Body-Oriented Treatments for Post-Traumatic Stress Disorder: A Scoping Review of Randomized Controlled Trials

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Abstract

Introduction. While Trauma-Focused Psychotherapies (TFPs) for Post-Traumatic Stress Disorder (PTSD) are the most effective of the available psychotherapies, they have important shortcomings. An emerging group of treatments that include either movement or bodily awareness, so-called Body-Oriented Treatments (BOTs), hold promise to overcome certain shortcomings of TFPs. *Aim.* This scoping review provides an overview of the RCT literature on BOTs for PTSD and to provide future research directions by identifying research gaps. *Methods.* Using a scoping review methodology, relevant articles were searched on Scopus, Web of Science, and PsychInfo. Data relevant to treatment, participants, completion, and study design were extracted and synthesized using qualitative assessment. *Results.* 27 studies showed that most RCTs on BOTs for PTSD are conducted on middle-aged, Western veterans. In addition, most RCTs on BOTs for PTSD are delivered within 8 to 12 weeks, in-person, in a group. *Conclusion.* While it is encouraging to see the number of RCTs on BOTs for PTSD growing in the last few years, important research gaps include participant diversity, mass-delivered treatments, and remotely delivered treatments. In addition, future research should conduct a systematic literature review, a meta-analysis, and explore secondary outcome measures.

Body-Oriented Treatments for Post-Traumatic Stress Disorder: A Scoping Review of Randomized Controlled Trials

Post-Traumatic Stress Disorder (PTSD) is a mental illness that may occur after being exposed to a traumatic event that involves actual or threatened death, serious injury, or sexual violence (Burback et al., 2023). PTSD symptoms can be grouped into four categories: 1) intrusive thoughts or memories of the traumatic event, 2) avoidance of reminders of the event, 3) negative changes in mood and cognition, and 4) hyperarousal (Kearney & Lanius, 2022). These symptoms must persist for at least one month following the traumatic event for PTSD to be diagnosed, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2022).

Besides the direct symptomatic consequences, PTSD is also associated with other mental and physical illnesses or dysfunctions. For example, PTSD has high comorbidity rates with major depressive disorder, anxiety disorders, and substance use disorder (Burback et al., 2023). In addition, PTSD is associated with impairments in cognitive functions such as attention and memory (Vasterling et al., 1998, 2012) and with emotional dysregulation (Raudales et al., 2020). Regarding physical ailments, PTSD is associated with an increased risk for coronary heart disease (Edmondson et al., 2013), increased mortality risk (Nilaweera et al., 2023), increased risk of late-onset dementia (Desmarais et al., 2020), and increased risk for diabetes type 2 (Vancampfort et al., 2016). Lastly, PTSD is associated with poor physical health (Currier et al., 2014; Sofko et al., 2016) and sleep problems (Sripada et al., 2017).

PTSD not only affects individuals but also has consequences for society. The global lifetime prevalence rate of PTSD is estimated to be 3.9% based on 26 population surveys conducted in 24 countries (Koenen et al., 2017). The societal costs of PTSD in the USA alone are estimated to be $232.2 billion in 2018. This is mainly due to PTSD healthcare costs, PTSD non-healthcare costs (for example, PTSD-related research and training, increased substance use disorder due to PTSD, homelessness due to PTSD, disability benefits due to PTSD), and indirect costs (for example, unemployment and productivity loss due to PTSD) (Davis et al., 2022). Given these risks and consequences for both individuals and society, it is important to have effective PTSD treatment options.

Challenges and Limitations of Current PTSD Treatments

Out of the available psychological treatments for PTSD, Trauma-Focused Psychotherapies (TFPs), such as Prolonged Exposure and Cognitive Processing Therapy, have the most robust evidence for their effectiveness (Burback et al., 2023; Mavranezouli et al., 2020; Weber et al., 2021). TFPs often include elements of psychoeducation, establishing a

sense of safety, exposure to and desensitization of trauma-related stimuli, cognitive restructuring, and creating a trauma narrative. The exposure and cognitive elements of TFPs are thought to result in fear extinction, changes in trauma-related cognitions, and changes in avoidance behaviors through focusing on emotion regulation during exposure to the trauma memory or its narrative (Burback et al., 2023).

Despite being the most effective option, TFPs have important shortcomings. It is not uncommon, for example, to find a nonresponse rate of more than 50% and a dropout rate of more than 20% for various TFPs (Schottenbauer et al., 2008). While the reasons for this are not yet fully understood, some potential explanations exist. For example, as mentioned, PTSD is associated with impairments in cognitive functions (Vasterling et al., 1998, 2012) and with emotional dysregulation (Raudales et al., 2020) such as decreased distress tolerance (Akbari et al., 2022). This is problematic for TFPs as they rely on such cognitive functions and require a certain amount of distress tolerance (Burback et al., 2023; Fonzo et al., 2020; Schottenbauer et al., 2008).

Moreover, general physical health (Currier et al., 2014; Sofko et al., 2016), pain (Bartoszek et al., 2017; Sripada et al., 2019), and sleep problems (Sripada et al., 2017) may influence individuals' energy and motivation in attending or engaging in treatment sessions, which might in turn influence nonresponse rates (Currier et al., 2014). Furthermore, comorbid disorders such as major depressive disorder, substance use disorder, and anxiety disorders have negative associations with executive functions, dysfunctional coping, and behavioral avoidance (Dewar et al., 2020; Kline et al., 2021; Phelps et al., 2018; Walter et al., 2020). All of these may play a role in both nonresponse and dropout rates of TFPs (Fonzo et al., 2020; Najavits, 2015). Lastly, there is evidence showing that shame (Schottenbauer et al., 2008) has a negative effect on nonresponse rates, possibly due to its association with avoidance behaviors (Burback et al., 2023; Saraiya & Lopez-Castro, 2016).

Even when TFPs are successful in treating PTSD, residual symptoms such as sleeping difficulties and concentration problems may persist (Burback et al., 2023; Larsen et al., 2019). In addition, PTSD is associated with a variety of somatic syndromes, such as chronic pain (Gupta, 2013), which are not targeted by TFPs and often remain present after PTSD treatment (Galovski et al., 2009; Shipherd et al., 2014). In conclusion, while TFPs have the most evidence for their effectiveness, they have important shortcomings that call for alternative or complementary approaches.

The Potential of Body-Oriented Treatments for PTSD to Overcome TFPs Shortcomings

In their state-of-the-art review, Burback et al. (2023) identify all current and emerging PTSD treatments. A subset of these PTSD treatments is characterized by their use of the body. Such Body-Oriented Treatments (BOTs) have the potential to bridge certain TFPs' shortcomings. While there does not exist a clear definition of BOTs, in general, they are described as treatments that involve movement, bodily awareness, or both (Kearney & Lanius, 2022; Liu et al., 2018; Rosenbaum et al., 2015; Tan et al., 2023; van de Kamp et al., 2019). For the present study, a treatment is considered a BOT if it contains at least one non-negotiable treatment element of movement or bodily awareness. Non-negotiable in this context refers to the requirement that the treatment element of movement or bodily awareness is integral to the treatment and not case-dependent. For example, in Acceptance and Commitment Therapy, mindfulness exercises of bodily sensations may be used (Twohig et al., 2023). However, it is not a required part of the treatment and, therefore, it is not considered a BOT. In contrast, exercise as a treatment is considered a BOT since it, per definition, includes movement (Björkman & Ekblom, 2022), Sensorimotor Psychotherapy due to its integral use of mindful awareness of bodily sensations and head and neck movement (Fisher, 2019), and Mindfulness-Based Stress Reduction (MBSR) because its protocol contains treatment elements of bodily awareness and movement (Goldsmith et al., 2014). The emerging PTSD treatments identified by Burback et al. (2023) that meet this BOT definition are listed and described in Table 1.

Table 1

Emerging PTSD Treatments (Burback et al., 2023) That Meet This Study's BOT Definition

PTSD Treatment	PTSD Treatment Description	BOT Element(s)
Acupuncture	A treatment that involves the insertion and manipulation of thin needles into specific points on the body (Kim et al., 2013).	Bodily awareness
Emotional Freedom Technique	A treatment that uses cognitive elements of Cognitive Behavioral Therapy and Prolonged Exposure to which somatic elements of acupressure which includes tapping on acupoints are added (Stapleton et al., 2023).	Bodily awareness
Exercise	A treatment that includes physical activity that is planned, structured, repetitive and with the purpose to improve or maintain physical fitness or health (Caspersen et al., 1985).	Movement and may include bodily awareness

Mindfulness-Based Treatments [a]	Treatments which aim to help individuals become more aware of their thoughts, emotions, and bodily sensations, and to develop a non-judgmental and accepting attitude towards them (Burback et al., 2023).	Bodily awareness and may include movement
Sensorimotor Psychotherapy	A treatment in which the goal is to mindfully observe the thoughts, feelings, and bodily sensations that arise when thinking or speaking about a particular event, rather than interpreting or analyzing them (Fisher, 2011).	Movement and bodily awareness
Somatic Experiencing	A treatment that focuses on modifying the trauma-related stress response by directing clients' attention to their internal sensations, both visceral and musculoskeletal (Kuhfuß et al., 2021).	Movement and bodily awareness
Yoga	A treatment which includes eight main elements: personal discipline, postures and poses, breathing, concentration, contemplation, meditation, and stillness (Chang et al., 2016).	Movement and bodily awareness

[a] Mindfulness-based treatments such as Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy are BOTs because they include the non-negotiable BOT elements of bodily awareness and movement. Mindfulness-based treatments such as Mantram Repetition or Lovingkindness Meditation are not considered BOTs because they do not include either movement or bodily awareness.

