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The effectiveness of web-based grief intervention for adults who lost a loved one: A systematic review and meta-analysis

Danyang Yao[1†], Fang Qian[1,2†], Tao-Hsin Tung[3], Huanhuan Shi[4*] and Dongjun Bi[4,5*]

Abstract

Background Many bereaved individuals suffer from intense grief, anxiety, depression and post-traumatic stress disorder. To prevent these conditions from worsening, web-based grief interventions have emerged as a promising solution for providing accessible, flexible, and anonymous support to bereaved individuals. However, two previous meta-analyses focused only on the post-intervention effects of web-based grief interventions on grief, post-traumatic stress disorder, and depression in bereavement individuals, relying on a small number of studies published before 2021. Therefore, after including new research, the present study evaluated the effects of web-based grief interventions on grief, anxiety, depression, and posttraumatic stress disorder in bereaved adults, both post-intervention and after three months of follow-up.

Methods Randomized controlled trials (RCTs) were retrieved from The Cochrane Library, PubMed, Web of Science, PsycARTICLES, Embase, CINAHL, Medline, and Clinical Trials, with a search time range from database establishment to February 1, 2024, without language limitations. The quality of the included RCTs was evaluated using the Cochrane Risk Assessment Tool, and evaluation was conducted using Review Manager 5.3. PROSPERO Registration: CRD42024506293.

Results A total of 726 and 771 participants were in the intervention and control groups, respectively. After the implementation of the web-based grief intervention, significant improvements were observed in anxiety (standard mean difference [SMD] = -0.37, 95% CI [-0.54, -0.20] $p < 0.0001$), posttraumatic stress disorder (SMD = -0.64, 95% CI [-0.78, -0.50], $p < 0.00001$), depression (SMD = -0.37, 95% CI [-0.47, -0.27], $p < 0.00001$), and grief (SMD = -0.30, 95% CI [-0.40, -0.19], $p < 0.00001$) among the bereaved individuals. In the intervention group, after three months of follow-up, significant improvements continued in grief (SMD = -0.19, 95% CI [-0.31, -0.08], $p = 0.001$), depression (SMD = -0.15, 95% CI [-0.26, -0.04], $p = 0.009$) and posttraumatic stress disorder (SMD = -0.23, 95% CI [-0.45, -0.01], $p = 0.04$), whereas no significant improvement was observed in anxiety (SMD = -0.02, 95% CI [-0.22, 0.19], $p = 0.86$).

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Conclusion Web-based grief interventions have a positive and promising effect on anxiety, depression, grief, and post-traumatic stress disorder in bereaved individuals following the intervention. However, after three months of follow-up, the web-based grief intervention had a lasting positive effect on grief, post-traumatic stress disorder, and depression, but not on anxiety.

Keywords Grief, Web-based, Online intervention, Systematic review, Meta-analysis

Introduction

Bereavement is a traumatic life event that can cause intense grief in individuals and lead to anxiety, depression, and post-traumatic stress disorder (PTSD) [1]. When this intense grief response persists for more than 12 months without diminishing, it develops into prolonged grief disorder [2]. About 5–10% of bereaved individuals experience prolonged grief disorder, which can trigger relationship problems and physical ailments, such as acute coronary syndrome and an increased risk of divorce [3–5]. Currently, web-based grief interventions are a promising approach to preventing intense grief reactions in the early stage, offering advantages such as easy access, low cost, and high privacy [6, 7].

Web-based grief intervention is an emerging field with several studies, including two previous meta-analyses [8, 9]. Differences in measurement outcomes between these meta-analyses may stem from variations in the types of interventions, participant characteristics, and study designs. Anxiety is also common in bereaved individuals, predisposing them to developing psychiatric disorders, leading to significant impairments in daily life and social and occupational functioning [10]. However, the two previous meta-analyses did not addressed the effects of web-based grief interventions on anxiety or examined the effects of web-based grief interventions on grief, depression and PTSD after three months of follow-up. Additionally, the previous two meta-analyses were based on only a small number of studies published before 2021, which require updating due to the growing interest in web-based grief intervention research over the past two years.

This study examined trends in the overall effect of a web-based grief intervention on anxiety, grief, depression, and PTSD among the bereaved, both immediately after the intervention and after three months of follow-up. By including new relevant randomized controlled trials (RCTs), this research provides a more reliable basis for incorporating these interventions into routine practice.

Methods

This systematic review and meta-analysis was based on a preassigned protocol registered with PROSPERO (CRD42024506293). The updated PRISMA 2020 statement was used to guide the review [11].

Search strategy

We conducted a comprehensive systematic literature search across seven electronic databases and one clinical registration center: The Cochrane Library, PubMed, PsycARTICLES, Embase, Web of Science, CINAHL, MEDLINE, and Clinical Trials, from the start date of the index to February 1, 2024.We included literature without imposing any language restrictions.The references of the identified studies were searched manually for additional potential articles. Search strings or terms were derived from the following keywords: psychotherapy, bereavement, Internet-based. In the advanced search of the database, a search strategy was constructed based on the above search terms using the "Medical Subject Headings (MESH)" and "Title/Abstract" with appropriate "AND" and "OR" Boolean operators. The complete search strategy and number of search results for each database are presented in Appendix 1.

Study selection

The inclusion criteria were as follows: (1) participants were aged 18 years or older and bereaved; (2) the experimental group received a grief intervention primarily through the implementation of network technology; (3) the control group received conventional treatment, placebo, blank control, waiting list, or other grief interventions facilitated by non-web-based technology; (4) the study outcome indicators included grief, PTSD, depression, or anxiety, and the type of assessment scale was not limited; and (5) the study design was a randomized controlled trial (RCT). Trials that did not meet the inclusion criteria were excluded. In addition, studies lacking basic information or indicators of interest, baseline incomparable studies between the experimental and control group, and studies with duplicate data were excluded.

EndNote X9 was used to exclude duplicate records and manage the included studies. Two researchers (FQ and DYY) selected studies independently based on a two-step screening process consisting of title and abstract screening followed by full-text review to identify studies according to the eligibility criteria. Other disputes and disagreements were resolved through discussions with a third researcher (THT) to reach a consensus. For example, DYY believes that the web-based grief intervention study published by Wagner et al. [12], 2007 meets the standards, while FQ believes that the study has data duplication issues and should be excluded.

