the meta-analysis indicate that PPT can effectively increase  
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42 365 positive psychological outcomes and decrease depression at post-treatment assessment. Both  
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44 366 comparisons with WLC and active control groups support the short-term efficacy of PPT.  
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47 367 Overall, there is too few data on the long-term efficacy of PPT. Additionally, moderator analyses  
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49 368 yielded that trial quality was significantly associated with effect size. For positive outcomes,  
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51 369 higher quality of trials was related to larger effect sizes. Whereas for depression, higher quality  
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54 370 of trials was related to smaller effect sizes. However, the low number of available trials, large



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3 371 heterogeneities, identification of some influential single trials in the sensitivity analyses and wide  
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5 372 prediction intervals call for cautious statements on the efficacy.  
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9 373 The findings support the short-term efficacy of PPT in increasing positive psychological  
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11 374 outcomes. However, the larger magnitude in effect sizes for comparisons with active control  
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13 375 conditions (pooled  $g = -0.92$ ) compared to WLC (pooled  $g = -0.72$ ) is surprising and  
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15 376 counterintuitive. Usually the opposite pattern is found in clinical research.[21, 28] Unplanned  
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17 377 post-hoc investigations on potential reasons hint towards the effect of an almost outlier in the  
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19 378 analysis involving active comparison groups.[7] This trial offered either PPT or treatment-as-  
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21 379 usual to cancer patients and yielded a strikingly large effect size at post-treatment assessment  
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23 380 favoring PPT ( $g = -2.79$ ) for increasing meaning in life. Furthermore, a second trial on cancer  
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25 381 patients also produced a large effect size for increasing happiness ( $g = -1.80$ ) as compared to  
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27 382 waitlist at post-treatment assessment.[6] While these two trials on cancer patients suggest that  
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29 383 PPT might be highly effective in increasing positive outcomes in this population, two trials  
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31 384 remain of course a slim evidence-base. It should be noted, however, that the analysis on passive  
32  
33 385 control conditions (i.e., waitlist controls) also involved an almost outlier.[40] This study offered  
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35 386 PPT to depressed patients and yielded a strikingly large effect size at post-treatment assessment  
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37 387 ( $g = -2.98$ ) favoring PPT in increasing hope. Both almost outlier studies involved a moderate  
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39 388 sample size (see Table 1). All this suggests that more trials are needed to allow for firmer  
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41 389 conclusions.  
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48 390 When PPT was compared to other established psychological interventions such as CBT,  
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50 391 current data did not suggest any significant difference in efficacy. Accordingly, the results of the  
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52 392 six RCTs included in this comparison suggests that PPT is similarly effective in increasing  
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3 393 positive psychological outcomes. However, due to the low number of trials for this comparison  
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5 394 these findings need to be viewed with due caution.  
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9 395 The first and foremostly assessed negative outcome in the PPT literature remains  
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11 396 depression. As suggested and intended by its developers, PPT was found moderately to largely  
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13 397 effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with  
14  
15 398 larger effect sizes in lowering depression for PPT in comparison to active control conditions  
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17 399 (pooled  $g = 0.94$ ) as opposed to WLC (pooled  $g = 0.57$ ). Once more, unplanned post-hoc  
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19 400 investigations were performed in an attempt to find potential reasons for the counterintuitive  
20  
21 401 finding. Again, we found that an almost outlier might explain the difference. The analysis  
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23 402 involving active control groups involved an almost outlier with an effect size of  $g = 2.45$ ,<sup>[44]</sup>  
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25 403 whereas the analysis involving WLC did not involve such an almost outlier.  
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30 404 Data on the efficacy at follow-up assessments altogether were scarce. The only feasible  
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32 405 analysis on follow-up assessment data (i.e., PPT vs. WLC in increasing positive outcomes)  
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34 406 yielded a non-significant effect size. The current available literature does not allow for any other  
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36 407 valid follow-up analyses and, thus, conclusions on the long-term efficacy of PPT cannot not yet  
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38 408 be made. This represents perhaps the main limitation of the literature on the efficacy of PPT. For  
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40 409 the same reason, additional sensitivity analyses (e.g., group vs. individual PPT, or PPT efficacy  
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42 410 by health condition vs. mental health condition) were not feasible.  
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47 411 Trial quality overall was moderate and, therefore, leaves room for improvement. Results  
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49 412 overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs)  
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51 413 more generally which report moderate effect sizes in increasing positive outcomes and  
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53 414 decreasing negative outcomes.<sup>[11-19]</sup> A recent meta-analysis on PPIs further also reports on a  
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3 415 significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary  
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5 416 considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not  
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8 417 straightforward.

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11 418 This represents the first meta-analysis with an exclusive focus on the efficacy of PPT.

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13 419 Several limitations need to be considered. First and foremost, the number of included trials is  
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15 420 relatively small and accordingly more research is needed to draw firmer conclusions. Secondly,  
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17 421 depression and SWL were the only two outcomes with enough trials to warrant sub-analyses.  
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19 422 More research is needed to allow for more homogenous analyses on PPT efficacy for specific  
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21 423 outcomes. Thirdly and related to the second limitation, the two overarching analyses on various  
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23 424 positive and negative outcomes involved large heterogeneity, respectively. The decision to  
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25 425 conduct such overarching analyses on heterogenous outcomes was based on the overall scarcity  
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27 426 of trials. We aimed at conducting more homogenous sub-analyses were possible which were, as  
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29 427 mentioned, only feasible for depression and SWL. As more trials accumulate, more fine-grained  
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31 428 analyses will become feasible. Fourthly and lastly, the long-term efficacy of PPT remains  
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33 429 uncertain due to lack of follow-up assessments.  
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### 39 **Conclusion**

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41 431 Our findings indicate that PPT can effectively increase positive outcomes and decrease  
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43 432 negative outcomes at post-treatment assessment. However, there is lack of follow-up data and  
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45 433 the number of available trials altogether remains scarce precluding many of the planned sub-  
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47 434 analyses. More research with high methodological rigor and including follow-up assessments is  
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49 435 needed to draw firmer and more precise conclusions on PPT efficacy.  
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3 438 **Statements**

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6 439 **Acknowledgments**

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8 440 None.

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14 442 **Data Availability Statement**

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16  
17 443 We performed a meta-analysis on published and publicly accessible data. No additional data  
18  
19 444 available.

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24 446 **Competing Interests Statement**

25  
26 447 The authors declare that they have no conflict of interest to declare

27  
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30  
31 449 **Funding Sources Statement**

32  
33 450 This research received no specific grant from any funding agency in the public, commercial or  
34  
35 451 not-for-profit sectors.

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40 453 **Ethics statement**

41 454 Not applicable. We performed a meta-analysis on published data.

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46 456 **Author Contributions Statement**

47  
48 457 THH and NM conceptualized the meta-analysis conducted the systematic literature search and  
49  
50 458 coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript  
51  
52 459 and agreed to be accountable for all aspects of the work.