These BOTs have the potential to have a positive influence on the factors that pose challenges to TFPs and through it overcome their shortcomings. For example, Sensorimotor Psychotherapy, yoga, mindfulness-based treatments, and exercise positively influence emotion regulation (Boyd et al., 2018; Fisher, 2011; Guendelman et al., 2017; Janjhua et al., 2020; Liu et al., 2022). Exercise has also been found to improve cognitive function (Antunes et al., 2006; Northey et al., 2017). In addition, there is evidence that yoga, exercise, acupuncture, and mindfulness-based treatments can reduce sleeping difficulties (Cao et al., 2009; Davis et al., 2021; Han et al., 2023; Kusko et al., 2024). Yoga, mindfulness-based treatments, and exercise can also positively affect physical health, such as cardiovascular health and somatic pain (Creswell et al., 2019; Gohel et al., 2021; Posadzki et al., 2020). There is also evidence for the effectiveness of mindfulness, yoga, Emotional Freedom Technique (EFT), and exercise on comorbid disorders such as depression (Cramer et al., 2013; D'Silva et al., 2012; Hofmann et al., 2010; Kvam et al., 2016; Luberto et al., 2013; Nelms & Castel, 2016; Schuch et al., 2016),

anxiety (Clond, 2016; Hofmann et al., 2010, 2016; Jayakody et al., 2014), and substance use disorder (Ashdown-Franks et al., 2020; Chiesa & Serretti, 2014; Kuppili et al., 2018; Linke & Ussher, 2015; Walia et al., 2021; Zschucke et al., 2012). Furthermore, there is preliminary evidence for the positive effect of mindfulness-based treatment on shame (Boyd et al., 2018; Goldsmith et al., 2014; Sedighimornani et al., 2019). In sum, these studies show the potential of BOTs to have a positive influence on the nonresponse rates and dropout rates of TFPs and their potential to positively influence the residual and unaddressed symptoms that remain after successful TFP treatment.

On top of this, there is evidence that BOTs have a direct positive effect on PTSD itself. Systematic reviews have been conducted on yoga, mindfulness-based treatments, exercise, Emotional Freedom Technique, and acupuncture, which all conclude that these BOTs have a positive effect on PTSD symptoms (Cushing & Braun, 2018; Kim et al., 2013; Niles et al., 2018; Stapleton et al., 2023; Taylor et al., 2020; van de Kamp et al., 2019). In addition, Taylor et al. (2020) add that yoga, mindfulness-based treatments, and exercise are low-cost, accepted, and safe treatments to augment current TFPs. Similarly, van de Kamp et al. (2019) state that exercise and yoga are both promising as either stand-alone or complementary treatments for PTSD.

Theoretical Background of BOTs for PTSD

Besides the empirical evidence, there are theoretical reasons for the potential of BOTs for PTSD. Kearney and Lanius (2022) have proposed a somatosensory perspective for trauma-related disorders through which the working mechanisms of BOTs might be understood. They hypothesize that somatic sensory processing is fundamental to the processing of interoceptive and exteroceptive sensory information and is implicated in PTSD symptoms through its effect on arousal, emotional regulation, and higher-order cognitive functions.

From a phylogenetic and ontogenetic perspective, the somatic sensory parts of the nervous system are the oldest in evolutionary terms and the first to develop in the womb (Kearney & Lanius, 2022). These somatic sensory systems are primarily concerned with an organism's survival. Phylogenetically and ontogenetically, mammalian social-emotional (limbic and neocortical) brain structures develop after the somatic sensory parts. While these ‘newer’ layers (limbic and neocortical) allow for more complex cognitions and behaviors, somatic sensory systems remain central and crucial for survival and sensorimotor functions. Due to its central role in survival, these somatic sensory subcortical systems are thought to be significantly affected in people with PTSD who, by definition, have had their survival challenged (Burback et al., 2023).

Dysfunctional somatic sensory processes could lead to cortical and subcortical structures becoming less integrated and isolated 'loops' to develop (Kearney & Lanius, 2022). Subcortical loops from somatosensory stimuli to the midbrain may avoid frontal regions, priming a traumatized individual for unconscious rapid activation of alerting mechanisms and defensive responses (Lanius et al., 2017). Cortico-thalamo-cortical loops may be involved in self-perpetuating cycles of rumination, obsessive thoughts, and a lack of the sense of a bodily self in traumatized individuals (Corrigan & Christie-Sands, 2020; Kearney & Lanius, 2022).

In addition, it is hypothesized that somatic sensory processes are fundamental to the experience of having a physical body and our sense of self. Disruptions due to traumatic experiences in these somatic sensory processes might lead to symptoms often seen in individuals with PTSD such as 'I feel like I don't know myself' (Foa et al., 1999), impaired self-awareness (Lanius et al., 2011), feeling that their body is unsafe, lack of agency over their body, or that their body is a source of shame and disgust (Frewen and Lanius, 2015 as cited in Kearney and Lanius, 2022).

Given that these somatic sensory processes might be fundamental to PTSD, engaging these structures in treatment might have positive effects on PTSD symptoms (Kearney & Lanius, 2022). More precisely, focusing on reconnecting with bodily experiences and movement within a safe and nurturing therapeutic alliance might undo the effects of traumatic somatic sensory experiences (van der Kolk, 2015), which might be difficult to achieve through cognitive approaches alone (Kearney & Lanius, 2022; Kuhfuß et al., 2021).

The Need for an Overview of the RCTs on BOTs for PTSD

To better understand the potential of BOTs in the treatment of PTSD, more research needs to be conducted. Specifically, more randomized controlled trials (RCTs) should be conducted as they are the gold-standard for investigating causal relationships (Hariton & Locascio, 2018). While some RCT reviews have been conducted on BOTs for PTSD, these have four important limitations that prevent them from giving a clear overview of the current state of RCTs on BOTs for PTSD.

First, most of these reviews are not comprehensive as they focus on specific types of BOTs, such as yoga and mindfulness-based treatments (Taylor et al., 2020), or on a specific population, such as veterans (Cushing & Braun, 2018). Second, many reviews include studies with participants who have experienced trauma but who do not have a PTSD diagnosis. This is an important distinction, as only a small minority of individuals who experience a traumatic event develop PTSD (Breslau, 2002). In addition, an individual might also develop major depressive disorder or generalized anxiety disorder after experiencing a traumatic event instead

of PTSD (Grant et al., 2008). Third, some of these reviews included research with non-BOTs by this study's definition. In Taylor et al. (2020), for example, the Mantram Repetition and Lovingkindness meditations are included, which are meditation exercises without non-negotiable elements of movement or bodily awareness. Fourth, some reviews include preliminary RCTs, such as pilot or feasibility RCTs. These, however, do not have the same characteristics and methodological quality that give RCTs their gold-standard status for investigating causal relationships. Due to small sample sizes, for example, preliminary RCTs are often underpowered and cannot be used to test for the effectiveness or efficacy of a treatment (Abbott, 2014). In sum, an overview of RCTs, on the full range of BOTs as listed in Table 1, conducted on individuals with a PTSD diagnosis, without population restrictions, does not exist.

Research Aims

This study aims to provide an overview of the RCT literature on BOTs for PTSD and to provide future research directions by identifying research gaps through answering the following research questions:

1. *What are the treatment characteristics of RCTs on BOTs for PTSD?*
2. *What are the participant characteristics of RCTs on BOTs for PTSD?*
3. *What are the treatment completion characteristics of RCTs on BOTs for PTSD*?
4. *What are the study design characteristics of RCTs on BOTs for PTSD?*

Methods

Using the scoping review guidelines of Peters et al. (2021) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) of Tricco et al. (2018), a scoping review was conducted to describe the current state of the RCTs on BOTs for PTSD, identify research gaps, and suggest future research directions. As this study analyzed existing literature, ethical approval was not necessary.

Eligibility Criteria

Table 2 outlines the inclusion and exclusion criteria for this scoping review. There are four main criteria. First, regarding the population, no age restrictions were set to gain insight into which age groups are represented in RCTs on BOTs for PTSD. However, only RCTs with participants who all had a PTSD diagnosis were included. This means that RCTs in which participants experienced 'trauma' or 'a traumatic event' without a PTSD diagnosis were not included. Nor were studies that based the PTSD diagnosis on screening measures such as the PTSD Checklist for DSM-5 (PCL-5), as these are not equipped to diagnose PTSD (Wilkins et al., 2011) and not recommended for diagnostic-based group assignment in research (McDonald

& Calhoun, 2010). In addition, if participants with other mental disorders or subthreshold PTSD were included in the RCT, the studies were only included if these groups were separately assessed on the PTSD outcome measure(s). Second, studies were included if they had at least one standardized PTSD outcome measure, such as the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5) or the PCL-5. Third, only RCTs with a BOT, as listed in Table 1, were included. However, studies were excluded if the BOT was a prevention or relapse intervention instead of a treatment. Fourth, preliminary RCTs, such as pilot and feasibility trials, were excluded. In addition to these four main criteria, only peer-reviewed articles in Dutch or English were included.

