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REVIEW ARTICLE

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A systematic review and meta-analysis on the efficacy of dialectical behavior therapy variants for the treatment of post-traumatic stress disorder

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ABSTRACT

Background: While there are well-established treatments for post-traumatic stress disorder (PTSD), these interventions appear to be less effective for individuals with comorbid borderline personality disorder (BPD) symptoms. Dialectical Behavior Therapy (DBT) for PTSD and DBT Prolonged Exposure (PE) are both effective interventions for treating these patients, but a comprehensive analysis evaluating the efficacy of these two interventions is lacking.
Objective: To determine the effect sizes of PTSD-specific DBT treatments.
Methods: We conducted a systematic review and pre-registered meta-analysis of the DBT literature for treating PTSD (osf.io/62rfq). Eligible trials and treatment evaluations published before September 2023 were searched in SCOPUS, PubMed, and the Cochrane Library databases. Thirteen articles were identified, and data were extracted for primary (PTSD symptoms) and secondary outcomes (BPD, depression, dissociation, non-suicidal self-injury [NSSI]). Treatment effects were calculated for randomised controlled trials, controlled clinical trials, and pre-post evaluations.
Results: Overall, the studies involved 663 participants. Compared with control groups, PTSD-specific DBT treatments showed moderate effects in reducing PTSD symptom severity $g = -0.69$ (95% CI −1.03 to −0.34, $p < .001$) and depression $g = -0.62$ (95% CI −1.13 to −0.12, $p = .016$). Moreover, the pre-post changes showed an overall effect size for dissociative symptoms of $g = -0.72$ (95% CI −1.05 to −0.40, $p < .001$), for BPD-associated symptoms of $g = -0.82$ (95% CI −1.06 to −0.59, $p < .001$), and for NSSI frequency ($g = -0.70$, 95% CI −1.12 to −0.28, $p = .001$).
Conclusions: Based on the results of our meta-analysis, DBT-PTSD and DBT PE were effective in reducing PTSD symptom severity and comorbid depressive symptoms. Further research on stage-based treatments should focus on systematically assessing NSSI, BPD symptoms, and suicidality.

Una revisión sistemática y metaanálisis sobre la eficacia de las variantes de la terapia dialéctica conductual para el tratamiento del trastorno de estrés postraumático

Antecedentes: Aunque existen tratamientos bien establecidos para el trastorno de estrés postraumático (TEPT), estas intervenciones parecen ser menos efectivas para individuos con síntomas comórbidos de trastorno límite de la personalidad (TLP). La terapia dialéctica conductual (DBT por sus siglas en ingles) para el TEPT y la DBT con exposición prolongada (EP) son intervenciones efectivas para tratar a estos pacientes, pero falta un análisis exhaustivo que evalúe la eficacia de estas dos intervenciones.
Objetivo: Determinar el tamaño del efecto de los tratamientos de DBT específicos para el TEPT.
Método: Realizamos una revisión sistemática y metaanálisis pre-registrado de la literatura sobre DBT para el tratamiento del TEPT (osf.io/62rfq). Los ensayos y evaluaciones de tratamiento elegibles publicados antes de septiembre de 2023 se buscaron en las bases de datos SCOPUS, PubMed y Cochrane Library. Se identificaron trece artículos y se extrajeron datos para los resultados primarios (síntomas de TEPT) y secundarios (TLP, depresión, disociación, autolesiones no suicidas [NSSI, por sus siglas en inglés]). Los efectos del tratamiento se calcularon para ensayos controlados aleatorizados, ensayos clínicos controlados y evaluaciones pre-post.

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Post-traumatic stress disorder; dialectical behavior therapy; prolonged exposure; DBT-PTSD; DBT PE; borderline personality disorder; depression; meta-analysis

PALABRAS CLAVE
Trastorno de estrés postraumático; terapia dialéctica conductual; exposición prolongada; DBT-TEPT; trastorno límite de la personalidad; depresión; metaanálisis; DBT-EP

HIGHLIGHTS

- We conducted the first meta-analysis assessing the efficacy of Dialectical Behavior Therapy for PTSD (DBT-PTSD) and Dialectical Behavior Therapy Prolonged Exposure (DBT PE) for individuals with comorbid PTSD and BPD symptoms.
- Based on RCTs/CCTs, we found moderately beneficial effects on PTSD symptoms, and depression for both stage-based interventions and large effects on non-suicidal self-injury frequency for DBT PE.
- DBT-PTSD and DBT PE resulted in pre-post improvements in dissociative symptoms, BPD-associated symptoms, and non-suicidal self-injury frequency.

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Resultados: En general, los estudios incluyeron a 663 participantes. En comparación con los grupos de control, los tratamientos de DBT específicos para el TEPT mostraron efectos moderados en la reducción de la gravedad de los síntomas del TEPT, con un $g = -0{,}69$ (IC 95% −1,03 a −0,34, $p < 0{,}001$) y de la depresión, con un $g = -0{,}62$ (IC 95% −1,13 a −0,12, $p = 0{,}016$). Además, los cambios pre-post mostraron un tamaño del efecto general para los síntomas disociativos de $g = -0{,}72$ (IC 95% −1,05 a −0,40, $p < 0{,}001$), para los síntomas asociados al TLP un $g = -0{,}82$ (IC 95% −1,06 a −0,59, $p < 0{,}001$), y para la frecuencia de NSSI ($g = -0{,}70$, IC 95% −1,12 a −0,28, $p = 0{,}001$).
Conclusión: Según los resultados de nuestro metaanálisis, la DBT-TEPT y la DBT EP fueron efectivas para reducir la gravedad de los síntomas de TEPT y los síntomas depresivos comórbidos. Futuras investigaciones sobre tratamientos basados en etapas deberían centrarse en evaluar de forma sistemática la NSSI, los síntomas del TLP y la suicidalidad.

