Medical Science

To Cite:
Przegienda K, Bacik M, Głodowska K, Kiereta K, Baran A, Szyda K. Post-traumatic stress disorder management: an overview of conventional and emerging therapeutic approaches. *Medical Science* 2026; 30: e208ms3996
doi:

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Peer-Review History
Received: 07 June 2026
Reviewed & Revised: 29/June/2026 to 25/October/2026
Accepted: 09 November 2026
Published: 18 November 2026

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

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DISCOVERY SCIENTIFIC SOCIETY

Post-traumatic stress disorder management: an overview of conventional and emerging therapeutic approaches

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ABSTRACT

Post-traumatic stress disorder (PTSD) is a complex psychiatric disorder that arises as a consequence of a traumatic experience and has a massive impact on a patient's day-to-day life and quality of life. It is therefore a condition that absolutely requires individualized treatment. There's been a huge amount of progress over the years in our understanding of the pathophysiology of PTSD and in the development of effective treatments. We still find it very difficult to get good outcomes in the patient who is non-responsive to the standard of care. This is a summary of the current state of the art in the treatment of PTSD. The treatments of choice in clinical practice are the established pharmacological and psychotherapeutic options (trauma-focused psychotherapies and exposure-based therapies). We also look at some of the newer approaches, in particular MDMA assisted therapy and VR exposure therapy, which may well have some additional therapeutic utility.

Keywords: PTSD treatment, MDMA for PTSD treatment, PTSD therapeutic methods, Virtual reality for PTSD, Exposure therapy

1. INTRODUCTION

Epidemiology and risk factors of PTSD

Lifetime prevalence of PTSD in the literature is all over the place and its very much sex dependent. It's estimated to be somewhere between 10-20% in women and 6-8% in men. Of course there are a whole number of environmental, economic, cultural and social factors that will have an effect on this. The nature and severity of the traumatic event itself and the methodology of the study are also very important. Approximately 9% of those who experience a traumatic event will go on to develop PTSD, with the risk being about double in females and also higher in younger people and in those with a personal or family history of psychiatric illness. Around half of those who develop PTSD will not in fact initially meet the criteria for acute stress disorder (ASD) (Koenen et al., 2017).

Definition and Pathophysiology of PTSD

PTSD is a chronic mental disorder that arises as a result of exposure to a traumatic event (either as a participant or as a witness) (Al Jowf et al., 2023). The risk of developing PTSD is greater in the case of traumatic events which are the result of human action than those which are the result of natural forces or chance (Bromet et al., 2017). When describing the traumatic events, it is important to be able to differentiate between stressors which are within the normal range of human experience and those which are outside that range and which are commonly associated with the development of PTSD (Al Jowf et al., 2023). The risk factors for PTSD are: witnessing murder, torture, serious physical injury, sexual assault, shootings, knife attacks, life-threatening accidents, and physical assault.

The pathophysiology of PTSD is still not fully understood. It's certainly not the case that everyone who's had a traumatic experience will go on to develop PTSD. With that in mind, we can postulate that there are certain biological and environmental predispositions which increase the risk of developing the disorder. These include HPA axis dysfunction, neurotransmitter dysregulation, genetic variations, the diathesis–stress models, and the biopsychosocial models (Sherin et al., 2011).

Clinical Features and Diagnosis of PTSD

The symptoms of PTSD can be described in line with the diagnostic criteria as set out in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) and 11th Revision (ICD-11) (Burback et al., 2024).

PTSD in the DSM-5 is defined as being in the presence of exposure to a traumatic event (either as a witness or a participant). The symptoms have to be present for at least one month and must be present across four domains: (a) intrusion symptoms (recurrent, involuntary and distressing memories or dreams of the event); (b) avoidance of stimuli associated with the event; (c) negative alterations in cognition and mood (including memory loss, anhedonia, detachment from others etc.); and (d) alterations in arousal and reactivity (including irritability, angry outbursts, hypervigilance, difficulty concentrating and sleeping).