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582 \*indicates that trial was included in the present meta-analysis  
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**Table 1.** Basic characteristics of included trials

Study	Country	Health condition	Intervention (treatment manual) <sup>a</sup>	Format	Control group (post-treatment n, format)	Nr. of sessions x Duration in min.	FU <sup>b</sup>	post-treatment N	Mean age ± SD or range	% female	Stat. analysis	Negative and/or positive psychological outcome analysed (utilized instrument)	QS
Abdeyan et al.[40]	Iran	Depression	PPT	Group	WLC (n = 32)	8 x 90	n.a. <sup>c</sup>	64	33 ± 6.21	60.90	n.r.	Hope (SHQ)	10
Asgharipoor et al.[45]	Iran	Depression	PPT (Sahebi, 2011)	Indiv.	CBT (n = 9, group)	12 x 120	n.a.	18	26.64 ± 5.97	72.22	n.r.	Depression (BDI-II) & happiness (OHQ)	12
Asl et al.[42]	Iran	Infertility and Depression	PPT (Parks-Sheiner, 2009)	Group	WLC (n = 16)	6 x 90	n.a.	31	30.99 ± 5.88	100	Compl.	SWL (SWLS)	21
Dowlatabadi et al.[6]	Iran	Breast cancer	PPT	Group	WLC (n = 17)	10 x 90	n.a.	33	36.83 ± 5.33	100	Compl.	Depression (BDI-II) & happiness (OHQ)	13
Furchtlehner et al.[46]	Austria	Depression	PPT (Rashid & Seligman, 2018)	Group	CBT (n = 46, group)	14 x 120	6	92	40.66 ± 11.40	64.10	ITT	Depression (BDI-II) & happiness (DHS)	26
Heydari et al.[43]	Iran	Hemophilia	PPT (Seligman et al. 2014)	Indiv.	WLC (n = 28)	8 x 120	2	56 <sup>c</sup>	10.25	58.93	Compl.	Hope (SHQ-C)	16
Hwang et al.[38]	South Korea	Depression	mPPT (self-developed)	Indiv.	WLC (n = 8) & NFB-M (n = 8, indiv.)	10 x 50	4	24	22.87 ± 2.1	75.00	Compl.	Negative affect (SPANE) & well-being (FS)	13
Khayatan et al.[8]	Iran	Multiple Sclerosis and depression	PPT	Group	WLC (n = 15)	6 x 90	n.a.	30	31.81 ± 6.4	100	n.r.	Depression (BDI-II)	13
Mohamadi et al.[20]	Iran	Irritable bowel syndrome	PPT (Lee, 2015)	Group	DBT (n = 16, group), MBCT (n = 20, group) and WLC (n = 20)	8 x 150	n.a.	73	29.7 ± 3.5	63.01	Compl.	Stress (PSS) & quality of life (IBS-QOL)	17
Nikrahan et al.[41]	Iran	Coronary artery disease	PPT	Group	TAU (n = 14)	6 x 90	2	27	56.85 ± 8.24	23.63	ITT	Depression (BDI-II)	26
Parks-Sheiner study 1[39]	USA	Mild to moderate depression	mPPT	Group	WLC (n = 55)	6 x 90	12	104	n.r.	46.00	Compl.	Depression (BDI-II) & SWL (SWLS)	18
Parks-Sheiner study 2[39]	USA	Mild to moderate depression	Online mPPT	Indiv.	Control exercise (n = 42)	n.r.	12	275	46.70 ± 12.43	78.10	Compl.	Depression (BDI-II) & SWL (SWLS)	23
Parks-Sheiner study 3[39]	USA	Mild to moderate depression	Online mPPT	Indiv.	WLC (n = 81)	n.r.	3	140	43.81 ± 11.86	75.70	Compl.	Depression (BDI-II) & SWL (SWLS)	23



## Meta-analytic review of positive psychotherapy

Saeedi et al.[7]	Iran	Cancer	PPT	Group	TAU (n = 31)	8 x 90	n.a.	61	47.40 ± 13.10	93.44	Compl.	Meaning in life (LAP)	14
Schrank et al.[4]	UK	Psychosis	PPT	Group	TAU (n = 41)	11 x 90	n.a.	84	42.40 ± 11.25	40.43	Compl.	Depression (DHS-S) & happiness (PPTI)	24
Seligman et al. study 1[1]	USA	Mild to moderate depression	PPT	Group	WLC (n = 20)	6 x 120	12	34	Students	42.50	Compl.	Depression (BDI-II) & SWL (SWLS)	17
Seligman et al. study 2[1]	USA	Depression	PPT	Indiv.	TAU (n = 9), TAU-MED (n = 12)	14 x n.r.	12	32	18 years	68.75	Compl.	Depression (BDI-II) & SWL (SWLS)	18
Taghvaenia et al.[47]	Iran	Depression	PPT	Group	WLC (n = 26)	10 x 120	n.a.	52	62.44 ± 12.81	100	Compl.	Depression (BDI-II) & happiness (OHQ)	20
Uliaszek et al.[5]	Canada	Psycho-pathology (trans-diagnostic)	PPT	Group	DBT (n = 27)	12 x 120	n.a.	54	22.7 ± 5.1	77.78	ITT	Depression & happiness (PPTI)	19
Zhang et al.[44]	China	Mild to moderate depression	PPT	Group	TAU (n = 42)	8 x 90	6	76	20.9 ± 1.0	94.90	Compl.	Depression (BDI-II) & self-efficacy (GSE)	14

BDI-II, Beck Depression Inventory 2<sup>nd</sup> edition; CBT, Cognitive Behavioral Therapy; Compl., Completer analysis; DBT, Dialectical Behavior Therapy; DHS, Depression-Happiness Scale; DHS-S, Depression-Happiness Scale – Short; FS, Flourishing Scale; FU, follow-up period in months (i.e., longest reported follow-up assessment); GSE, General Self Efficacy scale; HLM, Hierarchical Linear Modelling; IBS-QOL, Irritable Bowl Syndrome – Quality Of Life; indiv., individual; ITT, Intent-To-Treat analysis; LAP, Life Attitude Profile; MBCT, Mindfulness-Based Cognitive Therapy; mPPT, modified Positive Psychotherapy; n.a., not applicable; NFB-M, Neurofeedback-aided Meditation; post-treatment N, number of participants (experimental group + comparison group) at post-treatment assessment; n.r., not reported; OHQ, Oxford Happiness Questionnaire; PPT, Positive Psychotherapy as developed by Seligman et al., 2006,[1] unless indicated differently; PPTI, Positive Psychotherapy Inventory; PSS, Perceived Stress Scale; SHQ, Snyders' Hope Questionnaire; SHQ-C, Snyders' Hope Questionnaire – Child version; SPANE, Scale of Positive and Negative Experience; Stat. analysis, Statistical analysis applied; SWL, Satisfaction With Life; SWLS, Satisfaction With Life Scale; TAU, Treatment-As-Usual; TAU-MED, Treatment-As-Usual plus antidepressant medication; WLC, Waitlist Control condition.

<sup>a</sup>PPT, positive psychotherapy manual as founded by Seligman et al., 2006 [1].

<sup>b</sup>Longest reported follow-up assessment on relevant outcome(s) in months, FU assessment used in the meta-analysis.

<sup>c</sup>reported but irrelevant, as follow-up assessment was conducted at two weeks post-treatment; <sup>d</sup>no post-treatment assessment available, hence follow-up assessment n reported.