1. Introduction

Post-traumatic stress disorder (PTSD), resulting from direct experiencing, witnessing, or repeated exposure to distressing details of a potentially traumatic event like combat, sexual assault, or serious injury, is a severe and debilitating mental condition with a lifetime prevalence of 3.9% across different nations (Koenen et al., 2017; Martin et al., 2021). Symptoms comprise re-experiencing, avoidance, hyperarousal, alterations in mood and cognition, and in some cases symptoms of dissociation, including depersonalisation and derealization (World Health Organization (WHO), 2021; American Psychiatric Association, 2013). In the absence of successful interventions, PTSD frequently transitions into a chronic condition, marked by notable psychiatric comorbidities and symptoms (Atwoli et al., 2015; Cusack et al., 2016), such as borderline personality disorder (BPD) (Pagura et al., 2010), non-suicidal self-injury (NSSI) (Ford & Gómez, 2015) and major depression (Karatzias et al., 2019; Rytwinski et al., 2013). BPD in particular is a common comorbidity with 30–79% of patients with BPD meeting the criteria for both disorders and 22–24% of patients with PTSD meeting BPD criteria (Frías & Palma, 2015; Pagura et al., 2010). A shared risk factor for both disorders is interpersonal trauma, although individuals with comorbid PTSD and BPD have been found to be exposed to more interpersonal trauma in their lifetime than individuals with PTSD or BPD alone (Jowett, Karatzias, and Albert, 2020). The comorbidity of PTSD and BPD presents a severe clinical condition, which is associated with diminished quality of life, increased likelihood of depression, and lifetime suicide attempts (Barnicot & Priebe, 2013; Jowett, Karatzias, & Albert, 2020; Pagura et al., 2010; Zeifman et al., 2021). Among evidence-based psychological treatments for PTSD, trauma-focused interventions, aiming at processing traumatic memories and rooted in exposure principles, are considered first-line treatments and more efficacious in reducing PTSD symptoms compared to non-trauma-focused interventions (Bennett et al., 2016; Ehring et al., 2014; Lewis et al., 2020). However, none of these treatments specifically target the symptoms of comorbid BPD (Harned et al., 2014) which include intense unstable interpersonal relationships, an insecure sense of self, intense and volatile emotions, as well as self-harm (Copeland et al., 2014; Gunderson et al., 2018). Moreover, since acute suicidality and insecure life situations are contradictions for trauma-focused treatment, a significant number of patients with BPD are not recommended this treatment due to the expected risk of symptom exacerbation regarding suicidality and NSSI (Frías & Palma, 2015; Harned 2014). Conversely, an effective treatment for BPD is dialectical behaviour therapy (DBT) (Barnicot & Crawford, 2019; Linehan, 1993) which also effectively reduces self-harm (DeCou et al., 2019; Kothgassner et al., 2021) and externalising symptoms (Jakubovic & Drabick, 2023; Prillinger et al., 2023). However, individuals with PTSD and BPD tend to show a reduced response to DBT and less reduction in self-harm (Barnicot & Priebe, 2013).

Regarding this difficult-to-treat clinical presentation of PTSD and comorbid BPD symptoms, the emerging consensus in the field recommends integrated treatments with different systematically ordered symptom-focused phases as the optimal approach, enabling concurrent targeting of multiple problems in the same treatment (Bohus et al., 2019; Harned et al., 2021; Livesley, 2012; Rozek et al., 2022; Zeifman et al., 2021). In line with these recommendations are two interventions based on DBT, namely DBT for PTSD (DBT-PTSD) (Steil et al., 2011) and DBT Prolonged Exposure (DBT PE) (Harned, 2022) which represent the empirically most supported modular staged-based interventions for PTSD and comorbid BPD symptoms. They explicitly allow the inclusion of patients exhibiting self-injuring behaviour (Bohus et al., 2011, 2020; Harned et al., 2012, 2021). When specific predetermined criteria are met throughout the treatments, such as the effective regulation of stressful emotions and gaining sufficient control over higher-priority behaviours like suicidality, trauma-focused treatment elements are implemented (Zeifman et al., 2021). Research on

these stage-based treatments suggests their safety and efficacy for PTSD and some studies also show efficacy in reducing BPD pathology, potentially outperforming BPD-specific or trauma-focused approaches for comorbid PTSD and BPD symptoms (Zeifman et al., 2021).

DBT-PTSD (Bohus & Priebe, 2018; Steil et al., 2011) is a modification of DBT including methods from cognitive behavioural therapy, acceptance and commitment therapy, and compassion-focused therapy (Bohus et al., 2019). Originally developed as a specialised 12-week residential programme for individuals with childhood sexual abuse-related PTSD and emotion dysregulation (Bohus et al., 2019; Steil et al., 2011), DBT-PTSD has since been adapted for use in outpatient settings, with programmes extending up to 15 months (Bohus et al., 2020). In DBT-PTSD, skills learned during the programme are integrated into trauma exposure interventions to address symptoms common in BPD, like emotional over-engagement and dissociation to increase effectiveness, safety, and acceptance of exposure-based strategies. The exposure protocol enables patients to manage the intensity of memory activation using these learned skills, both during sessions and homework. DBT-PTSD objectives comprise (1) mitigating patients' fear of primary emotions associated with trauma, (2) examining secondary emotions such as guilt and shame, and (3) radically accepting trauma facts. While the termination of non-life-threatening self-harm is not obligatory before implementing trauma exposure techniques (Bohus et al., 2013), priority is given to addressing life-threatening or crisis-inducing behaviour whenever it arises, as well as to therapy-interfering behaviours.

The second intervention, DBT PE, was specifically developed for co-occurring chronic PTSD in BPD patients (Harned, 2022; Harned & Linehan, 2008). It combines a prolonged exposure (PE) protocol (Foa, 2011) with ongoing standard DBT and integrates methods tailored to the needs of individuals with BPD (Harned et al., 2012). DBT + DBT PE is typically implemented as outpatient treatment with a duration of over a year (Harned et al., 2012, 2014, 2021), but also administered in a shorter form with a duration of 12 weeks (Meyers et al., 2017). PE is a highly effective and evidence-based trauma treatment programme for PTSD (Foa, 2011; Foa et al., 2019) aiming to enhance the emotional processing of traumatic experiences by systematically and gradually confronting individuals in vivo and in sensu to trauma-associated stimuli (Foa, 2011; Harned et al., 2012). Strategies and techniques from DBT were integrated into PE with the following objectives: (1) enhance monitoring of potential adverse reactions to exposure, such as pre- and post-exposure ratings of suicidal urges, (2) address problems that may arise during or as a consequence of exposure using DBT skills and protocols, and (3) incorporating DBT therapist strategies tailored to meet the specific needs of patients with BPD. The PE protocol also outlines procedures for addressing higher-priority behaviours that may exacerbate during treatment, including a stipulation that the protocol should be paused, if intentional self-injury reoccurs (Harned et al., 2012).

In summary, evidence-based DBT interventions that incorporate trauma-specific exposure techniques, such as DBT-PTSD or DBT PE, appear promising in addressing the complex clinical conditions of individuals with comorbid PTSD and BPD. However, a comprehensive analysis assessing the efficacy of these two interventions is lacking. The current systematic review and meta-analysis aim to fill this gap. Considering the complexity of the clinical presentation in individuals with PTSD and BPD, we evaluate the efficacy of DBT modifications in reducing symptoms of PTSD (primary outcome), as well as BPD, dissociation, NSSI frequency, and depression (secondary outcomes) in randomised controlled trials (RCTs), controlled clinical trials (CCTs), and pre-post-evaluation studies.

2. Method

2.1. Search strategy

This meta-analysis was preregistered with the Open Science Framework (https://doi.org/10.17605/OSF.IO/62RFQ) and followed the PRISMA 2020 guidelines for systematic reviews and meta-analyses (Page et al., 2021) (see Supplement 1 for the PRISMA checklist). We searched SCOPUS, PubMed, and the Cochrane Library using the keywords: 'Dialectical Behavioral Therapy' OR 'DBT' AND 'Post-traumatic stress*' from the beginning of database records until September 2023. Studies were eligible to be included in the meta-analysis if they (1) were classified as RCTs, CCTs, or pre-post evaluations of DBT-PTSD or DBT PE protocols, (2) reported symptom severity scores for PTSD at baseline and post-treatment, and (3) included clinical samples. No limitations on participant age, publication status, or language were applied while searching for literature.