The DSM-5 has a wider range of psychological symptoms than the ICD-11 (guilt/shame, emotional insensitivity, disturbances in arousal and reactivity etc are all included) with impulsivity also being listed as a possible presentation. The ICD-11 is a far more restrictive system with the diagnosis based on three symptom clusters: re-experiencing the trauma, avoidance of trauma-related stimuli and a persistent sense of threat (which may be expressed as hypervigilance) (Burback et al., 2024).

PTSD Treatment Strategies

Treatment for PTSD can be broadly categorized into pharmacological interventions (both conventional and novel) and psychotherapeutic interventions (specifically trauma-focused cognitive behavioral therapy (TF-CBT)). There is clearly a gap in terms of access to treatment, with many patients not receiving the treatment they need. The delay in patients seeking professional help may be due to the level of distress that is associated with the fact that a key element of PTSD psychotherapy is the re-exposure to the traumatic memory. Experimental treatments such as virtual reality (VR) based on re-exposure to trauma reminders are also being investigated as a potential tool (Al Jowf et al., 2023).

2. REVIEW METHODS

For the literature search, we used PubMed, Scopus, and Google Scholar. Our search terms were a combination of keywords and phrases: 'PTSD treatment', 'MDMA for PTSD treatment', 'PTSD therapeutic methods', 'virtual reality for PTSD' and 'exposure therapy'.

We selected 58 English-language papers published between 2014 and 2024. They were selected on the basis of their relevance to the diagnostic criteria and to the treatment of PTSD. In the process of selection, we focused on established treatments as well as novel interventions under investigation. The article selection process had three stages. We first reviewed the titles and abstracts of the identified papers. We then reviewed the full texts of the selected papers. We compared the final results with the American Psychological Association (APA) recommendations for trauma treatment interventions (Figure 1).

3. RESULTS AND DISCUSSION

Psychotherapy

Psychotherapy remains one of the principal treatments for PTSD. The trauma itself can have a profound effect on a patient's mental health and on their day-to-day life. The most common symptoms reported by patients with PTSD are intrusive memories, nightmares, insomnia, anxiety, and a fear of any situation which is associated with the trauma. These symptoms can have a very significant impact on a patient's ability to function in their day-to-day lives. The main aim of psychotherapy is to help the patient come to understand

these reactions. The process of working through the trauma in a gradual way is what enables the patient to feel safe again (Lewis et al., 2020).