## Meta-analytic review of positive psychotherapy

**Table 2.** Quality assessment of included trials

Trial	Q1 - interview-based diagnostics	Q2 - manual-based treatment	Q3 - trained therapists	Q4 - integrity check	Q5 - ITT	Q6 - RCT	Q7 - independent randomisation	Q8 - blind assessments	Q9 - dropouts reported	Q sum
Abdeyan et al. (2018)	1	3	0	0	0	3	0	3	0	10
Asgharipoor et al. (2012)	3	3	0	0	0	3	0	3	0	12
Asl et al. (2016)	3	3	3	2	1	3	0	3	3	21
Dowlatabadi et al. (2016)	3	0	0	0	1	3	0	3	3	13
Furchtlehner et al. (2019)	3	3	2	3	3	3	3	3	3	26
Heydari et al. (2019)	3	3	0	0	1	3	0	3	3	16
Hwang et al. (2016)	1	0	0	2	1	3	0	3	3	13
Khayatan et al. (2014)	1	3	3	0	0	3	0	3	0	13
Mohamadi et al. (2019)	1	3	3	0	1	3	0	3	3	17
Nikrahan et al. (2016)	3	3	3	2	3	3	3	3	3	26
Parks-Sheiner (2009, study 1)	1	3	3	0	1	3	1	3	3	18
Parks-Sheiner (2009, study 2)	1	3	3	3	1	3	3	3	3	23
Parks-Sheiner (2009, study 3)	1	3	3	3	1	3	3	3	3	23
Saeedi et al. (2019)	1	3	0	0	1	3	0	3	3	14
Schrank et al. (2016)	3	3	3	2	1	3	3	3	3	24
Seligman et al. (2006, study 1)	1	3	3	0	1	3	0	3	3	17
Seligman et al. (2006, study 2)	0	3	3	2	1	3	0	3	3	18
Taghvaenia et al. (2019)	1	3	3	0	1	3	3	3	3	20
Uliaszek et al. (2016)	3	3	0	1	3	3	0	3	3	19
Zhang et al. (2015)	1	3	0	0	1	3	0	3	3	14

Q = quality criterion; Q sum = quality sum score. See paragraph on quality assessment in the method section for more details on the quality criteria and their scoring.

**Table 3**

Efficacy of PPT for increasing positive outcomes and decreasing negative outcomes

Comparison groups and timepoint of assessment (i.e., post vs. FU)	<i>k</i>	<i>g<sup>a</sup></i>	<i>SE</i>	95% CI PI	<i>I<sup>2</sup></i>	<i>NNT</i>
All trials						
Positive outcomes merged (i.e., SWL, happiness, well-being, hope, positive affect, quality of life, self-efficacy, & meaning in life)						
PPT vs. WLC at post	10	<b>-0.72*</b>	0.30	-1.31; -0.14 PI -2.55; 1.10	90.37***	2.55
PPT vs. WLC at FU	4	-0.36	0.24	-0.83; 0.11 PI -1.29; 0.57	74.34*	5.01
PPT vs. ACC at post	6	<b>-0.92*</b>	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. ( <i>k</i> = 2)					
PPT vs. OtherATC at post	6	-0.29	0.31	-0.89; 0.32 PI -1.71; 1.13	79.57***	6.24
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on SWL						
PPT vs. WLC – SWL at post	4	-0.15	0.13	-0.40; 0.09 PI -0.45; 0.15	11.20	11.55
PPT vs. WLC – SWL at FU	n.a. ( <i>k</i> = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. WLC at post	8	<b>0.48**</b>	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. WLC at FU	n.a. ( <i>k</i> = 3)					
PPT vs. ACC at post	All six trials conducted on depression, see below					
PPT vs. OtherATC at post	6	0.08	0.29	-0.48; 0.64 PI -1.23; 1.39	76.79***	22.22
PPT vs. OtherATC at FU	n.a. ( <i>k</i> = 1)					
Subanalyses on depression						
PPT vs. WLC – depression at post	6	<b>0.57**</b>	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. WLC – depression at FU	n.a. ( <i>k</i> = 3)					

## Meta-analytic review of positive psychotherapy

PPT vs. ACC - depression at post	6	<b>0.94*</b>	0.39	0.18; 1.70 PI -0.96; 2.83	90.28***	2.03
PPT vs. ACC - depression at FU	n.a. ( $k = 3$ )					
PPT vs. OtherATC - depression at post	n.a. ( $k = 3$ )					
Main-analyses with Seligman et al. [1] and Parks-Sheiner [39] omitted (i.e., alliance)						
Positive outcomes merged						
PPT vs. WLC at post	7	<b>-1.04**</b>	0.38	-1.79; -0.28 PI -3.04; 0.97	88.21	1.87
PPT vs. ACC at post	n.a. ( $k = 3$ )					
PPT vs. OtherATC at post	n.a. (i.e. no trials with alliance)					
Negative outcomes merged						
PPT vs. WLC at post	5	<b>0.63**</b>	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPT vs. ACC at post	n.a. ( $k = 3$ )					
PPT vs. OtherATC at post	n.a. (i.e. no trials with alliance)					

ACC, Active Control Conditions, included TAU and placebo;  $k$ , number of trials for the respective comparison; n.a., not applicable; FU, Follow-Up assessment;  $I^2$ , measure of heterogeneity in % including the p-value of the Q-statistic as indicated by asterisks; OtherATC, Other Active Treatment Conditions (included Cognitive Behavioral Therapy, Dialectic Behavioral Therapy, and Mindfulness-Based Cognitive Behavioral Therapy); PI, prediction interval; post, post-treatment assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of respective effect size.

<sup>a</sup>A negative Hedges'  $g$  for positive outcomes indicates efficacy in favor of PPT over control conditions (and vice versa). A positive Hedges'  $g$  for negative outcomes indicates efficacy in favor of PPT over control conditions (and vice versa).

\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

**Table 4**

Sub-analyses on trial quality and treatment length as potential moderators

Comparison groups and timepoint of assessment	<i>k</i>	Intercept	<i>b</i>	<i>rem. I<sup>2</sup></i>	<i>p</i>
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	10	-3.60	<b>0.17</b>	79.93***	<b>.003</b>
PPT vs. WLC at follow-up	4	-2.56	<b>0.12</b>	38.01	<b>.036</b>
PPT vs. ACC at post	6	-4.21	<b>0.18</b>	83.61***	<b>.015</b>
PPT vs. OtherATC at post	6	-0.13	-0.01	82.40***	.907
Sub-analysis on SWL					
PPT vs. WLC at post	4	-0.02	-0.01	56.42	.915
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. WLC at post	8	2.00	<b>-0.08</b>	0	<b>.003</b>
PPT vs. ACC at post	All six trials conducted on depression, see below				
PPT vs. OtherATC at post	6	-2.24	<b>0.13</b>	21.28	<b>&lt;.001</b>
Sub-analysis on depression					
PPT vs. WLC at post	6	2.50	<b>-0.11</b>	0	<b>&lt;.001</b>
PPT vs. ACC at post	6	4.47	<b>-0.17</b>	76.91***	<b>.005</b>
Potential Moderator: Treatment length <sup>a</sup>					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	9	-1.19	0.00	89.69	.734
PPT vs. WLC at follow-up	n.a. ( <i>k</i> = 3)				
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post	6	1.16	-0.00	74.95	.159
Sub-analysis on SWL					
PPT vs. WLC at post	n.a. ( <i>k</i> = 3)				
Negative outcomes merged (i.e., depression, negative affect & stress)					
PPT vs. WLC at post	7	0.92	-0.00	16.70	.368
PPT vs. ACC at post	n.a. ( <i>k</i> = 3)				
PPT vs. OtherATC at post	6	-0.98	0.00	74.26	.285
Sub-analysis on depression					
PPT vs. WLC at post	5	0.82	-0.00	21.67	.801

ACC, Active Control Condition; *b*, refers to the interaction term between treatment and covariate (in Hedges' *g*); OtherATC, Other Active Treatment Condition; PPT, Positive Psychotherapy; *rem. I<sup>2</sup>*, remaining amount of unexplained heterogeneity including the *p*-value of the *Q*-statistic as indicated by asterisks; post, post-treatment

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assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of moderation.

