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A meta-analytic review of positive psychotherapy

Thole H. Hoppen* & Nexhmedin Morina

Institute of Psychology, University of Münster, Münster, Germany

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*Corresponding author:
Thole H. Hoppen, PhD
Institute of Psychology
University of Münster
Fliednerstr. 21
48149 Münster (Germany)
e-Mail: thoppen@uni-muenster.de
Tel: +49 251 83 39415
Fax: +49 251 83 31331

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Meta-analytic review of positive psychotherapy

Abstract

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

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

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

Results: We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were found for increasing positive outcomes (g = -0.72, *95%CI:* -1.31; -0.14, k = 10, *NNT* = 2.55) and reducing negative outcomes (g = 0.48, *95%CI:* 0.18; 0.78, k = 8, *NNT* = 3.76) when PPT was compared to waitlist control conditions at post-treatment. A sub-analysis on decreasing depression yielded similar results (g = 0.57, *95%CI:* 0.21; 0.92, k = 6, *NNT* = 3.22). PPT yielded large effect sizes at post-treatment for increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05) and reducing depression (g = 0.94, *95%CI:* 0.18; 1.70, k = 6, *NNT* = 2.03) when compared to active control conditions. No significant differences in efficacy were found when compared to established treatments such as cognitive behavioural therapy. Moderator analyses revealed that trial quality was negatively related with effect sizes for depression and positively related with effect sizes for positive outcomes. Follow-up assessments, however, remained too scarce for most planned analyses.

Conclusions: Our findings support the short-term efficacy of PTT. However, results are to be regarded with due caution due to the low number of trials. More high-quality trials that assess follow-up efficacy are needed to draw firmer conclusions on long-term efficacy of PPT.

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

Introduction

Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology and proposes that psychopathology such as depression can be effectively treated by directly and primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging to and serving something greater than the self) and engagement (i.e., active involvement in daily life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be successfully dampened. While the founders believed from inception that PPT might be an effective treatment for various disorders, they started off by investigating its efficacy in treating depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three Good Things* and the *Gratitude Visit.* In *Using Your Strength*, for instance, participants are asked to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use their top five strengths more in daily life. Seligman and colleagues ended up including 26 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11 mildly to moderately depressed students per group and found that PPT was effective in lowering depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They also conducted a second RCT were they offered a 14-session individual PPT over 12 weeks in a sample of adults suffering from major depressive disorder. Again, PPT was found effective in decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1] Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further research on populations suffering depressive symptoms or depressive disorders, PPT has been investigated in various other contexts including patients with psychosis[4] and multiple other mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe

summarized the findings of 12 publications (from 9 individuals trials) published before May 2015.[3] The authors conclude that the application of PPT in intervention research is heterogenous in terms of both, the modifications of the original manual as well as the conditions targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-analysis on the efficacy of PPT has been published to this date. Against this background, we performed a meta-analysis of randomized controlled trials assessing the efficacy of PPT.

Methods

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

Literature Search Strategy

Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a minimum of ten participants per treatment arm at post-treatment with available data on at least one relevant outcome. No restrictions were placed on age of participants, comparison condition, or publication type. Studies that only applied a mixture of PPT with another intervention, such as a mixture of PPT and cognitive behavioral therapy in comparison to a control condition,[9] were excluded due to our narrow focus on the efficacy of PPT, as founded by Seligman et al.[1]. We

searched the following databases: PsycINFO, MEDLINE, and Web of Science from 2006 up to 13th of February 2020. The year 2006 represents the year where the theoretical underpinnings of the PPT were first published.[1] MeSH terms for Ebscohost (regarding MEDLINE and PsycINFO) were as follows: "SU positive psychotherapy OR TI positive psychotherapy OR AB positive psychotherapy". In Web of Science a similar search string to Ebscohost was chosen to search for "positive psychotherapy" in titles, abstracts, and keywords. To retrieve additional publications, the reference lists of all included papers and relevant (i.e., related) meta-analyses and systematic reviews were manually screened.[11–19] Secondary hand searches were conducted using Google Scholar.

Coding of Studies

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

one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and Drikvand potentially reported the means and SD for a relevant outcome (i.e., quality of life) in wrong order [20]. We contacted the authors twice via Email and were left with no response. Consequently, we calculated two analyses; one with changed order of means and SD and one with unchanged order.

We divided control conditions into passive control conditions, which turned out to exclusively consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual & placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy / CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy / MBCT).

Quality Assessment

Both authors independently rated the quality of the included trials by using a quality assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted in two subsequent meta-analyses.[21-23] This scale assesses the following nine quality criteria: 1) Were PTSD symptoms assessed with a semi-structured interview?, 2) Was a treatment manual used?, 3) Were therapists trained either specifically for the study or in a general training?, 4) Was treatment integrity checked by supervision and/or recordings and/or standardized instruments?, 5) Was data analyzed with intent-to-treat analysis?, 6) Was group allocation performed with a true randomization technique?, 7) Was randomization done by an independent third person (or computer or sealed envelopes)?, 8) Were blinded assessors used for interviews?, and 9) Were dropouts adequately reported? Items for each of the nine quality criteria were scored on a four-point scale, where 3 indicates high quality (e.g., a published treatment manual was used), 2 indicates limited quality (e.g., an unpublished treatment manual was used), 1 indicates lack of

required quality (e.g., no treatment manual was used), and 0 indicates unknown (i.e., required information not reported). When self-report measures were used to assess outcomes in a given trial, a score of 3 was given on the quality item concerning blinded assessments. In case of technology-based interventions, a trial received a score of 3 on the quality items concerning trained therapists and formal fidelity checks due to the technology-based standardized procedure. The nine ratings were then summed up to yield the respective trial quality sum score and used as a potential moderator in the analyses.

Data extraction of outcome measures

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

Statistical Analysis

Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-effects models given that we expected large heterogeneity in included studies.[24–26] We prioritized intent-to-treat (ITT) data when available (k = 3) over completer data (k = 17, including k = 3 with insufficient information on participant flow, see Table 1 for further

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 $J = 1\text{-}(3/(4df - 1))$ to yield Hedges's *g*.[27] Analyses were conducted if four or more trials were available for a given (sub-)analysis.[28] Effect sizes *g* may be conservatively interpreted with Cohen's convention of small (0.2), medium (0.5) and large (0.8) effects.[29] 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.[30] Because we expected large heterogeneity, we also calculated prediction intervals.[31] 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.[32] 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.[33, 34] However, no outliers were identified in any of the performed analyses. When analyses consisted of at least ten trials,[35] 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.[36] The trim-and-fill procedure yields an asymmetry-corrected estimate of the effect size (i.e., taking

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

Results

Study characteristics

Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with a passive control condition (PCC). All PCC turned out to be WLC. Hence, we will refer to WLC instead of PCC. Five trials (25%) compared PPT with an active control condition (e.g., treatment-as-usual, control exercises). Three trials (15%) compared PPT with another psychological intervention (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more than one control conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and the remaining 6 trials in an individual setting. Two of the latter trials described in one publication applied an internet-based PPT.[39] Treatment lengths was 917.06 minutes on average (unweighted mean across trials reporting on both, number and duration of sessions, k = 17) with a standard deviation of 374.79 minutes. Average number of sessions was 9.17 (*SD* = 2.71) and

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

results of Mohamadi et al.[20] were entered as reported in their publication (g = -0.82, *95%CI:* -1.39; -0.25, k = 10, *NNT* = 2.27). Number of available trials allowed for a publication bias check. While a visual inspection of the funnel plot led to the suspicion of publication bias (i.e., missing trials to the left) and a potential outlier to the far left (see Fig. A1 in the supplementary material), no trials were added by the trim and fill method and no statistical outlier (i.e., defined as an effect size ≤ or ≥ 3.3 SD above pooled effect) was found. No evidence was found for the efficacy of PPT in increasing positive outcomes compared to WLC at follow-up (g = -0.36, *95%CI:* -0.83; 0.11, k = 4, *NNT* = 5.01). See Figure A2 for the corresponding forest plot. Follow-up results are to be scrutinized with due caution in the light of low number of available trials (k = 4), large heterogeneity in outcomes and the wide range of the prediction interval. Satisfaction with life was the only positive outcome with enough trials to warrant a meta-analytic sub-analysis. In comparison to WLC at post-treatment, PPT was not found more effective in increasing satisfaction with life (g = -0.15, *95%CI:* -0.40; 0.09, k = 4, *NNT* = 11.55). See Figure A3 for the corresponding forest plot. Heterogeneity in outcomes was low. In comparison to active control conditions (i.e., treatment-as-usual and placebo exercises) at post-treatment, PPT yielded a large effect size in increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05). See Figure A4 for the corresponding forest plot. However, heterogeneity in outcomes was large and the prediction interval included the null illustrating large variability in findings. When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, & Neurofeedback-aided Mediation), no differences in efficacy at post-treatment were found for increasing positive outcomes (g = -0.29, *95%CI:* -0.89; 0.32, k = 6, *NNT* = 6.24). See Figure A5 for the corresponding forest plot. Again, heterogeneity in outcomes was large and the prediction interval included the null. Results remained insignificant when results of Mohamadi et al.[20] were

entered as reported in their publication (g = -0.65, *95%CI:* -1.31; 0.01, k = 6). Lastly, when trials with alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment remained similar (g = -1.04, *95%CI:* -1.79; -0.28, k = 7, *NNT* = 1.87, see Table 2).

The Efficacy of PPT in Decreasing Negative Outcomes

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

alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment remained similar (g = 0.63, *95%CI:* 0.20; 1.07, k = 5, *NNT* = 2.89, see Table 2).

Moderator-Analyses

Moderator analyses revealed that trial quality as a continuous variable was associated with effect sizes in most of the abovementioned analyses. See Table 3 for an overview of results. In terms of increasing positive outcomes, only positive moderations and two non-significant results were found. For the efficacy of PPT in increasing positive outcomes in comparison to WLC at post-treatment, trial quality was found to be a significant positive moderator (b = 0.17, p = .003) with higher trial quality being associated with higher effect sizes. A similar result was found for the follow-up results (b = 0.12, p = .036). In terms of the comparison with active control conditions at post-treatment, trial quality was also found to moderate effect sizes positively (b = 0.18, p = .015). No significant moderation of trial quality was found for the comparison with other active treatment conditions (b = -0.01, p = .907) nor for the sub-analysis on satisfaction with life only (b = -0.01, p = .915).

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

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 PTT 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

controls) also involved an almost outlier.[40] This study offered PPT to depressed patients and yielded a strikingly large effect size at post-treatment (g = -2.98) favoring PPT in increasing hope. Both almost outlier studies involved a moderate sample size (see Table 1). All this suggests that more trials are needed to allow for firmer conclusions.

When PPT was compared to other established psychological interventions such as CBT, current data did not suggest any significant difference in efficacy. Accordingly, the results of the six RCTs included in this comparison suggests that PPT is similarly effective in increasing positive psychological outcomes. However, due to the low number of trials for this comparison these findings need to be viewed with due caution.

The first and foremostly assessed negative outcome in the PPT literature remains depression. As suggested and intended by its developers, PPT was found moderately to largely effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with larger effect sizes in lowering depression for PPT in comparison to active control conditions (pooled g = 0.94) as opposed to WLC (pooled g = 0.57). Once more, unplanned post-hoc investigations were performed in an attempt to find potential reasons for the counterintuitive finding. Again, we found that an almost outlier might explain the difference. The analysis involving active control groups involved an almost outlier with an effect size of g = 2.45,[44] whereas the analysis involving WLC did not involve such an almost outlier.

Data on follow-up efficacy altogether were scarce. The only feasible follow-up analysis (i.e., efficacy of PPT vs. WLC in increasing positive outcomes) yielded a non-significant effect size. The current available literature does not allow for any other valid follow-up analysis and,

thus, conclusions on the long-term efficacy of PPT cannot not yet be made. This represents perhaps the main limitation of the literature on the efficacy of PPT.

Trial quality overall was moderate and, therefore, leaves room for improvement. Results overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs) more generally which report moderate effect sizes in increasing positive outcomes and decreasing negative outcomes.[11-19] A recent meta-analysis on PPIs further also reports on a significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not straightforward.

This represents the first meta-analysis on the efficacy of PPT. Several limitations need to be considered. First and foremost, the number of included trials is relatively small and accordingly more research is needed to draw firmer conclusions. Secondly, depression and SWL were the only two outcomes with enough trials to warrant sub-analyses. More research is needed to allow for more homogenous analyses on PPT efficacy for specific outcomes. Thirdly and related to the second limitation, we clustered positive and negative findings and, thereby, increased heterogeneity. This decision was based on the overall scarcity of trials. We aimed at conducting more homogenous sub-analyses were possible which were, as mentioned, only feasible for depression and SWL. As more trials accumulate, more fine-grained analyses will become feasible. Fourthly and lastly, the follow-up efficacy of PPT remains uncertain due to lack of research.

Conclusion

Our findings indicate that PTT can effectively increase positive outcomes and decrease negative outcomes at post-treatment. However, there is lack of follow-up data and the number of available trials altogether remains scarce precluding many of the planned sub-analyses. More research with high methodological rigor and including follow-up assessments is needed to draw firmer and more precise conclusions on PPT efficacy.

Statements

Competing Interests Statement

The authors declare that they have no conflict of interest to declare

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Ethics statement

Not applicable.

Author Contributions Statement

THH and NM conceptualized the meta-analysis conducted the systematic literature search and coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript.

Patient and Public Involvement Statement

Not applicable.

References

1* Seligman MEP, Rashid T, Parks AC. Positive psychotherapy. Am Psychol 2006;61:774–788.

2 Peterson C, Seligman MEP. Character strengths and virtues: A handbook and classification, Oxford University Press, 2004.

3 Walsh S, Cassidy M, Priebe S. The application of positive psychotherapy in mental health care: A systematic review. J Clin Psychol 2017;73:638–651.

4* Schrank B, Brownell T, Jakaite Z, *et al*. Evaluation of a positive psychotherapy group intervention for people with psychosis: Pilot randomised controlled trial. Epidemiol Psychiatr Sci 2016;25:235–246.

5* Uliaszek AA, Rashid T, Williams GE, *et al*. Group therapy for university students: A randomized control trial of dialectical behavior therapy and positive psychotherapy. Behaviour Research and Therapy 2016;77:78–85.

6* Dowlatabadi MM, Ahmadi SM, Sorbi MH, *et al*. The effectiveness of group positive psychotherapy on depression and happiness in breast cancer patients: A randomized controlled trial. Electron Physician 2016;8:2175.

7* Saeedi B, Khoshnood Z, Dehghan M, *et al*. The effect of positive psychotherapy on the meaning of life in patients with cancer: A randomized clinical trial. Indian J Palliat Care 2019;25:210.

8* Khayatan T, Azkhosh M, Bahmani B, *et al*. Group positive psychotherapy and depression of females affected by multiple sclerosis. Iran Rehabil J 2014;12:49–53.

9 Rashid T, Seligman MP. Positive Psychotherapy: Clinician Manual. Oxford University Press, 2018.

10 Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Ann Intern Med 2009;151:264–269.

11 Bolier L, Haverman M, Westerhof GJ, *et al*. Positive psychology interventions: A meta-analysis of randomized controlled studies. BMC Public Health 2013;13:119.

12 Chakhssi F, Kraiss JT, Sommers-Spijkerman M, *et al*. The effect of positive psychology interventions on well-being and distress in clinical samples with psychiatric or somatic disorders: A systematic review and meta-analysis. BMC Psychiatry 2018;18:211.

13 Davis DE, Choe E, Meyers J, *et al*. Thankful for the little things: A meta-analysis of gratitude interventions. J Couns Psychol 2016;63:20.

14 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of positive psychological interventions from non-western countries: A systematic review and meta-analysis. IJW 2018;8:71–98.

15 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of multi-component positive psychology interventions: A systematic review and meta-analysis of randomized controlled trials. J Happiness Stud 2020;21:357–390.

16 Hendriks T, Warren MA, Schotanus-Dijkstra M, *et al*. How WEIRD are positive psychology interventions? A bibliometric analysis of randomized controlled trials on the science of well-being. J Posit Psychol 2019;14:489–501.

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

18 Casellas-Grau A, Font A, Vives J. Positive psychology interventions in breast cancer. A systematic review. Psychooncology 2014;23:9–19.

19 White CA, Uttl B, Holder MD. Meta-analyses of positive psychology interventions: The effects are much smaller than previously reported. PloS One 2019;14:e0216588.
20* Mohamadi J, Ghazanfari F, Drikvand FM. Comparison of the effect of dialectical behavior therapy, mindfulness based cognitive therapy and positive psychotherapy on perceived stress and quality of life in patients with irritable bowel syndrome: A pilot randomized controlled trial. Psychiatr Q 2019;90:565–578.
21 Cuijpers P, van Straten A, Bohlmeijer E, *et al*. The effects of psychotherapy for adult depression are overestimated: a meta-analysis of study quality and effect size. Psychol Med 2010;40:211–223.
22 Smit Y, Huibers MJH, Ioannidis JPA, *et al*. The effectiveness of long-term psychoanalytic psychotherapy - A meta-analysis of randomized controlled trials. Clin Psychol Rev 2012;32:81–92.
23 Morina N, Koerssen R, Pollet TV. Interventions for children and adolescents with posttraumatic stress disorder: A meta-analysis of comparative outcome studies. Clin Psychol Rev 2016;47:41–54.
24 R Core Team: R. A Language and Environment for Statistical Computing 2019. Retrieved from http://www.R-project.org/.
25 Viechtbauer W. Conducting meta-analyses in R with the metafor package. Journal of statistical software 2010;36:1–48.
26 Borenstein M, Hedges LV, Higgins JPT, *et al*. Introduction to meta-analysis, John Wiley & Sons, 2011.
27 Lipsey MW, Wilson DB. Practical meta-analysis, [Nachdr.]. Applied social research methods series. Thousand Oaks, Calif., SAGE Publ, 2009, vol 49.
28 Hoppen TH, Morina N. Is high-quality of trials associated with lower treatment efficacy? A meta-analysis on the association between study quality and effect sizes of psychological interventions for pediatric PTSD. Clin Psychol Rev 2020:101855.
29 Cohen J. Statistical Power Analysis for the Behavioral Sciences, 2nd ed. Hoboken, Taylor and Francis, 2013.
30 Higgins JPT, Thompson SG, Deeks JJ, *et al*. Measuring inconsistency in meta-analyses. BMJ 2003;327:557–560.
31 IntHout J, Ioannidis JPA, Rovers MM, *et al*. Plea for routinely presenting prediction intervals in meta-analysis. BMJ Open 2016;6: e010247.
32 Riley RD, Higgins JPT, Deeks JJ. Interpretation of random effects meta-analyses. BMJ 2011;342:d549.
33 Hunter JE, Schmidt FL. Methods of meta-analysis: Correcting error and bias in research findings, London: Sage Publications, 2004.
34 Tabachnick BG, Fidell LS. Using Multivariate Statistics, ed. 6. 2013.
35 Sterne JAC, Sutton AJ, Ioannidis JPA, *et al*. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. BMJ 2011;343:d4002.
36 Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. Biometrics 2000;56:455–463.
37 Kraemer HC, Kupfer DJ. Size of treatment effects and their importance to clinical research and practice. Biol Psychiatry 2006;59:990–996.

38* Hwang K, Kwon A, Hong C. A preliminary study of new positive psychology interventions: Neurofeedback-aided meditation therapy and modified positive psychotherapy. Curr Psychol 2017;36:683–695.
39* Parks-Sheiner AC. Positive psychotherapy: Building a model of empirically supported self-help. Dissertations available from Pro-Quest 2009.
40* Abdeyan T, Mahsa KK, Mohammad Z, *et al*. The Effect of Psychosocial Group Based on Positive Psychology on Hopefulness in Patients with Major Depressive Disorder: A Clinical Trial. Electron J Gen Med 2018;15:em49.
41* Nikrahan GR, Laferton JAC, Asgari K, *et al*. Effects of positive psychology interventions on risk biomarkers in coronary patients: a randomized, wait-list controlled pilot trial. Psychosomatics 2016;57:359–368.
42* Asl STS, Sadeghi K, Bakhtiari M, *et al*. Effect of group positive psychotherapy on improvement of life satisfaction and the quality of life in infertile woman. Int J Fertil Steril 2016;10:105–112.
43* Heydari MG, Shirazi M, Sanagouyemoharer GR. Evaluating the Efficacy of Positive Psychotherapy on Life Expectancy in Students With Hemophilia: A Randomized Controlled Trial. Pract Clin Psychol 2019;7:63–70.
44* Zhang JP, Guo Y-F, Zhang X, *et al*. Effects of Positive Psychotherapy on Depression and Self-efficacy in Undergraduate Nursing Students Positive Psychotherapy. Res Rev J Nurs Health Sci 2015:12–18.
45*Asgharipoor N, Asgharnejad AA, Arshadi HR, *et al*. Comparative study on the effectiveness of positive psychotherapy and group cognitive-behavioral therapy for the patients suffering from major depressive disorder. Iran J Psychiatry Behav Sci 2012;2:33–41.
46*Furchtlehner LM, Schuster R, Laireiter AR. A comparative study of the efficacy of group positive psychotherapy and group cognitive behavioral therapy in the treatment of depressive disorders: A randomized controlled trial. J Posit Psychol 2019:1–14.
47*Taghvaienia A, Alamdari N. Effect of Positive Psychotherapy on Psychological Well-Being, Happiness, Life Expectancy and Depression Among Retired Teachers with Depression: A Randomized Controlled Trial. Community Ment Health J 2019;56:229–237.