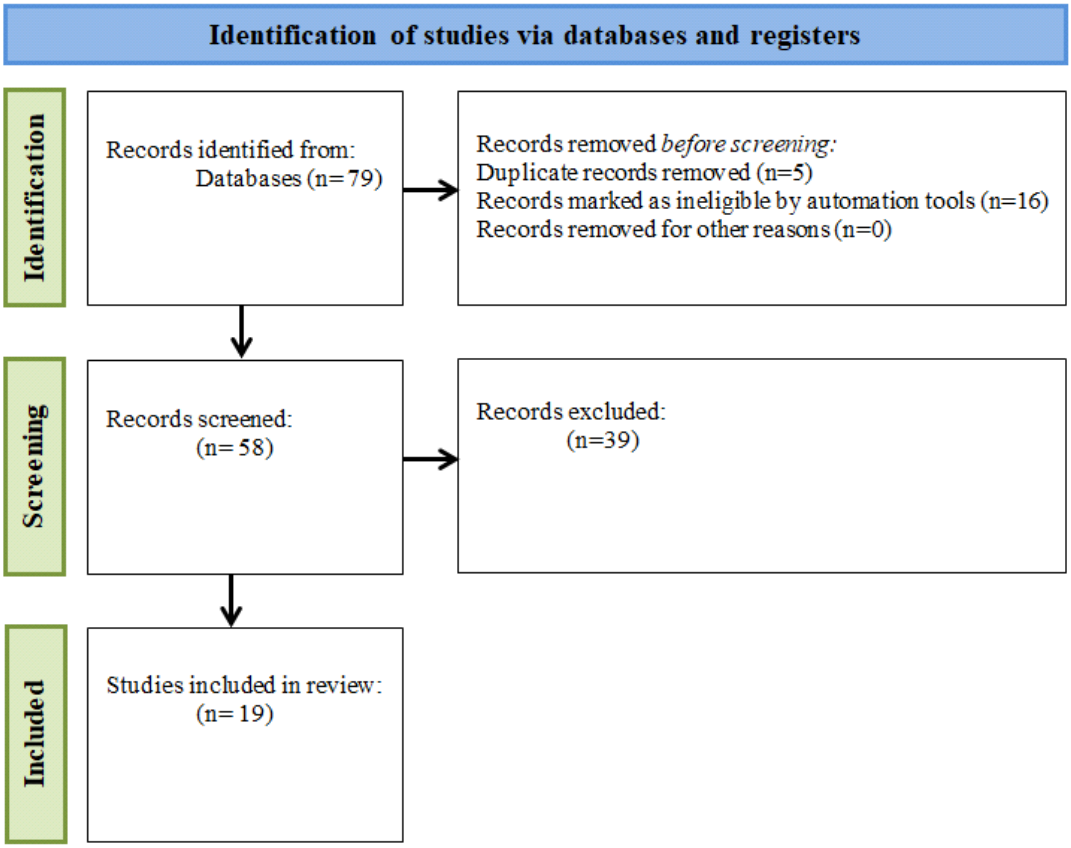


Figure 1. The PRISMA flow diagram

Therapy provides a safe and supportive space in which to work through the experience. A very important part of this is learning how to deal with the memories of the trauma without being overwhelmed by them. It's about learning to identify the negative thoughts that come up (particularly the thoughts of guilt, shame, and self-blame in relation to the trauma) and learning how to manage the emotions that are associated with the trauma (fear, anger, sadness). Over time, these skills can lead to a greater sense of confidence and greater preparedness for life in the here and now (Zalta, 2015; Alpert et al., 2023).

In psychotherapy, we use different treatment methods. Cognitive Behavioral Therapy teaches patients how to recognize and, eventually, change negative patterns of thinking and behavior. Prolonged Exposure Therapy includes gradually facing the traumatic memories and situations that underlie PTSD — situations that, by definition of the condition, patients tend to avoid. Eye Movement Desensitization and Reprocessing (EMDR) focuses on recalling traumatic experiences combined with bilateral stimulation – usually guided eye movements.

Studies have shown that both trauma focused CBT and EMDR lead to a significant reduction in PTSD symptoms (Lewis et al., 2020). Research into trauma focused treatment has demonstrated changes in brain activity in the areas of the brain involved in memory and emotion regulation. The mechanisms are still being investigated.

Psychotherapy has a massive effect on people's lives. There's a reduction in nightmares and flashbacks, a reduction in anxiety, and a greater ability to regulate your own emotions. It leads to better sleep, better relationships, and a much greater ability to get on with the normality's of life. Most importantly, it helps people to regain self-confidence and to develop a much more positive view of themselves. Psychotherapy provides an opportunity for the patient with PTSD to come to terms with their experience and learn how to live with their memories without them being the master of their life. The journey to recovery is very individual and can take a long

time. The right level of psychological support can make a huge difference to the patient's well-being and quality of life (Pierce & Black, 2023).

Exposure therapy

Exposure therapy is one of the most researched and most effective treatments within CBT (Morina et al., 2018) and is quite simply 'facing your fears'. It is a very structured form of therapy which is designed to change the maladaptive fear response and reduce avoidance. The key to exposure therapy is to break the cycle of avoidance. Avoidance of the situation, object, or memory associated with the trauma is one of the diagnostic criteria for PTSD. It provides short-term relief, but, in the long-term, actually perpetuates the belief that the feared stimulus is in fact dangerous. That's the mechanism that maintains the anxiety. Exposure therapy works by repeatedly and systematically exposing the patient to the feared stimulus in a safe and controlled way, thereby demonstrating that the stimulus is in fact not as dangerous as the patient believes and that they can cope with it. The efficacy of exposure therapy is thought to be due to the following mechanisms.

Inhibitory Learning Model

The available research clearly shows that successful exposure does not extinguish the original fear memory. What it does is create new inhibitory learning that competes with and ultimately suppresses the fear response. The patient learns that the previously feared stimulus can be encountered without fear.