\*  $p < .05$  \*\*  $p < .01$ , \*\*\*  $p < .001$

<sup>a</sup>Number of trials differs in comparison to main-analyses since not all publications reported on treatment length as can be witnessed in Table 1.

### Figure Legends

Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

Fig.2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment

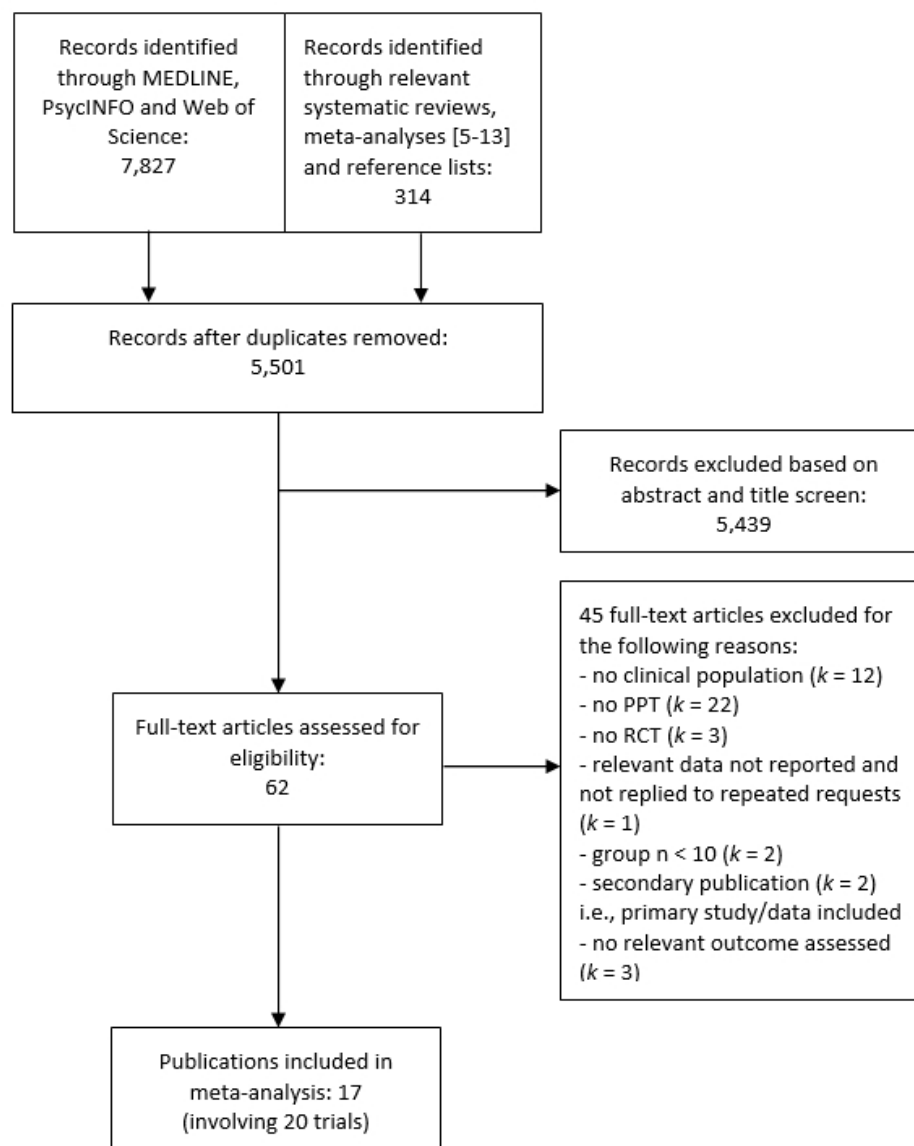
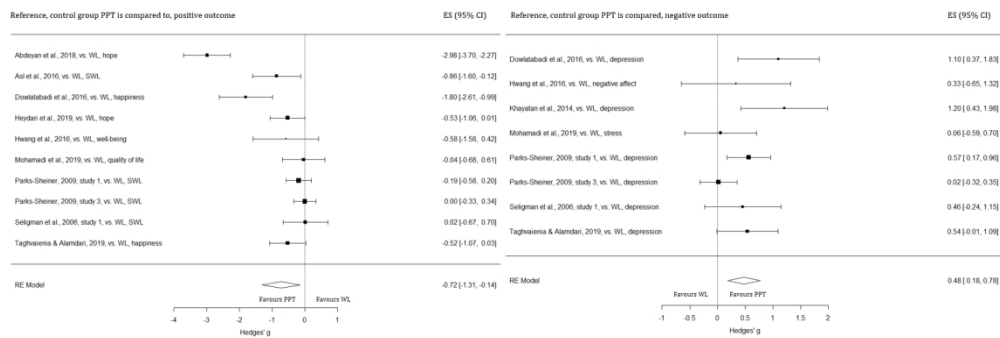


Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

Figure 2

Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment



CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control conditions. Size of squares indicates size of trial (i.e., N). Width of diamonds indicates the 95% confidence interval of pooled effect sizes.

Fig. 2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment



## Supplementary materials

**eList 1.** Search strategy (PsycINFO and MEDLINE)

**eFig. 1.** Funnel plot – Efficacy of PPT in increasing positive outcomes in comparison to waitlist control conditions at post-treatment

**eFig. 2.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to waitlist control conditions at follow-up

**eFig. 3.** Forest plot – Efficacy of PPT in increasing satisfaction with life in comparison to waitlist control conditions at post-treatment

**eFig. 4.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to active control conditions at post-treatment

**eFig. 5.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to other active treatment conditions at post-treatment

**eFig. 6.** Forest plot – Efficacy of PPT in decreasing depression in comparison to waitlist control conditions at post-treatment