2.2. Data extraction and coding

Data from the included articles were entered into a spreadsheet independently by three authors (ODK, KP, and CHG), who discussed and resolved any differences after completing the coding process. Study characteristics for each study, including descriptions of the samples (e.g. sample size, age, gender, and dropouts for the DBT and control groups) were noted. We then aimed to extract treatment completer data for our primary outcome's (PTSD symptoms) means and

standard deviations and secondary outcomes (i.e. BPD symptoms and depressive symptoms, dissociative symptoms, and NSSI frequency) whenever they were assessed and reported. Data from one article (Harned et al., 2018) was extracted using plot digitiser software (PlotDigitizer: Version 3.1.5, 2024).

2.3. Data analysis

All analyses were conducted using the R package metafor (Viechtbauer, 2010). To evaluate the efficacy of DBT variants in reducing the primary outcome as well as secondary outcomes in contrast to control treatments, we calculated the standardised mean difference (Hedge's *g*) using post-intervention scores. These calculations were derived from the means and standard deviations of DBT and control groups. For our analysis of the pre-to-post effects, we again calculated Hedge's *g* for each intervention. This was done by comparing the means and standard deviations before and after DBT-specific interventions by using the formula $g = (M_{Post} - M_{Pre})/SD_{pooled}$, where M_{Post} represents the post-intervention mean score, M_{Pre} is the pre-intervention mean score, and SD_{pooled} is the pooled standard deviation of both time points. The SD_{pooled} was determined using the formula $SD_{pooled} = SQRT((SD_{Pre}^2 + SD_{Post}^2)/2)$ (Lakens, 2013). Additionally, we conducted subgroup analyses separately for DBT-PTSD and DBT PE studies.

We subsequently utilised random-effects models to synthesise aggregated effect sizes and following established benchmarks (Cohen, 1988), an effect size of 0.20 was classified as small, 0.50 as medium, and 0.80 as large. To quantify the variability in study results, we reported heterogeneity using I^2 values, interpreting 25% as low heterogeneity, 50% as moderate, and 75% as high heterogeneity (Higgins et al., 2003). All data and codes are stored in a repository of the Open Science Framework (doi:10.17605/OSF.IO/RX35A).

2.4. Risk of bias assessments

The risk of bias for each study was assessed using predefined criteria based on the Agency for Healthcare Research and Quality method guide (see Supplement 1; Viswanathan et al. [2018]). Each study was assessed regarding randomisation, selection and attrition bias, confounding bias, measurement bias, and statistical problems, and received a rating of low, moderate, or high risk of bias. A low risk of bias indicates that the study was judged to be valid, moderate risk indicates concerns that probably do not invalidate the study's results, and a high risk of bias indicates significant concerns that likely invalidate the study's results. Two investigators (SF and AM) independently assessed the studies, and differences were reviewed until a consensus was reached.

3. Results

The literature search initially identified 253 articles from databases and two articles from other sources. After removing duplicates, 224 articles were found. The title, abstract, and main text of each study were independently examined by two authors (ODK and CHG) (see supplement for details of reasons for exclusion). After the screening, 13 articles were identified and included in the present study, 11 original studies and 2 secondary analyses with unpublished data (see Figure 1).

3.1. Study characteristics

Overall and at enrolment, the 11 original studies included a total of $N = 663$, which comprised $N = 403$ participants with PTSD who received DBT-PTSD ($n = 327$) or DBT PE ($n = 76$) and $N = 260$ participants with PTSD in control conditions ($n = 28$ regular DBT, $n = 135$ treatment as usual [TAU], and $n = 97$ cognitive processing therapy). The completer rate was 71% in PTSD-specific DBT interventions; this resulted in a final sample size of $N = 287$ ($n = 241$ DBT-PTSD, $n = 46$ DBT PE). For control conditions, the completer rate was relatively similar (64%), and $N = 166$ was the final sample size for controls ($n = 19$ regular DBT, $n = 89$ TAU, $n = 58$ cognitive processing therapy). Five studies conducted control groups: in two studies the control group received regular DBT (Harned et al., 2014, 2021); in two studies the control group received TAU, which included 6 months of any treatment of their choice except for DBT-PTSD (Bohus et al., 2013) or a high variety of trauma-specific therapies depending on patient and type of trauma (Oppenauer et al., 2023), and in one study the control group received cognitive processing therapy (Bohus et al., 2020). Participants were diagnosed with PTSD after experiencing various forms of trauma, such as sexual abuse or physical abuse in childhood, partner violence, adult rape, witnessing family violence, the suicide of a parent, and veteran trauma. However, ten of the included studies encompassed samples who primarily experienced childhood trauma (sexual, physical, or both). One study (Meyers et al., 2017) investigated veteran trauma. Participants were required to have a diagnosis of PTSD based on DSM-IV or DSM-V criteria. A large proportion of the participants had experienced several traumas over a longer period. All studies were published in peer-reviewed journals in English or German, and involved participants between the ages of 12–60; whereas adolescents were included in two studies (Cornelisse et al., 2021; Harned et al., 2021).