Expectation Violation

That's what exposure therapy for PTSD is all about. You're deliberately taking the patient into the feared situation and then having them compare their expectations against what actually happens. They very quickly see that their worst-case scenarios don't come to pass (Craske et al., 2014).

Emotional Processing and Corrective Learning

Exposure provides an opportunity to experience fear in a safe environment whilst simultaneously being given new information which challenges the previously held threat-related beliefs. This is a mechanism for emotional learning and is a contributor to improvement in PTSD symptoms.

Clinical Performance

Exposure ladder

Exposure exercises typically involve distressing situations, starting at the least distressing end of the scale and working progressively up to the most distressing (McLean & Foa, 2017).

Reduction of Safety Behaviors

Patients are asked to reduce any behaviors that give a false sense of security, as these can in fact impede the learning that the feared situation is in fact manageable.

Contextual variation

Research has shown that doing exposure exercises in a variety of situations and settings can actually enhance the effects of therapy and facilitate generalization of the treatment gains (Craske et al., 2014).

Virtual Reality in PTSD therapy

Virtual Reality Exposure Therapy (VRET) is an innovative form of psychotherapy. It implements computer-generated environments – safe and controlled - to help PTSD patients confront trauma-related memories, thoughts, and situations. It is based on the principles of traditional exposure therapy, but patients do not have to rely only on imagination. During therapy, they interact with immersive virtual environments that simulate aspects of their traumatic experiences (Maples-Keller et al., 2017; Deng et al., 2019).

In recent years, VRET has gained increasing attention as a possible treatment for PTSD. Researchers suggest that this approach may help reduce core PTSD symptoms, including anxiety, avoidance behaviors, and intrusive memories. The immersive virtual reality

format may make therapy more absorbing. It may help patients process the traumatic experiences more effectively, particularly when it is difficult to mention or visualize these experiences. (Maples-Keller et al., 2017).

Extensive systematic reviews and meta-analyses have shown that VRET produces a significant reduction in PTSD symptoms with efficacy comparable to that of conventional exposure therapy. The bulk of the work to date has been in the veteran population (Kothgassner et al., 2019; Deng et al., 2019). In spite of these promising findings, several limitations remain. Many studies have involved relatively small sample sizes. Comparisons across studies are even more difficult because VR tools, treatment protocols, and outcome measures differ (Carl et al., 2019).

Most of the research to date has been carried out in a military context, which, of course, does limit the generalizability of the findings to the civilian population. Data issues also mean that the long-term effectiveness of VRET remains uncertain. The available research does suggest that VRET has the potential to be a useful tool in the treatment of PTSD, in that it can be tailored to the individual patient and enables them to be an active participant in their own treatment. Further work is required to fully understand the benefits, limitations and place of VRET within the current treatment landscape.

PTSD conventional pharmacotherapy

There is no targeted treatment for PTSD. Fluoxetine and venlafaxine are commonly used as alternative treatments, but sufficient clinical evidence does not support them (Table 1). Initially, SSRIs were considered useful in patients who have PTSD along with anxiety and depression (Hamblen et al., 2019). Later became apparent that SSRIs could be beneficial in patients without those symptoms. Nevertheless, their therapeutic efficacy remains limited. Fluoxetine and venlafaxine are commonly used alternatives, but sufficient clinical evidence does not support them (Table 1). Second-line treatment options for PTSD include imipramine and phenelzine, as well as the antipsychotics risperidone, quetiapine, olanzapine, and aripiprazole. Antipsychotics are often used in cases of treatment-resistant PTSD (Hamblen et al., 2019).

Table 1. PTSD conventional pharmacotherapy

Class	Example
Selective serotonin reuptake inhibitors (SSRI)	Paroxetine Sertraline Fluoxetine
Serotonin–Norepinephrine Reuptake Inhibitors (SNRI)	Venlafaxine
Tricyclic Antidepressants (TCAs)	Imipramine
Monoamine Oxidase Inhibitors (MAOIs)	Phenelzine
Antipsychotics	Risperidone, Quetiapine, Olanzapine, Aripiprazole

A number of other drugs are in clinical use for the management of PTSD symptoms, albeit with very little evidence to support their use. These include mirtazapine, mood stabilizers, buspirone, clonidine, guanfacine, propranolol and trazodone. Prazosin is commonly prescribed to patients who have nightmares. Its effectiveness is however, still very much in question. Benzodiazepines are not recommended for the management of anxiety and sleep problems in PTSD. There is also concern that the use of benzodiazepines immediately following a traumatic event may actually increase the risk of developing PTSD (Burback et al., 2024).

