Guided self-help interventions for irritable bowel syndrome: a systematic review and meta-analysis

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Objective Although irritable bowel syndrome (IBS) is highly prevalent and is accompanied by high costs for respective healthcare systems, the data on treatment effectiveness are limited. Current treatment methods have limitations in terms of side effects and availability. Guided self-help (GSH) might be an easily accessible and cost-effective treatment alternative. This study is the first systematic review and meta-analysis of GSH interventions for IBS.

Methods Using electronic databases (MEDLINE, SCOPUS, PsycINFO, and Web of Science), we performed a systematic search for randomized-controlled trials. Using a random-effect model, we calculated the pooled standardized mean differences (SMDs) of GSH on IBS symptom severity (primary outcome) and quality of life (secondary outcome). We additionally examined the moderating effects of online-based interventions and face-to-face therapist contact by applying mixed models.

Results A systematic literature search identified 10 eligible randomized-controlled trials, including 886 participants. Compared with the control conditions, the effect size was medium for the decrease in IBS symptom severity (SMD = 0.72; 95% confidence interval: 0.34–1.08) and large for the increase in patients' quality of life (SMD = 0.84; 95% confidence interval: 0.46–1.22). Neither treatment format nor face-to-face contact was a predictor of therapy outcomes in between-group analyses. In contrast, within-group analyses led to the conclusion that online-based interventions are more effective than other self-help formats.

Conclusion GSH is an effective alternative for the treatment of IBS. As GSH methods are easy to implement, it seems sensible to integrate GSH into clinical practice.

Limitations With respect to the high study heterogeneity, the number of studies included was relatively small. Eur J Gastroenterol Hepatol 27:1209–1221

Introduction

Irritable bowel syndrome (IBS) is a chronic functional gastrointestinal disease that is characterized by intestinal problems in the absence of any detectable organic cause [1]. Primary symptoms are abdominal pain and altered bowel habits, which are either diarrhea-predominated, constipation-predominated, or both [2].

IBS is one of the most common and costly gastrointestinal disorders worldwide. It affects around 11% of the world's population, up to 10% in Eastern societies, and up to 18% in Western countries [2–5], predominantly women and younger individuals [2,6]. IBS significantly impacts not only patients' quality of life (QOL) but also their healthcare utilization [1,2]. IBS patients use healthcare services more frequently and cost 50% more than the general population [7,8]. For example, in 2004, IBS incited more than $1 billion in direct and indirect costs only in the USA [9].

Data on the effectiveness of current treatment options for IBS are limited [10–15]. In recent years, several clinical guidelines for IBS have been developed in different countries, but there is still no gold standard for the treatment of IBS [13,16,17]. Although the pathogenesis of IBS is still unclear, an interrelation of physiological, genetic, neurobiological, and psychosocial factors is highly plausible [10,18]. Thus, the treatment options range from pharmacological interventions and dietary changes to psychological interventions [12,14,19–23]. As IBS patients show a high rate of psychopathological comorbidities [24], pharmacological approaches especially focus on antidepressants [25]. Tricyclic antidepressants as well as selective serotonin reuptake inhibitors are effective for the treatment of IBS in one in four patients [14]. It has been shown that psychological therapies, especially cognitive behavioral therapy, hypnotherapy, multicomponent psychological therapy, and dynamic psychotherapy, provide similar beneficial effects [14,26–28]. However, both pharmacological and psychological interventions have limitations in terms of side effects, cost intensity or availability [29–31], and many patients with IBS are not receiving any treatment at all [2]. In contrast, psychologically based guided self-help (GSH) is rarely limited by geographic or personnel circumstances and may be a suitable low-threshold and cost-effective alternative or additional approach for the treatment of IBS. GSH is defined as a standardized psychological intervention program that is delivered by any kind of media that

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patients can work on independently (e.g. book, website), as well as supported limited contact with a healthcare professional (e.g. face-to-face, telephone, email). GSH has become very popular in recent years and has been shown to be efficacious for several physical and psychological conditions including tinnitus [32], headaches [33], insomnia [34], chronic pain [35], somatization [36], eating disorders [37], and obesity [38]. Several GSH approaches for IBS, such as online-based interventions and self-help based on other media, have been developed. However, the effect of GSH for the treatment of IBS is still contradictory and clinical use is minimal. The aim of this meta-analysis is to study the effect of GSH interventions for the treatment of IBS. Taking into account that the intervention design may affect treatment effectiveness [39], we also examine the moderating effects of online treatment programs and face-to-face therapist contact.

Methods

Search procedure

We conformed to the guidelines recommended by the PRISMA statement [40] to develop the study schedule and design. Using four electronic databases (MEDLINE, SCOPUS, PsycINFO, and Web of Science), we performed a computerized search for studies published before the 31st of September 2014 in the English language. We entered the following combination of search terms: (IBS OR 'irritable bowel*') AND (internet* OR web OR online* OR eHealth OR self-help OR 'computer based' OR 'self-administered' OR 'home based' OR 'minimal contact' OR 'self-instructed' OR bibliotherapy) AND (intervention* OR therapy OR therapies OR treatment* OR self-monitoring OR monitoring OR self-management OR management OR manual). Furthermore, we recorded all studies included in three previous systematic reviews of minimal contact and self-help interventions for IBS [11,41, 42] and scanned the reference lists for additional eligible studies. Two authors (C.Y.P. and G.L.) screened titles and abstracts of the produced records independently for potentially eligible studies using the previously defined inclusion and exclusion criteria. Each study that was screened positive by at least one of the authors was selected for a full-text analysis. The final study selection was performed by two additional authors (G.L. and C.P). Disagreements and ambiguities on inclusion and exclusion criteria were resolved by consensus.

Eligibility criteria

The following criteria had to be fulfilled for the reviewed study to be included in the meta-analysis:

(1) The evaluated intervention targeted adults (aged 16 years or over) with IBS.
(2) The diagnosis of IBS was made by a medical professional and/or was made on the basis of Rome I, Rome II, or Rome III criteria.
(3) The minimum duration of intervention was 4 weeks.
(4) Improvement in IBS symptom severity was an outcome measure.
(5) The study's design had to be a randomized-controlled trial (RCT) that compared a GSH intervention with either a waiting-list control, a treatment-as-usual control, or an active control condition without therapist contact (e.g. pure self-help or discussion forums).