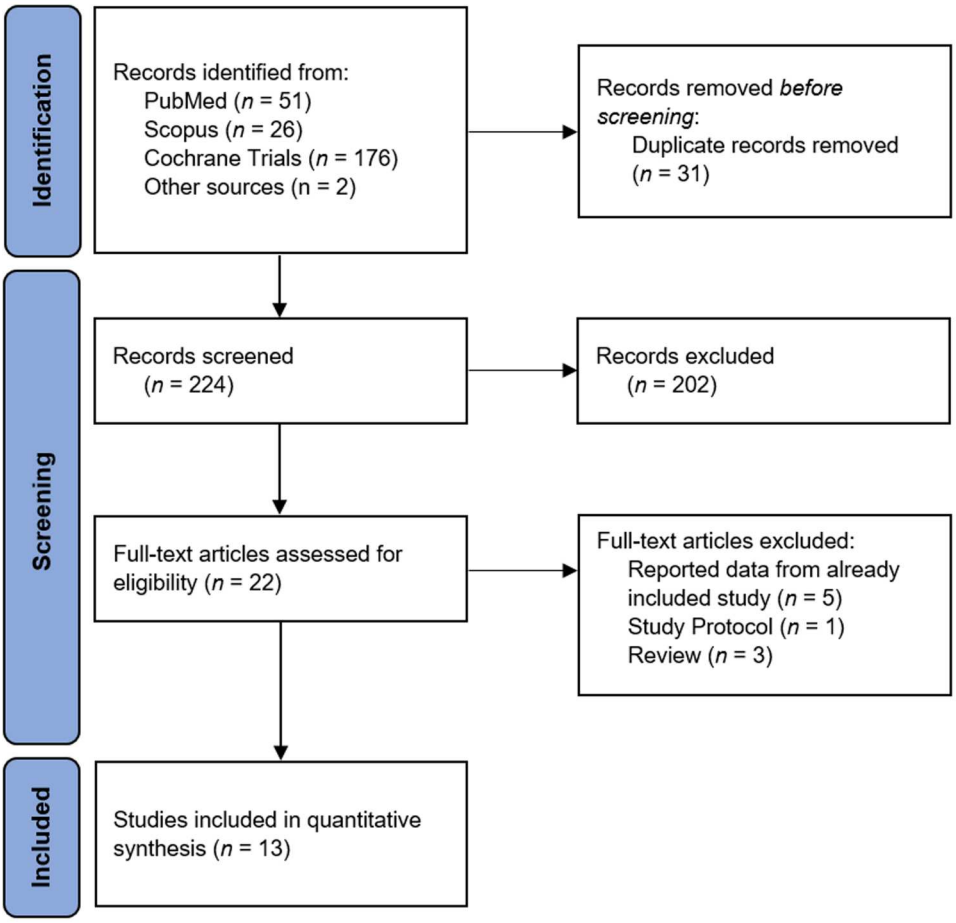

Figure 1. PRISMA flow diagram.

Five therapies were conducted in an outpatient setting (Cohen, 1988; Harned et al., 2012, 2014; Lakens, 2013; Viswanathan et al., 2018), four in an inpatient setting (Bohus et al., 2013; Görg et al., 2019; Oppenauer et al., 2023; Steil et al., 2011), one in a partial hospitalisation setting (Cornelisse et al., 2021), and one included outpatient and inpatient agencies (Harned et al., 2021). The studies using DBT-PTSD were conducted in Germany and Austria and the studies using DBT PE were conducted in the United States of America. See Table 1 for a summary of relevant study characteristics.

3.2. Efficacy of PTSD-specific DBT regarding PTSD symptom severity

Three RCTs (Bohus et al., 2013, 2020; Harned et al., 2014) and two CCTs (Harned et al., 2021; Oppenauer et al., 2023) were analysed to compare the efficacy of PTSD-specific DBT regarding PTSD symptom severity. The meta-analysis yielded an overall effect of $g = -0.69$ (95% CI −1.03 to −0.34, $p < .001$) in favour of both trauma-focused DBT treatments over control conditions (see Figure 2A for forest plot). For DBT-PTSD (Bohus et al., 2013, 2020; Oppenauer et al., 2023), the effect size was $g = -0.67$ (95% CI −1.13 to −0.22), whereas for DBT PE (Harned et al., 2014, 2021), the effect size was $g = -0.80$ (95% CI −1.48 to −0.12). Regarding within-subject changes, we also computed pre-post changes in PTSD-specific DBT treatments alone to have another indicator of the efficacy magnitude. This meta-analysis of pre-post comparisons revealed that PTSD symptom severity was reduced by $g = -1.30$ (95% CI −1.53 to −1.08, $p < .001$) in all PTSD-specific DBT treatments (see Figure 2B). In DBT-PTSD specifically, the pre-post reduction was $g = -1.23$ (95% CI −1.47 to −1.00), and in DBT PE, the decline was $g = -1.84$ (95% CI −2.51 to −1.17).

3.3. Efficacy of PTSD-specific DBT regarding borderline-personality disorder symptoms

Similarly, we analysed two RCTs (Bohus et al., 2013, 2020) and two CCTs (Harned et al., 2018; Oppenauer et al., 2023) to compare the efficacy of PTSD-specific DBT regarding BPD symptoms. Meta-analysis yielded an overall effect of $g = -0.61$ (95% CI −1.38 to 0.17, $p = .126$) favouring both trauma-focused DBT treatments over control conditions (see Figure 3A for forest plot). For DBT-PTSD (Bohus et al., 2013, 2020; Oppenauer et al., 2023), the effect size was $g = -0.32$ (95% CI −0.97 to 0.33), and for DBT-PE (Harned et al., 2018), the effect size was $g = -1.73$ (95% CI

Table 1. Summary of study characteristics of the 11 original studies and 2 publications containing secondary analyses.

Study	Intervention	Design	Index Trauma	Mean Age Index Trauma	Treatment Duration (months)	Control Group	Mean Age	% Female	*N* DBT		*N* Control		Assessments	Setting	Age range	Country
									Enrolled	Completed	Enrolled	Completed				
Bohus et al. (2013)	DBT-PTSD	RCT	Childhood sexual abuse	7.6	3	TAU	36	100	36	29	38	29	CAPS, BSL, BDI-II, DES	Inpatient	–	GER
Bohus et al. (2020)	DBT-PTSD	RCT	Childhood abuse	7.7	15	CPT	36.3	100	103	73	97	58	CAPS, BSL, BDI–II	Outpatient	–	GER
Cornelisse et al. (2021)	DBT-PTSD	Pre-Post	Childhood abuse	11.9	3	–	20.5	97.4	39	34	–	–	DTS, BSL, BDI-II	Partial hospitalisation	17–25	GER
Görg et al. (2019)	DBT-PTSD	Pre-Post	Childhood abuse	–	3	–	42.2	90.5	60	42	–	–	DTS	Inpatient	23–60	GER
Oppenauer et al. (2023)	DBT-PTSD	CCT	Childhood trauma	–	3	TAU	43	81.1	39	20	97	60	PCL, MSI-BPD, PHQ-9, DES	Inpatient	–	AUT
Steil et al. (2011)	DBT-PTSD	Pre-Post	Childhood sexual abuse	–	3	–	35.4	100	29	29	–	–	PDS, BDI-II	Inpatient	20–51	GER
Steil et al. (2018)	DBT-PTSD	Pre-Post	Childhood sexual abuse	11.9	6.6	–	34.1	100	21	14	–	–	CAPS, BSL, BDI-II, DES	Outpatient	19–50	GER
Krüger et al. (2014)[1]	DBT-PTSD	RCT	Childhood sexual abuse	7.5	3	–	35.8	100	36	34	–	–	SASII	Inpatient	17–65	GER
Harned et al. (2012)	DBT PE	Pre-Post	Primarily sexual abuse/physical abuse in childhood	5.2	12	–	39.4	100	10	7	–	–	PSS-I, HRSD, DES, SASII	Outpatient	18–60	USA
Harned et al. (2014)	DBT PE	RCT	Primarily sexual abuse/physical abuse in childhood	6.2	12	DBT (regular)	32.6	100	17	6	9	5	PSS-I, HRSD, DES, SASII	Outpatient	19–55	USA
Harned et al. (2021)	DBT PE	CCT	Primarily unwanted sexual contact	–	17.2	DBT (regular)	29.9	80	16	11	19	14	PSS-I, DES, SASII	Outpatient/ inpatient	12–56	USA
Meyers et al. (2017)	DBT PE	Pre-Post	Veteran trauma	–	3	–	43.2	48.5	33	22	–	–	PCL-C	Outpatient	23–58	USA
Harned et al. (2018)[2]	DBT PE		Primarily sexual abuse/physical abuse in childhood	–	12	DBT (regular)	35.0	100	30	18	8	8	BSL	Outpatient	19–57	USA

Note. BDI = Beck Depressive Inventory, BSL = Borderline Symptoms List, CAPS = Clinician-Administered PTSD Scale, CPT = Cognitive Processing Therapy, DES = Dissociative Experiences Scale, DTS = Davidson Trauma Scale, HRSD = Hamilton Rating Scale for Depression, MSI-BPD = MacLean Screening Instrument for BPD, PCL-C = PTSD Checklist-Civilian Version, PDS = Post-traumatic Diagnostic Scale, PHQ-9 = Patient Health Questionnaire-9, PSSI-I = PTSD Symptom Scale – Interview, SASII = Suicide Attempt Self-Injury Interview, [1]secondary analysis of NSSI data from Bohus et al., 2013; [2]secondary analysis of BPD data from Harned et al., 2012 and Harned et al., 2014.