MDMA - Assisted Therapy as an Innovative Approach to PTSD Treatment

So, a large number of patients with PTSD still have symptoms even after receiving first-line treatments. It's estimated that 40-60% of patients don't respond adequately to the conventional pharmacological treatments described above. The poor efficacy of the current treatments has led to a lot of research into alternative avenues in terms of pharmacotherapy. 4-methylenedioxymethamphetamine (MDMA) is currently under investigation as a potential treatment for PTSD. It works by acting on the presynaptic serotonin transporter

to increase the release of serotonin, which in theory may reduce the strength of fear memories and have an effect on their reconsolidation (Mitchell et al., 2021).

In 2021, a double blind, placebo-controlled phase 3 trial was conducted to assess the efficacy and safety of MDMA in patients with severe PTSD. 345 patients with similar durations of PTSD were randomized to 18 weeks of either MDMA or placebo treatment. All participants were assessed at baseline and at the end of the trial using the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5), the Sheehan Disability Scale (SDS), the Columbia-Suicide Severity Rating Scale (C-SSRS), and the Beck Depression Inventory-II (BDI-II) (Mitchell et al., 2021).

Changes in PTSD Symptom Severity: CAPS-5 Outcomes

Greater improvements were seen in the MDMA group with a mean reduction in CAPS-5 scores of 24.4 versus 13.9 in the placebo group. For patients with the dissociative subtype of PTSD, the mean CAPS-5 score reduction was 30.8 in the MDMA group and 12.8 in the placebo group (Mitchell et al., 2021). The therapy also showed encouraging results in the population with comorbidities, which are often associated with treatment resistance.

Changes in PTSD Symptom Severity: SDS Outcomes

The MDMA group had a greater reduction in total SDS scores. The mean change from baseline to the end of the study was −3.1 in the MDMA group compared to −2.0 in the placebo group.

Changes in Depressive Symptom Severity: BDI-II Outcomes

MDMA-assisted therapy was also found to be effective in reducing depressive symptoms as measured by the BDI-II. The mean change from baseline to the end of the study was $\Delta = -19.7$ in the MDMA group versus $\Delta = -10.8$ in the placebo group (Mitchell et al., 2021).

Safety and Adverse Events Associated with MDMA-Assisted Therapy

Patients in the MDMA group had more adverse events than those in the placebo group. These were generally transient and mild to moderate in severity and comprised increased muscle tension, sweating, chills, and decreased appetite. Both systolic and diastolic blood pressure rose transiently, with no evidence of QT interval prolongation. There was no increased risk of MDMA misuse or of suicidal ideation in the MDMA group (Mitchell et al., 2021).

4. CONCLUSION

The complex pathophysiology of PTSD and its wide range of clinical presentations, with the potential for persistent impairments in everyday functioning, means it's a significant public health issue. The first hurdle in any clinical intervention is diagnosis. DSM-5 and ICD-11 have different diagnostic criteria, which makes it very difficult to identify specific patient groups and to compare the results of different studies looking at the effectiveness of various treatments. Despite all the major advances in the field (in terms of both diagnosis and the range of diagnostic tools available), treatment of PTSD remains a major challenge. Primarily due to the individual's response to the experience that gives rise to the condition, the frequent co-existence of other mental disorders, and the fact that medical therapies are often only partially effective.

Trauma-focused psychotherapy remains one of the most important and best-documented forms of treatment for PTSD. It's very effective in reducing symptoms and improving emotional adjustment, which in turn can lead to improved functioning in daily life. Exposure therapy is a key tool in the management of PTSD, aimed at reducing avoidance and working on the development of new adaptive responses to trauma-related stimuli. VR has the potential to be a useful adjunct to conventional psychotherapies. The current body of evidence on the effectiveness of such treatment modalities suggests that VR may be effective in the reduction of PTSD symptoms. That said, given the relatively small number of studies, the heterogeneity of the data and the paucity of information on long-term outcomes, it still requires further investigation.