*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)[a]	Format	Control group (& format)	Nr. of sessions x Duration in min.	FU[b]	*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.[c]	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

Heydari et al.[43]	Iran	Hemophilia	PPT (Seligman et al. 2014)	Indiv.	WLC	8 x 120	2	56[c]	10-25	58.93	Compl.	Hope	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 & well-being	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	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 & quality of life	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	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 & SWL	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 & SWL	23

Parks-Sheiner study 3[39]	USA	Mild to moderate depression	Online mPPT	Indiv.	WLC	n.r.	3	140	43.21 ± 11.86	75.70	Compl.	Depression & SWL	23
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
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
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
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
Taghvaienia et al.[47]	Iran	Depression	PPT	Group	WLC	10 x 120	n.a.	52	62.64 ± 12.81	100	Compl.	Depression & happiness	20
Uliaszek et al.[5]	Canada	Psycho-pathology (trans-diagnostic)	PPT	Group	DBT	12 x 120	n.a.	54	22.17 ± 5.01	77.78	ITT	Depression & happiness	19
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

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

differently; Stat. analysis = Statistical analysis applied; SWL = Satisfaction With Life; TAU = Treatment-As-Usual; WLC = Waitlist Control condition.
[a]PPT = manual as founded by Seligman et al., 2006 [1].
[b]Longest assessed and reported follow-up assessment on relevant outcome(s)
[c]reported but irrelevant, as follow-up was conducted at two weeks post-treatment; [c]no posttreatment assessment available, hence follow-up n reported here.

Table 2

Efficacy of PPT for Increasing Positive Outcomes and Decreasing Negative Outcomes

Comparison groups and timepoint of assessment (post-treatment vs. FU)	*k*	*g*	*SE*	*95%* CI PI	I^2	*NNT*
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	**-0.72***	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	**-0.92***	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. (k = 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. (k = 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. (k = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. PCC at post-treatment	8	**0.48****	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. PCC at FU	n.a. (k = 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. (k = 1)					
Subanalyses on depression						
PPT vs. PCC – depression at post-treatment	6	**0.57****	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. PCC – depression at FU	n.a. (k = 3)					

PPT vs. ACC - depression at post-treatment	6	**0.94***	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	**-1.04****	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	**0.63****	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPTvs. 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	*k*	Intercept	*b*	*rem. I²*	*p*
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. PCC at post-treatment	10	-3.60	**0.17**	79.93***	**.003**
PPT vs. PCC at follow-up	4	-2.56	**0.12**	38.01	**.036**
PPT vs. ACC at post-treatment	6	-4.21	**0.18**	83.61***	**.015**
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	**-0.08**	0	**.003**
PPT vs. ACC at post-treatment	All six trials conducted on depression, see below				
PPT vs. OtherATC at post-treatment	6	-2.24	**0.13**	21.28	**<.001**
Sub-analysis on depression					
PPT vs. PCC at post-treatment	6	2.50	**-011**	0	**< .001**
PPT vs. ACC at post-treatment	6	4.47	**-0.17**	76.91***	**.005**
Potential Moderator: Treatment length[a]					
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. ($k = 3$)				
PPT vs. ACC at post-treatment	n.a. ($k = 3$)				
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. ($k = 3$)				
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. ($k = 3$)				
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. I² = remaining amount of unexplained heterogeneity in outcomes; SWL = Satisfaction With Life. **Bold** font indicates statistical significance of moderation.

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

[a]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

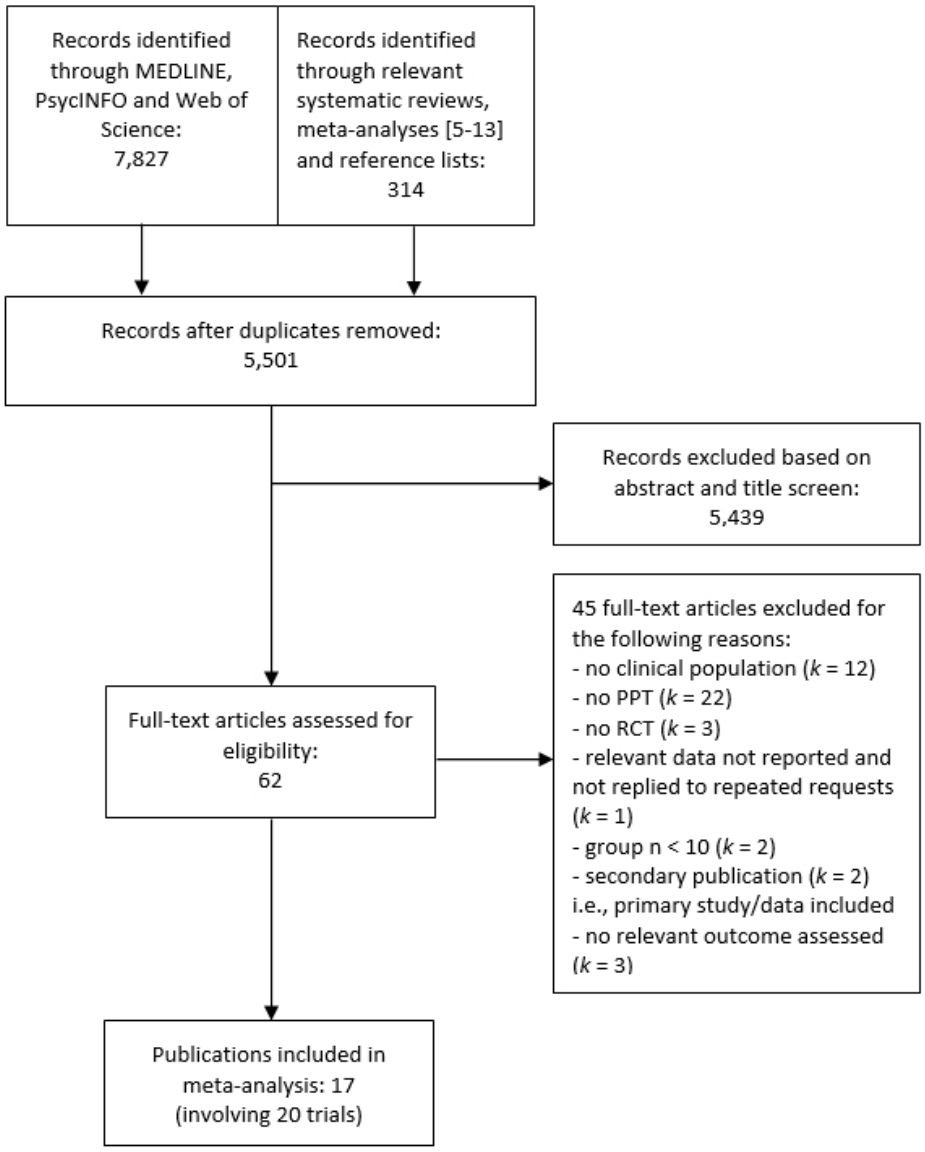
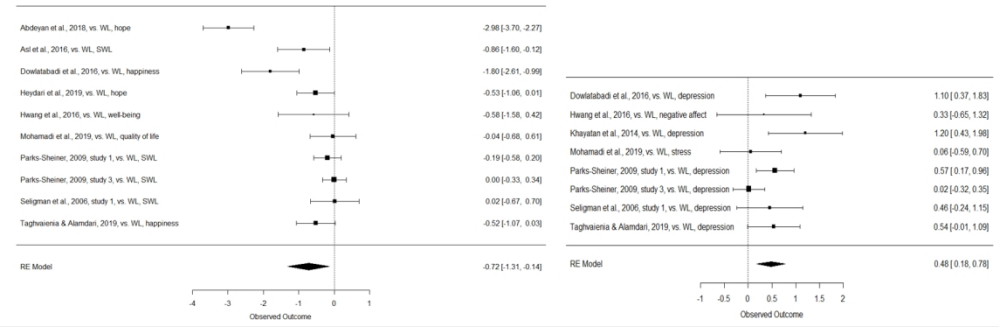


Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

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

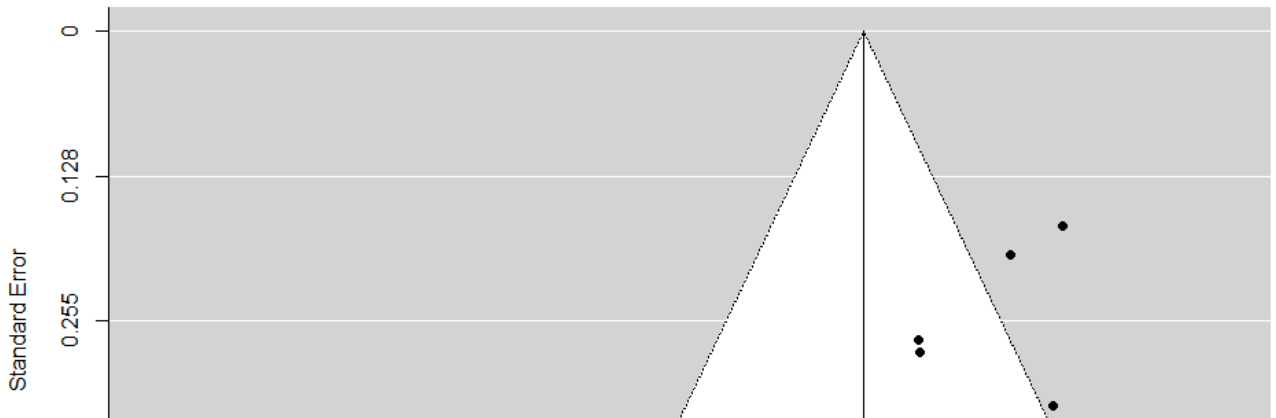


Fig. A2

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

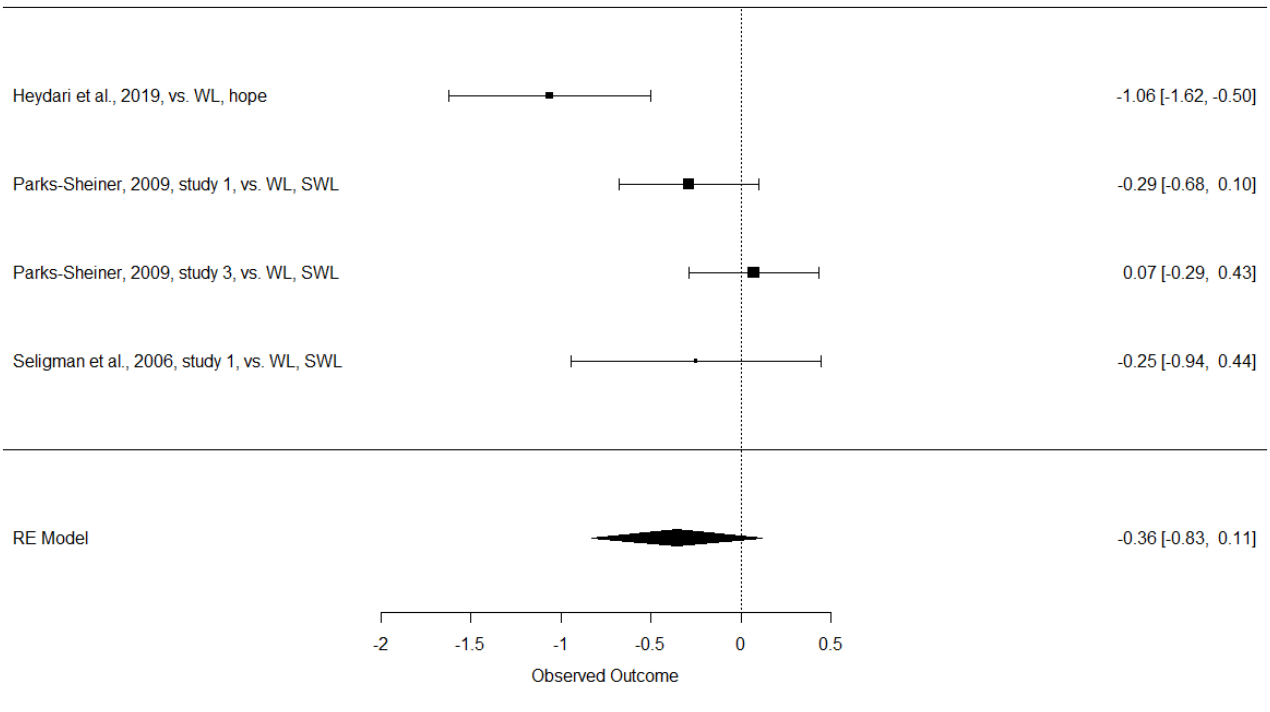


Fig. A3

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

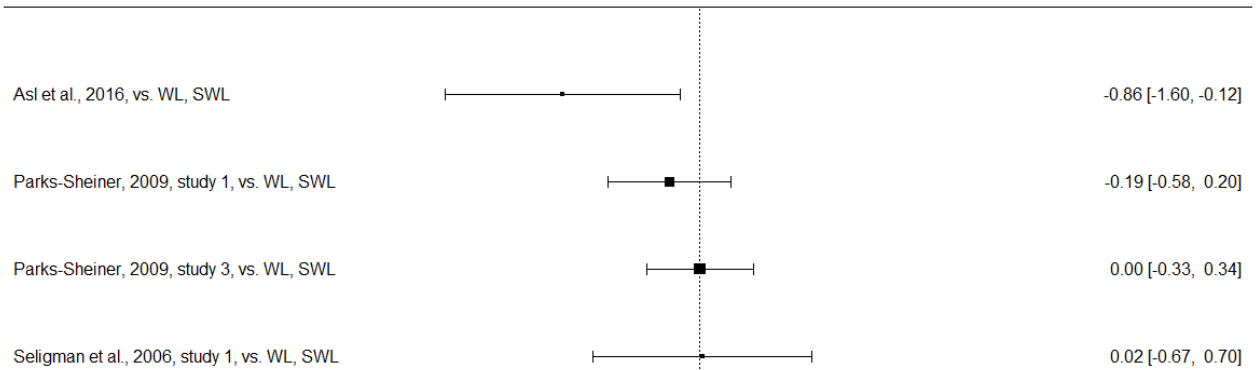


Fig. A4

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

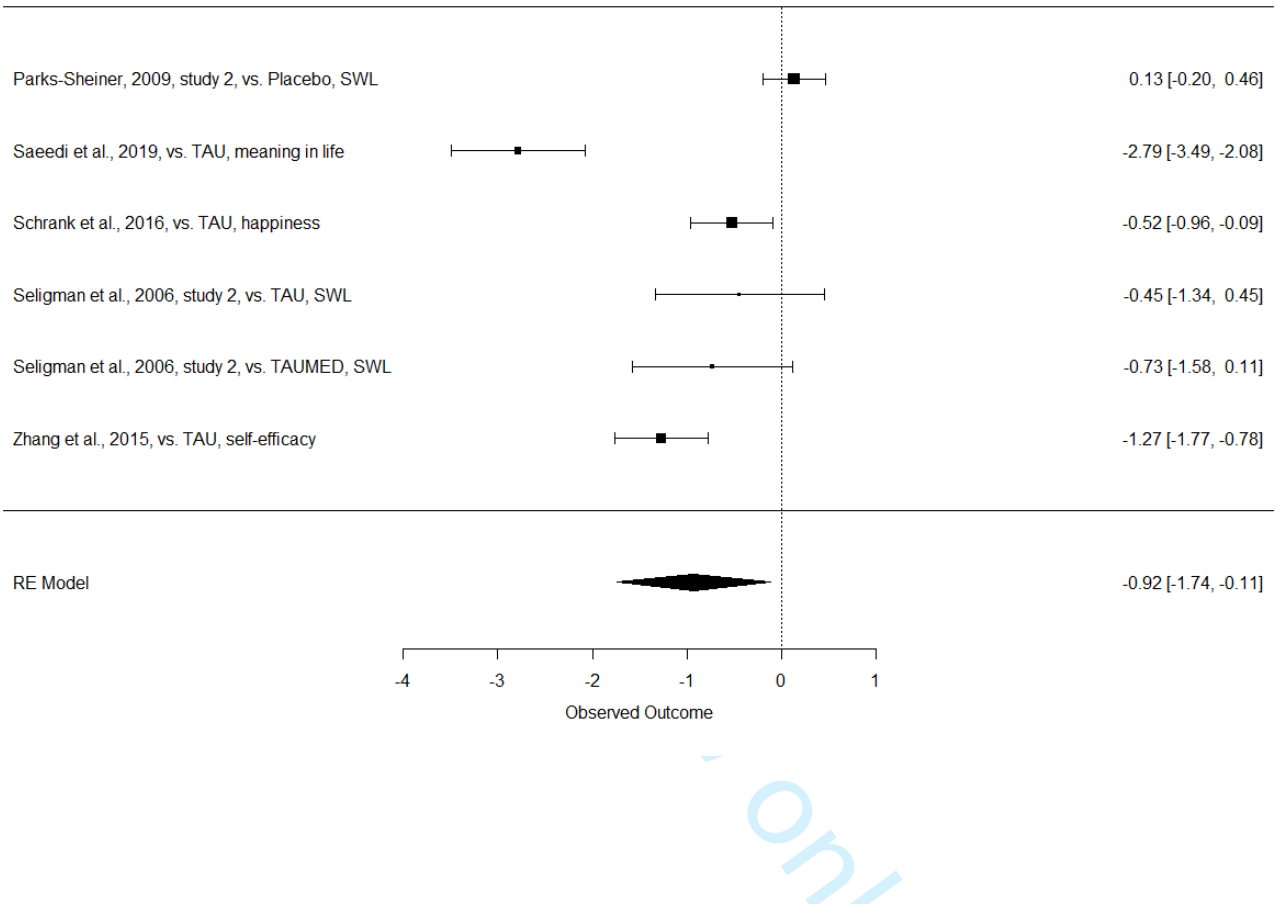


Fig. A5

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

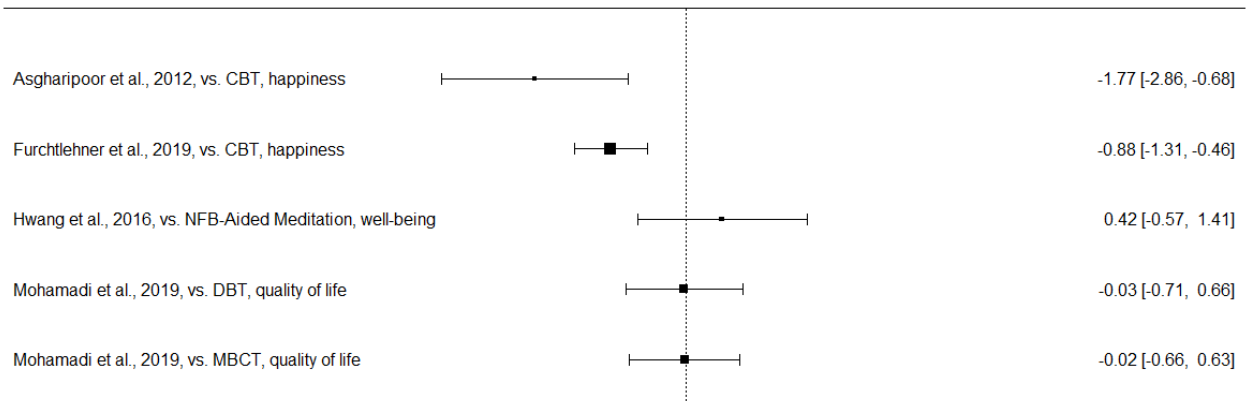


Fig. A6

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

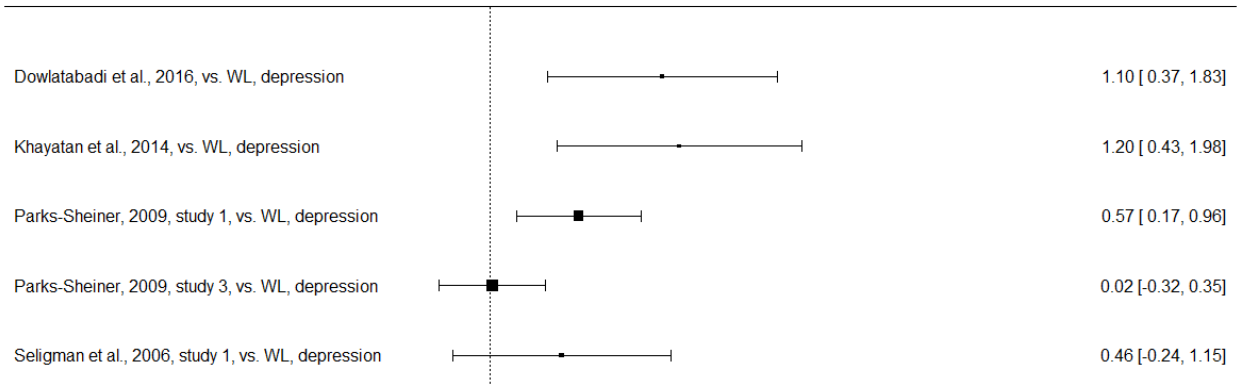


Fig. A7

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

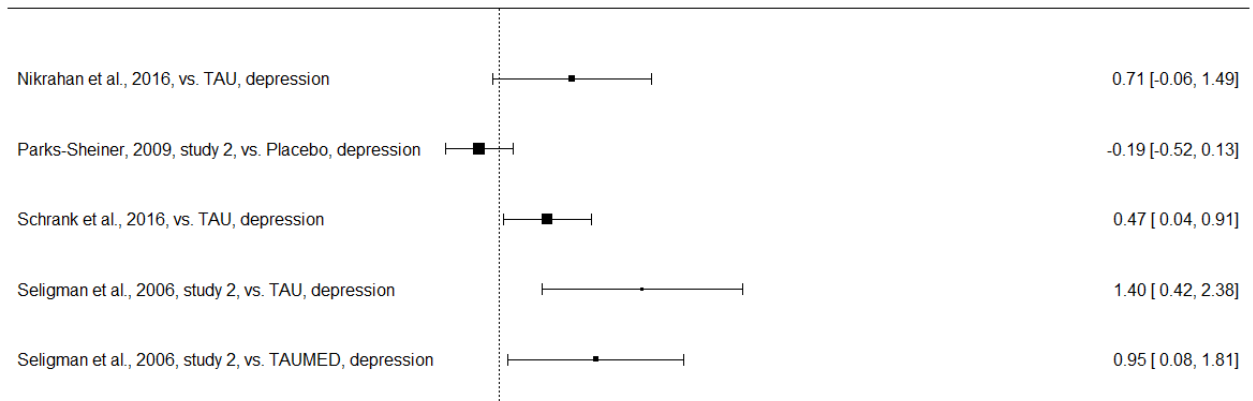
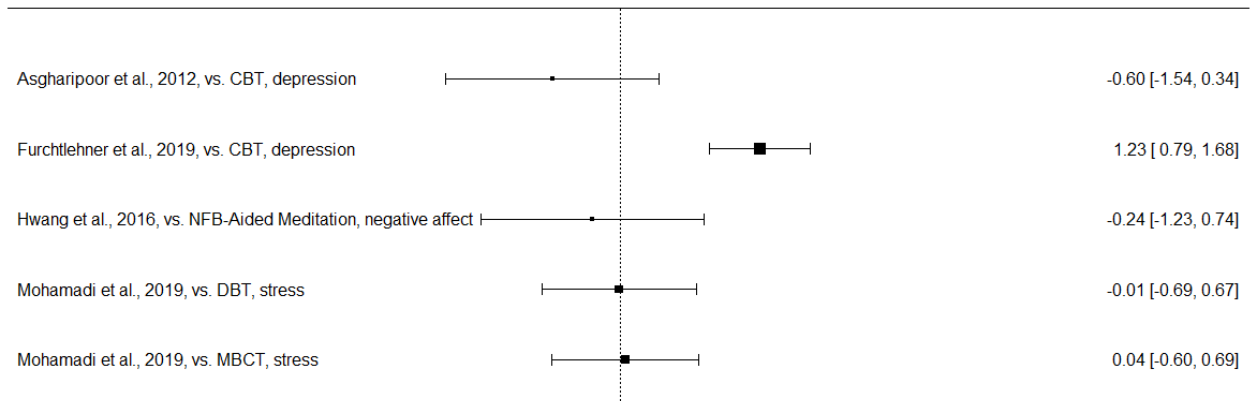


Fig. A8

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?
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	☑
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☑
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	☑
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	☑
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☑
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	☑
Support:			
Sources	5a	Indicate sources of financial or other support for the review	☑
Sponsor	5b	Provide name for the review funder and/or sponsor	☑
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☑
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	☑
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☑
METHODS			
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	☑
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	☑
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	☑

Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☑
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)	☑
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	☑
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	☑
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☑
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	☑
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	☑
	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 τ)	☑
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	☑
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☑
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	☑
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	☑

*** 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.**

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

Thole H. Hoppen* & Nexhmedin Morina

Institute of Psychology, University of Münster, Münster, Germany

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*Corresponding author:
Thole H. Hoppen, PhD
Institute of Psychology
University of Münster
Fliednerstr. 21
48149 Münster (Germany)
e-Mails: thoppen@uni-muenster.de; morina@uni-muenster.de
Tel: +49 251 83 39415
Fax: +49 251 83 31331

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Abstract

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

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

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

Results: We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were found for increasing positive outcomes (g = -0.72, *95%CI:* -1.31; -0.14, k = 10, *NNT* = 2.55) and reducing negative outcomes (g = 0.48, *95%CI:* 0.18; 0.78, k = 8, *NNT* = 3.76) when PPT was compared to waitlist control conditions at post-treatment assessment. When compared to active control conditions, PPT yielded large effect sizes for increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05) and reducing depression (g = 0.94, *95%CI:* 0.18; 1.70, k = 6, *NNT* = 2.03) at post-treatment assessment. No significant differences in efficacy were found when compared to established treatments such as cognitive behavioural therapy. Evidence was found to support an association between trial quality and effect sizes. For positive outcomes, higher trial quality was related with higher effect size. Whereas higher trial quality was related with lower effect size for depression. Follow-up assessments remained too scarce for most planned analyses.

Conclusions: Our findings support the short-term efficacy of PPT. However, results are to be regarded with due caution in the light of low number of trials. More high-quality trials that assess efficacy at follow-ups are needed to draw firmer conclusions on the long-term efficacy of PPT.

PROSPERO registration number: CRD42020173567

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 trials precluded many (sub-)analyses and asks for due caution in interpreting the present findings
- Due to lacking follow-up assessment, long-term efficacy could not be determined

Introduction

Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology and proposes that psychopathology such as depression can be effectively treated by directly and primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging to and serving something greater than the self) and engagement (i.e., active involvement in daily life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be successfully dampened. While the founders believed from inception that PPT might be an effective treatment for various disorders, they started off by investigating its efficacy in treating depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three Good Things* and the *Gratitude Visit.* In *Using Your Strength*, for instance, participants are asked to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use their top five strengths more in daily life. Seligman and colleagues ended up including 26 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11 mildly to moderately depressed students per group and found that PPT was effective in lowering depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They also conducted a second RCT were they offered a 14-session individual PPT over 12 weeks in a sample of adults suffering from major depressive disorder. Again, PPT was found effective in decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1] Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further research on populations suffering depressive symptoms or depressive disorders, PPT has been investigated in various other contexts including patients with psychosis[4] and multiple other mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe

summarized the findings of 12 publications (from 9 individuals trials) published before May 2015.[3] The authors conclude that the application of PPT in intervention research is heterogenous in terms of both, the modifications of the original manual as well as the conditions targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-analysis with an exclusive focus on the efficacy of PPT has been published to this date. Against this background, we performed a systematic literature review and meta-analysis of randomized controlled trials assessing the efficacy of PPT.

Methods

Following the recommendations by the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) group,[10] we defined the main structured research question describing the Population, Intervention, Comparison, Outcome, and Study design (PICOS) as "In individuals with mental or physical health complaints, does PPT (I), compared to control conditions (C), improve psychological outcomes (O) in randomized controlled trials (S)?". We pre-registered the present meta-analysis in the PROSPERO database (ID: CRD42020173567).

Patient and Public Involvement

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

Literature Search Strategy

Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a minimum of ten participants per treatment arm at post-treatment assessment with available data on at least one relevant outcome. No restrictions were placed on age of participants, comparison condition, or publication type. Studies that only applied a mixture of PPT with another

intervention, such as a mixture of PPT and cognitive behavioral therapy in comparison to a control condition,[9] were excluded due to our narrow focus on the efficacy of PPT, as founded by Seligman et al.[1]. We searched the following databases: PsycINFO, MEDLINE, and Web of Science from 2006 up to 13th of February 2020. The year 2006 represents the year where the theoretical underpinnings of the PPT were first published.[1] No other limits or filters were applied. MeSH terms for Ebscohost (regarding MEDLINE and PsycINFO) were as follows: "SU positive psychotherapy OR TI positive psychotherapy OR AB positive psychotherapy" (see also eList 1 in the supplementary materials). In Web of Science a similar search string to Ebscohost was chosen to search for "positive psychotherapy" in titles, abstracts, and keywords. To retrieve additional publications, the reference lists of all included papers and relevant (i.e., related) meta-analyses and systematic reviews were manually screened.[11–19] Secondary hand searches were conducted using Google Scholar. The study synthesis was performed independently by both authors.

Coding of Studies

The publications were independently coded by both authors. From each publication, the following study, intervention and participant characteristics were coded and extracted: country the trial was conducted in, clinical population targeted (i.e., any physical or mental health condition), experimental intervention type (i.e., original PPT manual or modified version), intervention format (i.e., individual or group), comparison group(s), session number and session duration in minutes, follow-up duration in months for the longest reported follow-up assessment of the relevant outcome(s), number of participants at post-treatment assessment, age of participants (i.e., mean and standard deviation or range), proportion of sample with female sex in percent, applied statistical analysis (i.e., completer or intent-to-treat analyses) and relevant

outcome(s) targeted by PPT. The post-treatment assessment experimental group and control group means, standard deviations and sample sizes on the relevant outcome(s) (see in more detail below) were extracted. When reported, follow-up assessment data on relevant outcomes per group were also extracted. When multiple follow-up assessments were reported, the data from the longest follow-up assessment were retrieved. When relevant data was not reported, it was either calculated from given data (e.g., standard deviations from standard errors) or the corresponding author of the respective publication was contacted via email twice with one month in between. In one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and Drikvand potentially reported the means and SDs for a relevant outcome (i.e., quality of life) in wrong order (i.e., means where SDs should be placed and vice versa) [20]. We contacted the authors twice via Email and were left with no response. Consequently, we calculated two analyses; one with changed order of means and SD and one with unchanged order.

We divided control conditions into passive control conditions, which turned out to exclusively consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual & placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy / CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy / MBCT). Note that included trials included different physical or mental health conditions and, therefore, TAU may involve various different treatment regimens.

Quality Assessment

Both authors independently rated the quality of the included trials by using a quality assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted in two subsequent meta-analyses.[21-23] After independent rating, regular digital meetings were held to discuss disagreements. This scale assesses the following nine quality criteria: 1) Were

symptoms/diagnoses assessed with a semi-structured diagnostic interview?, 2) Was a treatment manual used?, 3) Were therapists trained either specifically for the study or in a general training?, 4) Was treatment integrity checked by supervision and/or recordings and/or standardized instruments?, 5) Was data analyzed with intent-to-treat analysis?, 6) Was group allocation performed with a true randomization technique?, 7) Was randomization done by an independent third person (or computer or sealed envelopes)?, 8) Were blinded assessors used for interviews?, and 9) Were dropouts adequately reported? Items for each of the nine quality criteria were scored on a four-point scale, where 3 indicates high quality (e.g., a published treatment manual was used), 2 indicates limited quality (e.g., an unpublished treatment manual was used), 1 indicates lack of required quality (e.g., no treatment manual was used), and 0 indicates unknown (i.e., required information not reported). When self-report measures were used to assess outcomes in a given trial, a score of 3 was given on the quality item concerning blinded assessments. In case of technology-based interventions, a trial received a score of 3 on the quality items concerning trained therapists and formal fidelity checks due to the technology-based standardized procedure. The nine ratings were then summed up to yield the respective trial quality sum score and used as a potential moderator in meta-regressions.

Data extraction of outcome measures

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

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

Statistical Analysis

Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-effects models given that we expected large heterogeneity in reported effect sizes .[24–26] We prioritized intent-to-treat (ITT) data when available (k = 3) over completer data (k = 17, including k = 3 with insufficient information on participant flow, see Table 1 for further 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 $J = 1\text{-}(3/(4df - 1))$ to yield Hedges's g.[27] Analyses were conducted if four or more trials were available for a given (sub-)analysis.[28] Effect sizes g may be conservatively interpreted with Cohen's convention of small (±0.2), medium (±0.5) and large (±0.8) effects.[29] 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 of effect sizes 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.[30] Because we expected large heterogeneity, we also calculated prediction intervals.[31] 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.[32] 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.[33, 34] However, no outliers were identified in any of the performed analyses. When analyses consisted of at least ten trials,[35] 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.[36] The trim-and-fill procedure yields an asymmetry-corrected estimate of the effect size (i.e., taking publication bias into account). We calculated the numbers needed to treat (NNT) as a measure of efficacy that is easily interpretable from a clinical perspective. It informs about the numbers of patients that need to be treated until one adverse event is prevented.[37] NNT were calculated with the NNT function of the dmetar package and are based on the pooled effect sizes (i.e., Hedges' *g*). Lastly, we performed moderator analyses in R with trial quality sum score and treatment length (in minutes) as continuous variables (i.e., meta-regressions) and alliance as a dichotomous variable (i.e., trials with vs. without the involvement of the founders of PPT[1]) to check for potential moderating effects on efficacy outcomes. Since too few trials were available to check for alliance, we performed sensitivity analyses with trials involving the founders

omitted.[1] Moreover, we performed more general sensitivity analyses with the leaving1out function of the metafor package.

Results

Study characteristics

Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with WLC. Five trials (25%) compared PPT with an active control condition (e.g., treatment-as-usual, control exercises). Three trials (15%) compared PPT with another psychological intervention (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more than one control conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and the remaining 6 trials in an individual setting. Two of the latter trials described in one publication applied an internet-based PPT.[39] Treatment lengths was 917.06 minutes on average (unweighted mean across trials reporting on both, number and duration of sessions, k = 17) with a standard deviation of 374.79 minutes. Note that the pioneering manual of Seligman et al.[1] constitutes of a 720 minutes (i.e., 12 sessions á 60 minutes). Average number of sessions was 9.17 (*SD* = 2.71) and 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. The detailed quality assessment per trial can be found in Table 2.

-Table 1 here-

Participant characteristics

Basic characteristics of included participants per trial can be found in Table 1. A total of 1,360 participants 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 3. 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 assessment (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 results of Mohamadi et al.[20] were entered as reported in their publication (g = -0.82, *95%CI:* -1.39; -0.25, k = 10, *NNT* = 2.27). Number of available trials allowed for a

publication bias check. While a visual inspection of the funnel plot led to the suspicion of publication bias (i.e., missing trials to the left and a potential outlier to the far left, see eFig. 1 in the supplement), Egger's test did not indicate significant asymmetry (t = -1.91, p = .093). The sensitivity analysis yielded that one trial had particular influence on the pooled effect size. When Abdeyan et al., 2018 (i.e., assessed positive outcome = hope) was omitted, pooled effect size decreased to g = -0.44 (see eTable 1 in the supplement). No evidence was found for the efficacy of PPT in increasing positive outcomes compared to WLC at follow-up assessment (g = -0.36, *95%CI:* -0.83; 0.11, k = 4, *NNT* = 5.01). See eFigure 2 in the supplement for the corresponding forest plot. Follow-up assessment results are to be scrutinized with due caution in the light of low number of available trials (k = 4), large heterogeneity in effect sizes (I^2 = 74.34) and the wide range of the prediction interval (*PI* = -1.29; 0.57). Satisfaction with life was the only positive outcome with enough trials to warrant a meta-analytic sub-analysis. In comparison to WLC at post-treatment assessment, PPT was not found more effective in increasing satisfaction with life (g = -0.15, *95%CI:* -0.40; 0.09, k = 4, *NNT* = 11.55). See eFigure 3 in the supplement for the corresponding forest plot. Heterogeneity in outcomes was low (I^2 = 11.20). The sensitivity analysis did not yield that one of the four studies was particularly influential on the pooled effect with all leaving1out analyses yielding a non-significant pooled g (see eTable 1 in the supplement). In comparison to active control conditions (i.e., treatment-as-usual and placebo exercises) at post-treatment assessment, PPT yielded a large effect size in increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05). See eFigure 4 in the supplement for the corresponding forest plot. However, heterogeneity in outcomes was large (I^2 = 92.51) and the prediction interval included the null (*PI* = -2.98; 1.13) illustrating large variability in findings. When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, &

Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were found for increasing positive outcomes (g = -0.29, *95%CI:* -0.89; 0.32, k = 6, *NNT* = 6.24). See eFigure 5 in the supplement for the corresponding forest plot. Again, heterogeneity in outcomes was large (I^2 = 79.57) and the prediction interval included the null (*PI* = -1.71; 1.13). Results remained insignificant when results of Mohamadi et al.[20] were entered as reported in their publication (g = -0.65, *95%CI:* -1.31; 0.01, k = 6). Lastly, when trials with alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment assessment remained similar (g = -1.04, *95%CI:* -1.79; -0.28, k = 7, *NNT* = 1.87, see Table 3).

The Efficacy of PPT in Decreasing Negative Outcomes

PPT was found moderately more effective in reducing depression, negative affect and stress than WLC at post-treatment assessment (g = 0.48, *95%CI:* 0.18; 0.78, k = 8). See Figure 2 for the corresponding forest plot. To avoid one adverse event (i.e., depression, negative affect or stress), a little less than four patients needed to be treated (*NNT* = 3.76). The sensitivity analysis did not yield that one of the eight studies was particularly influential on the pooled effect with all leaving1out analyses yielding moderate pooled effect sizes between 0.40 and 0.58 (see eTable 1 in the supplement). Results on decreasing depression were similar (g = 0.57, *95%CI:* 0.21; 0.92, k = 6, *NNT* = 3.22). See eFigure 6 in the supplement for the corresponding forest plot. Again, the sensitivity analysis did not yield that one of the six studies was particularly influential with moderate pooled effect sizes between 0.47 and 0.68 for the leaving1out analyses (see eTable 1 in the supplement). Prediction intervals for both analyses (i.e., all negative outcomes and depression only) excluded the null (*PI* = -0.17; 1.13; *PI* = -0.18; 1.31, respectively) highlighting substantial levels of heterogeneity in efficacy outcomes and remaining uncertainty about the true

efficacy when similar future trials accumulate. In comparison to active control conditions (i.e., treatment-as-usual with or without medication and placebo exercises) at post-treatment assessment, PPT yielded large effect sizes in reducing depression (g = 0.94, *95%CI:* 0.18; 1.70, k = 6, *NNT* = 2.03). Please find the corresponding forest plot in eFigure 7 in the supplementary materials. Again, heterogeneity was large (I^2 = 90.28) and the prediction interval excluded the null (*PI* = -0.96; 2.83). When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, & Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were found for decreasing negative outcomes (g = 0.08, *95%CI:* -0.48; 0.64, k = 6, *NNT* = 22.22). Please find the corresponding forest plot in eFigure 8 in the supplement. Trials that included follow-up assessments on the efficacy of PPT in decreasing negative outcomes were too few to allow for meta-analytic review for all included comparisons (k < 4). Lastly, when trials with alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment assessment remained similar (g = 0.63, *95%CI:* 0.20; 1.07, k = 5, *NNT* = 2.89, see Table 3).

Moderator Analyses

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

found to moderate effect sizes with higher trial quality being associated with higher effect sizes (b = 0.18, p = .015). No significant moderation of trial quality was found for the comparison with other active treatment conditions (b = -0.01, p = .907) nor for the sub-analysis on satisfaction with life (b = -0.01, p = .915).

In terms of the efficacy of PPT in decreasing negative outcomes in comparison to WLC at post-treatment assessment, trial quality was found to be a significant moderator with higher trial quality being associated with lower effect sizes (b = -0.08, p = .003). A similar result was found for the sub-analyses on depression (b = -0.11, p < .001). Similarly, the sub-analysis on depression for the comparison of PPT and active control conditions yielded a significant moderation of trial quality with higher trial quality being associated with lower effect sizes (b = -0.17, p = .005). However, a significant moderation was found for the comparison with other active treatment conditions with higher trial quality being related to higher effect sizes in decreasing negative outcomes (b = 0.13, p < .001). No evidence was found for a moderation of treatment length in any of the analyses (see Table 4).

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 assessment. 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 significantly associated with effect size. For positive outcomes, higher quality of trials was related to higher effect sizes. Whereas for depression, higher quality

of trials was related to lower effect sizes. However, the low number of available trials, large heterogeneities, identification of some influential single trials in the sensitivity analyses 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 assessment 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 assessment.[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 controls) also involved an almost outlier.[40] This study offered PPT to depressed patients and yielded a strikingly large effect size at post-treatment assessment (g = -2.98) favoring PPT in increasing hope. Both almost outlier studies involved a moderate sample size (see Table 1). All this suggests that more trials are needed to allow for firmer conclusions.