In conformity with other authors, we defined GSH programs as standardized psychological-based interventions that patients can utilize independently using various health technology materials, such as websites, computer programs, workbooks, or audio files [39,43]. Although self-help had to be a distinctive part of the intervention, supportive guidance by a healthcare professional was also required. Guidance was allowed to be delivered in different ways, including through telephone, SMS, email, or face-to-face contact. The amount of face-to-face therapist sessions must not exceed half of the amount of self-help input.

Data extraction and quality assessment

Two authors (G.L. and C.Y.P.) independently extracted information on each study's characteristics, including intervention format, study population, methodological aspects, as well as data needed for effect size calculations and for study quality assessment.

We used a structured quality assessment tool, developed by the Cochrane Collaboration [44], to rate the risk of bias in each included study. This structured coding scheme contains seven criteria to assess the study quality of RCTs: (1) random sequence generation, (2) allocation concealment, (3) blinding of participants and personal, (4) blinding of outcome assessment, (5) appropriate dealing with incomplete outcome data, (6) no risk of selective reporting, and (7) no other bias. As the assessment of blinding of participants and personal is redundant for studies on psychological treatments [45,46], we did not use this criterion for our quality assessment. To determine the degree of risk of bias, we defined three categories as follows: 'low' when 5 or 6 criteria were fulfilled, 'medium' when 3 or 4 criteria were fulfilled, and 'high' when 2 or fewer criteria were fulfilled. If the risk of bias remained unclear for one of the quality criteria, the criterion was counted as 'not met'.

Outcome assessment

Our primary outcome was IBS symptom severity and our secondary outcome was QOL. For the calculation of pooled standardized mean differences (SMDs), we extracted means and SDs of the corresponding measures for the intervention group and the controls at each time point of interest (pretreatment, post-treatment, and follow-up). In cases when insufficient data were reported for effect size calculation, we contacted the study's corresponding author directly by email. If a study did not report a global score for IBS symptom severity, we used abdominal pain intensity as the IBS symptom severity measure. If more than one instrument was used to measure the same construct within a single study, we only extracted data of the instrument showing the best psychometric properties.

Data analysis

We calculated between-group standardized mean differences (SMD_B) using a formula for independent-group

study designs, as described by Feingold and colleagues [47–49]. Following Becker [50], we expanded upon this formula using a simple bias adjustment (c) for small sample sizes, resulting in the following formula:

$$SMD_B = c_T(M_{CHANGE\text{-}T}/SD_{PRE\text{-}T}) - c_C(M_{CHANGE\text{-}C}/SD_{PRE\text{-}C}),$$

where $M_{CHANGE\text{-}T}$ is the mean of the change scores in the treatment group, $M_{CHANGE\text{-}C}$ is the mean of the change scores in the control group, $SD_{PRE\text{-}T}$ is the pretreatment SD for the treatment group, and $SD_{PRE\text{-}C}$ is the pretreatment SD for the control group. The formula for the bias adjustments is as follows:

$$c_j = 1 - \left(3/\left(4\left(n_{pre(j)} + n_{post(j)} - 2\right) - 1\right)\right).$$

Accordingly, we utilized the following formula for the within-group effect sizes (SMD_W):

$$SMD_W = c_T(M_{CHANGE\text{-}T}/SD_{PRE\text{-}T}).$$

As recommended by Cohen [51], we interpreted SMDs of 0.2 as small, 0.5 as medium, and 0.8 as large effect sizes. For all outcome variables, positive effect size values indicate changes in the desired direction. Accordingly, positive effect sizes indicate decreasing symptom severity for the

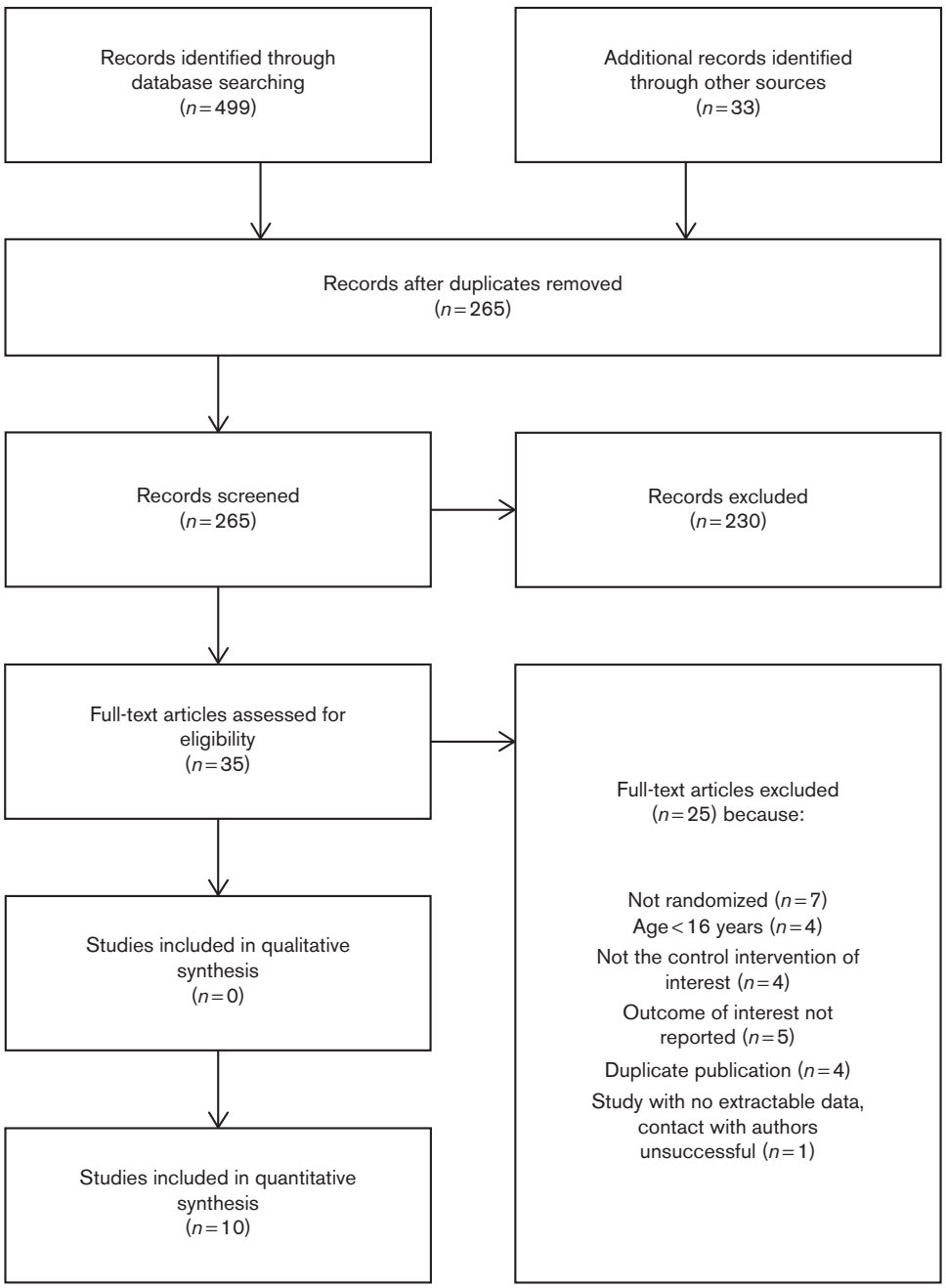

Fig. 1. Flow chart of the systematic literature review process.

primary outcome and increasing QOL for the secondary outcome.