After discussing with THT, a consensus was reached that there was data overlap between this study and another included article published by Wagner et al. [13], 2006, so the duplicated portion was excluded. Data other than duplicate publications were confirmed not to contribute further. Ultimately, the decision was made to exclude the study.

Quality assessment and data extraction

Two researchers (FQ and DYY) used the Cochrane Collaboration Tool for assessing the risk of bias in inclusion trials through Review Manager 5.3, which included the following: (1) random sequence generation, (2) allocation concealment, (3) blinding of participants and personnel, (4) blinding of outcome evaluation, (5) incomplete outcome data, (6) selective reporting, and (7) other sources of bias. Other disagreements were resolved through discussion with the third researcher (THT).

In the process of study quality assessment, the risk of bias evaluation for some studies was controversial. For the study by Van der houwen et al. [14], DYY believed that its randomization method met the criteria for low risk of bias, whereas FQ argued that while the study mentioned automatic randomization, it did not explicitly describe how the random order was generated, leaving the risk of bias unclear. Ultimately, we decided to invite a third researcher (THT) for evaluation, and based on their opinion, the random sequence generation of the study was rated as "unclear".

Data were extracted and managed by one researcher (DYY) and verified by a second researcher (FQ). Any differences or inconsistencies between the two researchers were reached through discussion and consensus with a third researcher (THT). The extracted information included the author, year/location, research participants, number of participants, intervention measures for the experimental and control groups, frequency, duration, follow-up, measurement outcome indicators, and measurement tools.

Statistical analysis

RevMan 5.3 (The Nordic Cochrane Centre for The Cochrane Collaboration, Copenhagen, Denmark) was used to merge and analyze the extracted data. First, the heterogeneity of the studies was examined by the p-value and I^2. If the *p*-value was less than 0.1, the heterogeneity was considered to be high. Heterogeneity was divided into none (I^2 = 0–24.9%), low (I^2 = 25–49.9%), moderate (I^2 = 50–74.9%), and high (I^2 = 75–100%) [15]. A fixed-effects model was used if I^2 was less than 50% and the p-value is greater than 0.1. Second, when the I^2 was greater than 50% and the *p*-value was less than 0.1, we performed a sensitivity analysis by excluding trials that may bias the results, or by using the random effects model. Lastly, a *p*-value lower than 0.05 was considered statistically significant. We used the standard mean difference (SMD) and a 95% confidence interval (CI) to examine the intervention effect, which was evaluated by relevant scales after the intervention and follow-up. Funnel plots were used to examine potential publication bias when more than 10 studies were included for an outcome.

Results

Literature search and study characteristics

Figure 1 illustrates the study selection process. We identified 2219 studies from seven electronic databases and one clinical registration center. Of these, 16 studies reported on the impact of web-based grief interventions on bereaved individuals. Table 1 listed the characteristics of each included study. This meta-analysis included 16 RCTs published between 2006 and 2023. The studies were conducted in Germany (seven studies), the Netherlands (four studies), USA (three studies), Switzerland (one study), and South Korea (one study). One study tested two interventions (exposure and behavioral activation) and compared them to the same control group [16]. For both grief and depression, Wagner et al. [17] used two different scales for assessment. Kaiser et al. [18] used two scales to assess grief of the bereaved. Sample sizes ranged from 26 to 455 participants, with a total of 726 participants in the intervention group and 771 participants in the control group.

Figure 2 presents a summary of the bias risk assessment using the Cochrane Collaboration Tool. Since blinding participants in intervention trials involving active participation is not feasible, and most trials require feedback from treatment staff or other researchers, all studies were judged to have a high risk of bias regarding participant and personnel blinding.

Anxiety

Seven studies [13, 18–23] examined the impact of a web-based grief intervention on anxiety. The pooled results showed no statistical significance (Z = 0.33, $p = 0.74$) and high heterogeneity ($\chi^2 = 39.32$, I^2 = 85%), necessitating a sensitivity analysis (Fig. 3A). Since the study by Dominick et al. [19] used the State-Trait Anxiety Scale, where a higher score indicated a lower level of anxiety (opposite to the scales used in other studies), we excluded this study from the sensitivity analysis. After excluding Dominick et al.'s [19] study, the remaining trails were analyzed and using a fixed-effects model due to low heterogeneity ($\chi^2 = 2.55$, I^2 = 0%). Anxiety in the web-based grief intervention group were significantly less severe than those in the control group (SMD = -0.37, 95% CI [-0.54, -0.20], $p < 0.0001$) (Fig. 3B). Three of the seven studies did not provide follow-up data; therefore, we analyzed the four