When PPT was compared to other established psychological interventions such as CBT, current data did not suggest any significant difference in efficacy. Accordingly, the results of the six RCTs included in this comparison suggests that PPT is similarly effective in increasing

positive psychological outcomes. However, due to the low number of trials for this comparison these findings need to be viewed with due caution.

The first and foremostly assessed negative outcome in the PPT literature remains depression. As suggested and intended by its developers, PPT was found moderately to largely effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with larger effect sizes in lowering depression for PPT in comparison to active control conditions (pooled $g = 0.94$) as opposed to WLC (pooled $g = 0.57$). Once more, unplanned post-hoc investigations were performed in an attempt to find potential reasons for the counterintuitive finding. Again, we found that an almost outlier might explain the difference. The analysis involving active control groups involved an almost outlier with an effect size of $g = 2.45$,[44] whereas the analysis involving WLC did not involve such an almost outlier.

Data on the efficacy at follow-up assessments altogether were scarce. The only feasible analysis on follow-up assessment data (i.e., PPT vs. WLC in increasing positive outcomes) yielded a non-significant effect size. The current available literature does not allow for any other valid follow-up analyses and, thus, conclusions on the long-term efficacy of PPT cannot not yet be made. This represents perhaps the main limitation of the literature on the efficacy of PPT. For the same reason, additional sensitivity analyses (e.g., group vs. individual PPT, or PPT efficacy by health condition vs. mental health condition) were not feasible.

Trial quality overall was moderate and, therefore, leaves room for improvement. Results overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs) more generally which report moderate effect sizes in increasing positive outcomes and decreasing negative outcomes.[11-19] A recent meta-analysis on PPIs further also reports on a

significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not straightforward.

This represents the first meta-analysis with an exclusive focus on the efficacy of PPT. Several limitations need to be considered. First and foremost, the number of included trials is relatively small and accordingly more research is needed to draw firmer conclusions. Secondly, depression and SWL were the only two outcomes with enough trials to warrant sub-analyses. More research is needed to allow for more homogenous analyses on PPT efficacy for specific outcomes. Thirdly and related to the second limitation, the two overarching analyses on various positive and negative outcomes involved large heterogeneity, respectively. The decision to conduct such overarching analyses on heterogenous outcomes was based on the overall scarcity of trials. We aimed at conducting more homogenous sub-analyses were possible which were, as mentioned, only feasible for depression and SWL. As more trials accumulate, more fine-grained analyses will become feasible. Fourthly and lastly, the long-term efficacy of PPT remains uncertain due to lack of follow-up assessments.

Conclusion

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

Statements

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None.

Data Availability Statement

We performed a meta-analysis on published und publicly accessible data. No additional data available.

Competing Interests Statement

The authors declare that they have no conflict of interest to declare

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Ethics statement

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

Author Contributions Statement

THH and NM conceptualized the meta-analysis conducted the systematic literature search and coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript and agreed to be accountable for all aspects of the work.

References

1* Seligman MEP, Rashid T, Parks AC. Positive psychotherapy. Am Psychol 2006;61:774–788.
2 Peterson C, Seligman MEP. Character strengths and virtues: A handbook and classification, Oxford University Press, 2004.
3 Walsh S, Cassidy M, Priebe S. The application of positive psychotherapy in mental health care: A systematic review. J Clin Psychol 2017;73:638–651.
4* Schrank B, Brownell T, Jakaite Z, *et al*. Evaluation of a positive psychotherapy group intervention for people with psychosis: Pilot randomised controlled trial. Epidemiol Psychiatr Sci 2016;25:235–246.
5* Uliaszek AA, Rashid T, Williams GE, *et al*. Group therapy for university students: A randomized control trial of dialectical behavior therapy and positive psychotherapy. Behaviour Research and Therapy 2016;77:78–85.
6* Dowlatabadi MM, Ahmadi SM, Sorbi MH, *et al*. The effectiveness of group positive psychotherapy on depression and happiness in breast cancer patients: A randomized controlled trial. Electron Physician 2016;8:2175.
7* Saeedi B, Khoshnood Z, Dehghan M, *et al*. The effect of positive psychotherapy on the meaning of life in patients with cancer: A randomized clinical trial. Indian J Palliat Care 2019;25:210.
8* Khayatan T, Azkhosh M, Bahmani B, *et al*. Group positive psychotherapy and depression of females affected by multiple sclerosis. Iran Rehabil J 2014;12:49–53.
9 Rashid T, Seligman MP. Positive Psychotherapy: Clinician Manual. Oxford University Press, 2018.
10 Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Ann Intern Med 2009;151:264–269.
11 Bolier L, Haverman M, Westerhof GJ, *et al*. Positive psychology interventions: A meta-analysis of randomized controlled studies. BMC Public Health 2013;13:119.
12 Chakhssi F, Kraiss JT, Sommers-Spijkerman M, *et al*. The effect of positive psychology interventions on well-being and distress in clinical samples with psychiatric or somatic disorders: A systematic review and meta-analysis. BMC Psychiatry 2018;18:211.
13 Davis DE, Choe E, Meyers J, *et al*. Thankful for the little things: A meta-analysis of gratitude interventions. J Couns Psychol 2016;63:20.
14 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of positive psychological interventions from non-western countries: A systematic review and meta-analysis. IJW 2018;8:71–98.
15 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of multi-component positive psychology interventions: A systematic review and meta-analysis of randomized controlled trials. J Happiness Stud 2020;21:357–390.
16 Hendriks T, Warren MA, Schotanus-Dijkstra M, *et al*. How WEIRD are positive psychology interventions? A bibliometric analysis of randomized controlled trials on the science of well-being. J Posit Psychol 2019;14:489–501.
17 Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. J Clin Psychol 2009;65:467–487.
18 Casellas-Grau A, Font A, Vives J. Positive psychology interventions in breast cancer. A systematic review. Psychooncology 2014;23:9–19.

19 White CA, Uttl B, Holder MD. Meta-analyses of positive psychology interventions: The effects are much smaller than previously reported. PloS One 2019;14:e0216588.
20* Mohamadi J, Ghazanfari F, Drikvand FM. Comparison of the effect of dialectical behavior therapy, mindfulness based cognitive therapy and positive psychotherapy on perceived stress and quality of life in patients with irritable bowel syndrome: A pilot randomized controlled trial. Psychiatr Q 2019;90:565–578.
21 Cuijpers P, van Straten A, Bohlmeijer E, *et al*. The effects of psychotherapy for adult depression are overestimated: a meta-analysis of study quality and effect size. Psychol Med 2010;40:211–223.
22 Smit Y, Huibers MJH, Ioannidis JPA, *et al*. The effectiveness of long-term psychoanalytic psychotherapy - A meta-analysis of randomized controlled trials. Clin Psychol Rev 2012;32:81–92.
23 Morina N, Koerssen R, Pollet TV. Interventions for children and adolescents with posttraumatic stress disorder: A meta-analysis of comparative outcome studies. Clin Psychol Rev 2016;47:41–54.
24 R Core Team: R. A Language and Environment for Statistical Computing 2019. Retrieved from http://www.R-project.org/.
25 Viechtbauer W. Conducting meta-analyses in R with the metafor package. Journal of statistical software 2010;36:1–48.
26 Borenstein M, Hedges LV, Higgins JPT, *et al*. Introduction to meta-analysis, John Wiley & Sons, 2011.
27 Lipsey MW, Wilson DB. Practical meta-analysis, [Nachdr.]. Applied social research methods series. Thousand Oaks, Calif., SAGE Publ, 2009, vol 49.
28 Hoppen TH, Morina N. Is high-quality of trials associated with lower treatment efficacy? A meta-analysis on the association between study quality and effect sizes of psychological interventions for pediatric PTSD. Clin Psychol Rev 2020:101855.
29 Cohen J. Statistical Power Analysis for the Behavioral Sciences, 2nd ed. Hoboken, Taylor and Francis, 2013.
30 Higgins JPT, Thompson SG, Deeks JJ, *et al*. Measuring inconsistency in meta-analyses. BMJ 2003;327:557–560.
31 IntHout J, Ioannidis JPA, Rovers MM, *et al*. Plea for routinely presenting prediction intervals in meta-analysis. BMJ Open 2016;6: e010247.
32 Riley RD, Higgins JPT, Deeks JJ. Interpretation of random effects meta-analyses. BMJ 2011;342:d549.
33 Hunter JE, Schmidt FL. Methods of meta-analysis: Correcting error and bias in research findings, London: Sage Publications, 2004.
34 Tabachnick BG, Fidell LS. Using Multivariate Statistics, ed. 6. 2013.
35 Sterne JAC, Sutton AJ, Ioannidis JPA, *et al*. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. BMJ 2011;343:d4002.
36 Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. Biometrics 2000;56:455–463.
37 Kraemer HC, Kupfer DJ. Size of treatment effects and their importance to clinical research and practice. Biol Psychiatry 2006;59:990–996.

38* Hwang K, Kwon A, Hong C. A preliminary study of new positive psychology interventions: Neurofeedback-aided meditation therapy and modified positive psychotherapy. Curr Psychol 2017;36:683–695.
39* Parks-Sheiner AC. Positive psychotherapy: Building a model of empirically supported self-help. Dissertations available from Pro-Quest 2009.
40* Abdeyan T, Mahsa KK, Mohammad Z, *et al*. The Effect of Psychosocial Group Based on Positive Psychology on Hopefulness in Patients with Major Depressive Disorder: A Clinical Trial. Electron J Gen Med 2018;15:em49.
41* Nikrahan GR, Laferton JAC, Asgari K, *et al*. Effects of positive psychology interventions on risk biomarkers in coronary patients: a randomized, wait-list controlled pilot trial. Psychosomatics 2016;57:359–368.
42* Asl STS, Sadeghi K, Bakhtiari M, *et al*. Effect of group positive psychotherapy on improvement of life satisfaction and the quality of life in infertile woman. Int J Fertil Steril 2016;10:105–112.
43* Heydari MG, Shirazi M, Sanagouyemoharer GR. Evaluating the Efficacy of Positive Psychotherapy on Life Expectancy in Students With Hemophilia: A Randomized Controlled Trial. Pract Clin Psychol 2019;7:63–70.
44* Zhang JP, Guo Y-F, Zhang X, *et al*. Effects of Positive Psychotherapy on Depression and Self-efficacy in Undergraduate Nursing Students Positive Psychotherapy. Res Rev J Nurs Health Sci 2015:12–18.
45*Asgharipoor N, Asgharnejad AA, Arshadi HR, *et al*. Comparative study on the effectiveness of positive psychotherapy and group cognitive-behavioral therapy for the patients suffering from major depressive disorder. Iran J Psychiatry Behav Sci 2012;2:33–41.
46*Furchtlehner LM, Schuster R, Laireiter AR. A comparative study of the efficacy of group positive psychotherapy and group cognitive behavioral therapy in the treatment of depressive disorders: A randomized controlled trial. J Posit Psychol 2019:1–14.
47*Taghvaienia A, Alamdari N. Effect of Positive Psychotherapy on Psychological Well-Being, Happiness, Life Expectancy and Depression Among Retired Teachers with Depression: A Randomized Controlled Trial. Community Ment Health J 2019;56:229–237.

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

Table 1

Basic characteristics of included trials

Study	Country	Health condition	Intervention (treatment manual)[a]	Format	Control group (& format)	Nr. of sessions x Duration in min.	FU[b]	*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.[c]	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

Heydari et al.[43]	Iran	Hemophilia	PPT (Seligman et al. 2014)	Indiv.	WLC	8 x 120	2	56[c]	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

Parks-Sheiner study 3[39]	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
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 (LAP)	14
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
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
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
Taghvaienia 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
Uliaszek et al.[5]	Canada	Psycho-pathology (trans-diagnostic)	PPT	Group	DBT	12 x 120	n.a.	54	22.17 ± 5.01	77.78	ITT	Depression & happiness (PPTI)	19
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

	self-efficacy (GSE)

BDI-II, Beck Depression Inventory 2nd 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.

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

[b]Longest reported follow-up assessment on relevant outcome(s) in months, FU assessment used in the meta-analysis.

[c]reported but irrelevant, as follow-up assessment was conducted at two weeks post-treatment; [c]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 randomization	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
Taghvaienia 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)	*k*	*g*[a]	*SE*	*95%* CI PI	I^2	*NNT*
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	**-0.72***	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	**-0.92***	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. (k = 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. (k = 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. (k = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. WLC at post	8	**0.48****	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. WLC at FU	n.a. (k = 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. (k = 1)					
Subanalyses on depression						
PPT vs. WLC – depression at post	6	**0.57****	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. WLC – depression at FU	n.a. (k = 3)					

PPT vs. ACC - depression at post	6	**0.94***	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	**-1.04****	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	**0.63****	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPTvs. 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.

[a]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	*k*	Intercept	*b*	*rem. I²*	*p*
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	10	-3.60	**0.17**	79.93***	**.003**
PPT vs. WLC at follow-up	4	-2.56	**0.12**	38.01	**.036**
PPT vs. ACC at post	6	-4.21	**0.18**	83.61***	**.015**
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	**-0.08**	0	**.003**
PPT vs. ACC at post	All six trials conducted on depression, see below				
PPT vs. OtherATC at post	6	-2.24	**0.13**	21.28	**<.001**
Sub-analysis on depression					
PPT vs. WLC at post	6	2.50	**-011**	0	**< .001**
PPT vs. ACC at post	6	4.47	**-0.17**	76.91***	**.005**
Potential Moderator: Treatment length[a]					
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. (*k* = 3)				
PPT vs. ACC at post	n.a. (*k* = 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. (*k* = 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. (*k* = 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. I², remaining amount of unexplained heterogeneity including the p-value of the Q-statistic as indicated by asterisks; post, post-treatment

assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of moderation.
* $p < .05$ ** $p < .01$, *** $p < .001$
[a]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

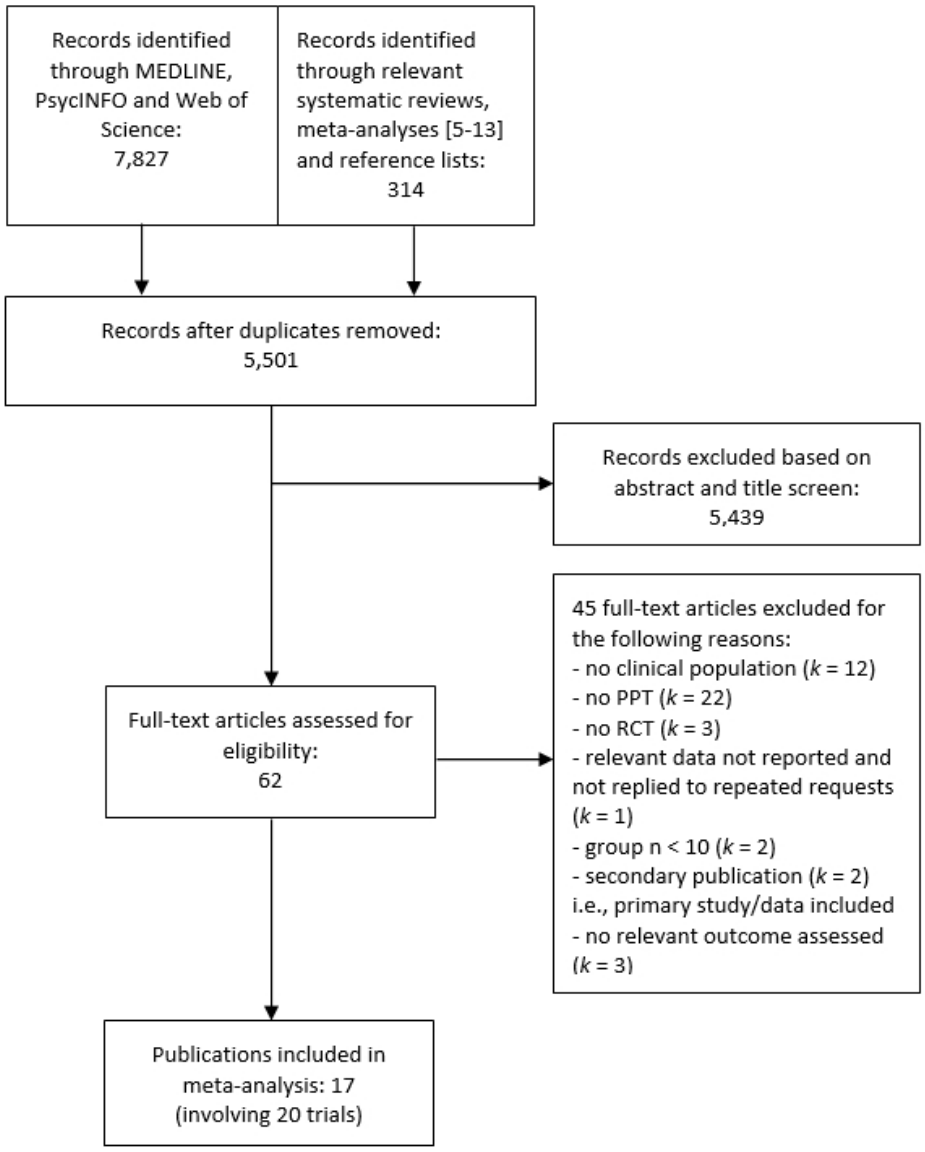


Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

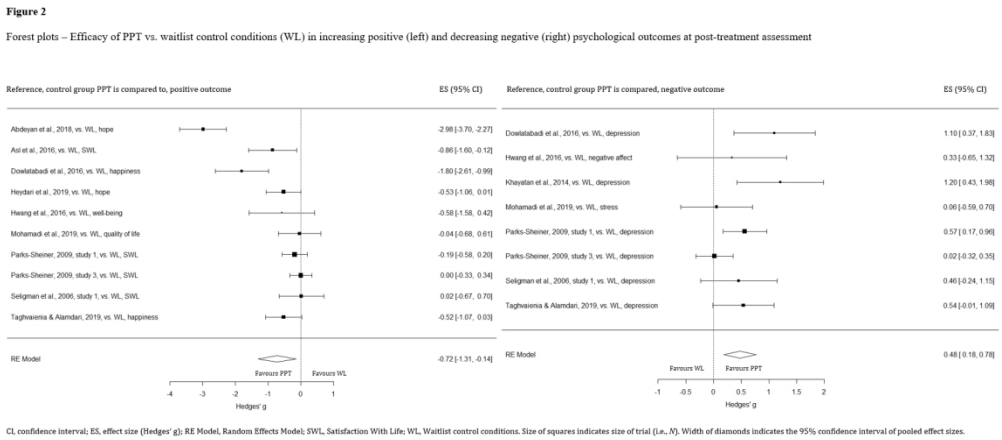


Fig. 2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment

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)

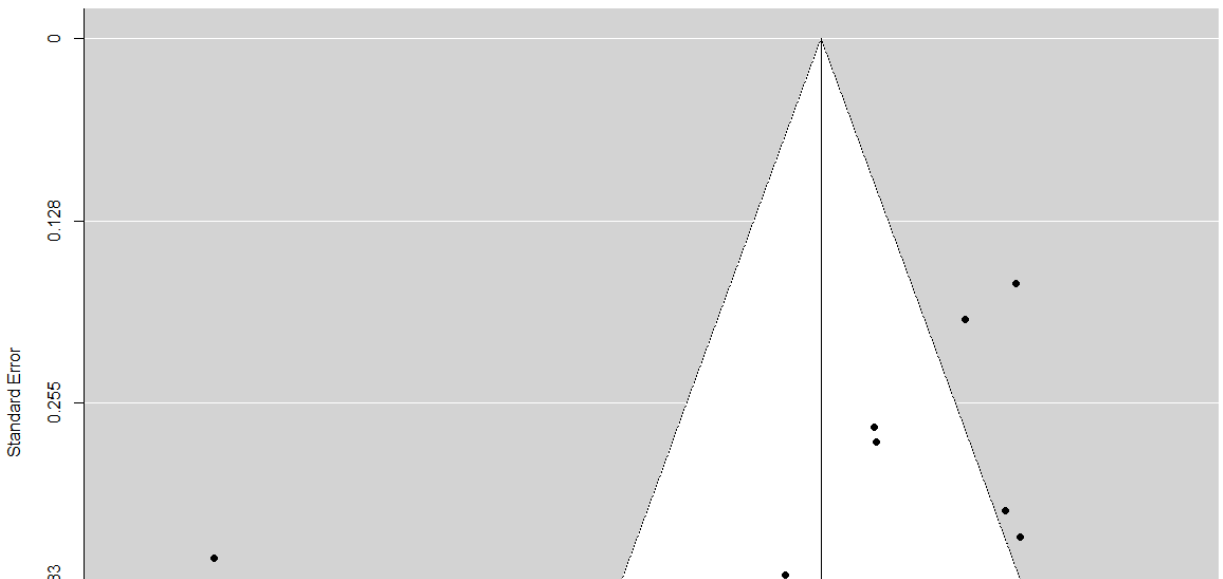
eList 1. Search strategy (PsycINFO and MEDLINE)

Search terms and strategy: "TI positive psychotherapy OR AB positive psychotherapy OR SU positive psychotherapy".