For each outcome, we calculated the pooled pretreatment to post-treatment between-group effect sizes, as well as the pooled pretreatment to post-treatment and pretreatment to follow-up within-group effect sizes. As the studies included vary in several conditions that may moderate effect sizes, we decided to use a random-effect model for our meta-analyses. We used the H-V random-effect method to estimate effect sizes and model parameters [52]. We calculated the Q-statistic to test for significant heterogeneity in effect sizes. In addition, we calculated τ^2 to estimate the between-study variability and we used the I^2-statistic as an indicator of relative heterogeneity (0% indicates no heterogeneity at all, 25% indicates low heterogeneity, 50% indicates moderate heterogeneity, and 75% indicates high heterogeneity [53]). We created forest plots to display single study effect sizes and their 95% confidence intervals (CIs). We used funnel plots and the Egger regression test to check for publication bias [54].

We included two dichotomous variables as potential moderators in a mixed model: (a) face-to-face sessions versus no face-to-face contact with a therapist and (b) online-based intervention programs versus self-help based on other media. In case of significant results, we carried out a subgroup analysis.

We calculated single SMDs applying Microsoft Office Excel. We used the metafor package for *R* to construct random-effect models, for publication bias testing, and for generating corresponding graphics and plots [55]. A significance level of 5% was assumed for all analyses.

Results

Study selection

The study search procedure yielded 265 relevant records after the removal of duplicates (Fig. 1). Title and abstract screening identified 35 studies for potential eligibility. A total of 25 of these studies did not fulfill eligibility criteria and were eliminated for the following reasons: no RCTs [56–62], participants were younger than 16 years of age [63–66], not a control intervention of interest [67–70], relevant outcome measure was not reported [22,63,71–74], duplicate publication [75–78], no extractable data, and contact with authors was unsuccessful [79].

Characteristics of the studies included

We included 10 studies in the meta-analysis, allocating 886 participants to our analysis [80–89]. Table 1 provides a summary of sample characteristics of all the studies included. Detailed information on the individual studies is presented in Table 2.

Overall, 85.8% of the participants were women. The average duration of IBS symptoms was 12 years. In most of the studies included, the IBS diagnosis was made on the basis of Rome II or Rome III criteria [80,83–87,89]. Two studies used Rome I criteria to identify IBS patients [81,87] and in one study, IBS was diagnosed by a medical professional, whereas concrete diagnostic criteria remained unknown [82]. The standardized duration of GSH programs ranged from 4 to 13 weeks. Four studies examined a 4- to 6-week self-help program [80,82,86,88] and in one study the treatment duration was 7 weeks [87]. In five studies, the treatment duration was 9 weeks or longer [81,83,84,86,89]. In five studies, online-based self-help programs were evaluated [80,82,84–86]. In four studies, face-to-face therapist contact was part of the intervention [81,83,87,89]. The average pretreatment to post-treatment dropout rate was 8.5%. The follow-up period ranged from 3 to 12 months (median = 4.5 months). All studies reported at least one IBS symptom severity outcome. Only three studies did not report a global symptom severity score and we used abdominal pain intensity to calculate effect sizes [81,88,89]. Nine studies included a quality-of-life outcome. All of these used IBS-QOL [91] to measure QOL.

Table 1. Summary of sample characteristics

Sample characteristics	
N (overall)	886
n (intervention group) [*n* (%)]	441 (49.8)[a]
n (online-based GSH) [*n* (%)]	243 (55.1)[b]
n (face-to-face guidance) [*n* (%)]	161 (36.5)[b]
Sex (female) (%)	85.8
Dropout rate pre-post (%)	8.5
Mean duration of IBS symptoms (years)[c]	12.07

GSH, guided self-help; IBS, irritable bowel syndrome.
[a]On the basis of the total sample.
[b]On the basis of participants in intervention groups.
[c]On the basis of six studies.

Omitting blinding of participants and personnel as a criterion for study quality, the risk of bias was low for nine studies and medium for one study [81].

Impact on IBS symptom severity

Figure 2 shows the forest plots for the between-group and within-group effect sizes on IBS symptom severity. The corresponding funnel plots, checking for potential publication bias, are presented in Fig. 3.

In the pretreatment to post-treatment between-group meta-analysis, we found a medium pooled effect size of GSH interventions compared with the control conditions (SMD = 0.72; 95% CI: 0.34–1.08; $z = 4.00$; $P < 0.0001$). Heterogeneity in the effect size distribution was high ($\tau^2 = 0.268$; $I^2 = 83.96\%$; $Q = 56.11$; $d.f. = 9$; $P < 0.0001$). The funnel plot was not fully symmetrical ($z = 2.25$; $P = 0.0242$), indicating publication bias. Although none of the potential moderators were found to be significant predictors of intervention effectiveness (face-to-face contact: $b = 0.38$; $z = 0.53$, $P = 0.5941$; online-based interventions: $b = 0.47$, $z = 0.67$, $P = 0.5046$), the residual heterogeneity was still significant ($\tau^2 = 0.360$; $I^2 = 87.19\%$; $Q = 54.66$; $d.f. = 7$; $P < 0.0001$).