SSRIs are still a cornerstone of pharmacological treatment of PTSD, though their efficacy in a proportion of patients is clearly limited, and this underlines the need for individualization of treatment and the need for more effective drugs. MDMA-assisted therapy has demonstrated efficacy in the reduction of PTSD symptoms, reduction in depressive symptoms, and improvement in psychosocial functioning. Given the occurrence of serious adverse events and safety-related events, further rigorous clinical research into the use of MDMA as a pharmacological agent in the treatment of PTSD is clearly indicated.

Acknowledgments
There are no acknowledgments to disclose.

Authors' Contributions
Małgorzata Bacik: Project administration, writing - rough preparation
Klaudia Głodowska: Formal analysis, supervision
Kacper Kiereta: Visualization, writing - rough preparation
Karina Przegienda: Conceptualization, methodology
Adrian Baran: Resources, data curation
Kamila Szyda: Review and editing
All authors have read and agreed to the published version of the manuscript.

Informed consent
Not applicable.

Ethical approval
Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

Funding
This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Conflict of interest
The authors declare that they have no conflicts of interest, competing financial interest or personal relationship that could have influenced the work reported in this paper.

Data and materials availability
All data associated with this study will be available based on the reasonable request to the corresponding author.

REFERENCES

1. Al Jowf GI, Ahmed ZT, Reijnders RA, de Nijs L, Eijssen LMT. To predict, prevent, and manage post-traumatic stress disorder (PTSD): a review of pathophysiology, treatment, and biomarkers. Int J Mol Sci. 2023;24(6):5238. doi:10.3390/ijms24065238.
2. Alpert E, Shotwell Tabke C, Cole TA, Lee DJ, Sloan DM. A systematic review of literature examining mediators and mechanisms of change in empirically supported treatments for posttraumatic stress disorder. Clin Psychol Rev. 2023;103:102300. doi:10.1016/j.cpr.2023.102300.
3. Bromet EJ, Atwoli L, Kawakami N, Navarro-Mateu F, Piotrowski P, King AJ, Aguilar-Gaxiola S, Alonso J, Bunting B, Demyttenaere K, Florescu S, de Girolamo G, Gluzman S, Haro JM, de Jonge P, Karam EG, Lee S, Kovess-Masfety V, Medina-Mora ME, Mneimneh Z, Pennell BE, Posada-Villa J, Salmerón D, Takeshima T, Kessler RC. Post-traumatic stress disorder associated with natural and human-made disasters in the World Mental Health Surveys. Psychol Med. 2017;47(2):227-41. doi:10.1017/S0033291716002026.
4. Burback L, Brémault-Phillips S, Nijdam MJ, McFarlane A, Vermetten E. Treatment of posttraumatic stress disorder: a state-of-the-art review. Curr Neuropharmacol. 2024;22(4):557-635. doi:10.2174/1570159X21666230428091433.
5. Carl E, Stein AT, Levihn-Coon A, Pogue JR, Rothbaum B, Emmelkamp P, Asmundson GJG, Carlbring P, Powers MB. Virtual reality exposure therapy for anxiety and related disorders: a meta-analysis of randomized controlled trials. J Anxiety Disord. 2019;61:27-36. doi:10.1016/j.janxdis.2018.08.003.
6. Craske MG, Treanor M, Conway CC, Zbozinek T, Vervliet B. Maximizing exposure therapy: an inhibitory learning approach. Behav Res Ther. 2014;58:10-23. doi:10.1016/j.brat.2014.04.006.
7. Deng W, Hu D, Xu S, Liu X, Zhao J, Chen Q, Liu J, Zhang Z, Jiang W, Ma L, Hong X, Cheng S, Liu B, Li X. The efficacy of

virtual reality exposure therapy for PTSD symptoms: a systematic review and meta-analysis. J Affect Disord. 2019;257:698-709. doi:10.1016/j.jad.2019.07.086.