Table 2

Eligibility Criteria

	Inclusion	Exclusion
Population	Participants of any age with a PTSD diagnosis	Participants who experienced 'trauma' or a 'traumatic event' without a PTSD diagnosis
		Participants whose PTSD diagnosis is based on an inadequate PTSD diagnostic measure such as a version of the PCL
		Participants with subthreshold PTSD diagnosis or other mental disorders who were not separated in the outcome measure(s)
Intervention	BOT	Prevention intervention
		Relapse intervention
Study Type	RCT	Preliminary RCT such as a pilot or feasibility RCT
		Protocol
		Review

	Inclusion	Exclusion
		Gray literature
Outcome	At least one standardized PTSD measure	No standardized PTSD measure
Other	Peer-reviewed	Full-text unavailable
	Dutch, English	
	Any year	

Note. RCT = Randomized Controlled Trial, PTSD = Post-Traumatic Stress Disorder, PCL = Post-Traumatic Stress Disorder Checklist, BOT = Body-Oriented Treatment.

Information Sources and Search Strategy

Since the use of multiple databases is recommended for literature searches (Bramer et al., 2017), the following three databases relevant to the field of clinical psychology were used: Scopus and Web of Science Core Collection for their comprehensive multidisciplinary coverage and PsycINFO for its specialization in psychology (Gusenbauer & Haddaway, 2020). The search was conducted on March 14th, 2024, using a search string based (see the textbox below) on variations of the term PTSD and the identified BOTs for PTSD in Table 1. In addition, for each database search it was specified that the keywords should appear in either the title, abstract, or keywords of the article.

(PTSD OR "Post Traumatic Stress Disorder" OR "Post-Traumatic Stress Disorder" OR “Posttraumatic Stress Disorder") **AND** (sensorimotor OR “somatic experiencing” OR mindful* OR MBSR OR MBCT OR yoga OR acupuncture OR "Emotional Freedom Technique" OR EFT OR exercise OR "physical activity" OR “physical-activity”)

Selection of Sources of Evidence

After conducting the search, the titles and abstracts were extracted, and duplicates were removed using a reference manager (Zotero). One reviewer (GCCS) conducted the screening using Microsoft Excel software (Version 16.84). As it is recommended to have at least two reviewers involved in the screening process (Xiao & Watson, 2019), another researcher screened ten random papers (of which two were relevant and eight irrelevant). No judgment conflict was found between the results of the reviewer (GCCS) and the other researcher. In the first screening stage, the studies were screened based on the title and abstract. The full list of

the excluded articles and exclusion reasons can be found in the supplementary file accessible on the Open Science Framework (https://osf.io/vcq6w/?view_only=3e2b14f30aba4d3b8a4f1888885647bb). When a study met the inclusion criteria, or there was any unclarity or uncertainty for its exclusion, it was moved to the second, full-text screening stage. The corresponding author was approached in the case of a non-available full text. In case of a non-response, the study was excluded. The list of excluded articles during the full-text screening stage and exclusion reasons can be found in Appendix A. The studies of which no full-text could be retrieved are in Appendix B. The result of the screening process is visually described in the PRISMA flow diagram (Fig. 1).

Data Charting

The author(s) name(s), article title, and publication year were extracted for the general items. For research question one (*What are the treatment characteristics of RCTs on BOTs for PTSD?*), the treatment approach, treatment delivery (in-person/remote, individual/group), treatment duration, and treatment manual accessibility were extracted. For research question two (*What are the participant characteristics of RCTs on BOTs for PTSD?*), the number of participants, sex, age, occupation (student/military/civilian employment), and country of recruitment were extracted. For research question three (*What are the treatment completion characteristics of RCTs on BOTs for PTSD?*), the treatment completion definition, dropouts, and the reason(s) for dropouts were extracted. For research question four (*What are the study design characteristics of RCTs on BOTs for PTSD?*), the control condition and outcome measures were extracted.

Data Summary and Synthesis

The extracted data were summarized in tabular formats. These overviews were then synthesized through a qualitative assessment and descriptive statistics to describe the current state of the RCTs on BOTs for PTSD, identify research gaps, and provide future research suggestions.

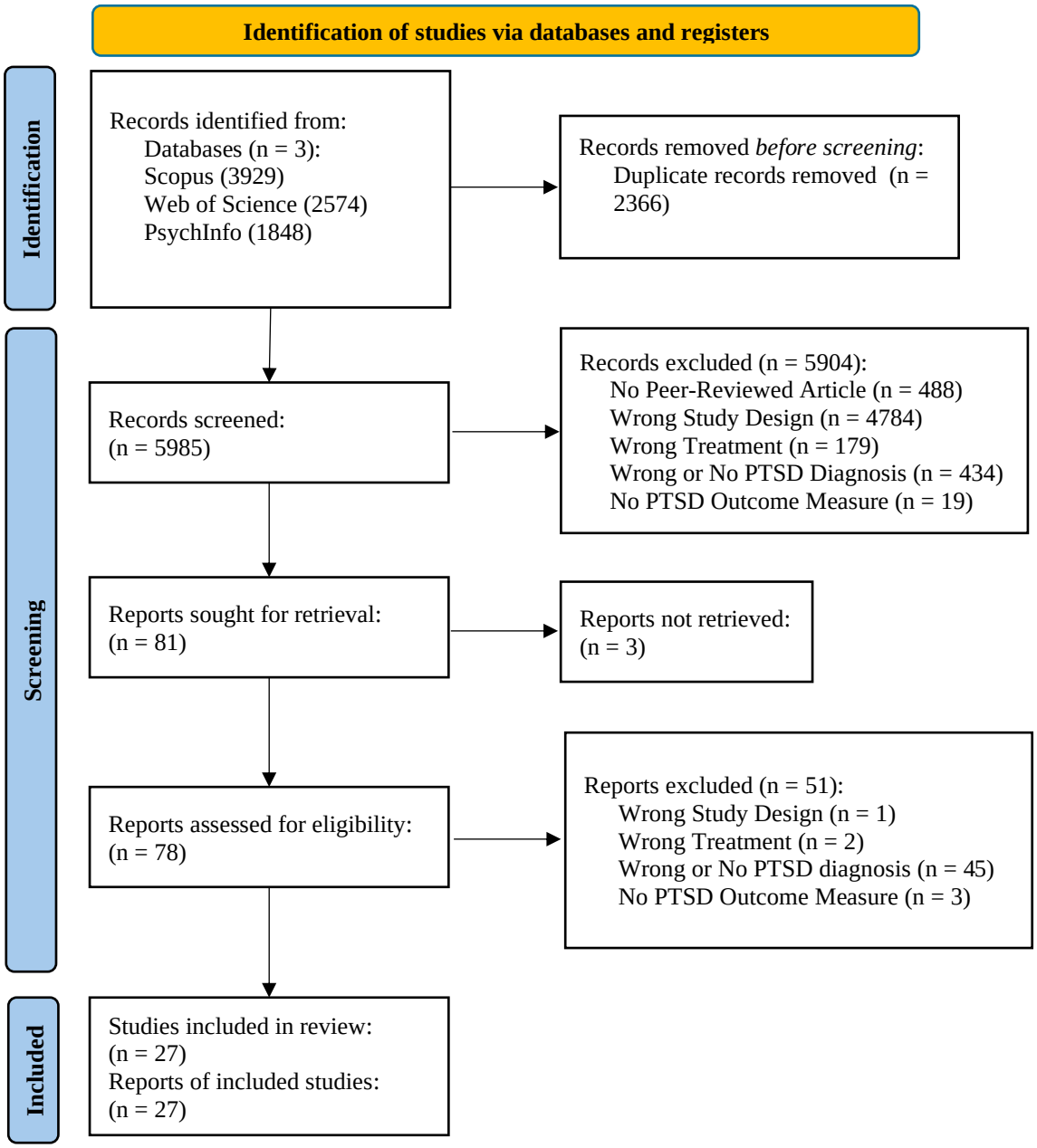
Results

Selection of Sources of Evidence

The literature search resulted in 5985 documents, of which 27 (0.5%) were included in the review. Figure 1 describes the screening process results. Table 3 shows the extracted data items for the study and treatment characteristics, while Table 4 shows the extracted data items for the participants and treatment completion characteristics.

Figure 1

PRISMA Flow Diagram Describing the Search and Screening Process



RQ 1: What are the Treatment Characteristics of RCTs on BOTs for PTSD?

Across the 27 included studies, yoga treatments were used in 30% (8/27) of the studies, mindfulness-based treatments in 26% (6/27), exercise combined with PTSD treatment as usual in 19% (5/27), acupuncture combined with PTSD treatment as usual in 11% (3/27), yoga combined with PTSD treatment as usual in 4% (1/27), Emotional Freedom Technique in 4% (1/27), acupuncture in 4% (1/27), and Somatic Experiencing (SE) in 4% (1/27). Treatment as usual in the context of PTSD treatments often refers to a TFP such as Prolonged Exposure or Cognitive Processing Therapy but this may differ depending on the study.

Regarding treatment delivery, 55% (16/27) of treatments were delivered in-person in a group, 26% (7/27) in-person individually, 4% (1/27) in-person individually with additional at-home practice, 4% (1/27) in-person in a group and at-home practice, 4% (1/27) the first half in-person in a group and the last half remotely, and 4% (1/27) did not report the delivery characteristics.