The within-group meta-analysis resulted in a large pretreatment to post-treatment effect size on IBS symptom severity (SMD = 1.09; 95% CI: 0.76–1.41; $z = 6.59$; $P < 0.0001$). We found significant heterogeneity in effect sizes ($Q = 32.16$; $d.f. = 8$; $P < 0.0001$) and a high variance level in the effect size distribution ($\tau^2 = 0.177$; $I^2 = 75.12\%$). The Egger regression test did not indicate funnel plot asymmetry ($z = 1.84$; $P = 0.0654$). Online forms of GSH were significant positive predictors of decreased IBS symptom severity (face-to-face contact: $b = 0.55$; $z = 0.26$, $P = 0.2646$; online-based interventions:

Table 2. Detailed information of the studies included

References	Study design	Diagnostic criteria	Symptom duration: mean (SD)	Sample size (% female)[a]	Dropout rate[a]	Self-help intervention format	Guidance	Control condition used for analyses	Symptom severity outcome	Quality-of-life outcome	Risk of bias
Everitt *et al.* [80]	RCT (three-arm): post-treatment at 6 weeks, follow-up at 12 weeks	Rome III	IG: 12.87 years (9.47) CG: 10.51 years (8.19)	90 (72)	Post-treatment: 3.3% Follow-up: 6.7%	6-week manualized online CBT (8 sessions)	Nurse telephone call (30 min) after session 2, email support (if required)	Pure self-help	IBS-SSS [90]	IBS-QOL [91]	Low
Heitkemper *et al.* [81]	RCT (3-arm): post-treatment at 9 weeks, follow-up at 6 and 12 months	Rome I	NA	92 (100)	Post-treatment: 9.5% Follow-up: 10.5%	Written CBT self-help manual within 9 weeks, relaxation tape	Initial 90- min FtF session with trained psychiatric nurse practitioner	TAU	Symptom diary [92]	IBS-QOL [91]	Medium
Hunt *et al.* [82]	RCT (2-arm): post-treatment at 6 weeks, follow-up at 3 months	Diagnosed by medical professional	NA	54 (81)	Post-treatment: 43% Follow-up: 64%	5-week online CBT (one module per week), homework	Weekly written email contact (feedback for homework)	WL	GSRS-IBS [93]	IBS-QOL [91]	Low
Jarrett *et al.* [89]	RCT (3-arm): post-treatment at 3 months; follow-up at 6, 12 months	Rome II	Full sample: 10 years (14)	118 (86)	Post-treatment: 2.5% Follow-up: 6.7%	Written CBT self-help manual within 9–13 weeks, homework	3 FtF sessions + 6 telephone sessions (60 min/session)	TAU	Symptom diary [92]	IBS-QOL [91]	Low
Lackner *et al.* [83]	RCT (3-arm): post-treatment at 12 weeks	Rome II	IG: 12 years (12.1) CG: 20.9 years (19.2)	52 (85)	Post-treatment: 19.2%	10-week patient-administered CBT with several self-study materials, homework	4 FtF sessions (60 min/session), 2 telephone calls in weeks 3 and 7 (10 min/call)	WL	IBS-SSS [90]	IBS-QOL [91]	Low
Ljótsson *et al.* [86]	RCT (2-arm): post-treatment at 6 weeks; follow-up at 3 months	Rome III	IG: 7.2 years (range: 0–41) CG: 5.5 years (range: 0–22)	85 (85)	Post-treatment: 5.9% Follow-up: 11.9%	5-week text-based online manual, 5-week online exposure exercises, online discussion forum, homework	Weekly written therapist feedback through an online message system, telephone calls (if required)	WL with access to online discussion forum	Symptom diary [86]	IBS-QOL [91]	Low
Ljótsson *et al.* [84]	RCT (2-arm): post-treatment at 10 weeks, follow-up at 6 months	Rome III	IG: 14.8 years (SD = 12.7) CG: 15.1 years (SD = 9.7)	195 (79)	Post-treatment: 2.1% Follow-up: 13.3%	10-week internet-delivered exposure-based CBT, online discussion forum	Weekly written therapist feedback through an online message system	Internet-delivered stress management	GSRS-IBS [93]	IBS-QOL [91]	Low
Ljótsson *et al.* [85]	RCT (2-arm): post-treatment at 10 weeks, follow-up at 12 months	Rome III	IG: 11.7 years (SD = 12.7) CG: 11.3 years (SD = 11.1)	61 (74)	Post-treatment: 18.0% Follow-up: 33.3%	10-week internet-delivered exposure-based CBT, online discussion forum	Weekly written therapist feedback through an online message system	WL with access to online discussion forum	GSRS-IBS [93]	IBS-QOL [91]	Low
Moss-Morris *et al.* [87]	RCT (2-arm): post-treatment at 2 months, follow-up at 5 and 8 months	Rome I and/or Rome II	NA	64 (73)	Post-treatment: 6.3% Follow-up: 18.8%	Written CBT self-help manual within 7 weeks (1 chapter/week), homework	Initial 60-min FtF session with health psychologist, two 60-min telephone sessions	TAU	IBS-SSS [90]	NA	Low
Oerlemans *et al.* [88]	RCT (2-arm): post-treatment at 4 weeks, follow-up at 3 months	Rome III	NA	75 (84)	Post-treatment: 4.0% Follow-up: 18.7%	4-week CBT on personal digital assistants (PDA), book about IBS	Daily therapist feedback through SMS	TAU	Pain severity scale [94]	IBS-QOL [91]	Low

CBT, cognitive behavioral therapy; CG, control group; FtF, face-to-face; IBS, irritable bowel syndrome; IG, intervention group; NA, not applicable; QOL, quality of life; RCTs, randomized-controlled trials; TAU, treatment-as-usual; WL, waiting list.

[a]On the basis of analyzed intervention and control group.