8. Hamblen JL, Norman SB, Sonis JH, Phelps AJ, Bisson JI, Nunes VD, Megnin-Viggars O, Forbes D, Riggs DS, Schnurr PP. A guide to guidelines for the treatment of posttraumatic stress disorder in adults: an update. Psychotherapy (Chic). 2019;56(3):359-73. doi:10.1037/pst0000231.
9. Koenen KC, Ratanatharathorn A, Ng L, McLaughlin KA, Bromet EJ, Stein DJ, Karam EG, Ruscio AM, Benjet C, Scott K, Atwoli L, Petukhova M, Lim CCW, Aguilar-Gaxiola S, Al-Hamzawi A, Alonso J, Bunting B, Ciutan M, de Girolamo G, Degenhardt L, Gureje O, Haro JM, Huang Y, Kawakami N, Lee S, Navarro-Mateu F, Pennell BE, Piazza M, Sampson N, ten Have M, Torres Y, Viana MC, Williams D, Xavier M, Kessler RC. Posttraumatic stress disorder in the World Mental Health Surveys. Psychol Med. 2017;47(13):2260-74. doi: 10.1017/S0033291717000708.
10. Kothgassner OD, Goreis A, Kafka JX, Van Eickels RL, Plener PL, Felnhofer A. Virtual reality exposure therapy for posttraumatic stress disorder (PTSD): a meta-analysis. Eur J Psychotraumatol. 2019;10(1):1654782. doi:10.1080/20008198.2019.1654782.
11. Lewis C, Roberts NP, Andrew M, Starling E, Bisson JI. Psychological therapies for post-traumatic stress disorder in adults: systematic review and meta-analysis. Eur J Psychotraumatol. 2020;11(1):1729633. doi:10.1080/20008198.2020.1729633.
12. Maples-Keller JL, Bunnell BE, Kim SJ, Rothbaum BO. The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. Harv Rev Psychiatry. 2017;25(3):103-13. doi:10.1097/HRP.0000000000000138.
13. McLean CP, Foa EB. Prolonged exposure therapy for post-traumatic stress disorder: a review of evidence and dissemination. Expert Rev Neurother. 2011;11(8):1151-63. doi: 10.1586/ern.11.94.
14. Mitchell JM, Bogenschutz M, Lilienstein A, Harrison C, Kleiman S, Parker-Guilbert K, Ot'alora G, Garas W, Paleos C, Gorman I, Nicholas C, Mithoefer M, Carlin S, Poulter B, Mithoefer A, Quevedo S, Wells G, Klaire SS, van der Kolk B, Tzarfaty K, Amiaz R, Worthy R, Shannon S, Woolley JD, Marta C, Gelfand Y, Hapke E, Amar S, Wallach Y, Brown R, Hamilton S, Wang JB, Coker A, Matthews R, de Boer A, Yazar-Klosinski B, Emerson A, Doblin R. MDMA-assisted therapy for severe PTSD: a randomized, double-blind, placebo-controlled phase 3 study. Nat Med. 2021;27(6):1025-33. doi:10.1038/s41591-021-01336-3.
15. Morina N, Stam K, Pollet TV, Priebe S. Prevalence of depression and posttraumatic stress disorder in adult civilian survivors of war who stay in war-afflicted regions. A systematic review and meta-analysis of epidemiological studies. J Affect Disord. 2018;239:328-38. doi:10.1016/j.jad.2018.07.027.
16. Pierce ZP, Black JM. The neurophysiology behind trauma-focused therapy modalities used to treat post-traumatic stress disorder across the life course: a systematic review. Trauma Violence Abuse. 2023;24(2):1106-23. doi:10.1177/15248380211048446.
17. Sherin JE, Nemeroff CB. Post-traumatic stress disorder: the neurobiological impact of psychological trauma. Dialogues Clin Neurosci. 2011;13(3):263-78. doi:10.31887/DCNS.2011.13.2/jsherin.
18. Zalta AK. Psychological mechanisms of effective cognitive-behavioral treatments for PTSD. Curr Psychiatry Rep. 2015;17(4):560. doi:10.1007/s11920-015-0560-6.