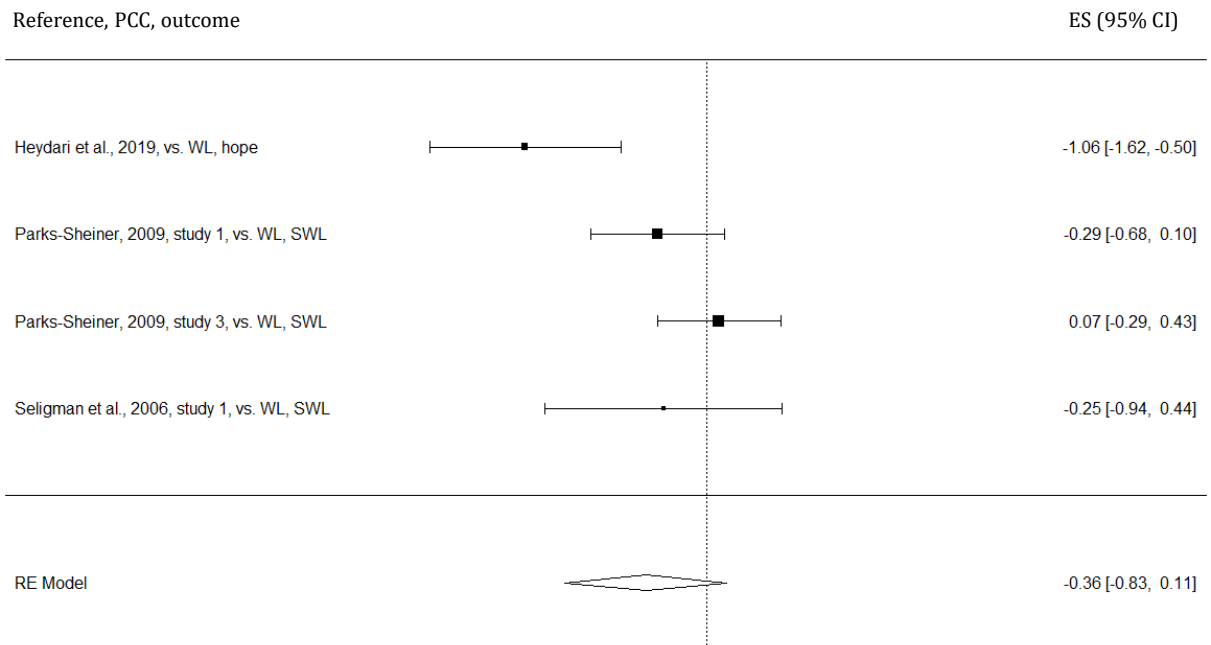
Time limit: Jan 1 2006 to Feb 13 2020.

Other limits and filters: None.

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

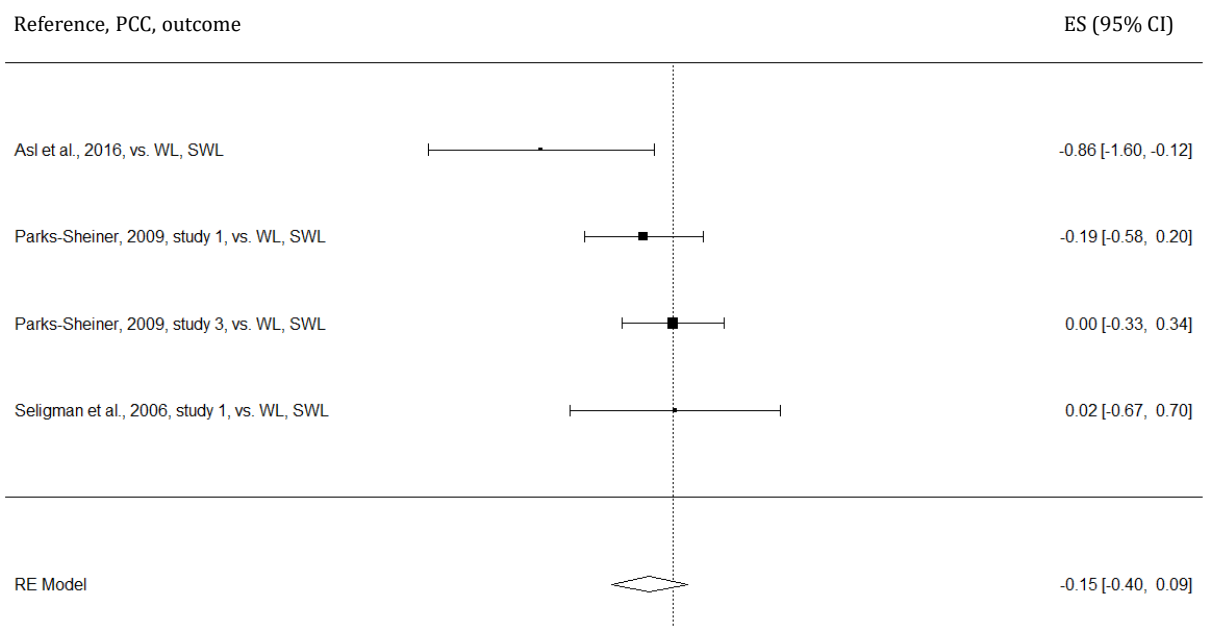


eFig. 2. Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to passive control conditions at follow-up



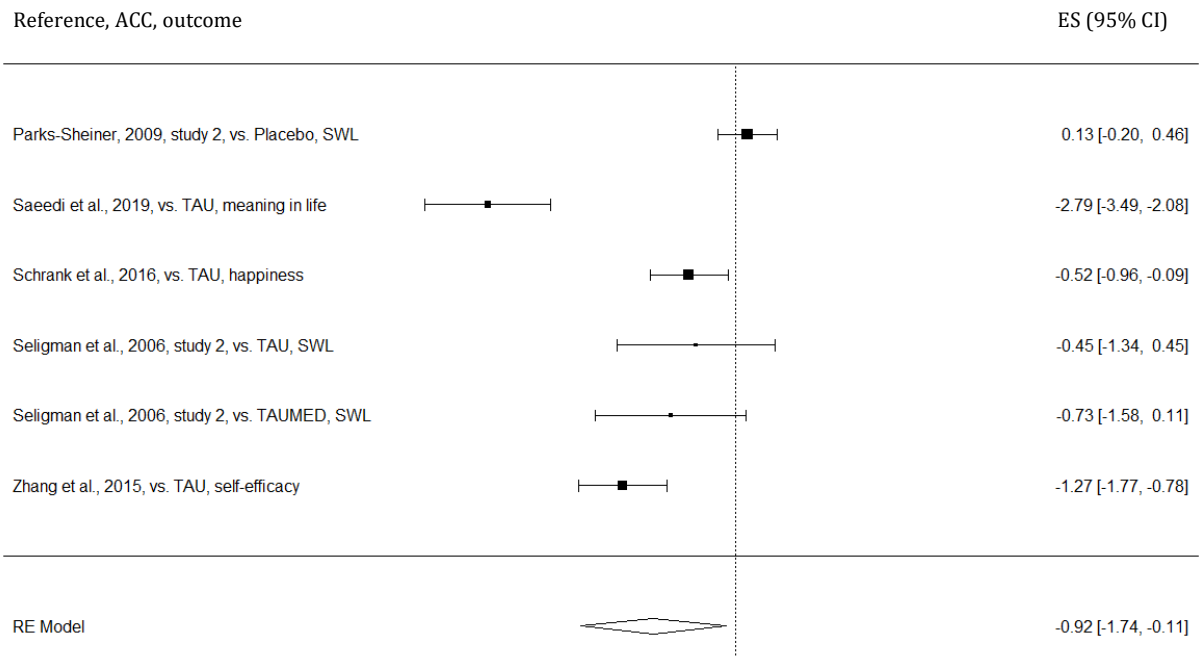
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the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



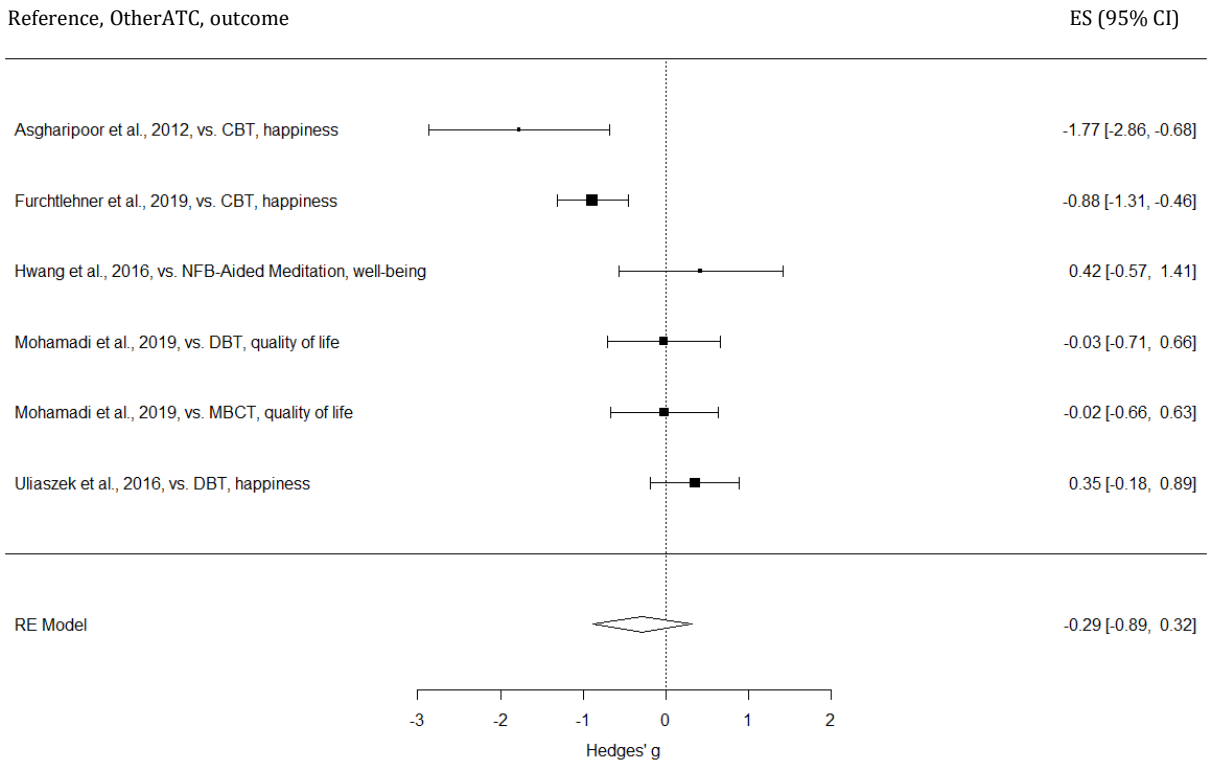
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled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

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



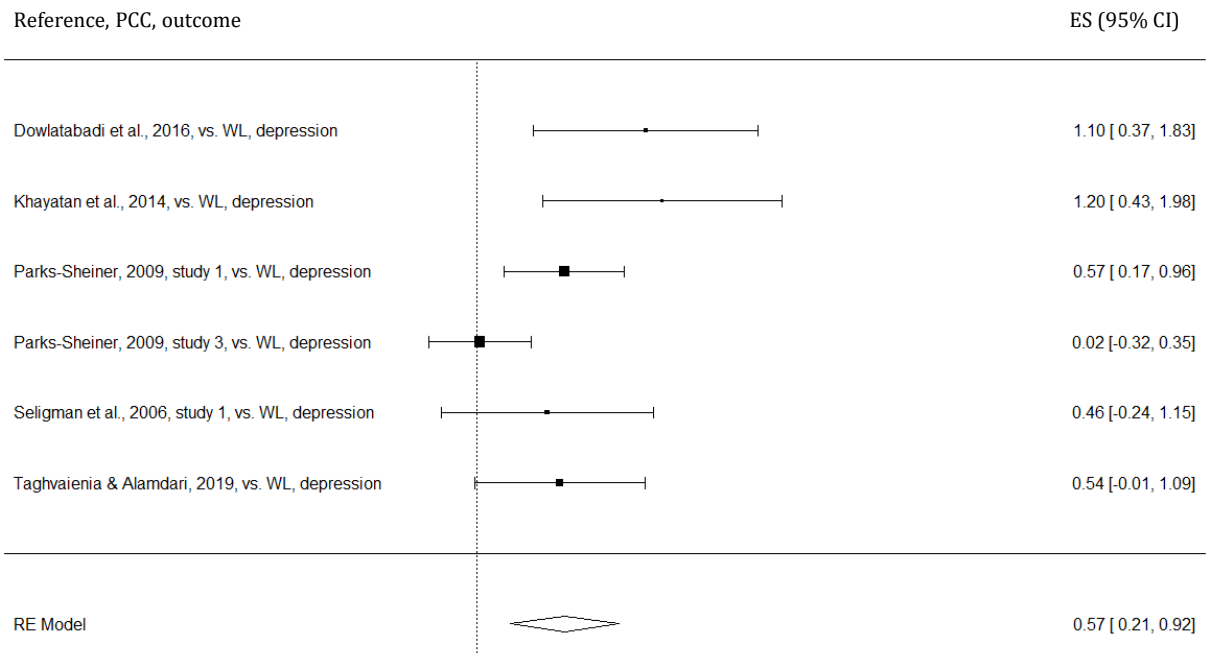
ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); Placebo, pill Placebo; RE Model, Random Effects Model; SWL, Satisfaction With Life; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e., *N*)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



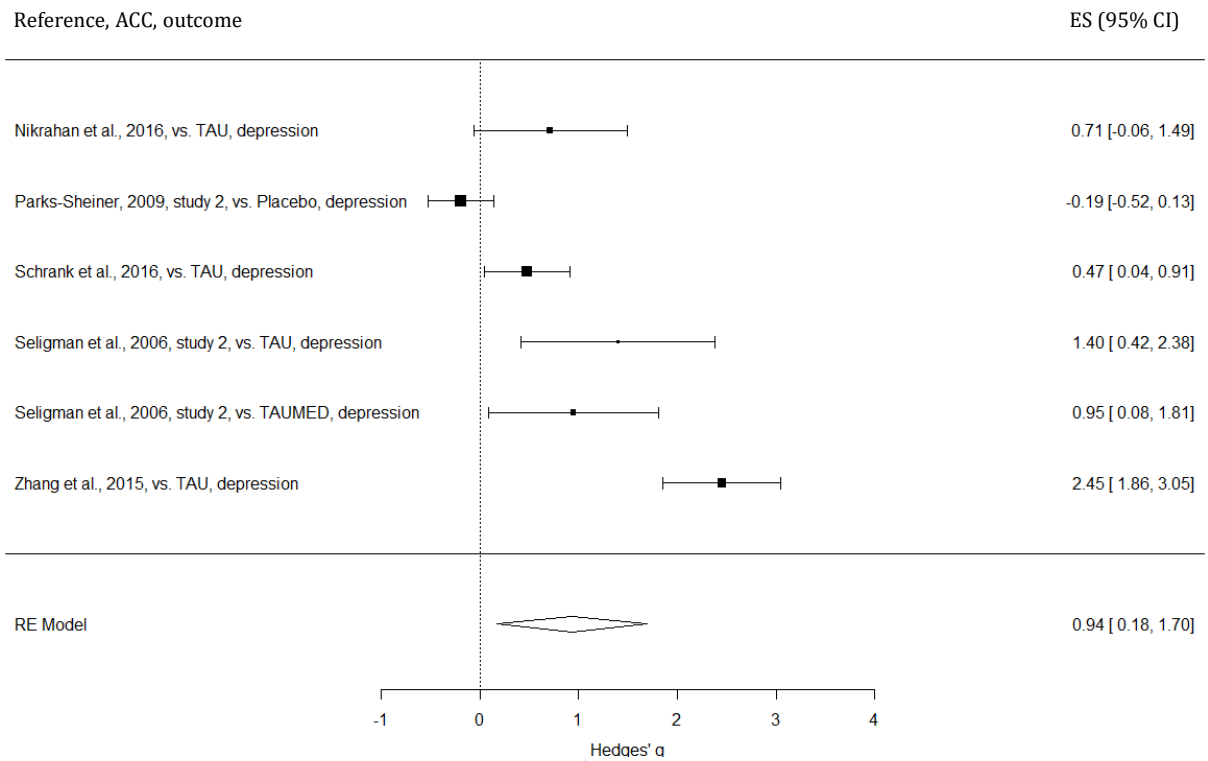
CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of 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



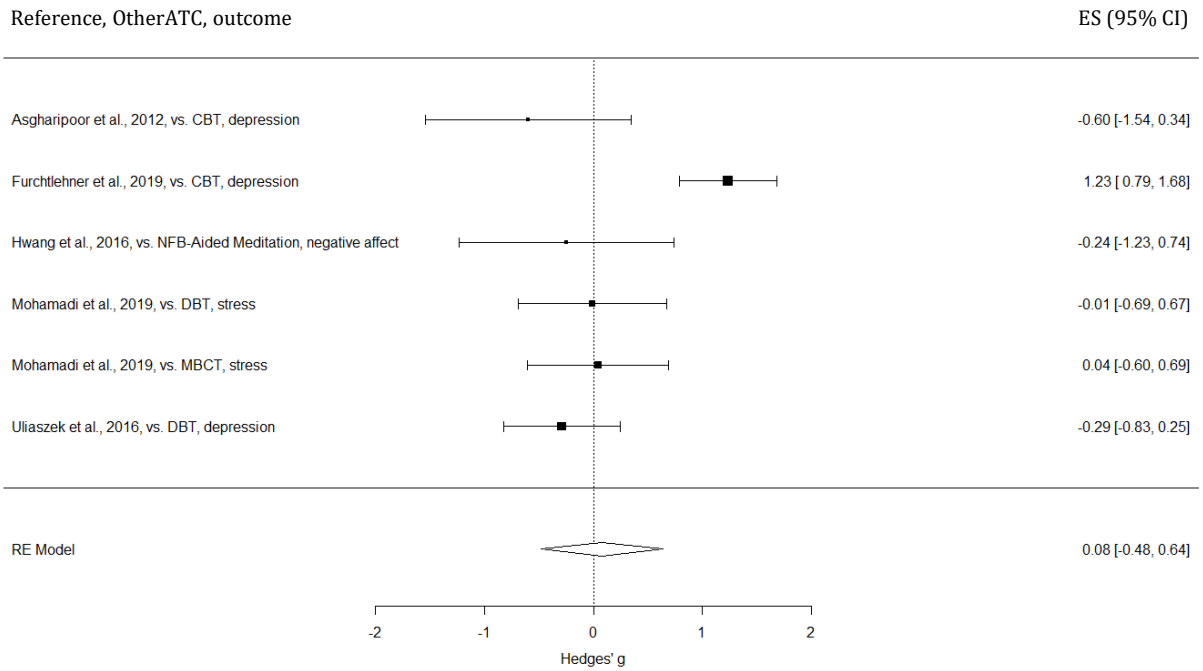
CI, confidence interval; ES, effect size (Hedges' g); PCC, Passive Control Conditions (included waitlist control only); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled 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)				
Trial omitted (negative outcome assessed)	**Corrected *g***	***SE***	***Z***	***Q***
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*
Taghvaienia & Alamdari, 2019 (depression)	0.48	0.18	2.73**	14.37*
Trial omitted (sub-analysis on depression only)				
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**
Taghvaienia & Alamdari, 2019	0.59	0.22	2.66**	13.27*
Trial omitted (positive outcome assessed)				
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***
Taghvaienia & Alamdari, 2019 (happiness)	-0.75	0.33	-2.25*	72.71***
Trial omitted (sub-analysis on SLW only)				
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
ADMINISTRATIVE INFORMATION				
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	☑	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	☑	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	☑	1/8-30
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☑	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	☑	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.
INTRODUCTION				
Rationale	6	Describe the rationale for the review in the context of what is already known	☑	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)	☑	5/108-113
METHODS				
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	☑	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	☑	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	☑	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	☑	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)	☑	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	☑	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 pre planned data assumptions and simplifications	☑	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	☑	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	☑	7/162-8/182
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	☑	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 τ)	☑	9/199-11/236
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	☑	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)	☑	10/229-11/236
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	☑	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

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

Thole H. Hoppen* & Nexhmedin Morina

Institute of Psychology, University of Münster, Münster, Germany

Short title: Meta-analytic review of positive psychotherapy

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

*Corresponding author:
Thole H. Hoppen, PhD
Institute of Psychology
University of Münster
Fliednerstr. 21
48149 Münster (Germany)
e-Mails: thoppen@uni-muenster.de; morina@uni-muenster.de
Tel: +49 251 83 39415
Fax: +49 251 83 31331

Number of Tables: 4

Number of Figures: 2

Word count: 4,784 (excl. abstract, key points, statements, references, Tables and Figures)

Abstract

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

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

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

Results: We included 20 RCTs with a total of 1,360 participants. Moderate effect sizes were found for increasing positive outcomes (g = -0.72, *95%CI:* -1.31; -0.14, k = 10, *NNT* = 2.55) and reducing negative outcomes (g = 0.48, *95%CI:* 0.18; 0.78, k = 8, *NNT* = 3.76) when PPT was compared to waitlist control conditions at post-treatment assessment. When compared to active control conditions, PPT yielded large effect sizes for increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05) and reducing depression (g = 0.94, *95%CI:* 0.18; 1.70, k = 6, *NNT* = 2.03) at post-treatment assessment. No significant differences in efficacy were found when compared to established treatments such as cognitive behavioural therapy. Evidence was found to support an association between trial quality and effect sizes. For positive outcomes, higher trial quality was related to larger effect size. Whereas higher trial quality was associated with smaller effect size for depression. Follow-up assessments remained too scarce for most planned analyses.