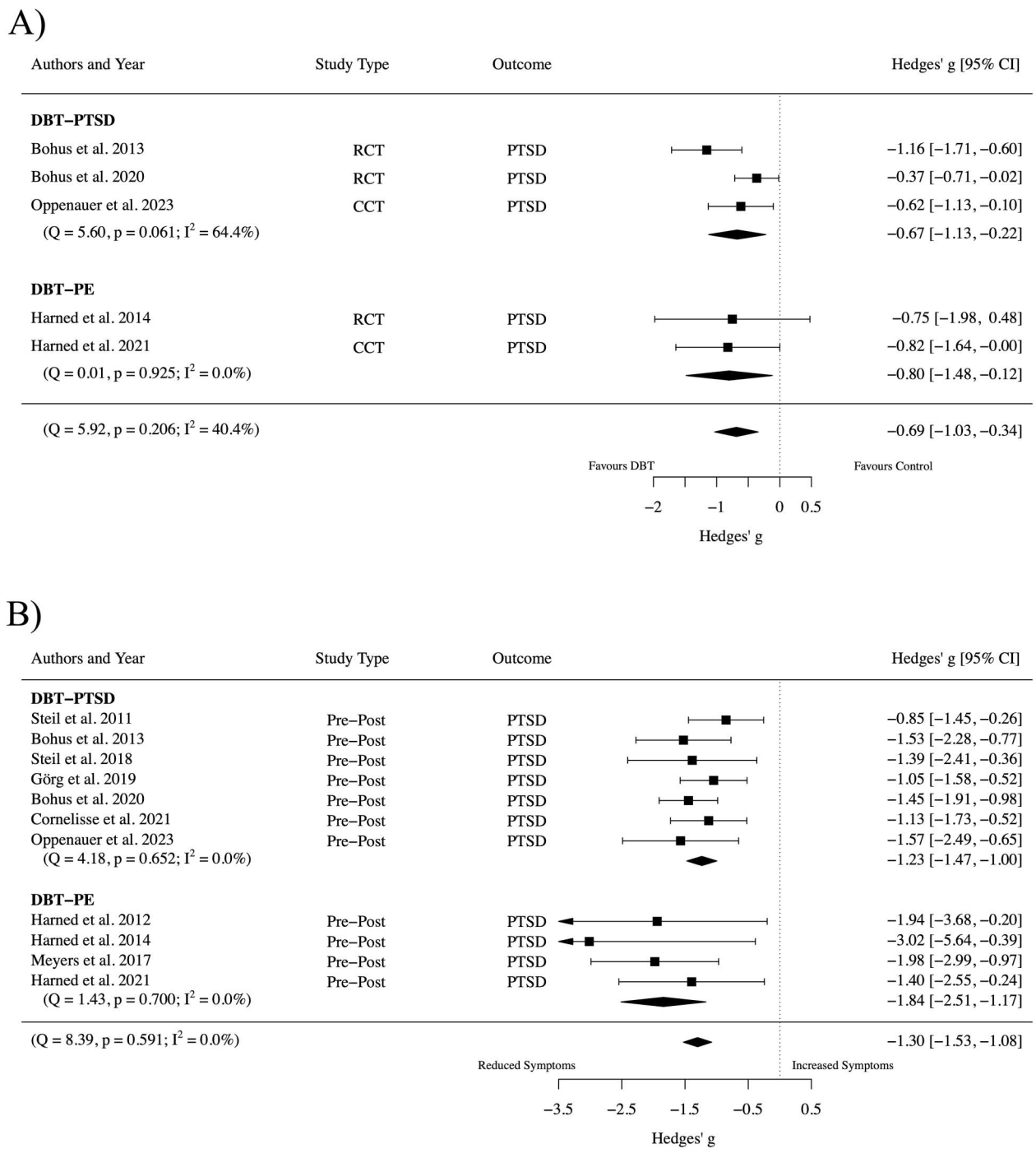

Figure 2. Forest plot of the standardised mean difference (Hedge's *g*) in post-treatment PTSD symptom severity of (A) PTSD-specific DBT treatments compared to control conditions, and (B) pre- to post-treatment effects of PTSD-specific DBT treatments. The average effect was calculated using a random-effects model.

−2.68 to −0.77). The overall effect was not significant; thus, trauma-focused DBT-treatments were not more effective in reducing BPD symptoms than control treatments. However, the meta-analysis of pre-post comparisons showed that BPD symptoms were significantly reduced by $g = -0.82$ (95% CI −1.06 to −0.58, $p < .001$) (see Figure 3B). In DBT-PTSD specifically, the pre-post reduction was $g = -0.82$ (95% CI −1.06 to −0.57), and in DBT PE, the reduction was $g = -0.89$ (95% CI −1.65 to −0.13). Please note that *N* for this analysis varied slightly because the secondary analysis publication providing BPD outcomes (Harned et al., 2018) employed different criteria for defining participants as completers compared to the original studies (Harned et al., 2012, 2014).

3.4. Efficacy of PTSD-specific DBT regarding depressive symptoms

Three RCTs (Bohus et al., 2013, 2020; Harned et al., 2014) and one CCT (Oppenauer et al., 2023) were analysed to compare the efficacy of PTSD-specific DBT compared to control conditions regarding depressive symptoms (see also Table 2). This meta-analysis