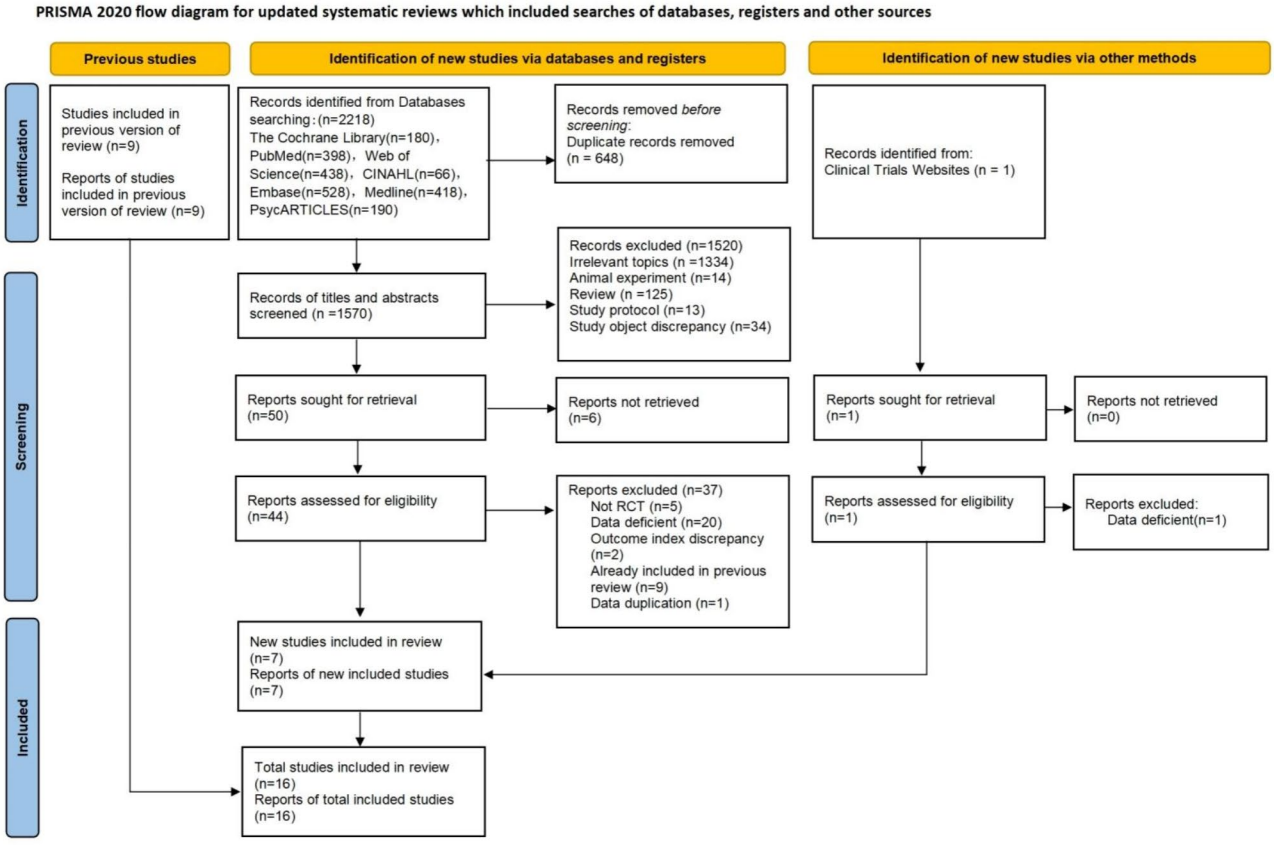

Fig. 1 PRISMA flow diagram

studies [13, 21–23] that provided three-month follow-up data. A fixed effects model was used due to low heterogeneity test ($\chi^2 = 0.99$, $I^2 = 0\%$). Anxiety did not significantly improved at the three months follow-up compared to post-intervention (SMD = -0.02, 95% CI [-0.22, 0.19], $p = 0.86$) (Fig. 3C).

PTSD

Nine studies [16–18, 21–26] examined the impact of web-based grief interventions on PTSD. Data from the selected trials were analyzed using a fixed-effects model due to low heterogeneity ($\chi^2 = 16.99$, $I^2 = 47\%$). The pooled result indicated that web-based grief interventions had a significant effect on PTSD in bereaved individuals immediately after the intervention (SMD = -0.64, 95% CI [-0.78, -0.50], $p < 0.00001$) (Fig. 4A). For three studies [21–23] that provided follow-up data at three-months, a fixed-effects model was used ($\chi^2 = 3.53$, $I^2 = 43\%$). PTSD significantly improved at the three months follow-up compared to post-intervention (SMD = -0.23, 95% CI [-0.45, -0.01], $p = 0.04$) (Fig. 4B).

Depression

Fifteen studies [13, 14, 16–18, 20–29] focused on the impact of web-based grief interventions on depression. The pooled results showed statistically significant differences ($Z = 5.22$, $p<0.00001$) and high heterogeneity ($\chi^2 = 37.41$, $I^2 = 57\%$), necessitating a sensitivity analysis (Fig. 5A). After sensitivity analysis, the study by Lenfrink et al. [24] was excluded. The remaining studies were analyzed using a fixed-effects model ($\chi^2 = 29.08$, $I^2 = 48\%$). Web-based grief interventions had a significant effect on depression in bereaved individuals (SMD = -0.37, 95% CI [-0.47, -0.27], $p < 0.00001$) (Fig. 5B). Seven studies [13, 14, 17, 21–23, 27] that provided three-month follow-up data were analyzed. A fixed-effects models was used due to low heterogeneity ($\chi^2 = 6.46$, $I^2 = 0\%$). Depression showed significant improvement at the three-month follow-up compared to post-intervention (SMD = -0.15, 95% CI [-0.26, -0.04], $p = 0.009$) (Fig. 5C).

Grief

Thirteen studies [14, 16–18, 21–29] focused on the impact of web-based grief interventions on grief. The pooled results showed statistically significant differences ($Z = 5.29$, $p<0.00001$) and high heterogeneity ($\chi^2 = 45.27$, $I^2 = 67\%$), necessitating a sensitivity analysis (Fig. 6A). After sensitivity analysis, the studies by Lenfrink et al. [24], Litz et al. [23], Kaiser et al. [18], and Treml et al. [29] were excluded. A fixed effects model was used due

Table 1 Basic characteristics of included studies

Author/ year/ Country	Research subjects	Participants sample (*n*)		Intervention methods		Intervention duration	Follow-up	Outcome	Measurement
		Treatment	Control	Treatment	Control				
Wagner et al. /2006/ Germany	Bereaved individuals with depression, intrusion, avoidance, and maladaptive behavior	26	25	Writing assignments based on CBT via email: (1) exposure to bereavement cues; (2) cognitive reappraisal; (3) integration and restoration.	Waiting for treatment	10 times, 45 min / 5 weeks	3-month	Anxiety, Depression	BSI
Dominick et al. /2009/ USA	Individuals who have experienced bereavement within the past 1–6 months	33	34	Making sense of grief intervention: (1) my grieving style; (2) how am I doing? (3) providing resources	Usual care	2 weeks	N/A	Anxiety	STAI
van der Houwen et al. /2010/ Netherland	Bereaved subjects significantly distressed by the loss	201	254	Writing assignments based on CBT via email: (1) exposure; (2) cognitive reappraisal; (3) integration and restoration.	Waiting for treatment	5 times / 5 weeks	3-month	Grief, Depression	9 items based on the DSM-V, CES-D
Kersting et al. /2011/ Germany	Participants who had lost a child during pregnancy	33	26	Writing assignments based on CBT via email: (1) self- confrontation; (2) cognitive restructuring; (3) social sharing	Waiting for treatment	10 times, 45 min / 5 weeks	3-month	PTSD, Grief, Depression, Anxiety	IES, ICG, BSI
Kersting et al. /2013/ Germany	Parents after the loss of a child during pregnancy	99	100	Writing assignments based on CBT via email: (1) self- confrontation; (2) cognitive restructuring; (3) social sharing	Waiting for treatment	10 times, 45 min / 5 weeks	3-month	PTSD, Grief, Depression, Anxiety	IES-R, ICG, BSI