Conclusions: Our findings support the short-term efficacy of PPT. However, results are to be regarded with due caution in the light of low number of trials. More high-quality trials that assess efficacy at follow-ups are needed to draw firmer conclusions on the long-term efficacy of PPT.

PROSPERO registration number: CRD42020173567

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 trials precluded many (sub-)analyses and asks for due caution in interpreting the present findings
- Due to lacking follow-up assessment, long-term efficacy could not be determined

Introduction

Positive Psychotherapy (PPT) is theoretically grounded in the field of positive psychology and proposes that psychopathology such as depression can be effectively treated by directly and primarily building and strengthening pleasure (i.e., positive emotions), meaning (i.e., belonging to and serving something greater than the self) and engagement (i.e., active involvement in daily life.[1] PPT presumes that by means of fostering positive resources, negative symptoms will be successfully dampened. While the founders believed from inception that PPT might be an effective treatment for various disorders, they started off by investigating its efficacy in treating depression. PPT consists of single positive interventions such as *Using Your Strength*, the *Three Good Things* and the *Gratitude Visit.* In *Using Your Strength*, for instance, participants are asked to fill out the Values in Action Inventory of Strengths (VIA-IS,[2]) and to think of ways to use their top five strengths more in daily life. Seligman and colleagues ended up including 26 positive exercises in their final PPT manual. In their first randomized controlled trial (RCT) on the efficacy of PPT, they offered a six-week, two-hour-per-week group intervention with 8-11 mildly to moderately depressed students per group and found that PPT was effective in lowering depressive symptoms and increasing satisfaction with life compared to waitlist controls.[1] They also conducted a second RCT were they offered a 14-session individual PPT over 12 weeks in a sample of adults suffering from major depressive disorder. Again, PPT was found effective in decreasing depression and increasing happiness, in this RCT compared to treatment-as-usual.[1] Since then, numerous other RCTs have assessed the efficacy of PPT.[3] Apart from further research on populations suffering depressive symptoms or depressive disorders, PPT has been investigated in various other contexts including patients with psychosis[4] and multiple other mental disorders[5] as well as in patients with several somatic complaints such as cancer[6, 7] or multiple sclerosis.[8] In their systematic review of the PPT literature, Walsh, Cassady and Priebe

summarized the findings of 12 publications (from 9 individuals trials) published before May 2015.[3] The authors conclude that the application of PPT in intervention research is heterogenous in terms of both, the modifications of the original manual as well as the conditions targeted by PPT as intended by the PPT developers.[1, 9] To the best of our knowledge, no meta-analysis with an exclusive focus on the efficacy of PPT has been published to this date. Against this background, we performed a systematic literature review and meta-analysis of randomized controlled trials assessing the efficacy of PPT.

Methods

Following the recommendations by the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) group,[10] we defined the main structured research question describing the Population, Intervention, Comparison, Outcome, and Study design (PICOS) as "In individuals with mental or physical health complaints, does PPT (I), compared to control conditions (C), improve psychological outcomes (O) in randomized controlled trials (S)?". We pre-registered the present meta-analysis in the PROSPERO database (ID: CRD42020173567).

Patient and Public Involvement

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

Literature Search Strategy

Inclusion criteria for the meta-analysis consisted of: 1) randomized controlled Trial (RCT), 2) evaluation of the efficacy of PPT as developed by Seligman et al.,[1] and (3) a minimum of ten participants per treatment arm at post-treatment assessment with available data on at least one relevant outcome. No restrictions were placed on age of participants, comparison condition, or publication type. Studies that only applied a mixture of PPT with another

intervention, such as a mixture of PPT and cognitive behavioral therapy in comparison to a control condition,[9] were excluded due to our narrow focus on the efficacy of PPT, as founded by Seligman et al.[1]. We searched the following databases: PsycINFO, MEDLINE, and Web of Science from 2006 up to 13th of February 2020. The year 2006 represents the year where the theoretical underpinnings of the PPT were first published.[1] No other limits or filters were applied. MeSH terms for Ebscohost (regarding MEDLINE and PsycINFO) were as follows: "SU positive psychotherapy OR TI positive psychotherapy OR AB positive psychotherapy" (see also eList 1 in the supplementary materials). In Web of Science a similar search string to Ebscohost was chosen to search for "positive psychotherapy" in titles, abstracts, and keywords. To retrieve additional publications, the reference lists of all included papers and relevant (i.e., related) meta-analyses and systematic reviews were manually screened.[11–19] Secondary hand searches were conducted using Google Scholar. The study synthesis was performed independently by both authors.

Coding of Studies

The publications were independently coded by both authors. From each publication, the following study, intervention and participant characteristics were coded and extracted: country the trial was conducted in, clinical population targeted (i.e., any physical or mental health condition), experimental intervention type (i.e., original PPT manual or modified version), intervention format (i.e., individual or group), comparison group(s), session number and session duration in minutes, follow-up duration in months for the longest reported follow-up assessment of the relevant outcome(s), number of participants at post-treatment assessment, age of participants (i.e., mean and standard deviation or range), proportion of sample with female sex in percent, applied statistical analysis (i.e., completer or intent-to-treat analyses) and relevant

outcome(s) targeted by PPT. The post-treatment assessment experimental group and control group means, standard deviations and sample sizes on the relevant outcome(s) (see in more detail below) were extracted. When reported, follow-up assessment data on relevant outcomes per group were also extracted. When multiple follow-up assessments were reported, the data from the longest follow-up assessment were retrieved. When relevant data was not reported, it was either calculated from given data (e.g., standard deviations from standard errors) or the corresponding author of the respective publication was contacted via email twice with one month in between. In one case, we contacted authors due to unusual results. Mohamadi, Ghazanfari and Drikvand potentially reported the means and SDs for a relevant outcome (i.e., quality of life) in wrong order (i.e., means where SDs should be placed and vice versa) [20]. We contacted the authors twice via Email and were left with no response. Consequently, we calculated two analyses; one with changed order of means and SD and one with unchanged order.

We divided control conditions into passive control conditions, which turned out to exclusively consist of waitlist control conditions (WLC), active control conditions (i.e., treatment-as-usual & placebo exercises) and other active treatment conditions (i.e., Cognitive Behavioral Therapy / CBT, Dialectic Behavioral Therapy / DBT, & Mindfulness-Based Cognitive Behavioral Therapy / MBCT). Note that included trials included different physical or mental health conditions and, therefore, TAU may involve various different treatment regimens.

Quality Assessment

Both authors independently rated the quality of the included trials by using a quality assessment constructed by Cuijpers, van Straten, Bohlmeijer, Hollon and Andersson and adjusted in two subsequent meta-analyses.[21-23] After independent rating, regular digital meetings were held to discuss disagreements. This scale assesses the following nine quality criteria: 1) Were

symptoms/diagnoses assessed with a semi-structured diagnostic interview?, 2) Was a treatment manual used?, 3) Were therapists trained either specifically for the study or in a general training?, 4) Was treatment integrity checked by supervision and/or recordings and/or standardized instruments?, 5) Was data analyzed with intent-to-treat analysis?, 6) Was group allocation performed with a true randomization technique?, 7) Was randomization done by an independent third person (or computer or sealed envelopes)?, 8) Were blinded assessors used for interviews?, and 9) Were dropouts adequately reported? Items for each of the nine quality criteria were scored on a four-point scale, where 3 indicates high quality (e.g., a published treatment manual was used), 2 indicates limited quality (e.g., an unpublished treatment manual was used), 1 indicates lack of required quality (e.g., no treatment manual was used), and 0 indicates unknown (i.e., required information not reported). When self-report measures were used to assess outcomes in a given trial, a score of 3 was given on the quality item concerning blinded assessments. In case of technology-based interventions, a trial received a score of 3 on the quality items concerning trained therapists and formal fidelity checks due to the technology-based standardized procedure. The nine ratings were then summed up to yield the respective trial quality sum score and used as a potential moderator in meta-regressions.

Data extraction of outcome measures

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

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

Statistical Analysis

Analyses were completed with the metafor package (v.1.9.8) in R 3.5. using random-effects models given that we expected large heterogeneity in reported effect sizes .[24–26] We prioritized intent-to-treat (ITT) data when available (k = 3) over completer data (k = 17, including k = 3 with insufficient information on participant flow, see Table 1 for further 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 $J = 1\text{-}(3/(4df - 1))$ to yield Hedges's g.[27] Analyses were conducted if four or more trials were available for a given (sub-)analysis.[28] Effect sizes g may be conservatively interpreted with Cohen's convention of small (±0.2), medium (±0.5) and large (±0.8) effects.[29] 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 of effect sizes 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.[30] Because we expected large heterogeneity, we also calculated prediction intervals.[31] 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.[32] When the prediction interval excludes the null, it is likely that similar future trials will also find significant effects. 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.[33, 34] However, no outliers were identified in any of the performed analyses. When analyses consisted of at least ten trials,[35] 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.[36] The trim-and-fill procedure yields an asymmetry-corrected estimate of the effect size (i.e., taking publication bias into account). We calculated the numbers needed to treat (NNT) as a measure of efficacy that is easily interpretable from a clinical perspective. It informs about the numbers of patients that need to be treated until one adverse event is prevented.[37] NNT were calculated with the NNT function of the dmetar package and are based on the pooled effect sizes (i.e., Hedges' *g*). Lastly, we performed moderator analyses in R with trial quality sum score and treatment length (in minutes) as continuous variables (i.e., meta-regressions) and alliance as a dichotomous variable (i.e., trials with vs. without the involvement of the founders of PPT[1]) to check for potential moderating effects on efficacy outcomes. Since too few trials were available to check for alliance, we performed sensitivity analyses with trials involving the founders omitted.[1] Moreover, we

performed more general sensitivity analyses with the leaving1out function of the metafor package.

Results

Study characteristics

Figure 1 describes the flow of hits during the study synthesis. Of the initial 5,501 hits, a total of 17 publications that described 20 trials met our inclusion criteria. Basic characteristics of the included trials can be found in Table 1. Nine trials (45%) compared the efficacy of PPT with WLC. Five trials (25%) compared PPT with an active control condition (e.g., treatment-as-usual, control exercises). Three trials (15%) compared PPT with another psychological intervention (e.g., CBT, DBT). Lastly, three trials (15%) compared PPT with more than one control conditions.[1, 21, 38] Fourteen trials (70%) applied PPT in a group setting and the remaining 6 trials in an individual setting. Two of the latter trials described in one publication applied an internet-based PPT.[39] Treatment lengths was 917.06 minutes on average (unweighted mean across trials reporting on both, number and duration of sessions, k = 17) with a standard deviation of 374.79 minutes. Note that the pioneering manual of Seligman et al.[1] constitutes of a 720 minutes (i.e., 12 sessions á 60 minutes). Average number of sessions was 9.17 (*SD* = 2.71) and 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. The detailed quality assessment per trial can be found in Table 2.

-Table 1 here-

Participant characteristics

Basic characteristics of included participants per trial can be found in Table 1. A total of 1,360 participants 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 only reported 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 3. 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 assessment (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 results of Mohamadi et al.[20] were entered as reported in their publication (g = -0.82, *95%CI:* -1.39; -0.25, k = 10, *NNT* = 2.27). Number of available trials allowed for a

publication bias check. While a visual inspection of the funnel plot led to the suspicion of publication bias (i.e., missing trials to the left and a potential outlier to the far left, see eFig. 1 in the supplement), Egger's test did not indicate significant asymmetry (t = -1.91, p = .093). The sensitivity analysis yielded that one trial had particular influence on the pooled effect size. When Abdeyan et al., 2018 (i.e., assessed positive outcome = hope) was omitted, pooled effect size decreased to g = -0.44 (see eTable 1 in the supplement). No evidence was found for the efficacy of PPT in increasing positive outcomes compared to WLC at follow-up assessment (g = -0.36, *95%CI:* -0.83; 0.11, k = 4, *NNT* = 5.01). See eFigure 2 in the supplement for the corresponding forest plot. Follow-up assessment results are to be scrutinized with due caution in the light of low number of available trials (k = 4), large heterogeneity in effect sizes (I^2 = 74.34) and the wide range of the prediction interval (*PI* = -1.29; 0.57). Satisfaction with life was the only positive outcome with enough trials to warrant a meta-analytic sub-analysis. In comparison to WLC at post-treatment assessment, PPT was not found more effective in increasing satisfaction with life (g = -0.15, *95%CI:* -0.40; 0.09, k = 4, *NNT* = 11.55). See eFigure 3 in the supplement for the corresponding forest plot. Heterogeneity in outcomes was low (I^2 = 11.20). The sensitivity analysis did not yield that one of the four studies was particularly influential on the pooled effect with all leaving1out analyses yielding a non-significant pooled g (see eTable 1 in the supplement). In comparison to active control conditions (i.e., treatment-as-usual and placebo exercises) at post-treatment assessment, PPT yielded a large effect size in increasing positive outcomes (g = -0.92, *95%CI*: -1.74; -0.11, k = 6, *NNT* = 2.05). See eFigure 4 in the supplement for the corresponding forest plot. However, heterogeneity in outcomes was large (I^2 = 92.51) and the prediction interval included the null (*PI* = -2.98; 1.13) illustrating large variability in findings. When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, &

Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were found for increasing positive outcomes (g = -0.29, *95%CI:* -0.89; 0.32, k = 6, *NNT* = 6.24). See eFigure 5 in the supplement for the corresponding forest plot. Again, heterogeneity in outcomes was large (I^2 = 79.57) and the prediction interval included the null (*PI* = -1.71; 1.13). Results remained insignificant when results of Mohamadi et al.[20] were entered as reported in their publication (g = -0.65, *95%CI:* -1.31; 0.01, k = 6). Lastly, when trials with alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment assessment remained similar (g = -1.04, *95%CI:* -1.79; -0.28, k = 7, *NNT* = 1.87, see Table 3).

The Efficacy of PPT in Decreasing Negative Outcomes

PPT was found moderately more effective in reducing depression, negative affect and stress than WLC at post-treatment assessment (g = 0.48, *95%CI:* 0.18; 0.78, k = 8). See Figure 2 for the corresponding forest plot. To avoid one adverse event (i.e., depression, negative affect or stress), a little less than four patients needed to be treated (*NNT* = 3.76). The sensitivity analysis did not yield that one of the eight studies was particularly influential on the pooled effect with all leaving1out analyses yielding moderate pooled effect sizes between 0.40 and 0.58 (see eTable 1 in the supplement). Results on decreasing depression were similar (g = 0.57, *95%CI:* 0.21; 0.92, k = 6, *NNT* = 3.22). See eFigure 6 in the supplement for the corresponding forest plot. Again, the sensitivity analysis did not yield that one of the six studies was particularly influential with moderate pooled effect sizes between 0.47 and 0.68 for the leaving1out analyses (see eTable 1 in the supplement). Prediction intervals for both analyses (i.e., all negative outcomes and depression only) excluded the null (*PI* = -0.17; 1.13; *PI* = -0.18; 1.31, respectively) highlighting substantial levels of heterogeneity in efficacy outcomes and remaining uncertainty about the true

efficacy when similar future trials accumulate. In comparison to active control conditions (i.e., treatment-as-usual with or without medication and placebo exercises) at post-treatment assessment, PPT yielded large effect sizes in reducing depression (g = 0.94, *95%CI:* 0.18; 1.70, k = 6, *NNT* = 2.03). Please find the corresponding forest plot in eFigure 7 in the supplementary materials. Again, heterogeneity was large (I^2 = 90.28) and the prediction interval excluded the null (*PI* = -0.96; 2.83). When compared to other active treatment conditions (i.e., CBT, DBT, MBCT, & Neurofeedback-aided Meditation), no differences in efficacy at post-treatment assessment were found for decreasing negative outcomes (g = 0.08, *95%CI:* -0.48; 0.64, k = 6, *NNT* = 22.22). Please find the corresponding forest plot in eFigure 8 in the supplement. Trials that included follow-up assessments on the efficacy of PPT in decreasing negative outcomes were too few to allow for meta-analytic review for all included comparisons (k < 4). Lastly, when trials with alliance (i.e., involvement of the founder) were omitted, results for the comparison with WLC at post-treatment assessment remained similar (g = 0.63, *95%CI:* 0.20; 1.07, k = 5, *NNT* = 2.89, see Table 3).

Moderator Analyses

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

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

In terms of the efficacy of PPT in decreasing negative outcomes in comparison to WLC at post-treatment assessment, trial quality was found to be a significant moderator with higher trial quality being associated with smaller effect sizes (b = -0.08, p = .003). A similar result was found for the sub-analyses on depression (b = -0.11, p < .001). Similarly, the sub-analysis on depression for the comparison of PPT and active control conditions yielded a significant moderation of trial quality with higher trial quality being associated with smaller effect sizes (b = -0.17, p = .005). However, a significant moderation was found for the comparison with other active treatment conditions with higher trial quality being related to larger effect sizes in decreasing negative outcomes (b = 0.13, p < .001). No evidence was found for a moderation of treatment length in any of the analyses (see Table 4).

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 assessment. 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 significantly associated with effect size. For positive outcomes, higher quality of trials was related to larger effect sizes. Whereas for depression, higher quality of trials was related to smaller effect sizes. However, the low number of available trials, large

heterogeneities, identification of some influential single trials in the sensitivity analyses 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 larger 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 assessment 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 assessment.[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 controls) also involved an almost outlier.[40] This study offered PPT to depressed patients and yielded a strikingly large effect size at post-treatment assessment (g = -2.98) favoring PPT in increasing hope. Both almost outlier studies involved a moderate sample size (see Table 1). All this suggests that more trials are needed to allow for firmer conclusions.

When PPT was compared to other established psychological interventions such as CBT, current data did not suggest any significant difference in efficacy. Accordingly, the results of the six RCTs included in this comparison suggests that PPT is similarly effective in increasing

positive psychological outcomes. However, due to the low number of trials for this comparison these findings need to be viewed with due caution.

The first and foremostly assessed negative outcome in the PPT literature remains depression. As suggested and intended by its developers, PPT was found moderately to largely effective in lowering depressive symptoms. Again, the counterintuitive pattern was found with larger effect sizes in lowering depression for PPT in comparison to active control conditions (pooled $g = 0.94$) as opposed to WLC (pooled $g = 0.57$). Once more, unplanned post-hoc investigations were performed in an attempt to find potential reasons for the counterintuitive finding. Again, we found that an almost outlier might explain the difference. The analysis involving active control groups involved an almost outlier with an effect size of $g = 2.45$,[44] whereas the analysis involving WLC did not involve such an almost outlier.

Data on the efficacy at follow-up assessments altogether were scarce. The only feasible analysis on follow-up assessment data (i.e., PPT vs. WLC in increasing positive outcomes) yielded a non-significant effect size. The current available literature does not allow for any other valid follow-up analyses and, thus, conclusions on the long-term efficacy of PPT cannot not yet be made. This represents perhaps the main limitation of the literature on the efficacy of PPT. For the same reason, additional sensitivity analyses (e.g., group vs. individual PPT, or PPT efficacy by health condition vs. mental health condition) were not feasible.

Trial quality overall was moderate and, therefore, leaves room for improvement. Results overall are comparable to related meta-analyses on Positive Psychology Interventions (PPIs) more generally which report moderate effect sizes in increasing positive outcomes and decreasing negative outcomes.[11-19] A recent meta-analysis on PPIs further also reports on a

significant relation between trial quality and the efficacy of PPIs.[15] However, PPIs vary considerably and generalizations from meta-analyses on PPIs on PPT are, therefore, not straightforward.

This represents the first meta-analysis with an exclusive focus on the efficacy of PPT. Several limitations need to be considered. First and foremost, the number of included trials is relatively small and accordingly more research is needed to draw firmer conclusions. Secondly, depression and SWL were the only two outcomes with enough trials to warrant sub-analyses. More research is needed to allow for more homogenous analyses on PPT efficacy for specific outcomes. Thirdly and related to the second limitation, the two overarching analyses on various positive and negative outcomes involved large heterogeneity, respectively. The decision to conduct such overarching analyses on heterogenous outcomes was based on the overall scarcity of trials. We aimed at conducting more homogenous sub-analyses were possible which were, as mentioned, only feasible for depression and SWL. As more trials accumulate, more fine-grained analyses will become feasible. Fourthly and lastly, the long-term efficacy of PPT remains uncertain due to lack of follow-up assessments.

Conclusion

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

Statements

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None.

Data Availability Statement

We performed a meta-analysis on published und publicly accessible data. No additional data available.