In terms of treatment duration, 4% (1/27) had a duration of two weeks, 4% (1/27) of four weeks, 11% (3/27) of six weeks, 19% (5/27) of eight weeks, 4% (1/27) of nine weeks, 19% (5/27) of ten weeks, 15% (4/27) of twelve weeks, 4% (1/27) of 15 weeks, 11% (3/27) of 16 weeks, 4% (1/27) of 20 weeks, and 7% (2/27) did not report on the duration. The frequency of treatment sessions was in 4% (1/27) of studies once every two weeks, 66% (18/27) weekly, 7% (2/27) twice a week, 7% (2/27) every other day, 4% (1/27) four times a week, and 11% (3/27) did not mention the frequency. The treatment sessions themselves lasted five to ten minutes in 7% (2/27) of studies, 20 minutes in 4% (1/27), 30 minutes in 7% (2/27), 45 minutes in 4% (1/27), 60 minutes in 33% (9/27), 60 to 70 minutes in 4% (1/27), 90 minutes in 19% (5/27), 120 minutes in 7% (2/27), 90 to 150 minutes in 4% (1/27, and 11% (3/27) did not report on the duration.

None of the publications provided full access to a treatment manual or protocol. In 30% (8/27) of the studies, there was a reference to a book, in 7% (2/27) a reference where no treatment manual or protocol was found, in 4% (1/27) a reference to an inaccessible treatment manual or protocol, and in 59% (16/27) there was no reference to a treatment manual or protocol.

Table 3

Study and Treatment Characteristics

Publication	Control Condition	Treatment Approach	Outcome Measure	Treatment Delivery	Treatment Duration	Manual Accessibility
Andersen et al., 2021	Supportive Therapy and exercise	Trauma-Focused Cognitive Behavioral Therapy and exercise	CAPS-5, PCL-5	In-person, individually	6wks, 10 sessions	Trauma-Focused Cognitive Behavioral Therapy protocol
Brom et al., 2017	Waitlist	Somatic Experiencing	CAPS, PDS	In-person, individually	15wks, 60min weekly	Book
Bryant et al., 2023	Exposure Therapy and passive stretching	Exposure Therapy + Aerobic Exercise	CAPS-2	In-person, group	9wks, 10min weekly aerobic exercise after each exposure therapy session	-
Colgan et al., 2016	Slow breathing, sitting quietly	Body scan and mindful breathing of Mindfulness-Based Stress Reduction	PCL-C	In-person, individual	6wks, 60min weekly	-
Davis et al., 2019	Person-Centred Group Therapy	Mindfulness-Based Stress Reduction	CAPS, PCL	In-person, group	8wks, 90min weekly, at-home practice, one 6h retreat	-

Publication	Control Condition	Treatment Approach	Outcome Measure	Treatment Delivery	Treatment Duration	Manual Accessibility
Davis et al., 2020	Wellness Lifestyle Program	Holistic Yoga Program	CAPS, PCL	In-person, group	16wks, 90min weekly	Inaccessible source
Davis et al., 2023	Wellness Lifestyle Program	Holistic Yoga Program	CAPS, PCL	In-person, group	16wks, 90min weekly	Inaccessible source
Engel et al., 2014	Treatment as usual	Treatment as usual and acupuncture	CAPS, PCL	In-person, individually	4wks, 60min twice weekly	-
Feng et al., 2019	Sertraline and CBT	Transcutaneous Electrical Acupoint Stimulation	CAPS, PCL	In-person, group	12wks weekly	-
Haller et al., 2023	Trauma-Focused Cognitive Behavioral Therapy	Trauma-Focused Cognitive Behavioral Therapy and Pranayama Yoga	PCL-5	In-person, individual	5-10min	Book
Jasbi et al., 2018	Sociotherapeutic group	Mindfulness-based Cognitive Therapy	PCL	In-person, group	8wks, 60-70min weekly	Book
Karatzias et al., 2011	Eye-Movement Desensitization and Reprocessing	Emotional Freedom Technique	CAPS, PCL-5	In-person, individual	8wks, 60min weekly	Book
Kelly et al., 2021	Cognitive Processing Therapy	Trauma-Centre Trauma Sensitive Yoga	MINI, CAPS-5, PCL-5	In-person, group	10wks, 60min weekly	-

Publication	Control Condition	Treatment Approach	Outcome Measure	Treatment Delivery	Treatment Duration	Manual Accessibility
King et al., 2016	Person-Centred Group Therapy	Mindfulness-Based Exposure Therapy and Prolonged Exposure	CAPS	In-person, group	16wks, 120min, at-home practice	-
Nguyen-Feng et al., 2020	Women's Health Education Class	Trauma-Centre Trauma Sensitive Yoga	CAPS, DTS	In-person, group	10wks, 60min weekly	Book
Nordbrandt et al., 2020	Treatment as usual and Treatment as usual and basic body awareness	Treatment as usual and Physical Activity	HTQ	In-person, group	20wks, 60min weekly, home-based exercises	-
Omidi & Hamidian, 2018	Medication	Mindfulness-based Cognitive Therapy and Mindfulness-Based Stress Reduction	SCID-I	In-person, group	8wks, 120min weekly	-
Reinhardt et al., 2018	Waitlist	Kripalu Yoga	CAPS-5, PCL-5	In-person, group	10wks, 90min twice weekly	Empty reference
Rosenbaum et al., 2015	Treatment as usual	Treatment as usual and exercise	PCL-C	In-person, group + at home self-guided	12wks, weekly	-

Publication	Control Condition	Treatment Approach	Outcome Measure	Treatment Delivery	Treatment Duration	Manual Accessibility
Shapira et al., 2022	Person-Centred Group Therapy	Mindfulness-Based Stress Reduction	CAPS, PCL	In-person, group	8wks, 90-150min weekly, 6h retreat, at-home practice	Book
van der Kolk et al., 2014	Women's Health Education Class	Trauma-Informed Yoga	CAPS, DTS	In-person, group	10wks, 60min weekly	Book
Voorendonk et al., 2023	Non-physical guided tasks	Prolonged Exposure, Eye-Movement Desensitization and Reprocessing, and physical activity	CAPS-5, PCL-5	In-person, group + remotely	Twice 4days with 3 days pause, four times 90min daily	-
Wahbeh et al., 2016	Slow breathing, sitting quietly	Body scan and mindful breathing of Mindfulness-Based Stress Reduction	CAPS, PCL	In-person, individual, at-home practice	6wks, 20min weekly, 20min at-home	-
Wang et al., 2012	Medication	Electroacupuncture	CAPS, PCL	In-person, individual	12wks, 30min every other day	-
Yi et al., 2022	Exchanging life experiences and playing board games	Kripalu Yoga	IES-R	In-person, group	12wks, 45min once every two weeks	-

Publication	Control Condition	Treatment Approach	Outcome Measure	Treatment Delivery	Treatment Duration	Manual Accessibility
Zaccari et al., 2023	Cognitive Processing Therapy	Trauma-Centre Trauma Sensitive Yoga	CAPS, PCL-C	In-person, group	10wks, 60min weekly	Book
Zhang et al., 2011	Cognitive Behavioral Therapy	Cognitive Behavioral Therapy and acupoint stimulation	IES-R	-	30min every other day	-

Note. CAPS = unspecified version of the Clinician-Administered PTSD Scale. CAPS-2 = Clinician-Administered PTSD Scale for DSM-II. CAPS-5 = Clinician-Administered PTSD Scale for DSM-5. DTS = Davidson Trauma Scale. HTQ = Harvard Trauma Questionnaire. IES-R = The Impact of Event Scale–Revised. MINI = Mini-International Neuropsychiatric Interview. PCL = unspecified version of the PTSD Checklist. PCL-5 = PTSD Checklist for DSM-5. PCL-C = PTSD Checklist for Civilians. PDS = Posttraumatic Stress Diagnostic Scale. SCID-I = Structured Clinical Interview for DSM-I.

RQ2: What are the Participant Characteristics of RCTs on BOTs for PTSD?

A total of 3141 participants took part in the studies, with 1552 in the treatment condition and 1589 in the control condition. The mean number of participants across all studies is 116 (SD = 73.3), with a range of 23 to 338. Across studies, 46% were female, and the average age was 44 (SD = 6.4), with a mean ranging from 32 to 55, while 4% (1/27) did not report a mean age. In 48% (13/27) of the studies, the participants were active-duty military personnel or veterans, in 37% (10/27) the participants were either civilians or students, and in 15% (4/27) of the studies, this was not reported.

In 33% (9/27) of the publications, the participants were recruited from the USA, in 7% (2/27) from Australia, in 11% (3/27) from China, in 7% (2/13) from Iran, in 4% (1/27) from both Denmark and Australia, in 4% (1/27) from the Netherlands, in 4% (1/27) from Israel, in 4% (1/27) from Germany, in 4% (1/27) from Scotland, and in 4% (1/27) participants were refugees in Denmark coming from Afghanistan, Chechnya, Former Yugoslavia, Iran, Iraq, Lebanon, Somalia, Syria, and other unspecified countries. In 18% (5/27) of publications, they did not state in which country the participants were recruited.