Table 1 (continued)

Author/ year/ Country	Research subjects	Participants sample (*n*)		Intervention methods		Intervention duration	Follow-up	Outcome	Measurement
		Treatment	Control	Treatment	Control				
Litz et al. /2014/ USA	Bereaved individuals at risk for prolonged grief disorder	32	42	HEAL: (1) education about loss and grief; (2) instruction on stress management and skills; (3) behavioral activation (self-care + social reengagement); (4) accommodation of loss + goal achievement; (5) relapse prevention	Waiting for treatment	18 times, 20 min / 6 weeks	3-month	PTSD, Grief, Depression, Anxiety	PCL-C, PG-13, BDI, BAI
Eisma et al. /2015/ Netherlands	Bereaved individuals with elevated levels of complicated grief and elevated grief rumination	Exposure:15	10	E-mailed homework assignments; Exposure: writing assignments, imaginal and/or in vivo exposure exercises;	Waiting for treatment	6 times / 6–8 weeks	N/A	PTSD, Grief,	PSS,
		Activation:11		Activation: 7- day activity diary, engagement in value-based activities				Depression	ICG-R, HADS
Brodbeck et al. /2019/ Switzerland	Elders with prolonged grief, psychological distress or adaptation problems	51	47	Internet-based self-help "LIVIA": (1) information about interpersonal loss and an assessment of the current situation; (2) exposure and loss-oriented interventions; (3) resources and restoration-oriented interventions	Waiting for treatment	10 times / 5 weeks	3-month	Grief, Depression	TRIG-D, BDI-II

Table 1 (continued)

Author/ year/ Country	Research subjects	Participants sample (*n*)		Intervention methods		Intervention duration	Follow-up	Outcome	Measurement
		Treatment	Control	Treatment	Control				
Treml et al. /2021/ Germany	Participants with prolonged grief disorder who had lost a close person to suicide	27	27	Internet-based cognitive behavioral grief therapy: (1) self-confrontation; (2) cognitive restructuring; (3) social sharing	Waiting for treatment	10 times / 5 weeks	N/A	Grief, Depression	ICG, GEQ
Godzik et al. /2021/ USA	Bereaved adults aged 55 and over	12	14	Online CBT-I: (1) get ready; (2) sleep window; (3) behaviors; (4) thoughts; (5) education; (6) looking ahead	Attention control: (1) insomnia; (2) grief; (3) positivity; (4) healthy eating; (5) exercise; (6) resilience	3 h a week / 6weeks	N/A	Anxiety Depression	DASS Short Form
Wagner and Hofmann et al. /2022/ Germany	Bereaved siblings aged 16–65 years	47	39	Writing assignments based on CBT via email: (1) self- confrontation; (2) cognitive restructuring; (3) social sharing	Waiting for treatment	12 times, 45 min / 6 weeks	N/A	Grief, Depression, PTSD	ICG, BDI-II. IES-R
Wagner and Grafiadeli et al. /2022/ Germany	Participants who have lost someone close to them to suicide, aged 18-75	52	48	Online group intervention based on CBT which consisted of weekly sessions with topics relevant to suicide survivors (e.g., guilt, stigma)	Waiting for treatment	12 times, 90 min / 12 weeks	3-month	Depression, Grief, PTSD	ICG-D, GEQ, IES-R, PHQ-9
Kaiser et al. /2022/ Germany	Individuals with grief bereaved by cancer	39	42	Online grief therapy via a secure website using the software: (1)self-confrontation; (2) cognitive restructuring; (3) social sharing	Waiting for treatment	10 times, 45 min / 5 weeks	N/A	Grief, Depression, Anxiety, PTSD	ICG, PHQ-9, GAD-7, IES-R

Table 1 (continued)

Author/ year/ Country	Research subjects	Participants sample (*n*)		Intervention methods		Intervention duration	Follow-up	Outcome	Measurement
		Treatment	Control	Treatment	Control				
Park et al. /2023/ South Korea	Individuals who had experienced family bereavement within a year	18	14	Art therapy via Zoom: (1) looking for images of scribbles; (2) imagining "valuable things"; (3) assuming the role; (4)listening to music; (5) expressing emotions in various elements; (6) watching a movie and expressing feelings; (7) being presented story; (8) sharing images of happy experiences	Waiting for treatment	8 times, 60 min / 8 weeks	N/A	Depression, Grief	BDI-II, TRIG
Lenferink et al. /2023/ Netherlands	Individuals bereaved through traffic accidents at least 1 year previously	11	17	Individual online CBT: (1) facing the loss and the pain; (2) keeping faith in life and the future; (3) doing helpful things.	Waiting for treatment	8 lessons / 12 weeks	N/A	Grief, PTSD, Depression	TGI-SR+, PCL-5, HADS-D
Reitsma et al. /2023/ Netherlands	Adults who lost a spouse, family member, or friend due to various causes, at least three months earlier during the pandemic.	19	32	Self-guided online CBT treatment: (1) exposure (2) cognitive restructuring; (3) expanded by an online protocol addressing behavioral activation	Waiting for treatment	8 lessons,2 h / 12 weeks	N/A	Grief, PTSD, Depression	TGI-CA, PCL-5, PHQ-9

Note: M: mean; SD: standard deviation; CBT: cognitive behavior therapy; BSI: brief symptom inventory; STAI: state-trait anxiety inventory; DSM-V: diagnostic and statistical manual of mental disorders, 5th edition; CES-D: center for epidemiological studies-depression scale; PTSD: post-traumatic stress disorder; IES: impact of event scale; ICG: inventory of complicated grief; BSI: brief symptom inventory; IES-R: impact of event scale-revised; PCL-C: post-traumatic checklist; PG-13: 13-item prolonged grief inventory; BDI: beck depression inventory; BAI: beck anxiety inventory; PSS: post-traumatic stress disorder symptom scale; ICG-R: inventory of complicated grief-revised; HADS: hospital anxiety and depression; TRIG-D: texas revised inventory of grief – german version; BDI-II: beck depression inventory II; GEQ: grief experience questionnaire; DASS Short Form: a 21-item measures depressive, anxiety, and stress symptoms; ICG-D: inventory of complicated grief; PHQ-9: short version of the patient health questionnaire; GAD-7: generalized anxiety disorder screener 7; TRIG: texas revised inventory of grief; TGI-SR+: traumatic grief inventory-self report plus; PCL-5: post-traumatic stress disorder checklist for DSM-5; HADS-D: depression sub-scale of the hospital anxiety depression; TGI-CA: traumatic grief inventory-clinician administered