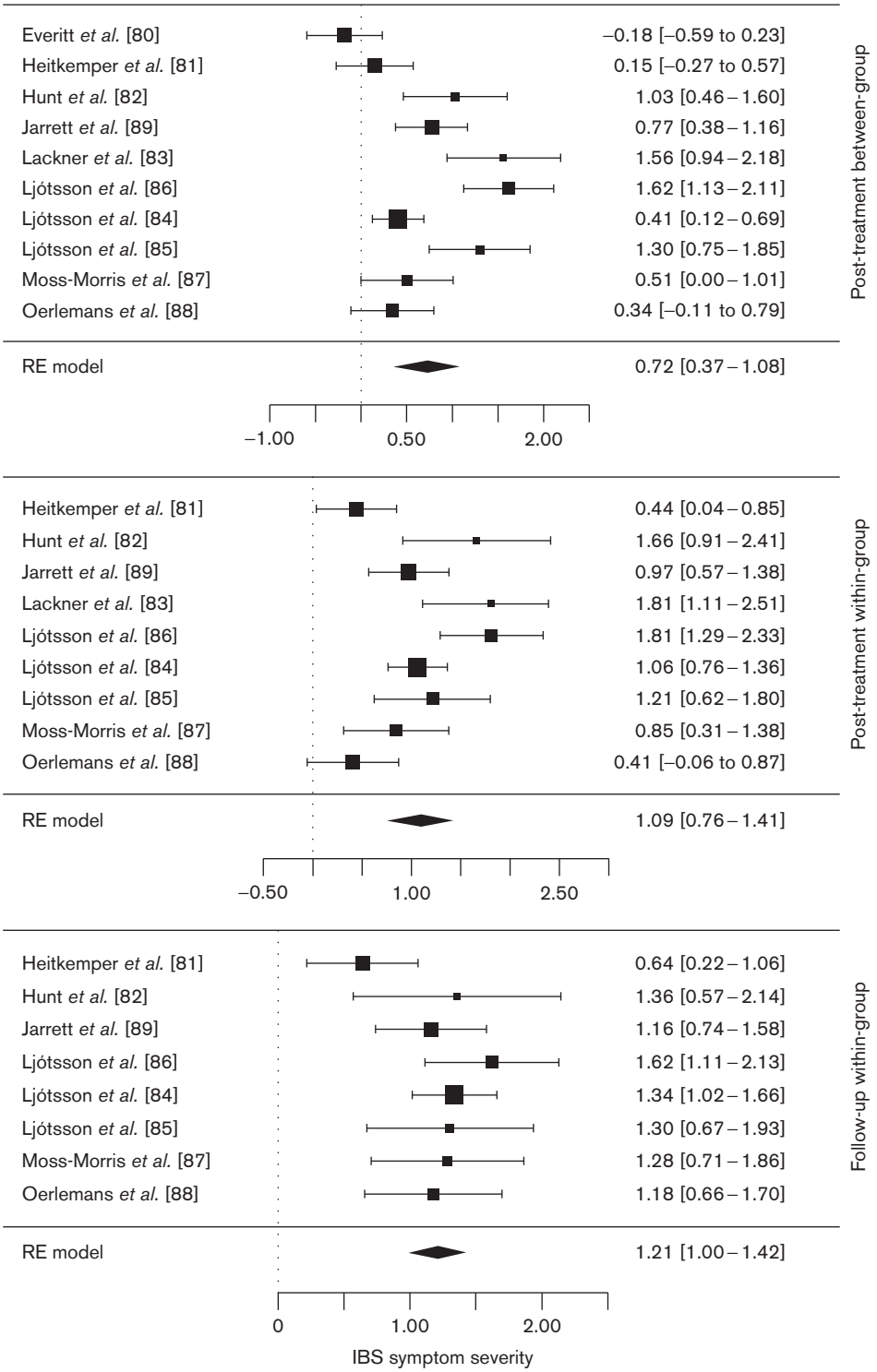

Fig. 2. Forest plots of effect sizes (SMDs) for IBS symptom severity between-group and within-group meta-analyses. IBS, irritable bowel syndrome; SMDs, standardized mean differences.

$b = 0.99$, $z = 2.01$, $P = 0.0440$), and the residual effect size heterogeneity was slightly reduced, but still significant after moderator analysis ($\tau^2 = 0.135$; $I^2 = 67.82\%$; $d.f. = 6$; $P = 0.0048$). Subgroup analyses indicated a larger effect size for online-based interventions (SMD = 1.41; 95% CI: 1.04–1.80; $z = 7.33$; $P < 0.0001$) than for other self-help formats (SMD = 0.84; 95% CI: 0.43–1.36; $z = 4.00$; $P < 0.0001$).

We found large within-group effects in the pretreatment to follow-up meta-analysis (SMD = 1.21; 95% CI: 1.00–1.42; $z = 11.21$; $P < 0.0001$) and a low level of heterogeneity ($\tau^2 = 0.030$; $I^2 = 33.15\%$; $Q = 10.47$; $d.f. = 7$; $P = 0.1634$). The funnel plot did not indicate publication bias ($z = 0.52$; $P = 0.6012$). Neither face-to-face therapist contact ($b = -0.19$; $z = -0.64$, $P = 0.522$) nor online-based self-help material ($b = 0.22$; $z = 0.73$, $P = 0.4631$) was

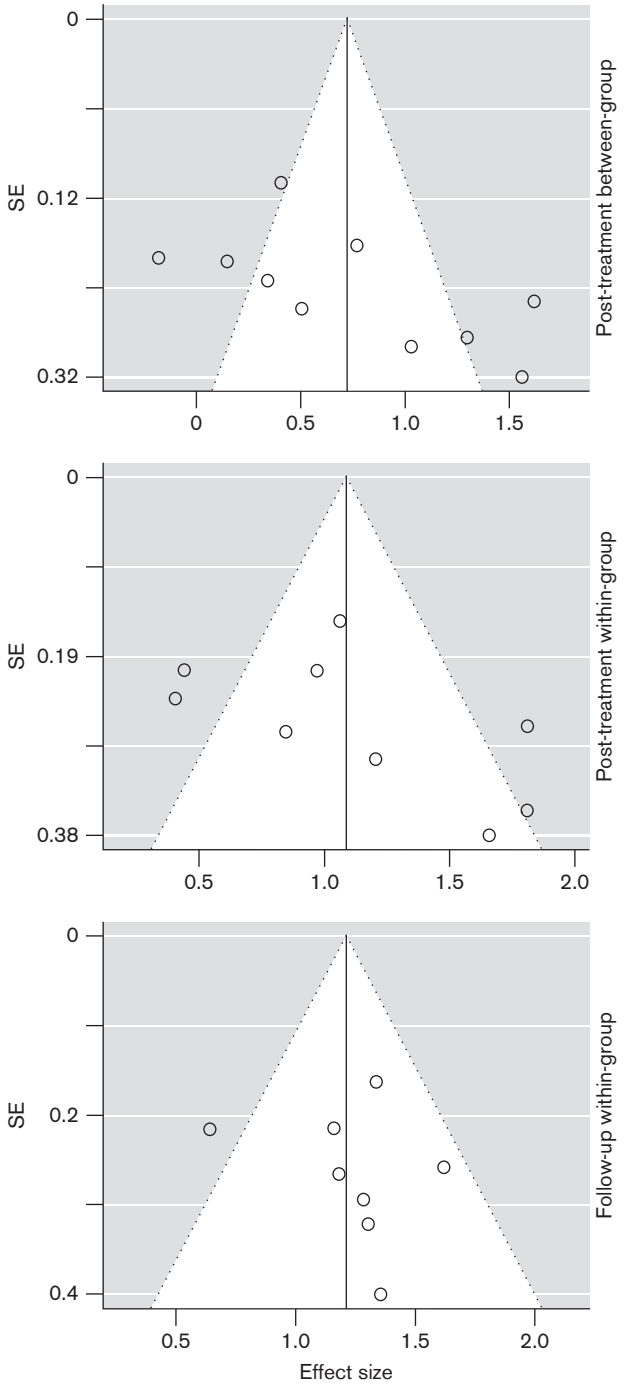

Fig. 3. Funnel plots of effect sizes (SMDs) for IBS symptom severity between-group and within-group meta-analyses. IBS, irritable bowel syndrome; SMDs, standardized mean differences.

found to be a predictor of follow-up symptom severity outcomes.