**eFig. 7.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to active control conditions at post-treatment

**eFig. 8.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to other active treatment conditions at post-treatment

**eTable 1.** Leave1out sensitivity analyses for main-analyses (PPT vs. WLC at post assessment)

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2  
3 **eList 1.** Search strategy (PsycINFO and MEDLINE)  
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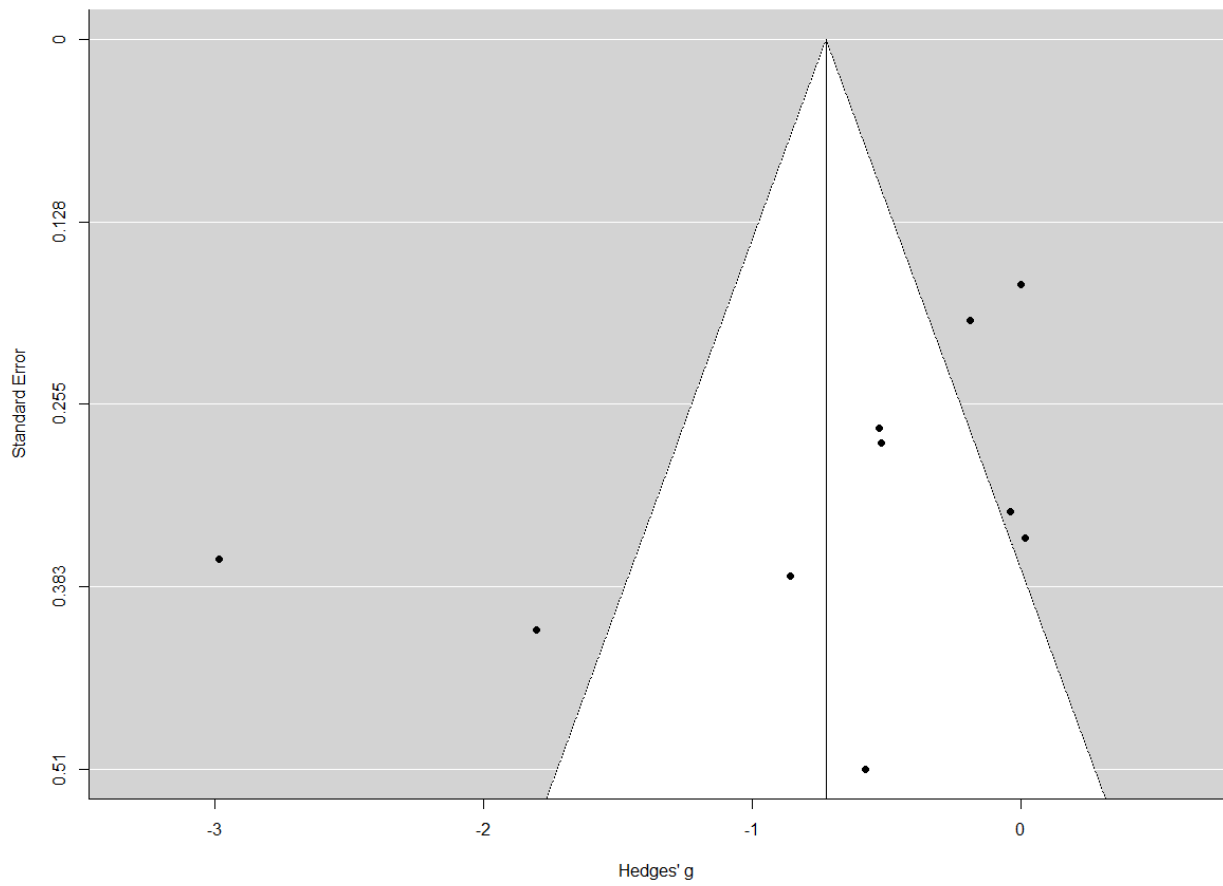
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6 SU positive psychotherapy".  
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8 **Time limit:** Jan 1 2006 to Feb 13 2020.  
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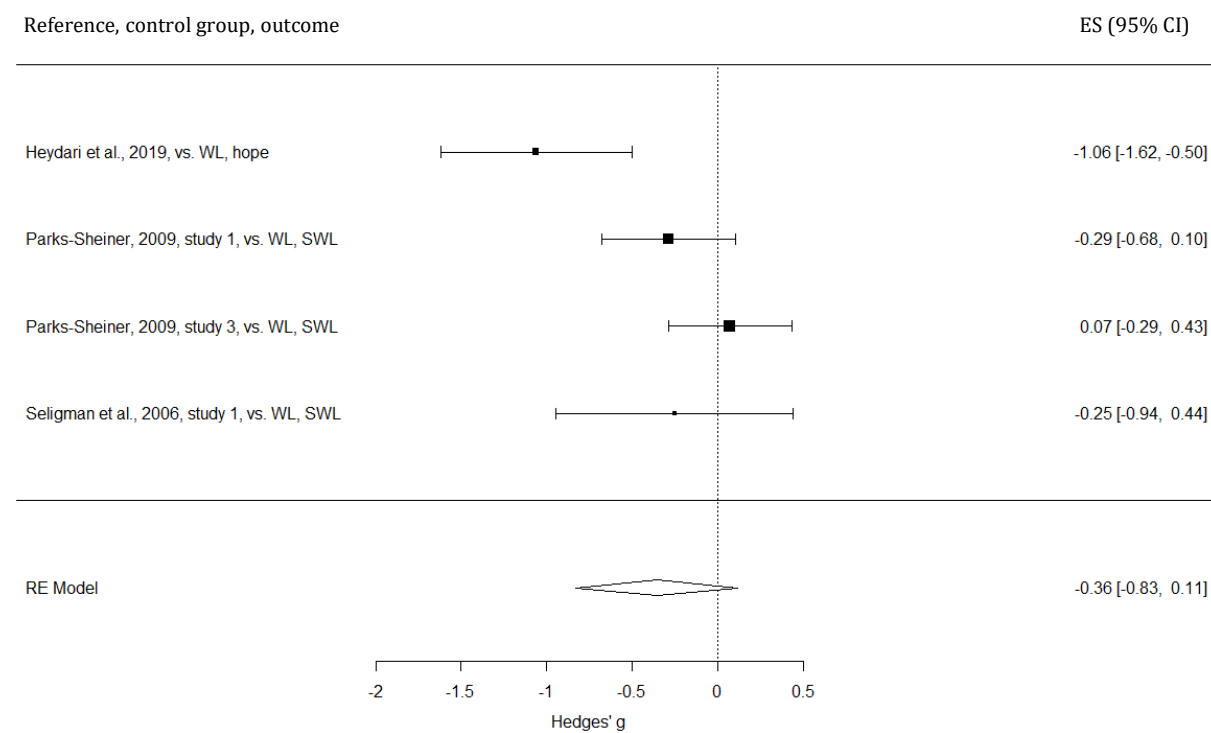
10 **Other limits and filters:** None.  
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**eFig. 1.** Funnel plot – Efficacy of PPT in increasing positive outcomes in comparison to waitlist control conditions at post-treatment