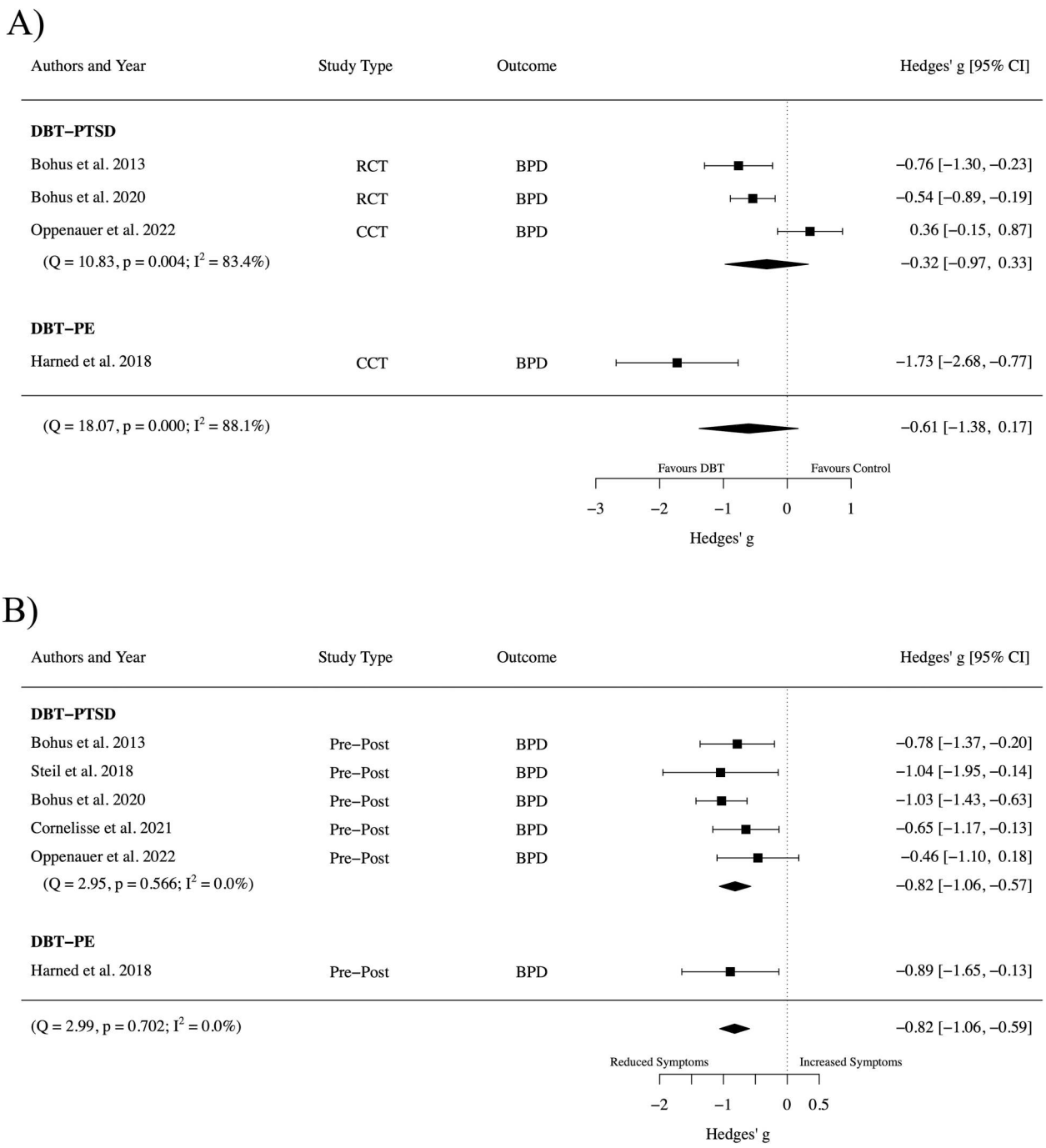

Figure 3. Forest plot of the standardised mean difference (Hedge's *g*) in post-treatment Borderline-Personality Disorder (BPD) symptoms of (A) DBT-PTSD treatments compared to control conditions, and (B) pre- to post-treatment treatment effects of DBT-PTSD. The average effect was calculated using a random-effects model.

yielded an overall effect of $g = -0.62$ (95% CI −1.13 to −0.12, $p = .016$) in favour of both DBT-specific treatments over control conditions. For DBT-PTSD (Bohus et al., 2013, 2020; Oppenauer et al., 2023), the effect size was $g = -0.57$ (95% CI −1.15 to 0.01), whereas for DBT PE (Harned et al., 2014), the effect size was $g = -1.03$ (95% CI −2.29 to 0.23). We again also computed pre-post changes in PTSD-specific DBT treatments for depressive symptoms. The meta-analysis of pre-post comparisons revealed that depressive symptoms were reduced by $g = -1.02$ (95% CI −1.25 to −0.78, $p < .001$) in all PTSD-specific DBT treatments. In DBT-PTSD the reduction pre-post treatment was $g = -1.00$ (95% CI −1.24 to −0.76), and in DBT PE the reduction was $g = -1.58$ (95% CI −3.02 to −0.13).

3.5. Efficacy of PTSD-specific DBT regarding dissociative symptoms

Two RCTs (Bohus et al., 2013; Harned et al., 2014) and two CCTs (Harned et al., 2021; Oppenauer et al., 2023) were scrutinised to assess the efficacy of PTSD-specific DBT about dissociative symptoms (refer to Table 2 for further details). This meta-analysis unveiled an insignificant overall effect size of $g = -0.17$ (95% CI

Table 2. Overall post-treatment effects on depressive symptoms, dissociative symptoms, and NSSI separated by treatments compared to control conditions (RCTs) and pre- to post-treatment effects.

Outcome	*k*	*n*	Hedge's *g*	95% CI	*p*
RCTs/CCTs at treatment completion					
Depressive Symptoms	**4**	**280**	**−0.62***	**−1.13 to −0.12**	**.016**
DBT-PTSD	3	269	−0.57	−1.15–0.01	.052
DBT PE	1	11	−1.03	−2.29–0.23	.101
Dissociative Symptoms	**4**	**174**	**−0.17**	**−0.49–0.15**	**.303**
DBT-PTSD	2	138	−0.10	−0.46–0.26	.577
DBT PE	2	36	−0.38	−1.05–0.28	.258
Non-Suicidal Self-Injury	–	–	–	–	–
DBT-PTSD	–	–	–	–	–
DBT PE	2	36	−0.91*	−1.60 **to** −0.22	.010
Pre-post reduction at treatment completion					
Depressive Symptoms	**8**	**212**	**−1.02***	**−1.25 to −0.78**	**<.001**
DBT-PTSD	6	199	−1.00*	−1.24 **to** −0.76	<.001
DBT PE	2	13	−1.58*	−3.03 **to** −0.13	.033
Dissociative Symptoms	**6**	**87**	**−0.72***	**−1.05 to −0.39**	**<.001**
DBT-PTSD	3	63	−0.62*	−1.00 **to** −0.25	.001
DBT PE	3	24	−1.05*	−1.73 **to** −0.37	.003
Non-Suicidal Self-Injury	**4**	**53**	**−0.70***	**−1.12 to −0.28**	**.001**
DBT-PTSD	1	29	−0.57*	−1.12 **to** −0.02	.041
DBT PE	3	24	−0.89*	−1.55 **to** −0.23	.008

Hedge's *g* indicates change from pre- to post-intervention such that a negative effect size indicates a reduction in that outcome following the intervention. * indicates statistically significant effect sizes ($p < .05$).