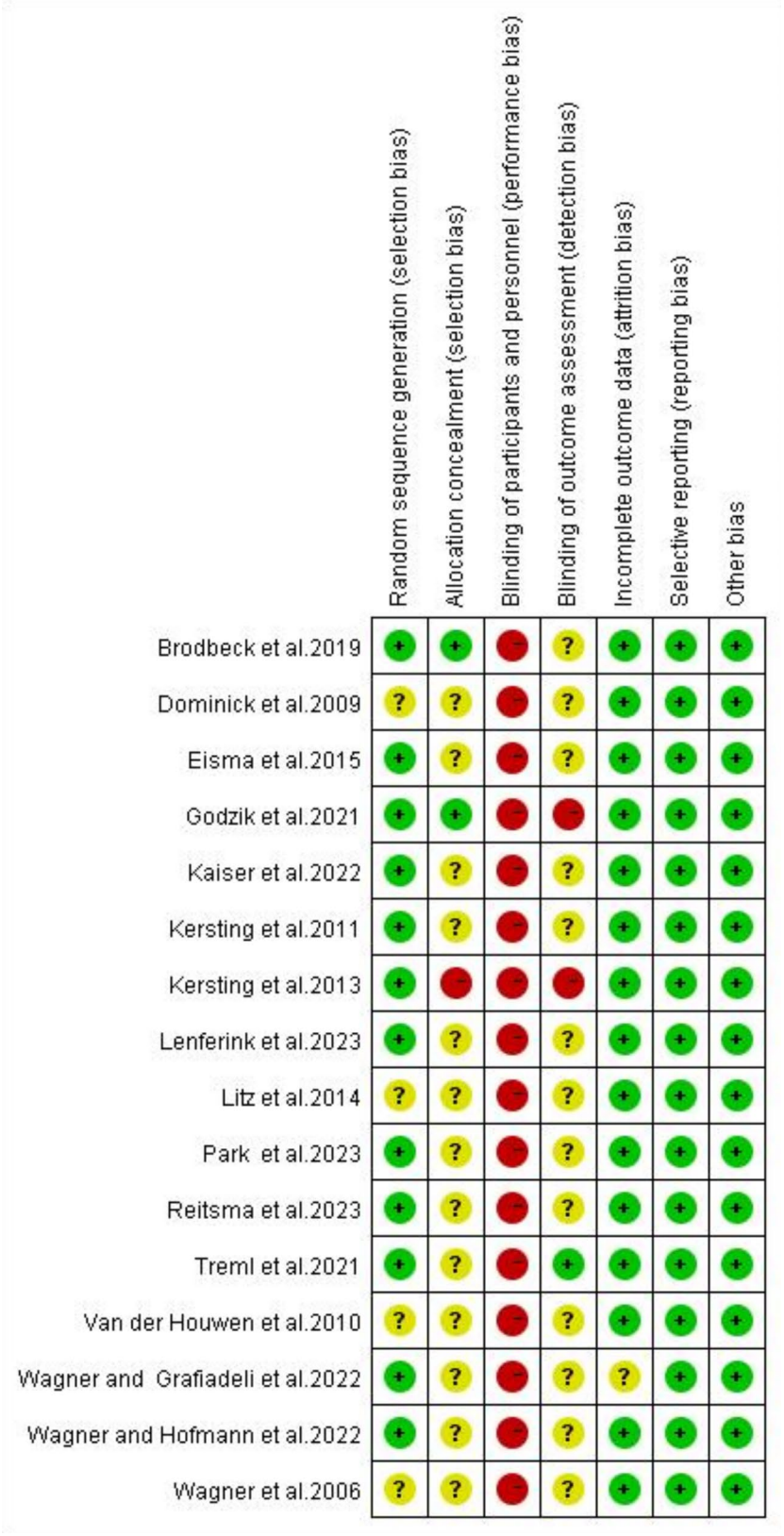

Fig. 2 Risk of bias summary graph

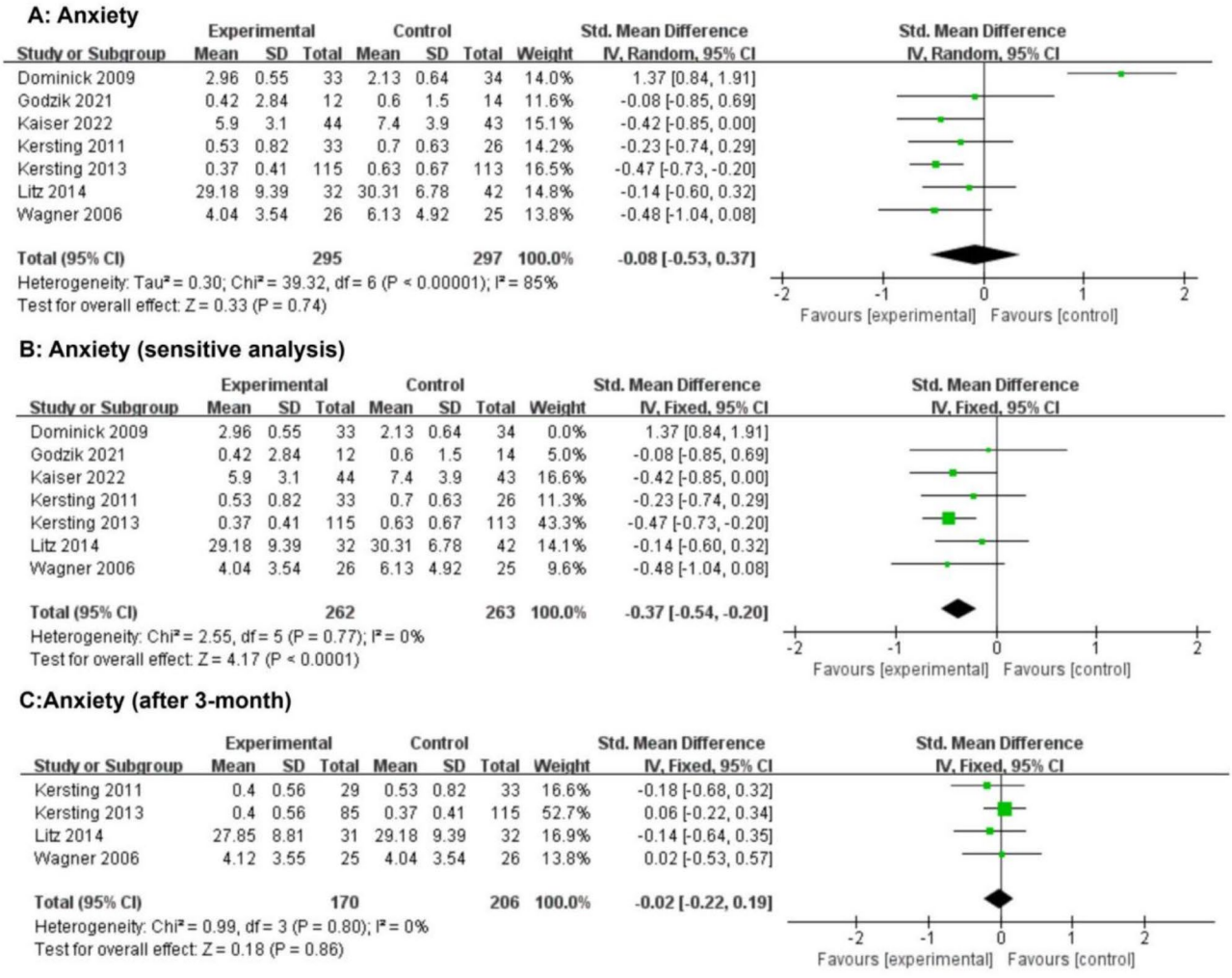

Fig. 3 Forest plot comparing change in anxiety

to the low heterogeneity ($\chi^2 = 16.71$, $I^2 = 40\%$). Grief in the web-based grief intervention group was significantly less severe than in the control group (SMD = -0.30, 95% CI [-0.40, -0.19], $p < 0.00001$) (Fig. 6B). For six studies [14, 17, 21–23, 27] that provided three-month follow-up data, a fixed-effects model was used due to low heterogeneity ($\chi^2 = 5.92$, $I^2 = 0\%$). Grief was significantly less severe at three-month follow-up than post-intervention (SMD = -0.19, 95% CI [-0.31, -0.08], $p = 0.001$) (Fig. 6C).

Publication bias

We conducted a publication bias analysis of the literature on PTSD, grief, and depression as more than 10 articles measured these outcomes. Funnel plot analysis showed relatively symmetrical left and right plots, suggesting a small publication bias (Fig. 7). The results reported in the literature appeared relatively stable.

Discussion

Bereaved individuals often experience elevated grief, anxiety, PTSD and depression [30–32]. Our meta-analysis showed that web-based grief interventions had a positive effect on grief, PTSD, and depression both immediately post- intervention and at three months of follow-up, consistent with results from numerous trials demonstrating the effectiveness of web-based interventions for grief, PTSD, and depression [33–35]. Although our meta-analysis showed that web-based grief interventions were effective in reducing anxiety