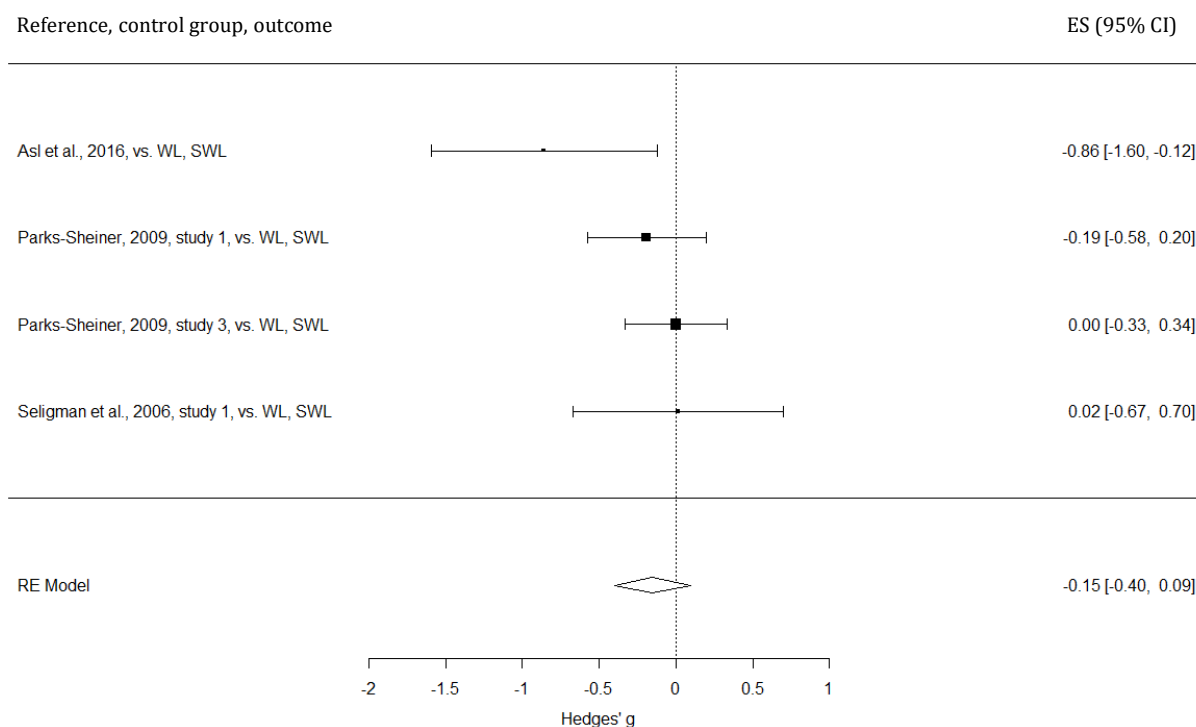


**eFig. 2.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to waitlist control conditions at follow-up



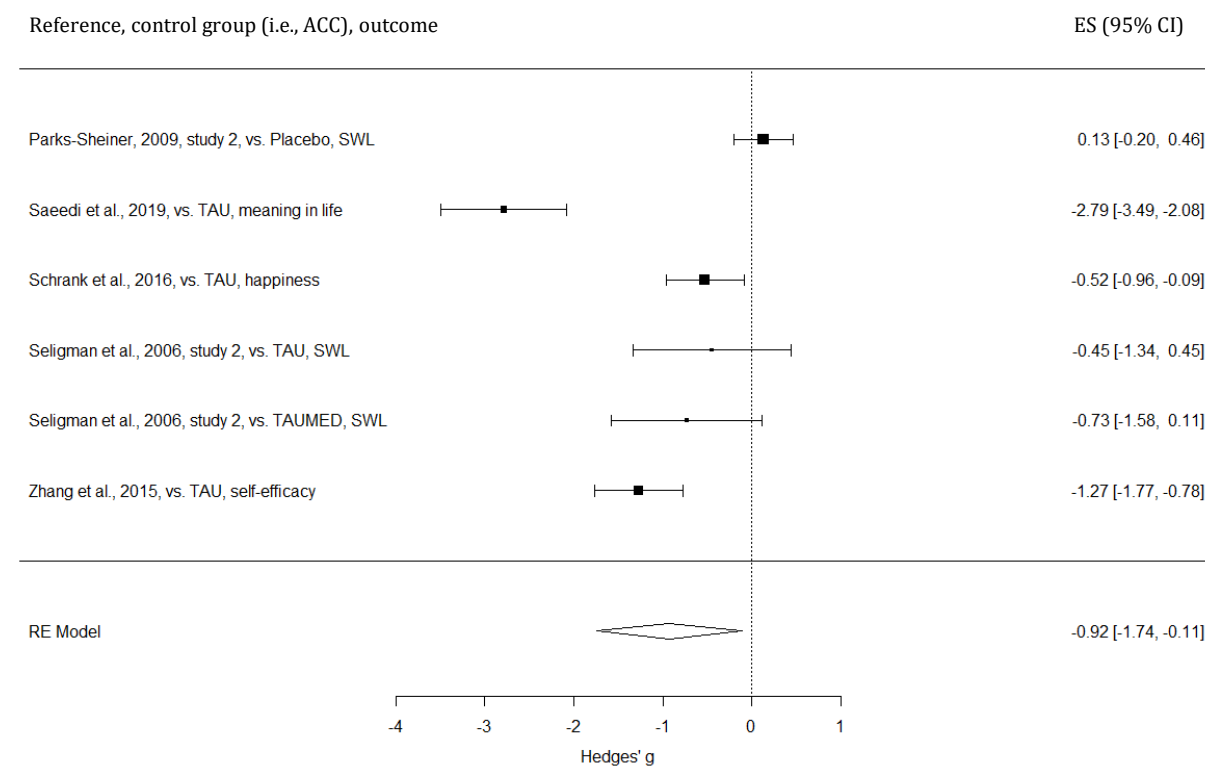
CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 3.** Forest plot – Efficacy of PPT in increasing satisfaction with life (SWL) in comparison to waitlist control conditions at post-treatment



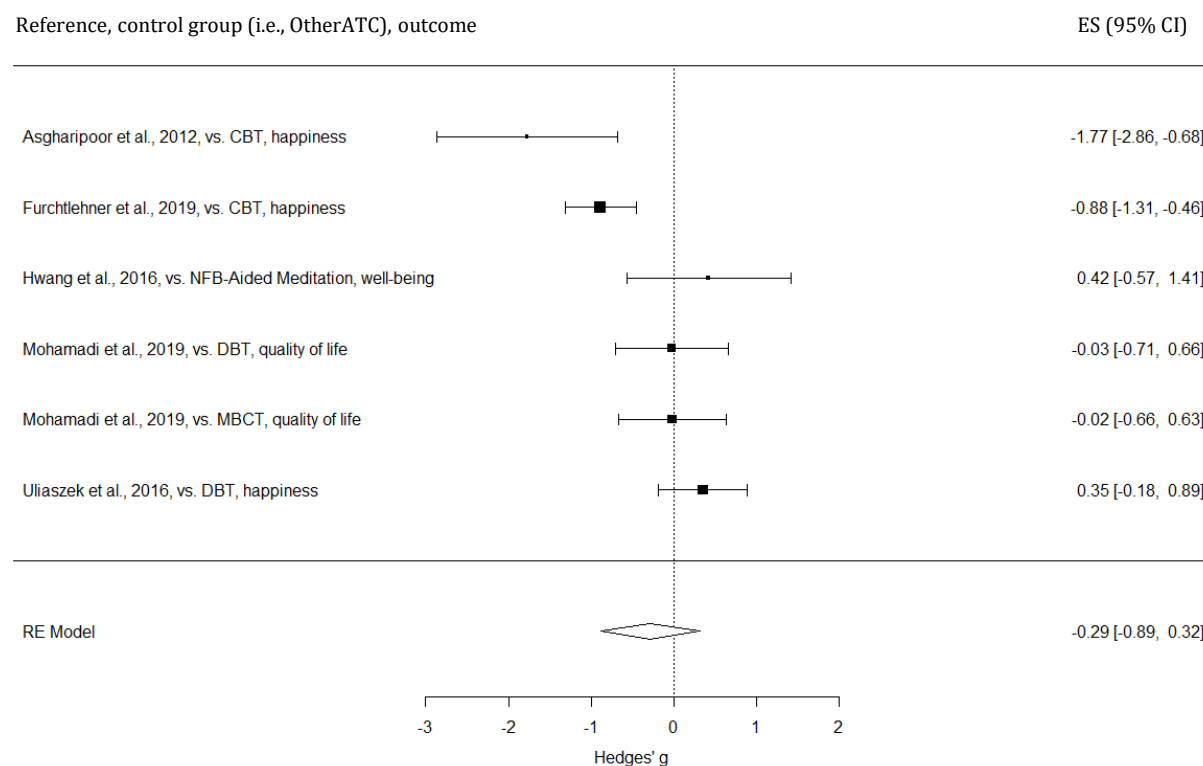
CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 4.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to active control conditions at post-treatment