Table 4

Participants and Study Completion Characteristics

Publication	n	% female	Mean age	Military/Veterans	Country of Recruitment	Completion Definition	Dropouts n (%)
Andersen et al., 2021	103	73%	42.1	Civilians	Australia and Denmark	-	10 (19%)
Brom et al., 2017	32	51%	51	Civilians	Israel	-	10 (19%)
Bryant et al., 2023	130	60%	39	Civilians, students	Australia	All sessions	5 (33%)
Colgan et al., 2016	102	6%	52	Veterans	USA	-	-
Davis et al., 2019	214	16%	35	Veterans	USA	-	11 (10%)
Davis et al., 2020	204	44%	51	Veterans, civilians	-	-	-

Publication	n	% female	Mean age	Military/Veterans	Country of Recruitment	Completion Definition	Dropouts n (%)
Davis et al., 2023	204	44%	51	Veterans, civilians	-	-	1 (4%)
Engel et al., 2014	55	31%	35	Active-duty military personnel	USA	-	12 (1%)
Feng et al., 2019	240	70%	41	-	China	-	9 (39%)
Haller et al., 2023	74	62%	44	-	Germany	-	0 (0%)
Jasbi et al., 2018	48	0%	53	Veterans	Iran	-	6 (24%)
Karatzias et al., 2011	46	57%	41	Civilians	Scotland	-	10 (41%)
Kelly et al., 2021	104	100%	48	Veterans	USA	7+ sessions	5 (5%)
King et al., 2016	23	0%	32	Veterans	USA	-	0 (0%)
Nguyen-Feng et al., 2020	64	100%	43	Civilians	-	-	16 (62%)
Nordbrandt et al., 2020	338	53%	45	Civilians	Denmark refugees [a]	-	0 (0%)
Omidi & Hamidian, 2018	62	0%	-	Veterans	Iran	6+ sessions	-
Reinhardt et al., 2018	51	14%	47	Veterans and active duty military personnel	USA	-	1 (3%)
Rosenbaum et al., 2015	81	16%	49	-	Australia	-	4 (7%)

Publication	n	% female	Mean age	Military/Veterans	Country of Recruitment	Completion Definition	Dropouts n (%)
Shapira et al., 2022	210	16%	55	Veterans	USA	-	-
van der Kolk et al., 2014	64	100%	43	Civilians	-	-	4 (6%)
Voorendonk et al., 2023	120	85%	38	-	The Netherlands	-	6 (13%)
Wahbeh et al., 2016	102	6%	52	Veterans	USA	-	25 (35%)
Wang et al., 2012	138	38%	49	-	China	-	-
Yi et al., 2022	94	100%	41	Civilians, students	-	-	-
Zaccari et al., 2023	131	100%	48	Veterans	USA	7+ sessions	10 (19%)
Zhang et al., 2011	91	60%	35	-	China	-	5 (33%)

[a] Refugees from Afghanistan, Chechnya, Former Yugoslavia, Iran, Iraq, Lebanon, Somalia, Syria, and other unspecified countries.

RQ 3: What are the Treatment Completion Characteristics of RCTs on BOTs for PTSD?

A completion definition was provided in 11% (3/27) of the studies. Of these, 66% (2/3) defined it as completing seven or more sessions, and 33% (1/3) as more than six sessions. In 89% (24/27) of the studies, no definition of completion was stated. In 37% (10/27) of the studies, the dropout rate was 10% or less, in 33% (9/27) it was between 10% and 40%, in 7% (2/27) it was above 40%, while 22% (6/27) of the studies did not report dropout rates. Across the studies that did report on dropouts, there was an average rate of 16%. Only 15% (4/27) provided reasons for dropouts, of which personal reasons such as travel time were mentioned most.

RQ 4: What are the Study Design Characteristics of RCTs on BOTs for PTSD?

The general study information, the control condition, and the outcome measure(s) were extracted for this research question. All studies were published during or after 2011, with 52%

(14/27) published in the last five years between 2019 and 2024. At least one active control group was used in 93% (25/27) of publications. The remaining 7% (2/27) utilized inactive (waitlist) control groups.

Seven distinct outcome measures were used across the studies. Only 11% (3/27) did not use either a version of the CAPS or a version of the PCL. These used the Impact of Event Scale-Revised, the Structured Clinical Interview for DSM-I, and the Harvard Trauma Questionnaire. 30% (8/27) of publications used a combination of a version of the CAPS and a version of the PCL, 11% (3/27) used only a version of the CAPS, and 11% (3/27) only a version of the PCL. In total, across studies, 11% (3/27) used the Impact of Event Scale-Revised, 4% (1/27) the Mini-International Neuropsychiatric Interview, 7% (2/27) the Davidson Trauma Scale, 4% (1/27) the Harvard Trauma Questionnaire, 4% (1/27) the Posttraumatic Stress Diagnostic Scale, and 4% (1/27) the Structured Clinical Interview for DSM-I.

Discussion

This scoping review aimed to provide an overview of the RCT literature on BOTs for PTSD and to provide future research directions by identifying research gaps guided by four research questions that will be discussed below.

Treatment Characteristics of RCTs on BOTs for PTSD

All BOTs listed in Table 1, except for Sensorimotor Psychotherapy, appear at least once in the 27 studies included in this review. Yoga appeared the most, followed by mindfulness-based treatment and exercise combined with PTSD treatment as usual. Most BOTs have a frequency of one session per week, take between 8 and 12 weeks, and have a duration between 60 and 90 minutes. This is similar to that of other PTSD treatments, such as Prolonged Exposure (Minnen & Foa, 2006). However, a difference with common PTSD treatments is that they are sometimes delivered in a higher frequency, so-called massed delivery (e.g., all sessions within one week). There is evidence for EMDR and Prolonged Exposure, that massed delivery is as effective as having a lower session frequency (Foa et al., 2018; Hurley, 2018). Because BOTs are thought to work through mechanisms different from such exposure-based treatments (Kearney & Lanius, 2022), it is unclear whether intense or massed delivery would work for BOTs, therefore, further research is warranted.

Most BOTs were delivered in person in a group. While there is evidence for the benefit of group treatment, such as a greater likelihood of adherence to PTSD treatment (Sripada et al., 2016), in an RCT on active-duty military personnel with PTSD, those with individual Cognitive Processing Therapy produced greater improvement compared to group Cognitive Processing Therapy (Resick et al., 2017). In addition, of the 27 studies, only one (Voorendonk

et al., 2023) partly delivered the treatment remotely. Given the evidence for the effectiveness of internet-delivered PTSD treatments (Morland et al., 2020; Shore et al., 2014) and the accessibility of technology and the internet, the ability of remotely-delivered treatments to overcome barriers such as travel time, costs, lack of mental health care providers, and stigma (Kantor et al., 2017), research in delivering BOTs remotely could be valuable.

Concerning the treatment manual or protocol accessibility, no study provided the entire manual in the publication. This is a problem because treatment manuals provide key treatment details, including techniques used, number and duration of sessions, and content, which are essential for RCT replication studies (Watts et al., 2020). Future RCTs on BOTs for PTSD should report or reference a treatment manual to facilitate replicability.

Participants' Characteristics of RCTs on BOTs for PTSD

While the difference is not big, more studies have been conducted on veterans and active-duty military personnel than on civilians. It is important to conduct more research on civilian populations because military personnel and veterans have unique PTSD aspects, such as non-fear emotional responses (Friedman et al., 2011) and the influence of military culture, such as stigma on psychological problems (Vermetten & Ambaum, 2019), which might cause them to respond differently to PTSD treatments than civilians. In specific, it will be valuable to conduct studies on civilian populations with high rates of trauma exposure, such as first responders and medical professionals (Lewis-Schroeder et al., 2018), which are currently lacking.

There is also an imbalance in the ages of participants in RCTs of BOT for PTSD. All studies included participants with mean ages between 32 and 55. None included children, teenagers, young adults, or elderly people. In their meta-analysis of psychological treatments for PTSD, Gutermann et al. (2016) conclude that psychological treatments for PTSD should be modified according to age. For example, elderly populations pose unique challenges with respect to PTSD treatment, such as declined cognitive functions (Lapp et al., 2011). Furthermore, BOTs pose unique challenges for the elderly, such as decreased range of motion (Holland et al., 2002). Future research is warranted to investigate if and how BOTs should be adapted to different age groups.

Lastly, regarding the country of recruitment, most participants were recruited from Western Educated Industrialized Rich and Democratic (WEIRD) countries. It is important to be mindful of the effect culture can have on treatment outcomes, as culturally adapted psychological treatments are more effective than their non-adapted counterparts (Bernal et al., 2009; Griner & Smith, 2006). According to Bernal et al. (1995), cultural considerations in

psychotherapy can be grouped into eight categories: language, persons, metaphors, content, concepts, goals, methods, and context. Watson-Singleton et al. (2019), for example, recommend mindfulness-based treatments with African Americans to use African American facilitators, incorporate cultural values and terminology, provide cultural resources, and address religious concerns, perceived benefits, and holistic health goals. Similar research should be conducted on all BOTs and other populations to investigate whether certain BOT elements are culturally sensitive, how this might affect their efficacy, and how to adapt them appropriately.

Treatment Completion Characteristics of RCTs on BOTs for PTSD

The average dropout rate across studies was 16%, below the average dropout rate of 19.7%, as found in a meta-analysis of 669 studies of adult psychotherapy (Swift & Greenberg, 2012). However, an important caveat to mention is the fact that the majority of the RCTs did not specify a definition of treatment completion. This is important as different treatments could have different standards for considering someone a dropout. For example, in Kelly et al. (2021), participants were considered to have completed the Trauma Centre Trauma Sensitive Yoga treatment if they attended seven or more of the ten sessions. Using this definition would result in a different dropout number than without a definition and only looking at who completed all sessions. Since dropout rates are considered an important challenge in all areas of psychological treatment (Swift & Greenberg, 2012), it is important to be precise when reporting on them in future research.