immediately after the intervention, the effect on anxiety was not significant after three months of follow-up. This may be related to the high rate of subsequent loss, resulting in a small sample size, and the possible lack of adequate ongoing support in web-based intervention over time [21–23]. Additionally, the persistence of anxiety may be influenced by factors such as the individual's life situation, social support system, and coping style [2].

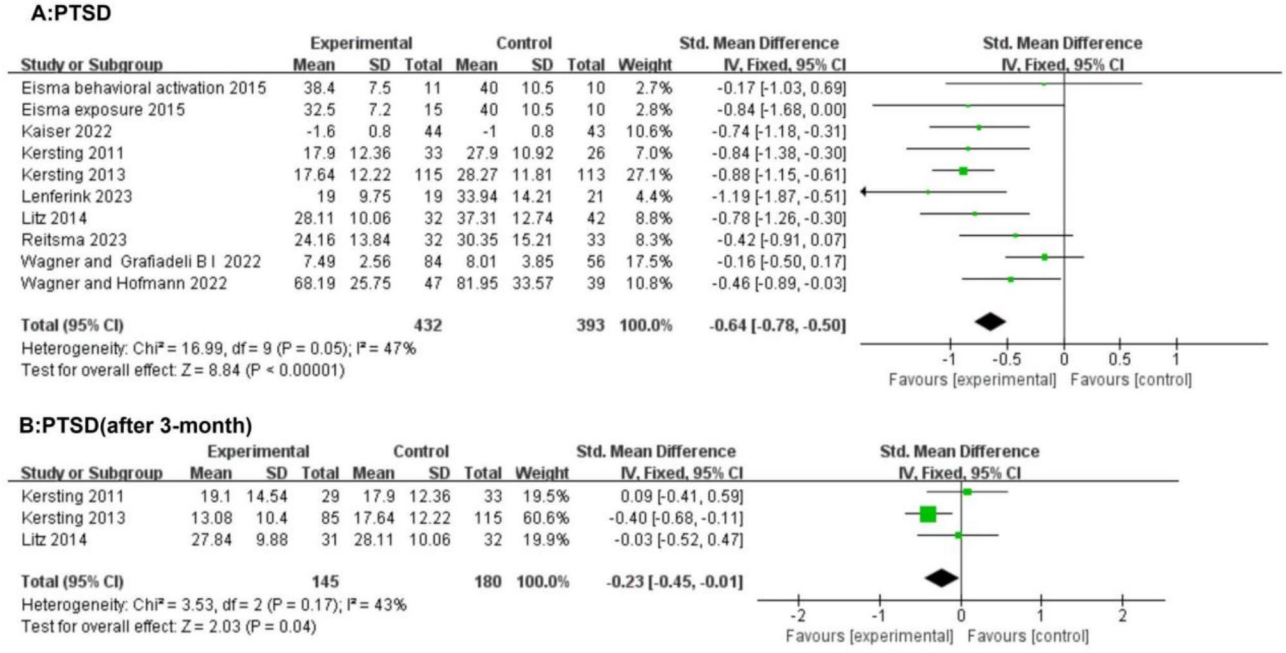

Fig. 4 Forest plot comparing change in post-traumatic stress disorder (PTSD)

The positive effects of web-based grief intervention on anxiety, depression, grief and PTSD may be related to the integration of cognitive behavioral therapy (CBT).We found that several studies we included combined CBT with web-based platforms to address grief in bereaved individuals [13, 14, 17, 18, 20–22, 24–26, 29]. CBT posits that emotions and behaviors are driven by an individual's perceptions [36]. Previous studies have shown promising results for CBT in addressing PTSD and emotional distress [37–39]. Through structured web-based lessons, interactive modules, or self-help tools on an online platform, combined with cognitive restructuring and emotion regulation techniques, CBT can help participants identify and challenge negative thought patterns, such as self-blame and excessive worry, that often exacerbate grief [40, 41]. Participants can access the web-based platform anytime and anywhere, and the program can be tailored to their individual progress, allowing for personalized interventions.