−0.49 to 0.15, $p = .303$). When focusing on DBT-PTSD (Bohus et al., 2013; Oppenauer et al., 2023), the effect size amounted to $g = -0.10$ (95% CI −0.46 to 0.26), while DBT PE (Harned et al., 2014; Harned et al., 2021) exhibited an effect size of $g = -0.38$ (95% CI −1.05 to 0.28). Thus, both DBT variants were not more effective in reducing dissociative symptoms than control treatments. The meta-analysis of pre-post comparisons, in contrast, showed a significant reduction in dissociative symptoms with an effect size of $g = -0.72$ (95% CI −1.05 to −0.39, $p < .001$) across all PTSD-specific DBT treatments. For DBT-PTSD the pre–post reduction effect size was $g = -0.62$ (95% CI −1.00 to −0.25), while for DBT PE the reduction yielded an effect size of $g = -1.05$ (95% CI −1.73 to −0.37).

3.6. Efficacy of PTSD-specific DBT regarding NSSI frequency

One RCT (Harned et al., 2014) and one CCT (Harned et al., 2021) were analysed to assess the efficacy of PTSD-specific DBT in relation to NSSI frequency (see Table 2 for details). These studies showed an overall effect size of $g = -0.91$ (95% CI −1.60 to −0.22, $p = .010$), which suggests that DBT PE might significantly reduce NSSI frequency when compared to control conditions, considering the limitation of the available data. The meta-analysis of pre–post comparisons revealed a reduction in NSSI frequency with an effect size $g = -0.70$ (95% CI −1.12 to −0.28, $p = .0018$). Three studies included in this pre–post comparison were DBT PE treatments specifically (Harned et al., 2012, 2014, 2021), which showed a pre–post effect of $g = -0.89$ (95% CI −1.55 to −0.23), while one DBT-PTSD intervention (Krüger et al., 2014) had an effect of $g = -0.57$ (95% CI −1.12 to −0.02).

3.7. Risk of bias

The risk of bias assessment revealed that ten of the eleven included studies (91%) were classified as having a moderate overall risk of bias, while the remaining study (9%) was rated as high (see Table S3). Among the three RCTs included in the analysis, randomisation bias was noted to be moderate in two studies (67%) and low in one study (33%). Selection bias was identified as high in two studies (18%), moderate in seven studies (64%), and low in two studies (18%). Confounding bias was generally low across the studies, with one study (9%) rated as high, three studies (27%) as moderate, and seven studies (64%) as low. Measurement bias was found to be low, with two studies (18%) rated as moderate and nine (82%) rated as low, due to the common use of standardised measurement instruments. However, statistical problems were more prevalent, as some of the included studies were underpowered. Two studies (18%) were rated as having a high risk of bias and eight (73%) as moderate, leaving only one study (9%) rated as low in this regard.

4. Discussion

Given the existing research gap regarding a comprehensive analysis of the efficacy of trauma-specific DBT interventions in reducing PTSD symptoms and comorbid psychopathology in patients with PTSD and BPD, we conducted a systematic review and meta-analysis to guide evidence-based clinical decision-making. Our meta-analysis, which includes 13 studies involving 663 participants, provides evidence supporting the efficacy of both interventions, DBT-PTSD and DBT PE, in reducing PTSD severity and depression with moderate effects compared to control interventions. While the efficacy of the two trauma-specific DBT treatments showed no significant difference, we report large within-group reductions in PTSD symptoms across DBT variants, with Hedge's *g* averaging −1.30. However, when compared to control conditions, the effect size is smaller ($g = -0.69$). This effect size is also smaller compared to results from meta-analyses on trauma-focused treatments, which report standardised mean differences of −1.46 for trauma-focused CBT, −1.22 for non-trauma-focused

CBT, and −1.19 for interpersonal psychotherapy, all compared to a waitlist control group (Mavranezouli et al., 2020) and −1.22 for CBT without a trauma focus versus supportive counselling (Lewis et al., 2020). The observed smaller effect size could be attributed to the comparison with guideline-recommended treatments, which are effective and thus set a higher bar for demonstrating additional benefits. This discrepancy might also be attributed to the high levels of impairment and problematic clinical features associated with co-occurring PTSD and BPD symptoms of the included samples, which render the treatment more complex (Cackowski et al., 2016; Harned et al., 2010; Krause-Utz, 2021; Marshall-Berenz et al., 2011). Moreover, individuals with comorbid PTSD and BPD are more likely to report a history of childhood abuse, neglect, and extensive poly-victimization, compared to those with a PTSD diagnosis, which additionally influences treatment approaches and outcomes (Ford & Courtois, 2021; Frost et al., 2020).

Our findings highlight the potential of PTSD-specific DBT to simultaneously improve PTSD and depressive symptoms. This is in line with existing meta-analyses which found that evidence-based PTSD treatments and DBT interventions for adolescents are effective in alleviating comorbid depression (Cook & Gorraiz, 2016; Ronconi et al., 2015). Future research should examine the interplay among depression, PTSD, and BPD symptoms in influencing treatment outcomes to inform tailored therapeutic approaches.

Further, our results showed that trauma-specific DBT reduced BPD symptoms with a large effect size ($g = -0.82$), however, it was not more effective than control treatments. This aligns with a recent meta-analysis evaluating psychotherapeutic PTSD treatments for patients with personality disorders (Slotema et al., 2020), which reported no significant change in BPD symptoms when compared to control conditions. However, when including nonrandomized-controlled and uncontrolled studies, significant improvements for all outcomes (including depression, anxiety, borderline symptoms, and PTSD) were found. Notably, studies with patients having diverse personality disorders reported higher PTSD symptom reduction than those focusing solely on BPD (Slotema et al., 2020). Our results differ from the moderate effect size obtained in a meta-analysis comparing DBT to control conditions in reducing BPD symptoms (Oud et al., 2018). One explanation could be the complex symptomatology of the included samples, comprising individuals with both BPD and PTSD, which show a tendency for more severe BPD symptoms throughout treatment than patients without comorbid PTSD (Barnicot & Priebe, 2013). Additionally, some studies included participants without a formal BPD diagnosis (Bohus et al., 2020; Görg et al., 2019; Steil et al., 2011). Our meta-analysis could also include patients with complex PTSD, who share some BPD symptoms but exhibit treatment-relevant differences that could contribute to limited improvement in BPD symptoms (Cloitre, 2020; Ford & Courtois, 2021; Jowett, Karatzias, Shevlin, et al., 2020). This variability in patient profiles could significantly impact treatment outcomes and the interpretation of results. Further, emotional numbing, commonly observed in individuals with PTSD, can potentially present added difficulties for patients with comorbid PTSD and BPD in terms of recognising emotional distress and effectively employing DBT skills which are integral components of DBT and crucial for the improvement of BPD symptoms (Barnicot & Priebe, 2013).