Impact on quality of life

The single and pooled between-group and within-group effect sizes for QOL outcomes are presented in Fig. 4. Figure 5 shows the corresponding funnel plots.

We found a large pretreatment to post-treatment between-group effect size of GSH interventions on the increase of QOL (SMD = 0.84; 95% CI: 0.46–1.22; $z = 4.34$; $P < 0.0001$). We found that heterogeneity was statistically significant, and there was also a marked variance level in the between-group effect size distribution ($\tau^2 = 0.528$; $I^2 = 84.78\%$; $Q = 52.55$; $d.f. = 8$; $P < 0.0001$). The Egger regression test did not yield a significant funnel plot asymmetry ($z = 1.9567$; $P = 0.0504$). We did not find significant predictors of intervention effectiveness (face-to-face contact: $b = 0.42$; $z = 0.61$, $P = 0.5401$; online-based interventions: $b = 0.97$, $z = 1.45$, $P = 0.1347$), and the heterogeneity did not essentially change using the mixed model ($\tau^2 = 0.542$; $I^2 = 84.80\%$; $Q = 39.48$; $d.f. = 6$; $P < 0.0001$).

The within-group meta-analysis found a medium pooled pretreatment to post-treatment effect size on quality-of-life outcomes (SMD = 0.77; 95% CI: 0.51–1.04; $z = 5.76$; $P < 0.0001$) and moderate heterogeneity between the single study effect sizes ($Q = 18.16$; $d.f. = 7$; $P = 0.0113$; $\tau^2 = 0.084$; $I^2 = 61.45\%$). The Egger regression test did not indicate funnel plot asymmetry ($z = 1.05$; $P = 0.2953$). However, the moderator analysis did yield a marked reduction in effect size heterogeneity ($\tau^2 = 0.018$; $I^2 = 24.30\%$; $Q = 6.60$; $d.f. = 5$; $P = 0.2517$). Online self-help was found to be a significant positive predictor of treatment effectiveness (face-to-face contact: $b = 0.55$; $z = 1.76$, $P = 0.0786$; online-based interventions: $b = 0.85$, $z = 2.80$, $P = 0.0050$). Subgroup analyses resulted in a large effect size for online-based interventions (SMD = 0.98; 95% CI: 0.76–1.20; $z = 8.78$; $P < 0.0001$), but in only a medium effect size for other self-help formats (SMD = 0.57; 95% CI: 0.18–0.94; $z = 2.90$ $P = 0.0038$).

In the pretreatment to follow-up meta-analysis, we found a large pooled within-group effect size (SMD = 0.83; 95% CI: 0.59–1.07; $z = 6.81$; $P < 0.0001$) and a moderate, nonsignificant level of heterogeneity ($\tau^2 = 0.046$; $I^2 = 46.18\%$; $Q = 11.15$; $d.f. = 6$; $P = 0.0839$). The funnel plot did not indicate publication bias ($z = 0.54$; $P = 0.5918$). Both face-to-face therapist contact ($b = 0.65$; $z = 2.21$, $P = 0.0274$) and self-help format ($b = 0.88$; $z = 3.13$, $P = 0.0018$) were found to be significant predictors of therapy effectiveness. Subgroup analysis found that treatments without any face-to-face therapist contact (SMD = 0.86; 95% CI: 0.49–1.23; $z = 4.91$; $P < 0.0001$) are slightly more effective than self-help formats with additional face-to-face sessions (SMD = 0.78; 95% CI: 0.49–1.06; $z = 4.93$; $P < 0.0001$). Online-based self-help (SMD = 1.01; 95% CI: 0.78–1.23; $z = 8.75$; $P < 0.0001$) was found to be more helpful than interventions using other media (SMD = 0.59; 95% CI: 0.19–0.98; $z = 2.93$; $P = 0.0034$).

Discussion

The present meta-analytic review indicates that psychological-based GSH is an effective treatment option for IBS. Compared with several control conditions, we found a medium effect size on the decrease of IBS symptom severity (SMD = 0.72) and a large effect size on the increase of patients' QOL (SMD = 0.84). Although effect size heterogeneity was high, neither treatment format nor face-to-face therapist contact was a predictor of therapy outcomes in the pretreatment to post-treatment between-group analyses. In contrast, the within-group analyses led