Web-based grief intervention provides convenient, personalized and anonymous psychological support, offering important practical value for psychological development and policy making. First, web-based interventions offer innovative approaches to address grief. Psychologists can use these web-based platforms for clinical research to explore the effectiveness of different interventions, such as cognitive behavioral therapy, mindfulness therapy, and more, enabling extensive data collection beyond the limitations of traditional face-to-face interventions [42, 43]. Second, web-based grief interventions can inform policy development by providing policymakers with essential information about mental health, bereavement support, and medical care, improving access to mental health services, particularly for bereaved individuals in remote areas with limited mental health resources [44, 45].

Our study has some limitations. First, the studies included in this review may be heterogeneous due to variability in age, gender ratio, course of treatment, and outcome measures. Women, people with higher educational attainment, and those with higher socioeconomic status were more likely to participate in the studies. This may be due to the higher proportion of women affected by bereavement, as well as the requirement for participants to have some computer literacy, English comprehension, and Internet access [46]. Second, some studies had smaller sample sizes and higher dropout rates, which may be related to lack of Internet access or platform accessibility among participants and overly cumbersome treatment modules [25]. Third, the overall methodological quality of the included studies was relatively low. Some studies only measured outcomes via self-report, did not make clinical diagnoses, and did not clarify whether participants received additional help besides web-based grief interventions, which could affect the objectivity of outcome measures and reduce the credibility of the results. Lastly, although this review was as comprehensive as possible, there may still be some important studies that were not included due to the unavailability after contacting the authors.

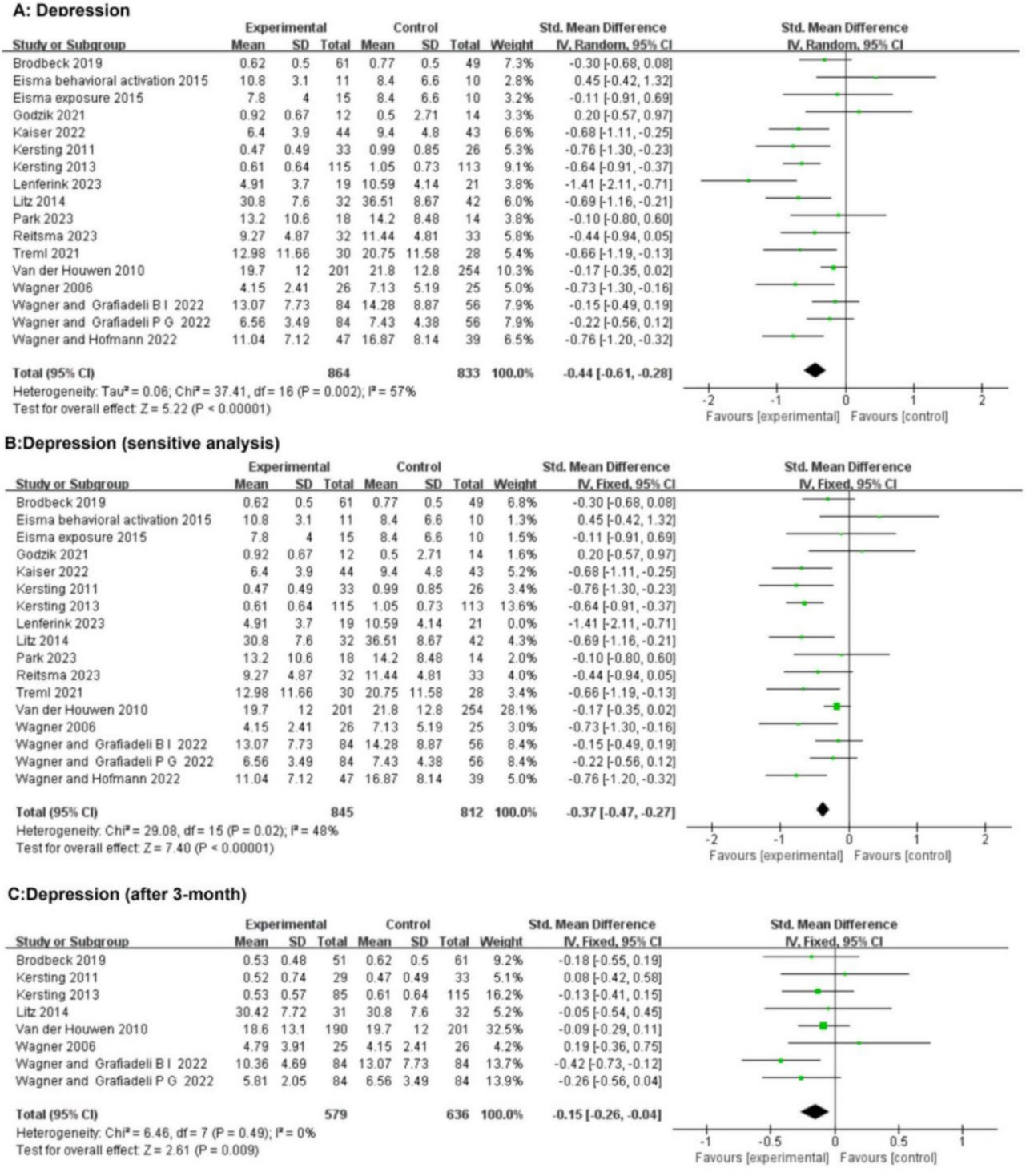

Fig. 5 Forest plot comparing change in depression

Conclusion

In conclusion, our review indicates that web-based grief interventions can effectively alleviate grief, depression, anxiety, and PTSD in bereaved individuals shortly after the intervention. Three months after the intervention, web-based grief interventions remain effective for grief, PTSD and depression, but not for anxiety. For future research, we recommend conducting long-term follow-up studies to access the lasting effects of web-based interventions and to explore how individual differences, such as gender, age and cultural background - might influence their effectiveness. Additionally, future studies could