Competing Interests Statement

The authors declare that they have no conflict of interest to declare

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Ethics statement

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

Author Contributions Statement

THH and NM conceptualized the meta-analysis conducted the systematic literature search and coding of studies. THH performed the statistical analyses. THH and NM wrote the manuscript and agreed to be accountable for all aspects of the work.

References

1* Seligman MEP, Rashid T, Parks AC. Positive psychotherapy. Am Psychol 2006;61:774–788.
2 Peterson C, Seligman MEP. Character strengths and virtues: A handbook and classification, Oxford University Press, 2004.
3 Walsh S, Cassidy M, Priebe S. The application of positive psychotherapy in mental health care: A systematic review. J Clin Psychol 2017;73:638–651.
4* Schrank B, Brownell T, Jakaite Z, *et al*. Evaluation of a positive psychotherapy group intervention for people with psychosis: Pilot randomised controlled trial. Epidemiol Psychiatr Sci 2016;25:235–246.
5* Uliaszek AA, Rashid T, Williams GE, *et al*. Group therapy for university students: A randomized control trial of dialectical behavior therapy and positive psychotherapy. Behaviour Research and Therapy 2016;77:78–85.
6* Dowlatabadi MM, Ahmadi SM, Sorbi MH, *et al*. The effectiveness of group positive psychotherapy on depression and happiness in breast cancer patients: A randomized controlled trial. Electron Physician 2016;8:2175.
7* Saeedi B, Khoshnood Z, Dehghan M, *et al*. The effect of positive psychotherapy on the meaning of life in patients with cancer: A randomized clinical trial. Indian J Palliat Care 2019;25:210.
8* Khayatan T, Azkhosh M, Bahmani B, *et al*. Group positive psychotherapy and depression of females affected by multiple sclerosis. Iran Rehabil J 2014;12:49–53.
9 Rashid T, Seligman MP. Positive Psychotherapy: Clinician Manual. Oxford University Press, 2018.
10 Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Ann Intern Med 2009;151:264–269.
11 Bolier L, Haverman M, Westerhof GJ, *et al*. Positive psychology interventions: A meta-analysis of randomized controlled studies. BMC Public Health 2013;13:119.
12 Chakhssi F, Kraiss JT, Sommers-Spijkerman M, *et al*. The effect of positive psychology interventions on well-being and distress in clinical samples with psychiatric or somatic disorders: A systematic review and meta-analysis. BMC Psychiatry 2018;18:211.
13 Davis DE, Choe E, Meyers J, *et al*. Thankful for the little things: A meta-analysis of gratitude interventions. J Couns Psychol 2016;63:20.
14 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of positive psychological interventions from non-western countries: A systematic review and meta-analysis. IJW 2018;8:71–98.
15 Hendriks T, Schotanus-Dijkstra M, Hassankhan A, *et al*. The efficacy of multi-component positive psychology interventions: A systematic review and meta-analysis of randomized controlled trials. J Happiness Stud 2020;21:357–390.
16 Hendriks T, Warren MA, Schotanus-Dijkstra M, *et al*. How WEIRD are positive psychology interventions? A bibliometric analysis of randomized controlled trials on the science of well-being. J Posit Psychol 2019;14:489–501.
17 Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. J Clin Psychol 2009;65:467–487.
18 Casellas-Grau A, Font A, Vives J. Positive psychology interventions in breast cancer. A systematic review. Psychooncology 2014;23:9–19.

19 White CA, Uttl B, Holder MD. Meta-analyses of positive psychology interventions: The effects are much smaller than previously reported. PloS One 2019;14:e0216588.
20* Mohamadi J, Ghazanfari F, Drikvand FM. Comparison of the effect of dialectical behavior therapy, mindfulness based cognitive therapy and positive psychotherapy on perceived stress and quality of life in patients with irritable bowel syndrome: A pilot randomized controlled trial. Psychiatr Q 2019;90:565–578.
21 Cuijpers P, van Straten A, Bohlmeijer E, *et al*. The effects of psychotherapy for adult depression are overestimated: a meta-analysis of study quality and effect size. Psychol Med 2010;40:211–223.
22 Smit Y, Huibers MJH, Ioannidis JPA, *et al*. The effectiveness of long-term psychoanalytic psychotherapy - A meta-analysis of randomized controlled trials. Clin Psychol Rev 2012;32:81–92.
23 Morina N, Koerssen R, Pollet TV. Interventions for children and adolescents with posttraumatic stress disorder: A meta-analysis of comparative outcome studies. Clin Psychol Rev 2016;47:41–54.
24 R Core Team: R. A Language and Environment for Statistical Computing 2019. Retrieved from http://www.R-project.org/.
25 Viechtbauer W. Conducting meta-analyses in R with the metafor package. Journal of statistical software 2010;36:1–48.
26 Borenstein M, Hedges LV, Higgins JPT, *et al*. Introduction to meta-analysis, John Wiley & Sons, 2011.
27 Lipsey MW, Wilson DB. Practical meta-analysis, [Nachdr.]. Applied social research methods series. Thousand Oaks, Calif., SAGE Publ, 2009, vol 49.
28 Hoppen TH, Morina N. Is high-quality of trials associated with lower treatment efficacy? A meta-analysis on the association between study quality and effect sizes of psychological interventions for pediatric PTSD. Clin Psychol Rev 2020:101855.
29 Cohen J. Statistical Power Analysis for the Behavioral Sciences, 2nd ed. Hoboken, Taylor and Francis, 2013.
30 Higgins JPT, Thompson SG, Deeks JJ, *et al*. Measuring inconsistency in meta-analyses. BMJ 2003;327:557–560.
31 IntHout J, Ioannidis JPA, Rovers MM, *et al*. Plea for routinely presenting prediction intervals in meta-analysis. BMJ Open 2016;6: e010247.
32 Riley RD, Higgins JPT, Deeks JJ. Interpretation of random effects meta-analyses. BMJ 2011;342:d549.
33 Hunter JE, Schmidt FL. Methods of meta-analysis: Correcting error and bias in research findings, London: Sage Publications, 2004.
34 Tabachnick BG, Fidell LS. Using Multivariate Statistics, ed. 6. 2013.
35 Sterne JAC, Sutton AJ, Ioannidis JPA, *et al*. Recommendations for examining and interpreting funnel plot asymmetry in meta-analyses of randomised controlled trials. BMJ 2011;343:d4002.
36 Duval S, Tweedie R. Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. Biometrics 2000;56:455–463.
37 Kraemer HC, Kupfer DJ. Size of treatment effects and their importance to clinical research and practice. Biol Psychiatry 2006;59:990–996.

38* Hwang K, Kwon A, Hong C. A preliminary study of new positive psychology interventions: Neurofeedback-aided meditation therapy and modified positive psychotherapy. Curr Psychol 2017;36:683–695.

39* Parks-Sheiner AC. Positive psychotherapy: Building a model of empirically supported self-help. Dissertations available from Pro-Quest 2009.

40* Abdeyan T, Mahsa KK, Mohammad Z, *et al*. The Effect of Psychosocial Group Based on Positive Psychology on Hopefulness in Patients with Major Depressive Disorder: A Clinical Trial. Electron J Gen Med 2018;15:em49.

41* Nikrahan GR, Laferton JAC, Asgari K, *et al*. Effects of positive psychology interventions on risk biomarkers in coronary patients: a randomized, wait-list controlled pilot trial. Psychosomatics 2016;57:359–368.

42* Asl STS, Sadeghi K, Bakhtiari M, *et al*. Effect of group positive psychotherapy on improvement of life satisfaction and the quality of life in infertile woman. Int J Fertil Steril 2016;10:105–112.

43* Heydari MG, Shirazi M, Sanagouyemoharer GR. Evaluating the Efficacy of Positive Psychotherapy on Life Expectancy in Students With Hemophilia: A Randomized Controlled Trial. Pract Clin Psychol 2019;7:63–70.

44* Zhang JP, Guo Y-F, Zhang X, *et al*. Effects of Positive Psychotherapy on Depression and Self-efficacy in Undergraduate Nursing Students Positive Psychotherapy. Res Rev J Nurs Health Sci 2015:12–18.

45*Asgharipoor N, Asgharnejad AA, Arshadi HR, *et al*. Comparative study on the effectiveness of positive psychotherapy and group cognitive-behavioral therapy for the patients suffering from major depressive disorder. Iran J Psychiatry Behav Sci 2012;2:33–41.

46*Furchtlehner LM, Schuster R, Laireiter AR. A comparative study of the efficacy of group positive psychotherapy and group cognitive behavioral therapy in the treatment of depressive disorders: A randomized controlled trial. J Posit Psychol 2019:1–14.

47*Taghvaienia A, Alamdari N. Effect of Positive Psychotherapy on Psychological Well-Being, Happiness, Life Expectancy and Depression Among Retired Teachers with Depression: A Randomized Controlled Trial. Community Ment Health J 2019;56:229–237.

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

Table 1. Basic characteristics of included trials

Study	Country	Health condition	Intervention (treatment manual)[a]	Format	Control group (post-treatment n, format)	Nr. of sessions x Duration in min.	FU[b]	**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.[c]	64	38 ± 6.35	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	26.44 ± 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	30.39 ± 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	36.33 ± 5.03	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	40.56 ± 12.40	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[c]	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	22.17 ± 2.31	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	31.51 ± 6.24	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	29.47 ± 3.95	63.01	Compl.	Stress (PSS) & quality of life (IBS-QOL)	17
Nikrahan et al.[41]	Iran	Coronary artery disease	PPT	Group	TAU (n = 14)	6 x 90	2	27	56.25 ± 8.20	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	43.41 ± 11.86	75.70	Compl.	Depression (BDI-II) & SWL (SWLS)	23

Saeedi et al.[7]	Iran	Cancer	PPT	Group	TAU (n = 31)	8 x 90	n.a.	61	47.10 ± 12.10	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	42.20 ± 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	18-55 years	68.75	Compl.	Depression (BDI-II) & SWL (SWLS)	18
Taghvaienia et al.[47]	Iran	Depression	PPT	Group	WLC (n = 26)	10 x 120	n.a.	52	62.64 ± 13.81	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	22.67 ± 5.91	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	20.29 ± 1.20	94.90	Compl.	Depression (BDI-II) & self-efficacy (GSE)	14

BDI-II, Beck Depression Inventory 2nd 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.

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

[b]Longest reported follow-up assessment on relevant outcome(s) in months, FU assessment used in the meta-analysis.

[c]reported but irrelevant, as follow-up assessment was conducted at two weeks post-treatment; [c]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 randomization	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
Taghvaienia 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)	*k*	*g*[a]	*SE*	*95%* CI PI	I^2	*NNT*
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	**-0.72***	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	**-0.92***	0.41	-1.74; -0.11 PI -2.98; 1.13	92.51***	2.05
PPT vs. ACC at FU	n.a. (k = 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. (k = 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. (k = 3)					
Negative outcomes merged (i.e., depression, negative affect & stress)						
PPT vs. WLC at post	8	**0.48****	0.15	0.18; 0.78 PI -0.17; 1.13	51.34*	3.76
PPT vs. WLC at FU	n.a. (k = 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. (k = 1)					
Subanalyses on depression						
PPT vs. WLC – depression at post	6	**0.57****	0.18	0.21; 0.92 PI -0.18; 1.31	61.33	3.22
PPT vs. WLC – depression at FU	n.a. (k = 3)					

PPT vs. ACC - depression at post	6	**0.94***	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	**-1.04****	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	**0.63****	0.22	0.20; 1.07 PI -0.14; 1.41	44.80	2.89
PPTvs. 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.

[a]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	*k*	Intercept	*b*	*rem. I²*	*p*
Potential Moderator: Trial quality					
Positive outcomes merged (e.g., happiness, SWL, hope, quality of life)					
PPT vs. WLC at post	10	-3.60	**0.17**	79.93***	**.003**
PPT vs. WLC at follow-up	4	-2.56	**0.12**	38.01	**.036**
PPT vs. ACC at post	6	-4.21	**0.18**	83.61***	**.015**
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	**-0.08**	0	**.003**
PPT vs. ACC at post	All six trials conducted on depression, see below				
PPT vs. OtherATC at post	6	-2.24	**0.13**	21.28	**<.001**
Sub-analysis on depression					
PPT vs. WLC at post	6	2.50	**-011**	0	**< .001**
PPT vs. ACC at post	6	4.47	**-0.17**	76.91***	**.005**
Potential Moderator: Treatment length[a]					
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. (*k* = 3)				
PPT vs. ACC at post	n.a. (*k* = 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. (*k* = 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. (*k* = 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. I², remaining amount of unexplained heterogeneity including the p-value of the Q-statistic as indicated by asterisks; post, post-treatment

assessment; SWL, Satisfaction With Life; WLC, Waitlist Control conditions. **Bold** font indicates statistical significance of moderation.
* $p < .05$ ** $p < .01$, *** $p < .001$
[a]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

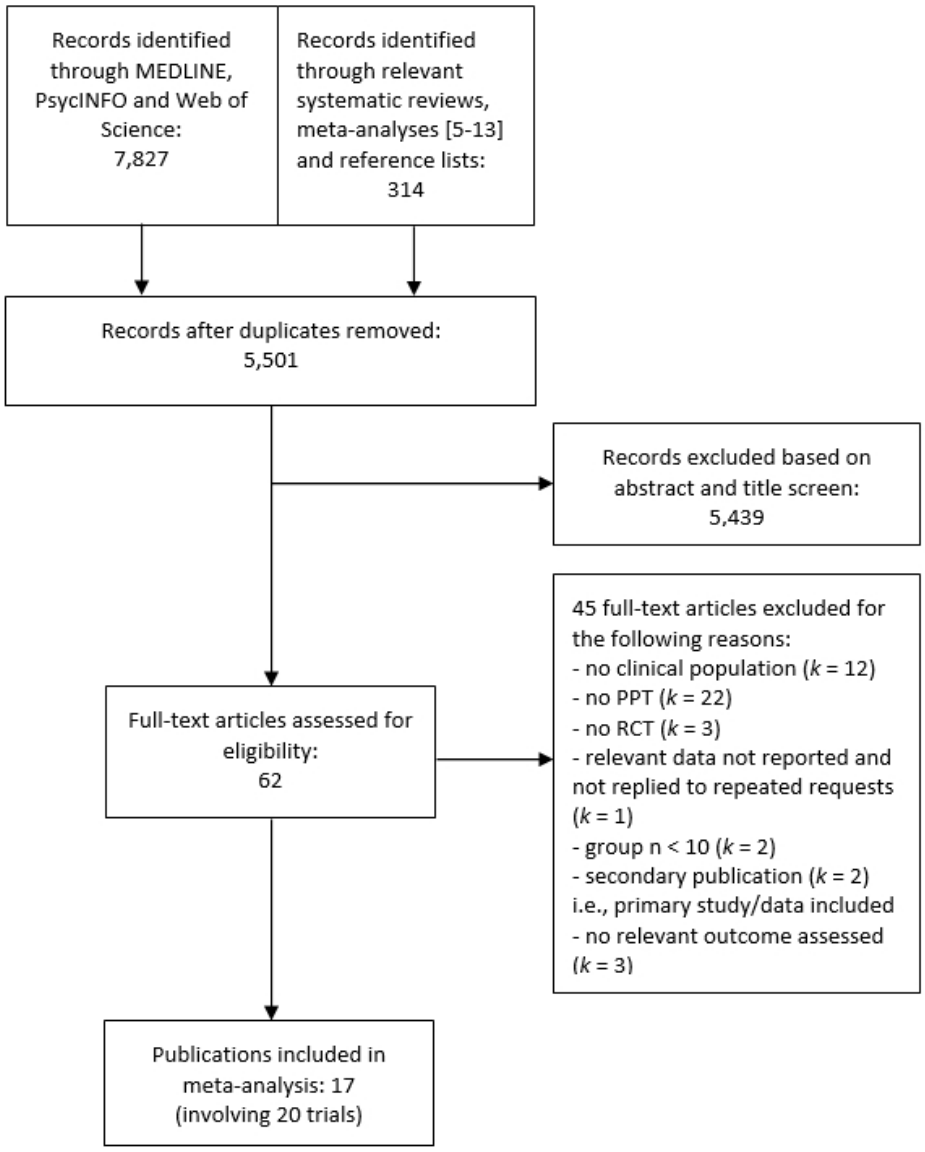


Fig.1 PRISMA flowchart depicting synthesis of included randomized controlled trials

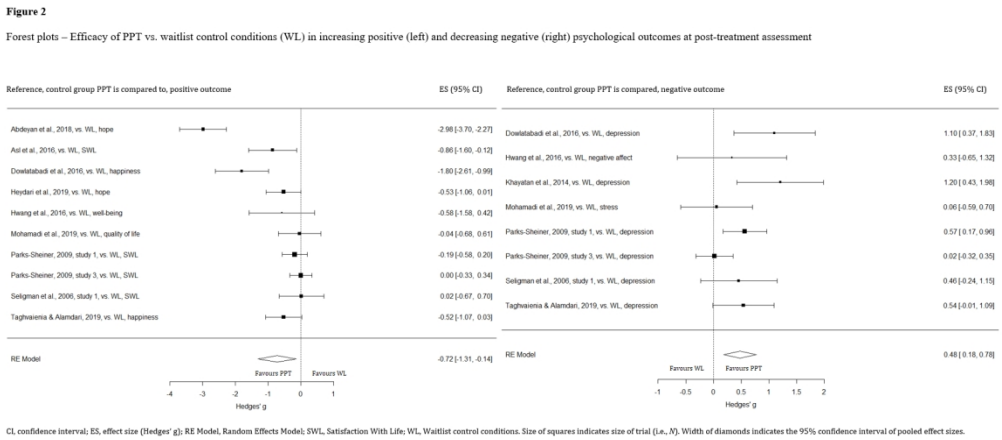


Fig. 2 Forest plots – Efficacy of PPT vs. waitlist control conditions (WL) in increasing positive (left) and decreasing negative (right) psychological outcomes at post-treatment assessment

Supplementary materials

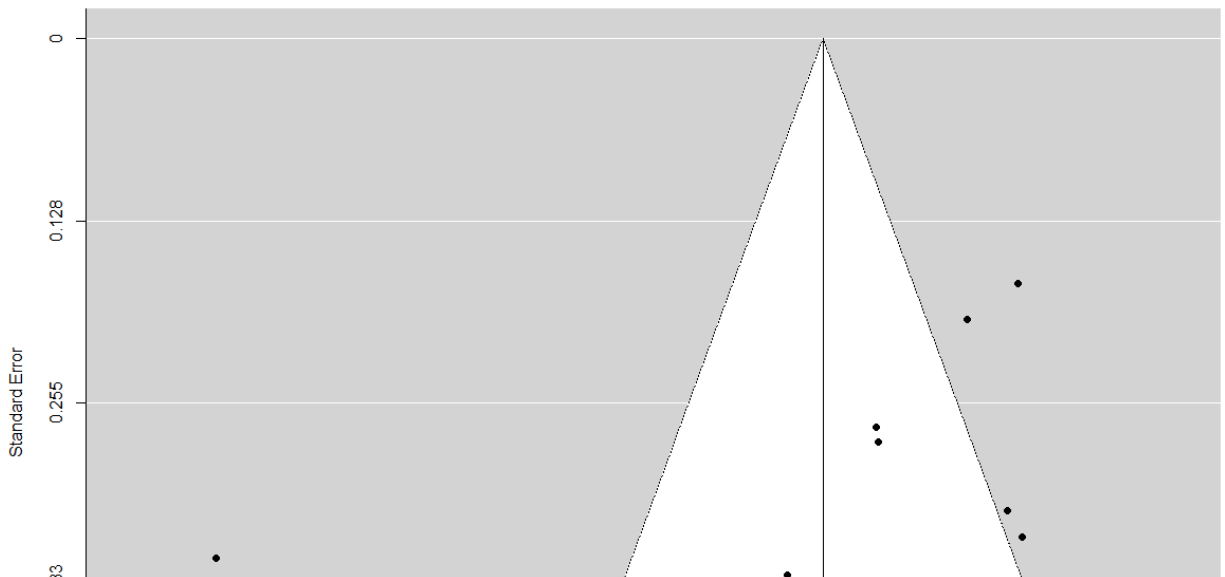
eList 1. Search strategy (PsycINFO and MEDLINE)

Search terms and strategy: "TI positive psychotherapy OR AB positive psychotherapy OR SU positive psychotherapy".