Study Design Characteristics of RCTs on BOTs for PTSD

All RCTs on BOTs for PTSD have been published since 2011, and most used an active control group. Regarding the outcome measures, most studies used either a version of the CAPS, a version of the PCL, or a combination of these two. While comparison between different outcome measures is possible when they test the same construct, there is a risk for slight differences between the measures. For example, certain behaviors might be indicators for the avoidance symptoms of PTSD by one measure but not for another. It might be best, therefore, to use the most used outcome measures (versions of the CAPS and versions of the PCL) in future RCTs to increase the comparability of outcomes.

With respect to self-report PTSD measures there is evidence that certain measures are more appropriate for certain populations (Bowen-Salter et al., 2021). For example, for non-specific trauma, the PCL and the Short Post-Traumatic Stress Disorder Rating Interview are recommended. However, for refugees, the Impact of Event Scale-Revised and for prisoners, the Davidson Trauma Scale is recommended (for a full overview, see Table 3 in Bowen-Salter

et al., 2021). It is therefore advised to carefully consider and substantiate the use of an outcome measure, especially with respect to what is most appropriate for the study itself (for example, population characteristics) and for comparison between RCTs.

Strengths and Limitations

A strength of this study was the chosen review methodology. Of the 48 different types of reviews identified by Sutton et al. (2019), the scoping review fitted the best considering that BOTs are an emerging research topic and that the aim was to describe the literature, identify research gaps, and inform future research (O'Brien et al., 2016; Tricco et al., 2016). On top of this, the recently developed methodological protocols and guidelines such as PRISMA-ScR safeguard the quality of scoping reviews (Peters et al., 2015, 2020, 2021; Tricco et al., 2018).

A limitation of this scoping review study relates to the number of reviewers. At least two reviewers should be involved in the screening process (Xiao & Watson, 2019), while this study only had one reviewer. This could have increased the risk of bias involved during the screening process and, through it, increased the risk of excluding relevant articles. To mitigate this risk another researcher screened ten random papers to allow for any judgment conflict to inform the further screening process.

Lastly, in contrast with systematic literature reviews, scoping reviews often do not include a critical appraisal of the literature (Peters et al., 2020; Tricco et al., 2018). Scoping reviews cannot, therefore, draw conclusions on the feasibility, appropriateness, meaningfulness, or effectiveness of BOTs (Peters et al., 2020). Due to this limitation, scoping reviews can only provide future directions to research and cannot extend this to clinical practice (Peters et al., 2020). However, this limitation is of less relevance since this review aims to provide future research direction.

Future Directions

There are three future directions for the research of RCTs on BOTs for PTSD based on the identified research gaps. First, there is a need to research BOTs in RCTs on civilian populations, on groups with a high risk of trauma exposure other than veterans or active-duty military personnel, on different age groups, and to recruit participants from non-WEIRD countries and subpopulations within WEIRD countries. Second, there is value in exploring the effectiveness of BOTs when delivered with a higher session frequency (i.e., massed delivery) and remotely. Third, all future RCTs on BOTs for PTSD should provide access to the treatment manual or protocol, define treatment completion, and use either a version of the CAPS or a version of the PCL as the PTSD outcome measure.

In addition to these three research suggestions based on the identified research gaps, it would be valuable for future research to conduct a systematic literature review (SLR). A SLR has the benefit over a scoping review of adding insights into the quality of evidence such as methodological limitations or risk of bias and can provide information about the feasibility, appropriateness, or effectiveness of treatments (Pearson, 2004; Peters et al., 2020). While it is difficult to say when an SLR should be conducted, Paul et al. (2021) suggest that when a research field has 40 articles for review there is enough data for an SLR to make substantial contributions. Given that there are currently 27 RCTs on BOTs for PTSD and that half of them have been published in the past five years, it is expected that an SLR will be relevant to conduct in the near future.

Similarly, researchers should consider conducting meta-analyses as this has the added benefit of drawing conclusions on the direction of a relationship between variables and resolving any contradictory results through the exploration of moderator variables (Haidich, 2010; Paul & Barari, 2022). It is recommended that only sufficiently homogeneous studies are included in a meta-analysis so that the summary result is meaningful (Haidich, 2010). Given that within the selected 27 studies there are six different treatments, there might be too much heterogeneity for a meta-analysis to give a meaningful summary result. However, a meta-analysis of all 27 studies should still be considered as it could provide beneficial insight into what kind of heterogeneity is present besides the treatment type and whether or how this affects the summary result (Haidich, 2010). In addition, within these 27 studies, eight used yoga, six used mindfulness-based treatments, and five used exercise in combination with PTSD treatment as usual. This might be enough research to do a meta-analysis for each of these BOTs separately.

Lastly, when an SLR or meta-analyses are conducted it should be considered to include secondary outcome measures, such as quality of life and somatic functioning, instead of only primary PTSD outcome measures as was done in this scoping review. This is important as mental health is a combination of mental well-being and mental illness. Moreover, mental well-being, measured by secondary outcome measures, is independent of mental illness (Bohlmeijer & Westerhof, 2021). Conducting a review that includes secondary outcome measures would, therefore, give a more comprehensive overview of how BOTs for PTSD affect mental health. In addition, exploring secondary outcome measures is also of interest as higher levels of mental well-being can lower the risk of developing mental health issues and disorders (Lamers et al., 2015; Schotanus-Dijkstra et al., 2016), and might thus also be a mitigating factor in PTSD relapse.

Conclusion

While the number of RCTs on BOTs for PTSD has increased substantially in the last few years, there are still important research gaps to be closed. The most notable ones are participant diversity, massed delivered BOTs, and remotely delivered BOTs. In addition, future research should conduct a systematic literature review, meta-analyses, and explore secondary outcome measures.

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Sripada, R. K., Pfeiffer, P. N., Rampton, J., Ganoczy, D., Rauch, S. A. M., Polusny, M. A., & Bohnert, K. M. (2017). Predictors of PTSD Symptom change among outpatients in the

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Voorendonk, E. M., Sanches, S. A., Tollenaar, M. S., Hoogendoorn, E. A., de Jongh, A., & van Minnen, A. (2023). Adding physical activity to intensive trauma-focused treatment for post-traumatic stress disorder: Results of a randomized controlled trial. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1215250

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Yi, L., Lian, Y., Ma, N., & Duan, N. (2022). A randomized controlled trial of the influence of yoga for women with symptoms of post-traumatic stress disorder. *Journal of Translational Medicine*, *20*(1). https://doi.org/10.1186/s12967-022-03356-0

Zaccari, B., Higgins, M., Haywood, T. N., Patel, M., Emerson, D., Hubbard, K., Loftis, J. M., & Kelly, U. A. (2023). Yoga vs cognitive processing therapy for military sexual trauma-related posttraumatic stress disorder: A randomized clinical trial. *JAMA Network Open*, *6*(12), E2344862. https://doi.org/10.1001/jamanetworkopen.2023.44862

Zhang, Y., Feng, B., Xie, J., Xu, F., & Chen, J. (2011). Clinical study on treatment of the earthquake-caused post-traumatic stress disorder by cognitive-behavior therapy and

acupoint stimulation. *Journal of Traditional Chinese Medicine*, *31*(1), 60–63. https://doi.org/10.1016/S0254-6272(11)60014-9

Zschucke, E., Heinz, A., & Ströhle, A. (2012). Exercise and physical activity in the therapy of substance use disorders. *The Scientific World Journal*, *2012*, 1–19. https://doi.org/10.1100/2012/901741

Appendix

Appendix A

Full-Text Screening Results

Publication	Wrong Study Design	Wrong Treatment	Wrong Diagnosis	Wrong Outcome Measure
Abanes, J. J., Ridner, S. H., Dietrich, M. S., Hiers, C., & Rhoten, B. (2022). Acupuncture for sleep disturbances in post-deployment military service members: A randomized controlled trial. *Clinical Nursing Research, 31*(2), 239–250. https://doi.org/10.1177/10547738211030602			Participants with no PTSD diagnosis	
Aizik-Reebs, A., Yuval, K., Hadash, Y., Gebreyohans Gebremariam, S., & Bernstein, A. (2021). Mindfulness-based trauma recovery for refugees (MBTR-R): Randomized waitlist-control evidence of efficacy and safety. *Clinical Psychological Science, 9*(6), 1164–1184. https://doi.org/10.1177/2167702621998641			Participants with no PTSD diagnosis	
Aizik-Reebs, A., Yuval, K., Kesete, Y. B., Lurie, I., & Bernstein, A. (2022). Prevalence and prevention of suicidal ideation among asylum seekers in a high-risk urban post-displacement setting. *Epidemiology and psychiatric sciences, 31*, e76. https://doi.org/10.1017/S2045796022000579			No PTSD diagnosis	
Amir, I., Aizik-Reebs, A., Yuval, K., Hadash, Y., & Bernstein, A.			Participants with no	