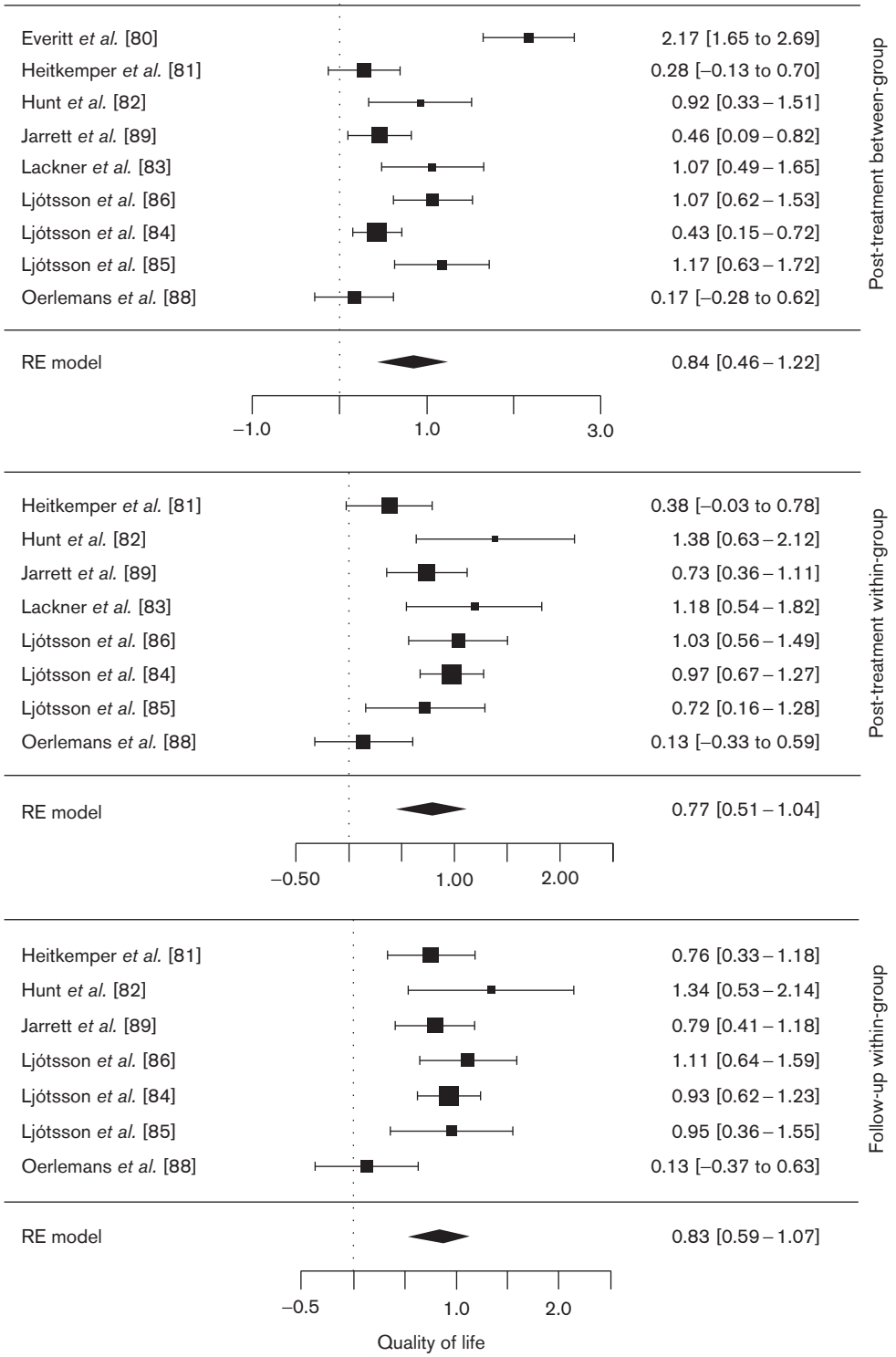

Fig. 4. Forest plots of effect sizes (SMDs) for quality-of-life between-group and within-group meta-analyses. SMDs, standardized mean differences.

to the conclusion that online-based interventions are more effective than other self-help formats. In the pretreatment to post-treatment analysis, we found larger effect sizes of online GSH on the reduction of IBS symptom severity (SMD = 1.41 vs. 0.84 for other formats) and on quality-of-life outcomes (SMD = 0.98 vs. 0.57 for other formats). The inclusion of moderators in the model estimation led to a considerable reduction of within-group effect size heterogeneity. In the follow-up analysis, we found large effect sizes for symptom severity outcomes (SMD = 1.00), which were homogeneous for different treatment conditions. Interestingly, not only online formats but also interventions without face-to-face therapist contact led to slightly better quality-of-life outcomes in follow-up investigations.

IBS is highly prevalent in Western societies, representing a major healthcare issue [2,17,95]. However, there is still no well-established standard for the treatment of IBS [19,41]. IBS is a chronic functional condition that seriously

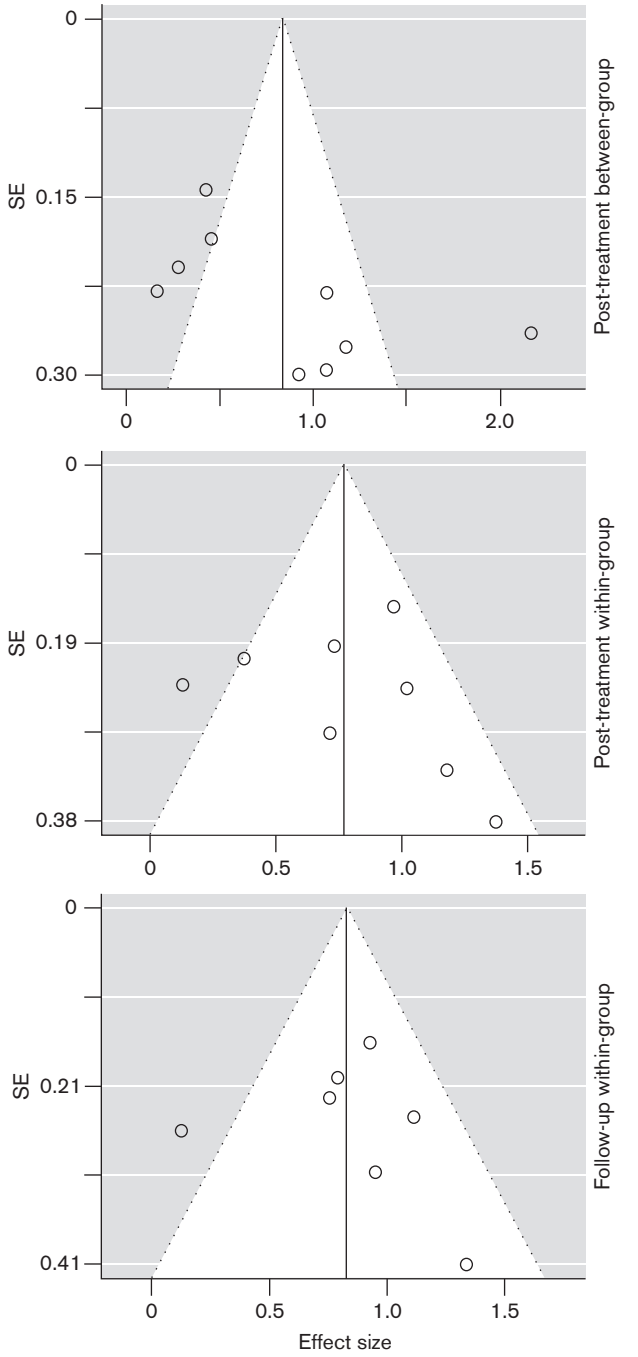

Fig. 5. Funnel plots of effect sizes (SMDs) for quality-of-life between-group and within-group meta-analyses. SMDs, standardized mean differences.