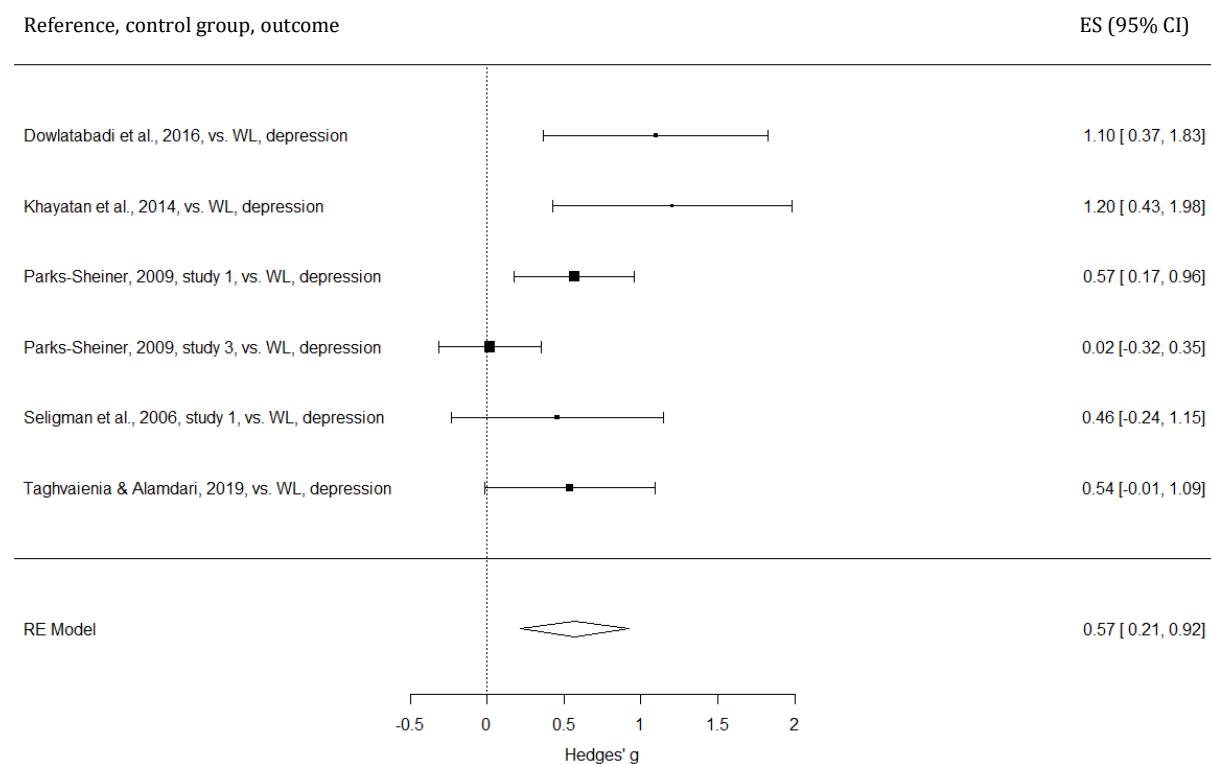
ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); Placebo, pill Placebo; RE Model, Random Effects Model; SWL, Satisfaction With Life; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 5.** Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to other active treatment conditions (OtherATC) at post-treatment



CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

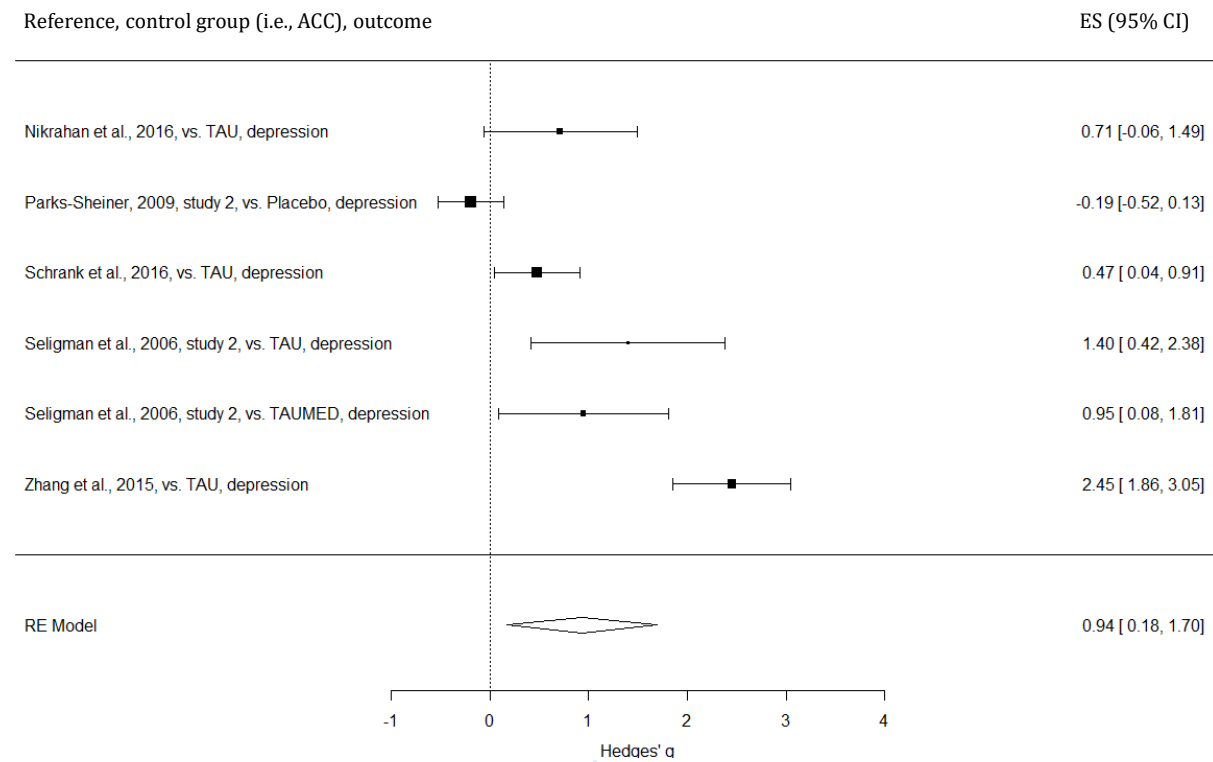
**eFig. 6.** Forest plot – Efficacy of PPT in decreasing depression in comparison to waitlist control conditions at post-treatment



CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

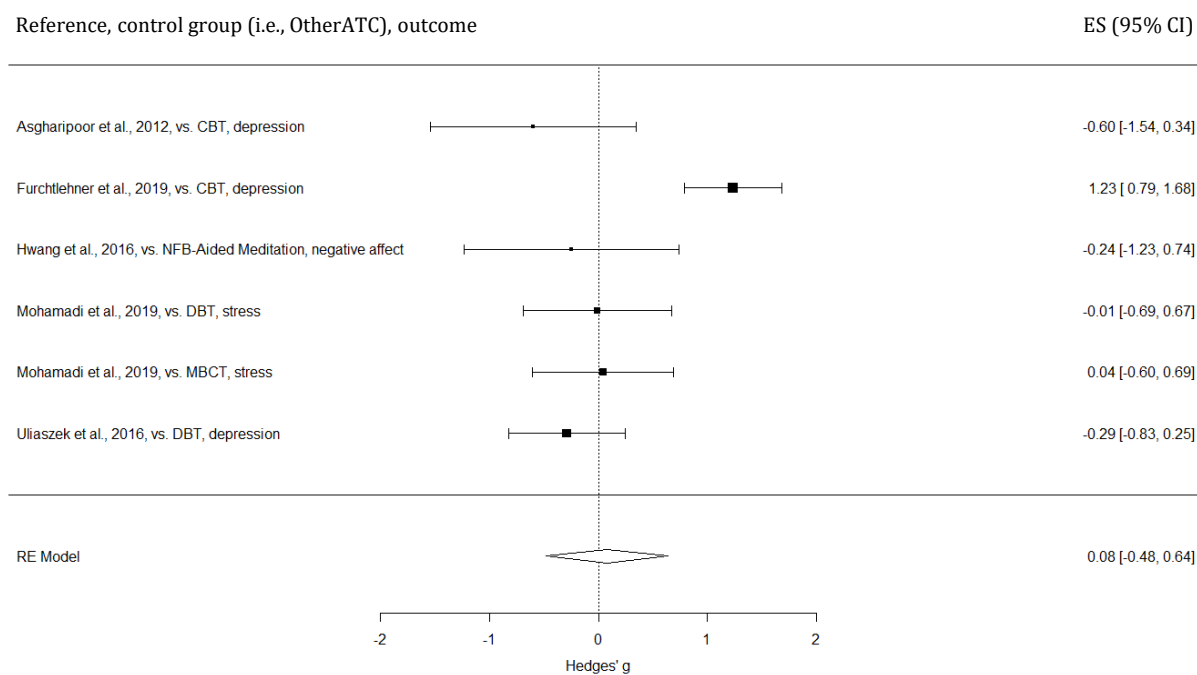


**eFig. 7.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to active control conditions at post-treatment



ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

**eFig. 8.** Forest plot – Efficacy of PPT in decreasing negative outcomes in comparison to other active treatment conditions (OtherATC) at post-treatment



CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of squares indicates size of trial (i.e.,  $N$ ) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

<b>eTable 1. Leaveout sensitivity analyses for main-analyses (PPT vs. WL at post assessment)</b>				
<b>Trial omitted (negative outcome assessed)</b>	<b>Corrected <i>g</i></b>	<b><i>SE</i></b>	<b><i>Z</i></b>	<b><i>Q</i></b>
Dowlatabadi et al., 2016 (depression)	0.40	0.15	2.76**	10.90
Hwang et al., 2016 (negative affect)	0.50	0.16	3.03**	14.63*
Khayatan et al., 2014 (depression)	0.40	0.14	2.79**	10.28
Mohamadi et al., 2019 (stress)	0.54	0.16	3.28**	13.46*
Parks-Sheiner, 2009, study 1 (depression)	0.47	0.18	2.61**	13.74*
Parks-Sheiner, 2009, study 3 (depression)	0.58	0.12	4.93***	7.30
Seligman et al., 2006, study 1 (depression)	0.49	0.17	2.86**	14.62*
Taghvaenia & Alamdari, 2019 (depression)	0.48	0.18	2.73**	14.37*
<b>Trial omitted (sub-analysis on depression only)</b>				
Dowlatabadi et al., 2016	0.48	0.18	2.64**	10.02*
Khayatan et al., 2014	0.47	0.17	2.68**	9.41
Parks-Sheiner, 2009, study 1	0.59	0.23	2.55*	12.84*
Parks-Sheiner, 2009, study 3	0.68	0.13	5.21***	3.96
Seligman et al., 2006, study 1	0.60	0.21	2.79**	13.41**
Taghvaenia & Alamdari, 2019	0.59	0.22	2.66**	13.27*
<b>Trial omitted (positive outcome assessed)</b>				
Abdeyan et al., 2018 (hope)	-0.44	0.17	-2.55*	21.89**
Asl et al., 2016 (SWL)	-0.71	0.33	-2.14*	71.62***
Dowlatabadi et al., 2016 (happiness)	-0.61	0.31	2.00*	61.85***
Heydari et al., 2019 (hope)	-0.75	0.33	-2.24*	72.70***
Hwang et al., 2016 (well-being)	-0.74	0.33	-2.25*	72.70***
Mohamadi et al., 2019 (quality of life)	0.80	0.32	-2.48*	70.88***
Parks-Sheiner, 2009, study 1 (SWL)	-0.79	0.33	-2.40*	70.19***
Parks-Sheiner, 2009, study 3 (SWL)	-0.82	0.32	-2.53*	62.36***
Seligman et al., 2006, study 1 (SWL)	-0.81	0.32	-2.51*	70.66***
Taghvaenia & Alamdari, 2019 (happiness)	-0.75	0.33	-2.25*	72.71***
<b>Trial omitted (sub-analysis on SLW only)</b>				
Asl et al., 2016	-0.07	0.12	-0.57	0.60
Parks-Sheiner, 2009, study 1	-0.22	0.26	-0.85	4.53
Parks-Sheiner, 2009, study 3	-0.29	0.20	-1.42	3.30
Seligman et al., 2006, study 1	-0.24	0.20	-1.20	4.37

Corrected *g*, pooled Hedges' *g* effect size when given trial was omitted from the random effects analysis; *SE*, standard error; SWL, Satisfaction With Life; WL = Waitlist control conditions; *Z*, standardized z-score for pooled effect size including statistical significance level as indicated below.

\*  $p < .05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < .001$

## PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol

Section and topic	Item No	Checklist item	Obedied?	Where? page
<b>ADMINISTRATIVE INFORMATION</b>				
Title:		The efficacy of positive psychotherapy in reducing negative and enhancing positive psychological outcomes: A meta-analysis of randomized controlled trials		
Identification	1a	Identify the report as a protocol of a systematic review	<input checked="" type="checkbox"/>	5
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	n.a.	n.a.
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	<input checked="" type="checkbox"/>	2 & 5
Authors:				
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	<input checked="" type="checkbox"/>	1
	3b	Describe contributions of protocol authors and identify the guarantor of the review	<input checked="" type="checkbox"/>	20
Contributions				
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	n.a.	n.a.
Support:				
Sources	5a	Indicate sources of financial or other support for the review	<input checked="" type="checkbox"/>	20
Sponsor	5b	Provide name for the review funder and/or sponsor	n.a.	n.a.
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	n.a.	n.a.
<b>INTRODUCTION</b>				
Rationale	6	Describe the rationale for the review in the context of what is already known	<input checked="" type="checkbox"/>	5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	<input checked="" type="checkbox"/>	5
<b>METHODS</b>				
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	<input checked="" type="checkbox"/>	5 & 6
Information	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial	<input checked="" type="checkbox"/>	6 & 7

sources		registers or other grey literature sources) with planned dates of coverage		
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	<input checked="" type="checkbox"/>	6 & eList 1 (supplement)
Study records:				
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	<input checked="" type="checkbox"/>	5 & 6
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	<input checked="" type="checkbox"/>	6
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	<input checked="" type="checkbox"/>	6 & 7
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any planned data assumptions and simplifications	<input checked="" type="checkbox"/>	6 & 7 8 & 9
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	<input checked="" type="checkbox"/>	6 & 7 & 8 & 9
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	<input checked="" type="checkbox"/>	7 & 8
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	<input checked="" type="checkbox"/>	7 & 8
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as $I^2$ , Kendall's $\tau$ )	<input checked="" type="checkbox"/>	9 & 11
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	<input checked="" type="checkbox"/>	10 & 11
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	n.a.	n.a.
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	<input checked="" type="checkbox"/>	10 & 11
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	<input checked="" type="checkbox"/>	9 & 10