(2023). Cognitive inhibition in trauma recovery among asylum seekers: Test in a randomized trial of mindfulness-Based Trauma Recovery for Refugees. *Clinical Psychological Science*, 216770262311649. https://doi.org/10.1177/21677026231164958	PTSD diagnosis
Andersen, T. E., Lahav, Y., Ellegaard, H., & Manniche, C. (2017). A randomized controlled trial of brief Somatic Experiencing for chronic low back pain and comorbid post-traumatic stress disorder symptoms. *European Journal of Psychotraumatology*, *8*(1), 1331108. https://doi.org/10.1080/20008198.2017.1331108	PTSD Diagnosis with self-report questionnaire and including sub-clinical diagnosis
Bayley, P. J., Schulz-Heik, R. J., Tang, J. S., Mathersul, D. C., Avery, T., Wong, M., Seppälä, E. M. (2022). Randomised clinical non-inferiority trial of breathing-based meditation and cognitive processing therapy for symptoms of post-traumatic stress disorder in military veterans. *BMJ Open*, *12*(8), e056609. https://doi.org/10.1136/bmjopen-2021-056609	PTSD diagnosis using self-report measure
Church, D. (2014). Reductions in pain, depression, and anxiety symptoms after PTSD remediation in veterans. *Explore*, *10*(3), 162–169. https://doi.org/10.1016/j.explore.2014.02.005	PTSD diagnosis using self-report measure

Church, D., Hawk, C., Brooks, A. J., Toukolehto, O., Wren, M., Dinter, I., & Stein, P. (2013). Psychological trauma symptom improvement in veterans using emotional freedom techniques: A randomized controlled trial. *The Journal of Nervous and Mental Disease, 201*(2), 153–160. https://doi.org/10.1097/NMD.0b013e31827f6351	PTSD diagnosis using self-report measure
Church, D., & Nelms, J. (2016). Pain, range of motion, and psychological symptoms in a population with frozen shoulder: A randomized controlled dismantling study of clinical EFT (emotional freedom techniques). *Archives of Scientific Psychology, 4*(1), 38–48. https://doi.org/10.1037/arc0000028	Participants with no PTSD diagnosis
Church, D., & Palmer-Hoffman, J. (2014). TBI symptoms improve after PTSD remediation with emotional freedom techniques. *Traumatology, 20*(3), 172–181. https://doi.org/10.1037/h0099831	PTSD diagnosis using self-report measure
Church, D., Sparks, T., & Clond, M. (2016). EFT (emotional freedom techniques) and resiliency in veterans at risk for PTSD: A randomized controlled trial. *Explore, 12*(5), 355–365. https://doi.org/10.1016/j.explore.2016.06.012	PTSD diagnosis using self-report measure
Clement, E., Murphy, P., Lee, A., Ericson, A., Gratton, C., Clements, T., Widder, S. (2021). Mindfulness as an intervention after multisystem trauma. *Trauma, 23*(4), 338–346.	Participants with no PTSD diagnosis

https://doi.org/10.1177/1460408620961014			
Crombie, K. M., Cisler, J. M., Hillard, C. J., & Koltyn, K. F. (2021). Aerobic exercise reduces anxiety and fear ratings to threat and increases circulating endocannabinoids in women with and without PTSD. *Mental Health and Physical Activity, 20*, 100366. https://doi.org/10.1016/j.mhpa.2020.100366	No RCT but a randomized, counterbalance approach		
Crombie, K. M., Sartin-Tarm, A., Sellnow, K., Ahrenholtz, R., Lee, S., Matalamaki, M., Cisler, J. M. (2021). Aerobic exercise and consolidation of fear extinction learning among women with posttraumatic stress disorder. *Behaviour Research and Therapy, 142*, 103867. https://doi.org/10.1016/j.brat.2021.103867			No PTSD outcome measure
Dick, A. M., Niles, B. L., Street, A. E., DiMartino, D. M., & Mitchell, K. S. (2014). Examining mechanisms of change in a yoga intervention for women: The influence of mindfulness, psychological flexibility, and emotion regulation on PTSD symptoms. *Journal of Clinical Psychology, 70*(12), 1170–1182. https://doi.org/10.1002/jclp.22104		Included participants with subthreshold PTSD	
DiNardo, M. M., Greco, C., Phares, A. D., Beyer, N. M., Youk, A. O., Obrosky, D. S., Siminerio, L. (2022). Effects of an integrated mindfulness intervention for veterans with diabetes distress: A		Participants with no PTSD diagnosis	

randomized controlled trial. *BMJ Open Diabetes Research & Care, 10*(2), e002631. https://doi.org/10.1136/bmjdrc-2021-002631	
Dumarkaite, A., Truskauskaite-Kuneviciene, I., Andersson, G., & Kazlauskas, E. (2022). The effects of online mindfulness-based intervention on posttraumatic stress disorder and complex posttraumatic stress disorder symptoms: A randomized controlled trial with 3-month follow-up. *Frontiers in Psychiatry, 13*, 799259. https://doi.org/10.3389/fpsyt.2022.799259	PTSD diagnosis using self-report measure
Fetzner, M. G., & Asmundson, G. J. G. (2015). Aerobic exercise reduces symptoms of posttraumatic stress disorder: A randomized controlled trial. *Cognitive Behaviour Therapy, 44*(4), 301–313. https://doi.org/10.1080/16506073.2014.916745	Included participants with subsyndromal PTSD
Gordon, J. S., Staples, J. K., Blyta, A., Bytyqi, M., & Wilson, A. T. (2008). Treatment of posttraumatic stress disorder in postwar Kosovar adolescents using mind-body skills groups: A randomized controlled trial. *The Journal of Clinical Psychiatry, 69*(9), 1469–1476. https://doi.org/10.4088/jcp.v69n0915	PTSD diagnosis using self-report measure
Hoerster, K. D., Tanksley, L., Sulayman, N., Bondzie, J., Brier, M., Damschroder, L., Nelson, K.	PTSD diagnosis using self-

(2021). Testing a tailored weight management program for veterans with PTSD: The MOVE! + UP randomized controlled trial. *Contemporary Clinical Trials, 107*, 106487. https://doi.org/10.1016/j.cct.2021.106487	report measure
Hwangbo, S.-Y., Kim, Y.-J., Shin, D. G., An, S.-J., Choi, H., Lee, Y., Ha, I.-H. (2023). Effectiveness and safety of progressive loading–motion style acupuncture treatment for acute low back pain after traffic accidents: A randomized controlled trial. *Healthcare, 11*(22), 2939. https://doi.org/10.3390/healthcare11222939	Participants with no PTSD diagnosis
Kahn, J. R., Collinge, W., & Soltysik, R. (2016). Post-9/11 veterans and their partners improve mental health outcomes with a self-directed mobile and web-based wellness training program: A randomized controlled trial. *Journal of Medical Internet Research, 18*(9), e255. https://doi.org/10.2196/jmir.5800	Participants with no PTSD diagnosis
Kang, S. S., Sponheim, S. R., & Lim, K. O. (2022). Interoception underlies therapeutic effects of mindfulness meditation for posttraumatic stress disorder: A randomized clinical trial. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 7*(8), 793–804. https://doi.org/10.1016/j.bpsc.2021.10.005	Included participants with subthreshold PTSD diagnosis

Killeen, T. K., Wen, C.-C., Neelon, B., & Baker, N. (2023). Predictors of treatment completion among women receiving integrated treatment for comorbid posttraumatic stress and substance use disorders. *Substance Use & Misuse, 58*(4), 500–511. https://doi.org/10.1080/10826084.2023.2170183	Relapse prevention instead of treatment intervention	
Kim, S. H., Schneider, S. M., Bevans, M., Kravitz, L., Mermier, C., Qualls, C., & Burge, M. R. (2013). PTSD symptom reduction with mindfulness-based stretching and deep breathing exercise: Randomized controlled clinical trial of efficacy. *The Journal of Clinical Endocrinology and Metabolism, 98*(7), 2984–2992. https://doi.org/10.1210/jc.2012-3742		PTSD diagnosis using self-report measure
Kummar, A. S., Correia, H., Tan, J., & Fujiyama, H. (2023). An 8-week compassion and mindfulness-based exposure therapy program improves posttraumatic stress symptoms. *Clinical Psychology & Psychotherapy, 31*(1), e2929. https://doi.org/10.1002/cpp.2929		PTSD diagnosis using self-report measure
Lang, A. J., Malaktaris, A., Maluf, K. S., Kangas, J., Sindel, S., Herbert, M., Liu, L. (2021). A randomized controlled trial of yoga vs nonaerobic exercise for veterans with PTSD: Understanding efficacy, mechanisms of change, and mode of delivery. *Contemporary Clinical Trials Communications, 21*, 100719.		PTSD diagnosis using self-report measure

https://doi.org/10.1016/j.conctc.2021.100719		
Lee, M. Y., Zaharlick, A., & Akers, D. (2017). Impact of meditation on mental health outcomes of female trauma survivors of interpersonal violence with co-occurring disorders: A randomized controlled trial. *Journal of interpersonal violence, 32*(14), 2139-2165. https://doi.org/10.1177/0886260515591277	No PTSD diagnosis	
Leitch, M. L., Vanslyke, J., & Allen, M. (2009). Somatic experiencing treatment with social service workers following Hurricanes Katrina and Rita. *Social Work, 54*(1), 9-18. https://doi.org/10.1093/sw/54.1.9	No PTSD diagnosis	
Marzabadi, E. A., & Zadeh, S. M. H. (2014). The Effectiveness of Mindfulness Training in Improving the Quality of Life of the War Victims with Post Traumatic stress disorder (PTSD). *Iranian journal of psychiatry, 9*(4), 228–236.		No PTSD outcome measure
Mathersul, D. C., Schulz-Heik, R. J., Avery, T. J., Allende, S., Zeitzer, J. M., & Bayley, P. J. (2023). US veterans show improvements in subjective but not objective sleep following treatment for posttraumatic stress disorder: Secondary analyses from a randomised controlled trial. *Depression and Anxiety, 2023*, 1–13. https://doi.org/10.1155/2023/7001667	PTSD diagnosis using self-report measure	