affects patients' QOL [96,97] and shows considerable comorbidity with psychiatric disorders such as depression [24,98]. Consequently, psychological treatments and antidepressants have been recommended as potential therapies for IBS symptoms. Although existing meta-analytic reviews found promising results for psychological treatments and antidepressants [14,26], both come with limitations. Pharmacological therapies, including tricyclic antidepressants, as well as selective serotonin reuptake inhibitors, involve the risk of adverse effects [99,100] and may lead to high costs for our healthcare systems [30, 31,101]. Besides antidepressants, other pharmacological treatment options, including spasmolytics, probiotics, and in some cases 5-HT3-antagonists, are recommended for IBS pain treatment. However, peripheral analgesics or opiates are not recommended [13,20]. There is evidence for the effectiveness of psychotherapy for the treatment of IBS, but the number of studies is small and the quality of the studies is unreliable [26,102]. The same applies to gut-directed hypnotherapy [103,104]. Relaxation exercise, such as progressive muscle relaxation, is a treatment option, but it seems less effective as monotherapy [14, 105]. A recent meta-analytic review on psychological treatments for IBS found medium effect sizes compared with treatment-as-usual or waiting-list controls (SMD = 0.62) and large, but heterogeneous effect sizes in the within-group pretreatment to post-treatment analyses (SMD = 0.97) for the improvement of IBS symptom severity [102]. For QOL outcomes, the pooled between-group effect size was SMD = 0.47 [102]. Thus, the effect of GSH on IBS patients seems comparable with psychological face-to-face interventions in terms of symptom severity (SMD = 0.62 vs. 0.72). Similar results have been shown for the treatment of anxiety and depression, where GSH is as effective as conventional face-to-face psychological interventions [43]. The impact of GSH on QOL is even larger compared with other psychological-based IBS interventions (SMD = 0.47 vs. 0.84) [102].

Self-help interventions have become very popular in recent years and have been shown to be helpful for several health conditions [36,39,43]. Moreover, self-help programs are low-threshold, cost-saving, and easily accessible treatment options as they are not limited by geographic location or availability of personnel [106]. Self-help seems to be more effective with additional minimal therapist contact [39], likely because of motivational aspects and the possibility of a positive therapeutic relationship [29].

Currently, there are several systematic reviews on minimal contact therapies and/or GSH interventions for IBS, discussing GSH as a promising treatment option [11, 41,42]. A recent meta-analysis on psychological therapies for IBS included RCTs on GSH in their quantitative analyses [14]. This study also carried out several subgroup analyses (categories included 'self-administered/minimal contact cognitive behavioral therapy', 'cognitive behavioral therapy via internet', 'multicomponent psychological therapy via telephone'), but there was no subcategory that integrated different treatment approaches that can be defined as GSH. Thus, the current study is the first meta-analysis to quantify the effectiveness of GSH for the treatment of IBS on symptom severity and QOL.

With the aim of gaining a more complete picture of the impact of an intervention, the inclusion of quality-of-life outcomes as endpoints in clinical trials was recently required by the European Medicines Agency and the US Food and Drug Administration [107,108]. It is noteworthy that all of the studies included used the same scale to measure QOL, indicating high internal validity of the meta-analytic results.

There are several limitations to this meta-analytic review that should be considered when interpreting the results. (a) The exclusion of studies that have not been published in peer-reviewed journals in English language may affect generalizability. The funnel plot for the between-group meta-analysis of the primary study

outcome indicated publication bias, possibly because of missing gray literature sources. However, we used well-established databases for the literature search. The Cochrane Central Register of Controlled Trials comprises collections of controlled trials, retrieved from specialized registers and additionally through manual search. Furthermore, the funnel plots created were not asymmetrical for most of the analyses carried out. (b) We included only 10 RCTs in our analyses. Although our sample size ($n = 886$) was overall satisfactory, the number of studies in our analyses was relatively small when constructing random-effect models, especially with respect to the considerable study heterogeneity that we found in our between-group analysis. In addition, the sample size was rather small when constructing mixed models to explore the impact of moderators. Nevertheless, we decided to carry out multivariate analyses as they take account of both the relationship between moderator and therapy effectiveness and the relationship between the potential predictors among each other. This seems reasonable as most of the interventions using online formats did not offer face-to-face therapist contact or vice versa. (c) The studies included were heterogeneous in their study design, duration, or control condition. This might be an explanation for the moderate to high effect size heterogeneity between the RCTs. This clearly leads to the assumption that there are other moderators of treatment effectiveness, which we did not consider for our analyses. In particular, we did not control for study quality, type of control condition, treatment duration, follow-up period, or intensity of therapist contact. Moreover, the studies included used different methods to identify IBS. Forest plots did not indicate systematic effect size differences between the use of Rome I, Rome II, and Rome III criteria. This is in agreement with epidemiological studies indicating accordance of respective criteria for identification of IBS [109,110]. However, one study reported that the diagnoses of IBS were made by a medical professional without giving nearer information of diagnostic criteria, which might have led to higher variance in our results. In addition, the studies included used different outcomes to measure IBS symptom severity. Although most of the studies reported a global IBS symptom score, we had to use pain intensity as a symptom severity measure in three studies. Looking at the forest plots, the latter tend to slightly underestimate effect sizes, possibly because changes in diarrhea and constipation symptoms were not taken into consideration, which could have affected effect size heterogeneity. However, the number of studies included was too small to consider all of these potential predictors in our statistical analyses. Interestingly, the follow-up effects were much more homogeneous among GSH intervention formats, indicating similar long-term effectiveness of different intervention types.

In summary, GSH seems to be similarly effective for the treatment of IBS as psychological face-to-face therapies. As GSH interventions are easily accessible and cost-effective, they could reduce the impact on a patient's QOL without consuming too many resources of the healthcare system. However, the implementation of GSH in practice is rare and the availability is nominal. For example, the German Consensus Guidelines on IBS recommend GSH (level of evidence A), but note that there is no version in the German language [13]. Considering the effect of GSH, it is surprising that the social security carrier does not devote more efforts toward supporting this treatment option. Further studies should strengthen the evidence for GSH on IBS and clarify which intervention form shows the best outcome. On the basis of these results, online-based interventions, in particular, seem to be a promising GSH format for future IBS treatment.

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Conflicts of interest

There are no conflicts of interest.

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