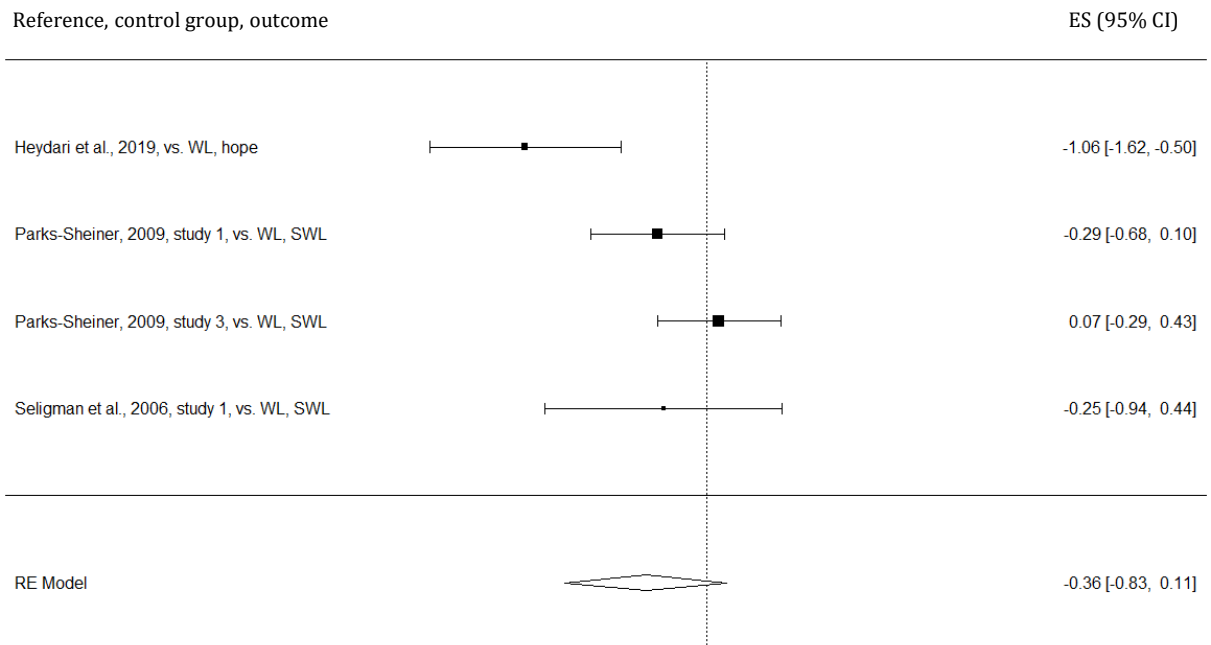
Time limit: Jan 1 2006 to Feb 13 2020.

Other limits and filters: None.

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

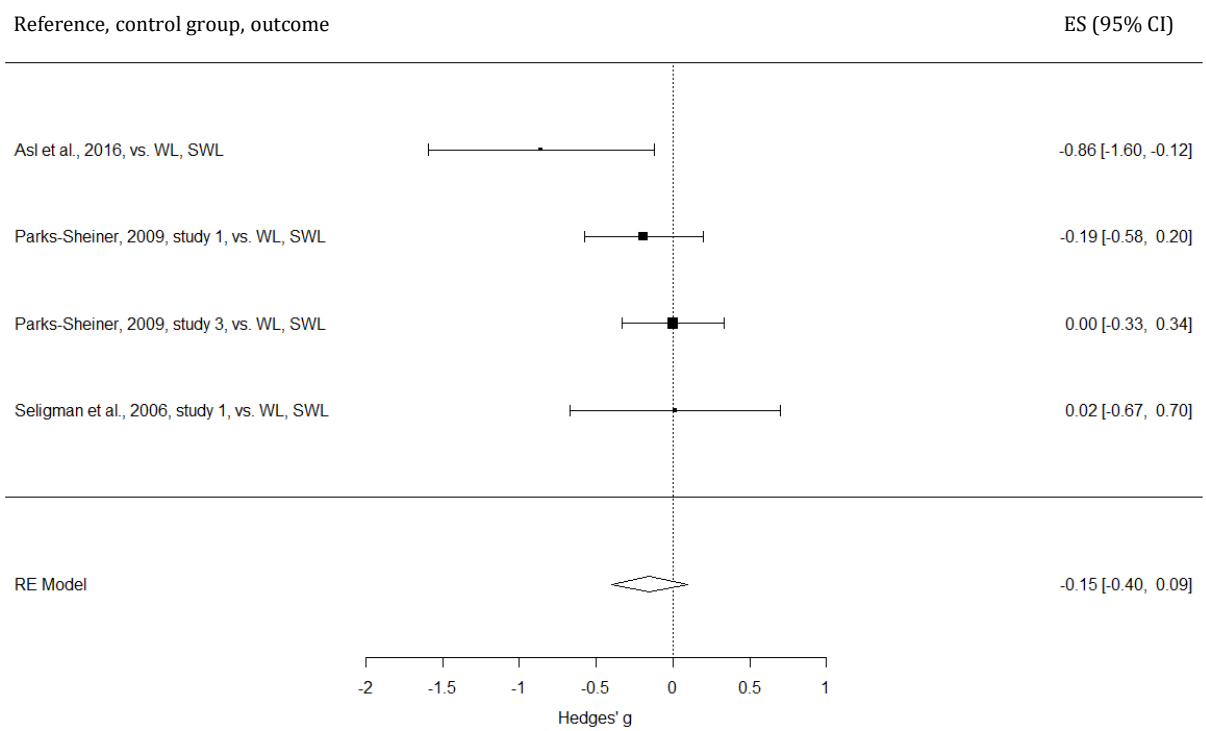


eFig. 2. Forest plot – Efficacy of PPT in increasing positive outcomes in comparison to waitlist control conditions at follow-up



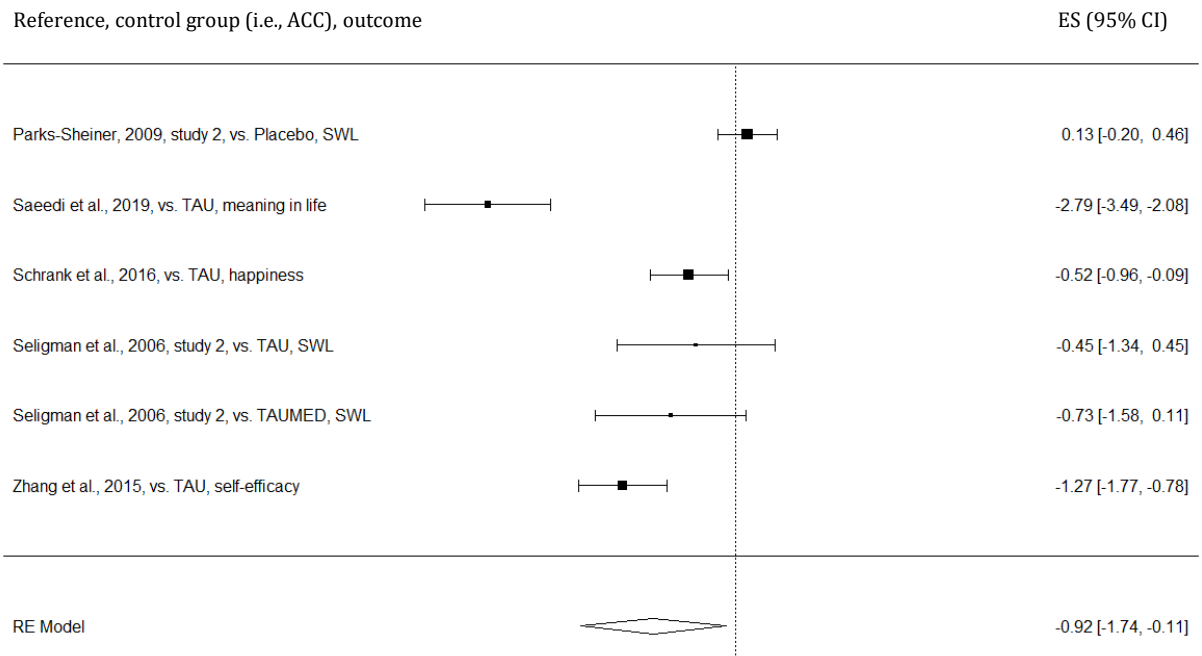
CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; SWL, Satisfaction With Life; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

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



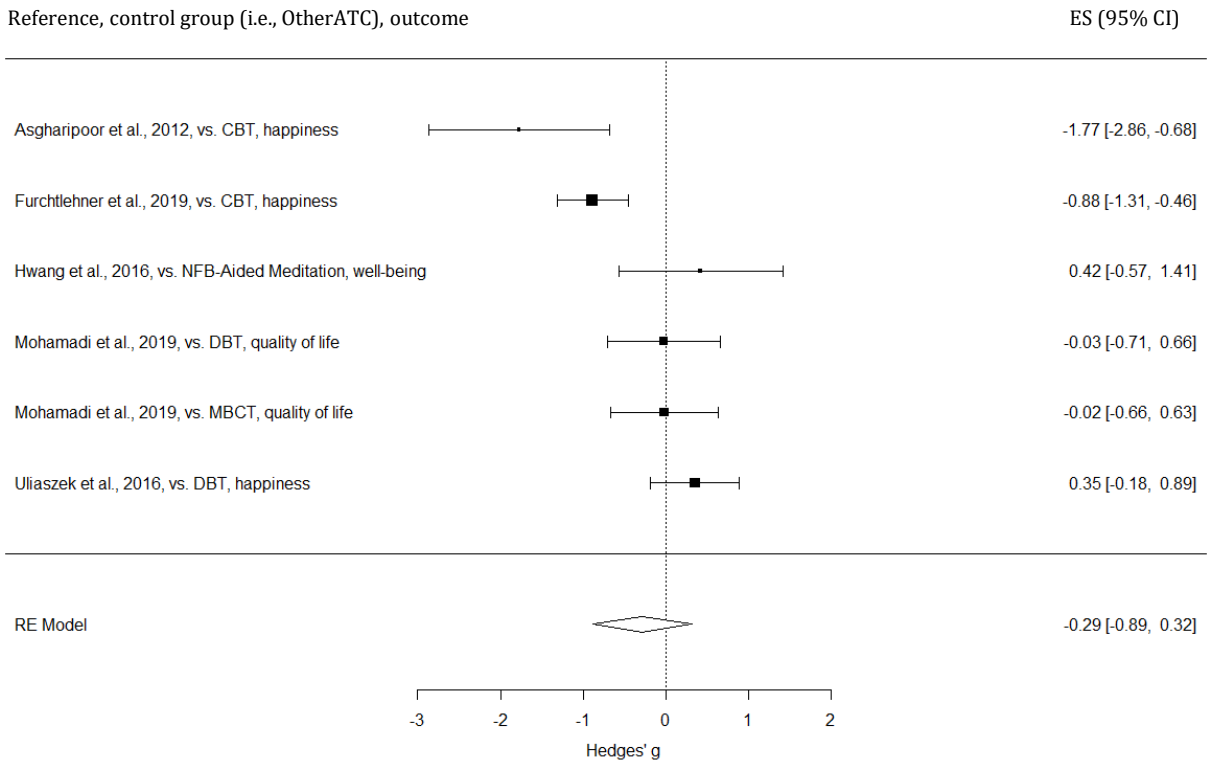
CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

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



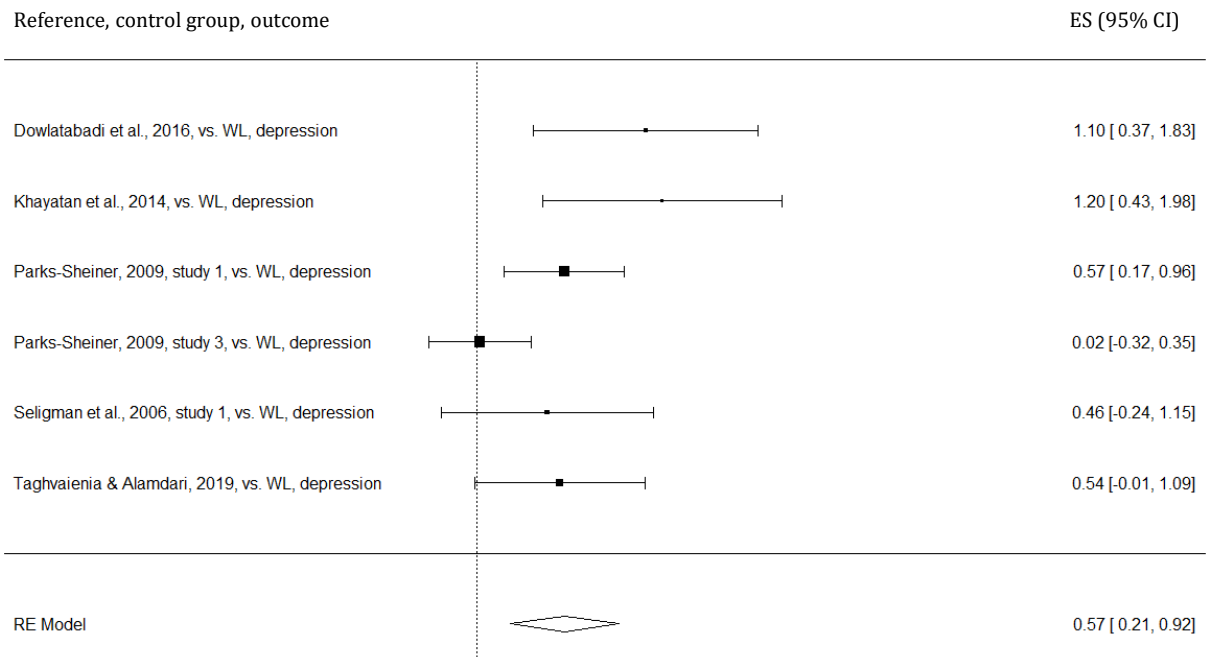
ACC, Active Control Condition; CI, confidence interval; ES, effect size (Hedges' g); Placebo, pill Placebo; RE Model, Random Effects Model; SWL, Satisfaction With Life; TAU, Treatment-As-Usual; TAUMED, Treatment-As-Usual plus antidepressant Medication. Size of squares indicates size of trial (i.e., *N*)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



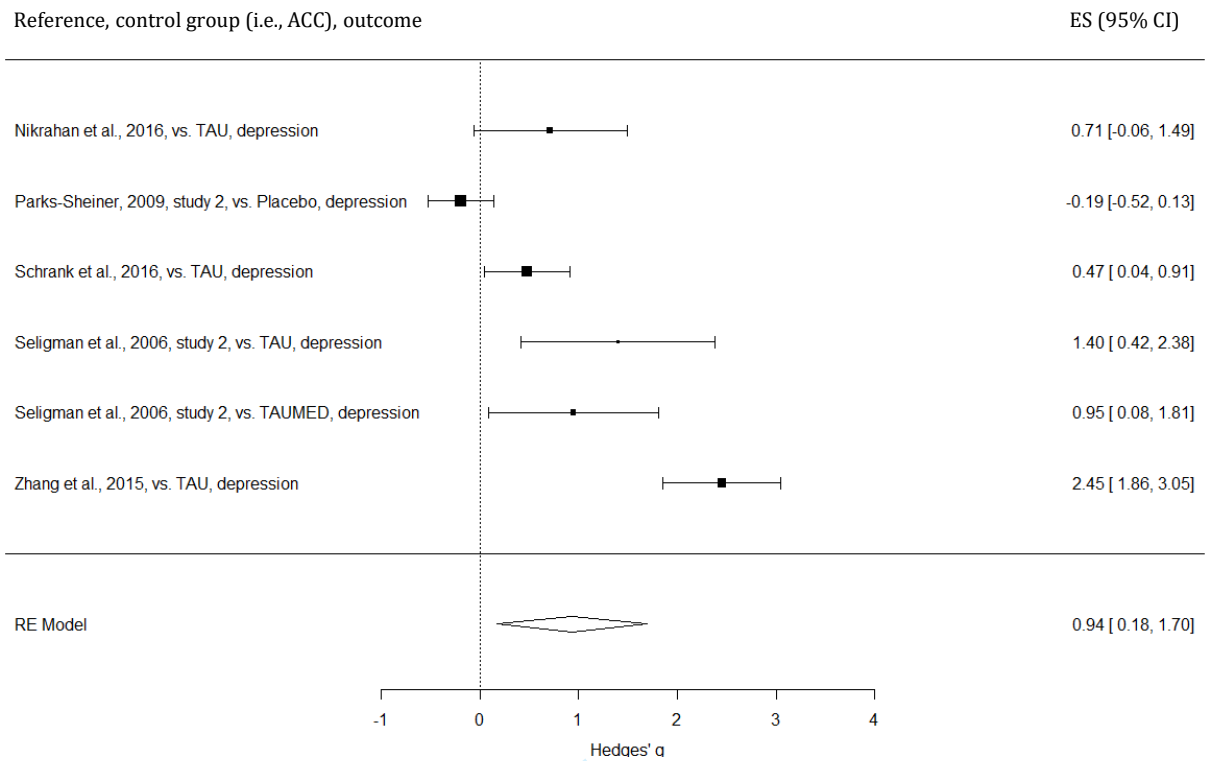
CBT, Cognitive Behavior Therapy; CI, confidence interval; DBT, Dialectic Behavior Therapy; ES, effect size (Hedges' g); MBCT, Mindfulness-Based Cognitive Therapy; NFB-Aided Meditation, Neurofeedback-Aided Meditation; OtherATC, Other Active Treatment Condition; RE Model, Random Effects Model. Size of 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



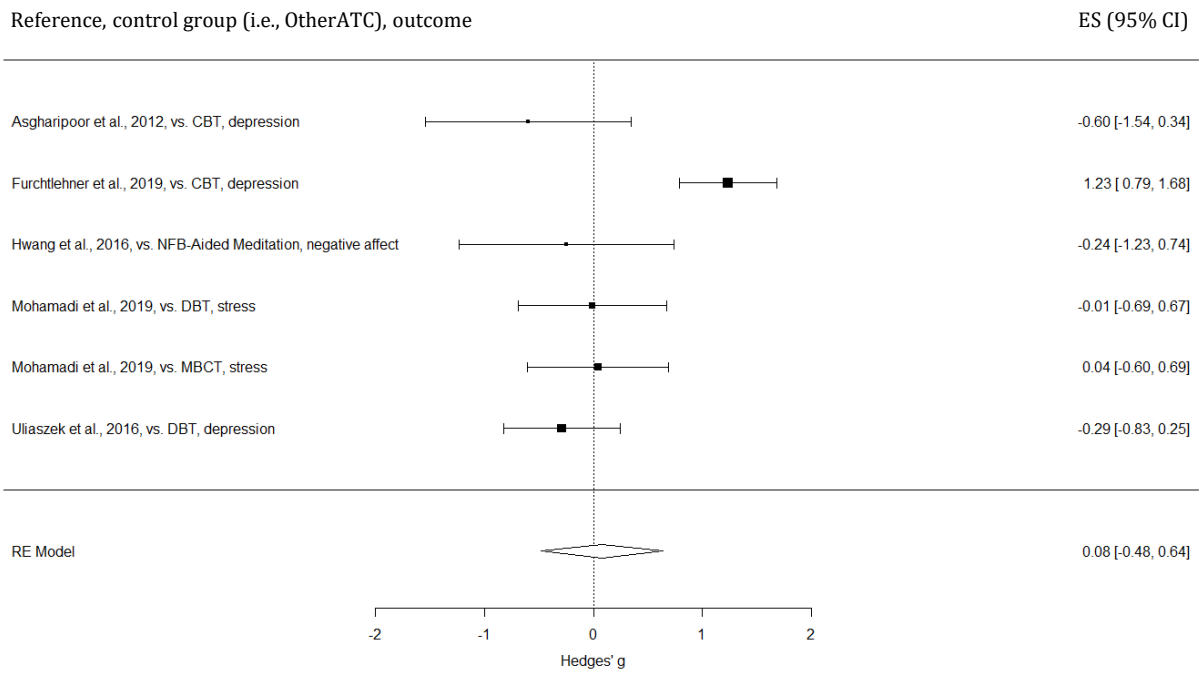
CI, confidence interval; ES, effect size (Hedges' g); RE Model, Random Effects Model; WL, Waitlist control. Size of squares indicates size of trial (i.e., *N*) proportionally. Width of diamond indicates the 95% confidence interval of pooled effect size.

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.

eTable 1. Leave1out sensitivity analyses for main-analyses (PPT vs. WL at post assessment)				
Trial omitted (negative outcome assessed)	**Corrected *g***	***SE***	***Z***	***Q***
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*
Taghvaienia & Alamdari, 2019 (depression)	0.48	0.18	2.73**	14.37*
Trial omitted (sub-analysis on depression only)				
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**
Taghvaienia & Alamdari, 2019	0.59	0.22	2.66**	13.27*
Trial omitted (positive outcome assessed)				
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***
Taghvaienia & Alamdari, 2019 (happiness)	-0.75	0.33	-2.25*	72.71***
Trial omitted (sub-analysis on SLW only)				
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	Obeyed?	Where? page
ADMINISTRATIVE INFORMATION				
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	☑	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	☑	2 & 5
Authors:				
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	☑	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☑	20
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	☑	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.
INTRODUCTION				
Rationale	6	Describe the rationale for the review in the context of what is already known	☑	5
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☑	5
METHODS				
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	☑	5 & 6
Information	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial	☑	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	☑	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	☑	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)	☑	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	☑	6 &7
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	☑	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	☑	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	☑	7 & 8
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	☑	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 τ)	☑	9 & 11
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	☑	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)	☑	10 & 11
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	☑	9 & 10