Similarly, our examination of dissociative symptoms, in contrast to control conditions, yielded non-significant effects whereas in pre-post comparisons PTSD-specific DBT treatments revealed moderate to high effect sizes. This constitutes a notable finding considering discourse positing that individuals with dissociation may derive the most benefit from stage-based treatments (Cloitre et al., 2012; Steele et al., 2005). While no direct comparison of the two PTSD-specific DBT interventions exists, DBT-PTSD has been compared with guideline-recommended PTSD interventions, specifically cognitive processing therapy (Bohus et al., 2020) and various trauma-specific therapies (Oppenauer et al., 2023), whereas DBT PE has been compared with DBT (Harned et al., 2014, 2021), the first-line treatment for BPD. Both interventions showed efficacy over their comparators, highlighting the stage-based treatments' superiority. The lack of significant differences in outcomes related to BPD and dissociation symptoms when comparing PTSD-specific DBT variants to controls could be attributed to the efficacy of the comparison treatments. Given that DBT-PTSD and DBT PE include either standard or a modification of DBT, an improvement in BPD-related symptoms is expected (Bagley, 2022; Dimeff & Linehan, 2001). Similarly, reductions in dissociation symptoms have been documented with both standard DBT and various PTSD interventions (Atchley & Bedford, 2021; Bohus et al., 2000), providing a possible explanation for the non-significant differences observed with PTSD-specific DBT variants.

Regarding NSSI frequency, two DBT PE studies found a significant and large reduction ($g = -0.91$) when compared to the control group. This indicates the intervention's efficacy in diminishing NSSI symptoms and underscores its safety for patients with PTSD and comorbid BPD symptoms. Our observed effect size for reducing NSSI was notably higher than that reported in a meta-analysis ($g = 0.32$) (Cristea et al., 2017), which compared psychotherapies and control conditions for adults with BPD, and superior to a

study on EMDR in patients with BPD, which reported no changes in NSSI outcomes (Slotema et al., 2019). For DBT-PTSD, a medium pre-post reduction in NSSI frequency was found. It needs to be mentioned that the studies analysed in the current meta-analysis used different inclusion criteria regarding self-harm and suicidality. Some focused solely on patients with recent or imminent suicidal behaviour or severe NSSI (Harned et al., 2012, 2014), but required specific criteria for starting the DBT PE part, such as no imminent risk of suicide or ability to control self-injurious behaviour urges when confronted with cues (Harned et al., 2012, 2014, 2021). Further, certain studies included individuals with ongoing self-harm or other high-risk behaviours but excluded those with life-threatening behaviour in the preceding months (Bohus et al., 2013, 2020; Oppenauer et al., 2023; Steil et al., 2018). These differences limit the comparability of the results and might make treatments less accessible for some severely ill individuals with PTSD and BPD symptoms.

Apart from the included interventions, other treatments such as brief intensive trauma-focused treatment programmes including EMDR and PE therapy showed feasibility and safety for PTSD patients with BPD symptoms (De Jongh et al., 2020; Van Woudenberg et al., 2018). An eight-day intervention without any form of stabilisation before the trauma-focused elements showed a decrease in PTSD and BPD symptoms in individuals with PTSD and BPD alongside low dropout rates (De Jongh et al., 2020). However, a comparative study in patients with complex PTSD involving a stage-based treatment that combined skills training with narrative therapy did not demonstrate superiority over non-stage-based interventions such as PE and skills training alone (Sele et al., 2023). Similar findings were observed in patients with PTSD related to childhood abuse when comparing a stage-based treatment including skills training and PE to PE and intensified PE (Oprel et al., 2021). These results underscore the necessity for future research to investigate which patient populations might benefit most from stage-based versus non-stage-based therapeutic approaches, enhancing our understanding of personalised treatment efficacy.

Our meta-analysis of PTSD-specific DBT treatments revealed heterogeneous dropout rates between 12.8% (Cornelisse et al., 2021) at a part-stationary adolescent treatment centre and 48.7% (Oppenauer et al., 2023) in a clinical setting at a residential mental health centre, whereas one study (Steil et al., 2011) at a PTSD residential treatment unit reported no dropouts. Overall, the studies have comparable dropout rates for DBT-PTSD (0–48.7%) and DBT PE (23.1–41.2%) with some studies specifically reporting no dropouts during the exposure intervention (Harned et al., 2012; Meyers et al., 2017; Steil et al., 2018). However, on average, DBT-PTSD treatments were shorter and had a lower dropout rate.

Upcoming studies on these stage-based treatments should investigate the effects of self-harm, suicidality, and BPD symptom severity on treatment outcomes as well as self-harm urges after trauma exposure sessions. This is of particular interest as this patient group frequently faces challenges in accessing PTSD treatment due to self-harming behaviour and suicidality (Frías & Palma, 2015; Harned 2014). An additional restraint is that the number of individuals with BPD included in the study samples varies. While some studies required a formal diagnosis of BPD as an inclusion criterion, for example (Harned et al., 2012, 2014), other studies included patients who met varying numbers of BPD criteria, for example (Oppenauer et al., 2023; Steil et al., 2018).

Further limitations comprise the uneven number of included studies and patients that have either examined the efficacy of DBT-PTSD or DBT PE as well as the diverse designs of these studies, which may affect the reliability of comparative analyses. It is also important to note that effect sizes derived from pre-post outcomes could be inflated.

Furthermore, research groups responsible for developing the interventions have undertaken the majority of studies incorporated in this meta-analysis and the sample sizes of the included studies range from 13 to 98 individuals with some trials only including female participants. The resource-intensive implementation of DBT-PTSD and DBT PE regarding the required training of clinicians in DBT and trauma-focused techniques constitutes a further limitation of these approaches. In addition, we did not conduct a meta-regression analysis to examine potential confounders, and non-specific variables may have had a significant impact on the results. Due to the small number of available studies, it was not possible to examine the impact of potential moderators and there was evidence of a moderate risk of bias. These factors warrant careful interpretation of the results and highlight the need for future research with larger and more balanced sample sizes to validate these findings.

Despite these limitations, the present meta-analysis substantially contributes to the existing scientific literature by systematically investigating the efficacy of two distinct trauma-specific DBT interventions for difficult-to-treat individuals with PTSD and BPD symptoms. Our findings emphasize the efficacy of DBT-PTSD and DBT PE for the reduction of PTSD and comorbid depressive symptoms. These evidence-based approaches address the unique needs and complex clinical conditions of individuals with a dual diagnosis of PTSD and BPD. Additionally, both approaches seem to be promising in the treatment of complex PTSD. There remains a need for future

research to investigate the specific factors contributing to the effects of stage-based treatments.

CRediT author statement

Conceptualisation: ODK, AG; Methodology: AG, ODK; Formal analysis: AG, CHG; Investigation: KP, AG, CHG, CO, ODK; Resources: PLP, ODK; Data Curation: CHG, AL, SF, AM, ODK; Writing – Original Draft: KP, AG; Writing – Review & Editing: SM, CHG, AL, SF, AM, CO, PLP, ODK; Visualisation: AG, Supervision: PLP, ODK; Project administration: KP, ODK; Funding acquisition: ODK.

Data availability statement

Data and code supporting this study are openly available in a repository of the Open Science Framework at https://doi.org/10.17605/OSF.IO/RX35A.

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