Mathersul, D. C., Zeitzer, J. M., Schulz-Heik, R. J., Avery, T. J., & Bayley, P. J. (2024). Emotion regulation and heart rate variability may identify the optimal posttraumatic stress disorder treatment: Analyses from a randomized controlled trial. *Frontiers in Psychiatry, 15*, 1331569. https://doi.org/10.3389/fpsyt.2024.1331569	PTSD diagnosis using self-report measure
Özümerzifon, Y., Ross, A., Brinza, T., Gibney, G., & Garber, C. E. (2022). Exploring a dance/movement program on mental health and well-being in survivors of intimate partner violence during a pandemic. *Frontiers in Psychiatry, 13*, 887827. https://doi.org/10.3389/fpsyt.2022.887827	No PTSD diagnosis
Peacock, K. S., Stoerkel, E., Libretto, S., Zhang, W., Inman, A., Schlicher, M., Walter, J. (2019). A randomized trial comparing the Tennant Biomodulator to transcutaneous electrical nerve stimulation and traditional Chinese acupuncture for the treatment of chronic pain in military service members. *Military Medical Research, 6*(1), 37. https://doi.org/10.1186/s40779-019-0227-4	No PTSD diagnosis
Polusny, M. A., Erbes, C. R., Thuras, P., Moran, A., Lamberty, G. J., Collins, R. C., Lim, K. O. (2015). Mindfulness-based stress reduction for posttraumatic stress	Included participants with

disorder among veterans. *JAMA 314*(5), 456. https://doi.org/10.1001/jama.2015.8361	subthreshold PTSD	
Possemato, K., Bergen-Cico, D., Treatman, S., Allen, C., Wade, M., & Pigeon, W. (2016). A randomized clinical trial of primary care brief mindfulness training for Veterans with PTSD. *Journal of Clinical Psychology, 72*(3), 179–193. https://doi.org/10.1002/jclp.22241	Included participants with subthreshold PTSD	
Price C. (2005). Body-oriented therapy in recovery from child sexual abuse: an efficacy study. *Alternative therapies in health and medicine, 11*(5), 46–57.	No PTSD diagnosis	
Prisco, M. K., Jecmen, M. C., Bloeser, K. J., McCarron, K. K., Akhter, J. E., Duncan, A. D., Reinhard, M. J. (2013). Group auricular acupuncture for PTSD-related insomnia in veterans: A randomized trial. *Medical Acupuncture, 25*(6), 407–422. https://doi.org/10.1089/acu.2013.0989		No PTSD outcome measure
Saban, K. L., Collins, E. G., Mathews, H. L., Bryant, F. B., Tell, D., Gonzalez, B., Janusek, L. W. (2022). Impact of a mindfulness-based stress reduction program on psychological well-being, cortisol, and inflammation in women veterans. *Journal of General Internal Medicine, 37*(Suppl 3), 751–761. https://doi.org/10.1007/s11606-022-07584-4	No PTSD diagnosis	

Schellekens, M. P. J., Van den Hurk, D. G. M., Prins, J. B., Donders, A. R. T., Molema, J., Dekhuijzen, R., & Speckens, A. E. M. (2017). Mindfulness-based stress reduction added to care as usual for lung cancer patients and/or their partners: A multicentre randomized controlled trial. *Psycho-oncology, 26*(12), 2118-2126. https://doi.org/10.1002/pon.4430	No PTSD diagnosis
Schulz-Heik, R. J., Avery, T. J., Jo, B., Mahoney, L., & Bayley, P. J. (2022). Posttraumatic stress disorder does not compromise behavioral pain treatment: Secondary analysis of a randomized clinical trial among Veterans. *Global Advances in Health and Medicine, 11*, 21649561221075578. https://doi.org/10.1177/21649561221075578	No PTSD diagnosis
Schulz-Heik, R. J., Lazzeroni, L. C., Hernandez, B., Avery, T. J., Mathersul, D. C., Tang, J. S., Bayley, P. J. (2022). Valued living among veterans in breath-based meditation treatment or cognitive processing therapy for posttraumatic stress disorder: Exploratory outcome of a randomized controlled trial. Global *Advances in Health and Medicine, 11*, 2164957X221108376. https://doi.org/10.1177/2164957X221108376	PTSD diagnosis using self-report measure
Seppälä, E. M., Nitschke, J. B., Tudorascu, D. L., Hayes, A., Goldstein, M. R., Nguyen, D. T.	No PTSD diagnosis

H., Davidson, R. J. (2014). Breathing-based meditation decreases posttraumatic stress disorder symptoms in U.S. military veterans: a randomized controlled longitudinal study. *Journal of Traumatic Stress, 27*(4), 397–405. https://doi.org/10.1002/jts.21936	
Stoller, C. C., Greuel, J. H., Cimini, L. S., Fowler, M. S., & Koomar, J. A. (2012). Effects of sensory-enhanced yoga on symptoms of combat stress in deployed military personnel. *The American Journal of Occupational Therapy, 66*(1), 59–68. https://doi.org/10.5014/ajot.2012.001230	No PTSD diagnosis
Telles, S., Singh, N., Joshi, M., & Balkrishna, A. (2010). Post traumatic stress symptoms and heart rate variability in Bihar flood survivors following yoga: A randomized controlled study. *BMC Psychiatry, 10*(1), 18. https://doi.org/10.1186/1471-244X-10-18	No PTSD diagnosis
Valdez, C. E., & Lilly, M. M. (2016). Self-compassion and trauma processing outcomes among victims of violence. *Mindfulness, 7*(2), 329–339. https://doi.org/10.1007/s12671-015-0442-3	No PTSD diagnosis
Wild, J., El-Salahi, S., Degli Esposti, M., & Thew, G. R. (2020). Evaluating the effectiveness of a group-based resilience intervention versus psychoeducation for emergency responders in England:	No PTSD diagnosis

A randomised controlled trial. *PloS One, 15*(11), e0241704. https://doi.org/10.1371/journal.pone.0241704		
Williams, R. M., Day, M. A., Ehde, D. M., Turner, A. P., Ciol, M. A., Gertz, K. J., & Jensen, M. P. (2022). Effects of hypnosis vs mindfulness meditation vs education on chronic pain intensity and secondary outcomes in veterans: A randomized clinical trial. *Pain, 163*(10), 1905-1918.		No PTSD diagnosis
Yanos, P. T., Vayshenker, B., Pleskach, P., & Mueser, K. T. (2016). Insight among people with severe mental illness, co-occurring PTSD and elevated psychotic symptoms: Correlates and relationship to treatment participation. *Comprehensive Psychiatry, 68*, 172–177. https://doi.org/10.1016/j.comppsych.2016.04.016	No BOT	
Young-McCaughan, S., Straud, C. L., Bumstead, S., Pruiksma, K. E., Taylor, D. J., Jacoby, V. M., Peterson, A. L. (2023). Aerobic exercise improves sleep in U. S. active duty service members following brief treatment for posttraumatic stress disorder symptoms. *Frontiers in Psychology, 14*, 1249543. https://doi.org/10.3389/fpsyg.2023.1249543		PTSD diagnosis using self-report measure
Zhao, C., Zhao, Z., Levin, M. E., Lai, L., Shi, C., Hu, J., … Ren, Z. (2023). Efficacy and acceptability of mobile application-delivered		PTSD diagnosis using self-

acceptance and commitment therapy for posttraumatic stress disorder in China: A randomized controlled trial. *Behaviour Research and Therapy, 171*, 104440. https://doi.org/10.1016/j.brat.2023.104440	report measure

Appendix B

Studies of which no full-text could be retrieved:

1. Aizik-Reebs, A., Amir, I., Yuval, K., Hadash, Y., & Bernstein, A. (2022). Candidate mechanisms of action of mindfulness-based trauma recovery for refugees (MBTR-R): Self-compassion and self-criticism. *Journal of Consulting and Clinical Psychology*, *90*(2), 107–122. https://doi.org/10.1037/ccp0000716
2. Hollifield, M., Hsiao, A.-F., Smith, T., Calloway, T., Jovanovic, T., Smith, B., Cocozza, K. (2024). Acupuncture for combat-related posttraumatic stress disorder. *JAMA Psychiatry* (Chicago, Ill.). https://doi.org/10.1001/jamapsychiatry.2023.5651
3. Possemato, K., Bergen-Cico, D., Buckheit, K., Ramon, A., McKenzie, S., Smith, A. R., Pigeon, W. R. (2022). Randomized clinical trial of brief primary care-based mindfulness training versus a psychoeducational group for veterans with posttraumatic stress disorder. *The Journal of Clinical Psychiatry*, *84*(1). https://doi.org/10.4088/JCP.22m14510

Appendix C

Abbreviations Used in the Text and Their Meaning

Abbreviation	Meaning
BOT	Body-Oriented Treatment
CAPS	Unspecified version of the Clinician-Administered PTSD Scale
CAPS-5	Clinician-Administered PTSD Scale for DSM-5
PCL	Unspecified version of the PTSD Checklist
PCL-5	PTSD Checklist for DSM-5
PCL-C	PTSD Checklist for Civilians
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
PTSD	Post-Traumatic Stress Disorder
RCT	Randomized Controlled Trial
SLR	Systematic Literature Review
WEIRD	Western, Educated, Industrialized, Rich, and Democratic