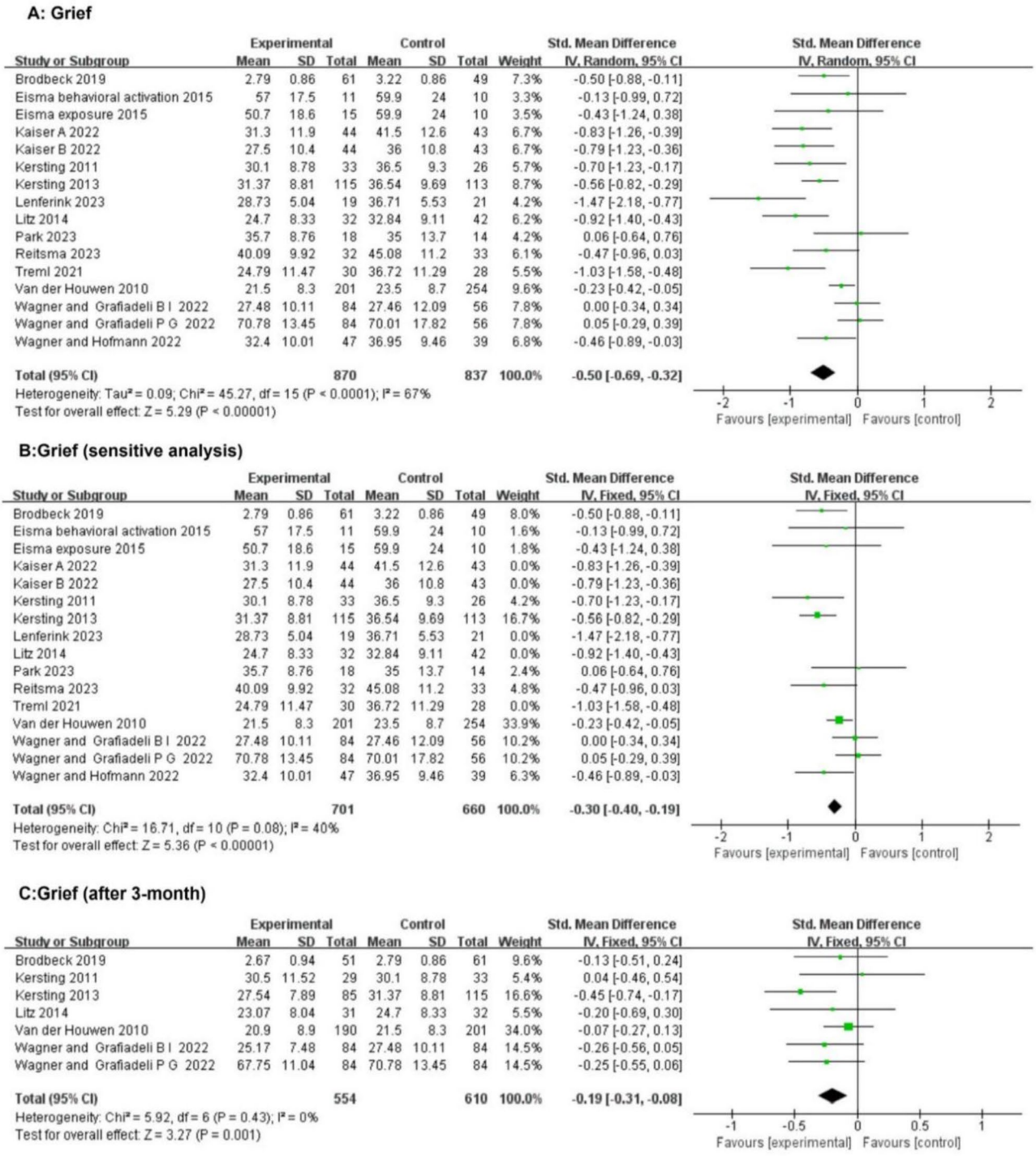

Fig. 6 Forest plot comparing change in grief

compare different types of web-based interventions, such as self-directed programs versus therapist-led platforms, to identify which approaches are most effective for different needs. Finally, the cost-effectiveness and feasibility of web-based grief interventions should also be evaluated.

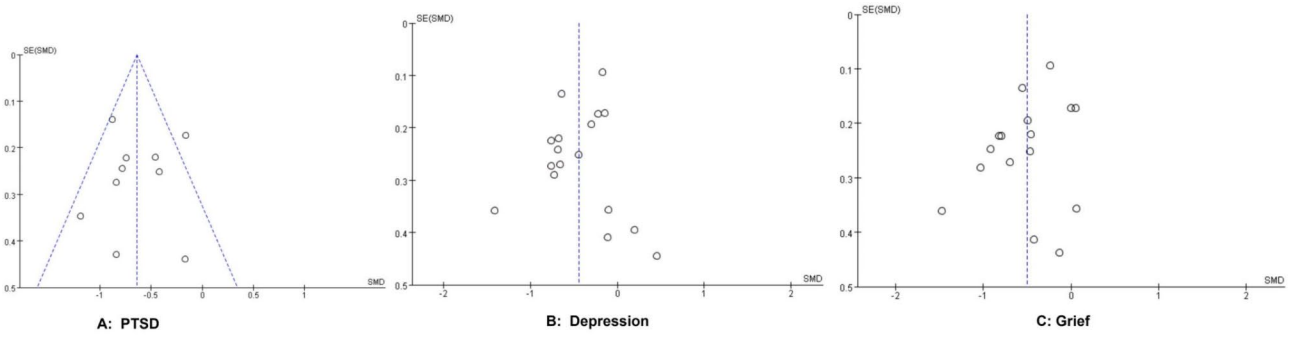

Fig. 7 Assessment of publication bias-funnel plot based on meta-analysis

Abbreviations

PTSD	Posttraumatic stress disorder
RCT	Randomized controlled trial
SMD	Std mean difference
CBT	Cognitive behavioral theory

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Author contributions

DanYang Yao and Fang Qian performed literature search and screening, data extraction, data visualization, and writing manuscripts. Tao-Hsin Tung guides the methodology, supervises, validates and reviews the entire study. Huanhuan Shi provides methodological guidance, supervises, validates and reviews and edits manuscripts during the research process. Dongjun Bi provides research concepts, supervises, validates, reviews and edits throughout the research process. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

The authors declare no competing interests.

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Consent to participate

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