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## **Post-traumatic Stress Disorder and Major Depressive Disorder: Impact of Mass Shootings**

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**ABSTRACT**

**Introduction:** Post-traumatic stress disorder (PTSD) is a debilitating mental health condition that may develop following exposure to severe traumatic events, including mass shootings. Although less than 10% of those exposed ultimately develop PTSD, a substantial proportion of patients, up to 52%, also meet the criteria for major depressive disorder (MDD), which is associated with more severe symptoms and poorer treatment outcomes. **Materials and methods:** A review of chosen literature from PubMed and Google Scholar was conducted, using key words including "PTSD", "MDD", "comorbidity" "symptoms", "treatment".

**Summary:** This review synthesises recent studies examining the prevalence, symptom profiles, and treatment responses in individuals with comorbid PTSD and MDD following mass shootings. Findings indicate that PTSD prevalence varies considerably according to trauma type and exposure level, with direct and indirect exposures exerting distinct influences on

symptomatology.

**Conclusions:** Comorbid MDD appears to exacerbate functional impairments and may attenuate the effectiveness of standard PTSD interventions. Evidence suggests that early intervention, comprehensive assessment of trauma and risk factors, and tailored therapeutic approaches, including sequential treatment strategies, are critical in mitigating long-term psychological and functional impairments in this population. These results underscore the need for improved screening, intervention, and support systems for survivors of mass shootings to enhance recovery and long-term outcomes.

**Keywords:** PTSD, MDD, comorbidity, symptoms, treatment

## **Introduction**

Post-traumatic stress disorder (PTSD) is a mental health condition that can occur after encountering deeply distressing events, such as interpersonal violence, warfare, severe accidents, or natural disasters [1]. However, it does so only in approximately less than 10% of cases [2]. In 2013, the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) revised the classification of PTSD, moving it from the category of anxiety disorders to a newly established category of trauma- and stressor-related disorders [3]. PTSD is a potentially long-lasting and debilitating condition marked by symptoms of reliving traumatic events, avoidance behaviours, and negative changes in thinking and emotional arousal [4]. Depression frequently coexists with PTSD, as 52% of individuals diagnosed with PTSD also meet the criteria for major depressive disorder (MDD) [5]. Co-occurring MDD is strongly linked to more severe symptoms, reduced functioning, increased dissociation, a higher number of prior treatment attempts, and a greater number of current co-occurring diagnoses [6]. The lifetime prevalence of PTSD varies globally. In the general American and European population, 1-year prevalence ranges from 0.9% to 3.5% [7] when lifetime frequency may be up to 7-10% [8–10]. PTSD can occur across individuals of all ages in any population, although certain groups experience exceptionally high rates. Women are more likely to be diagnosed with PTSD than men [11]. In military service members and veterans, PTSD prevalence ranges from 5.4 to 16.8%. The rise in global terrorism and military conflicts has been associated with increased PTSD prevalence

among individuals exposed to such events [4]. The prevalence for crime victims ranges between 19-75% (up to 80% after rape), 30-40% for disaster victims, 10-20% for rescue workers and a prevalence ranging from 6-32% for police, fire and emergency service workers [12]. These diverse findings underscore the complexity of PTSD's clinical presentation, prompting further investigation into its manifestation in survivors of mass shootings. Research indicates that 11% to 62% of youth develop post-traumatic stress after a mass shooting, with rates varying based on assessment type, exposure level, and time since the traumatic event [13]. This review examines the prevalence and treatment outcomes of MDD in PTSD patients following mass shootings, with a focus on distinct symptom presentations and potential screening or intervention strategies.

### **Post-traumatic stress disorder**

Mass shootings have profound mental health impacts on both child and adolescent survivors, as well as those who are indirectly exposed. Research suggests that witnessing such violence can be even more traumatising than experiencing a wide range of other natural or human-made disasters [14]. Around 16% of children and adolescents develop PTSD after experiencing a DSM-IV or DSM-5 criterion trauma. The risk of PTSD varies significantly by trauma type: approximately 10% develop PTSD after non-interpersonal trauma, while about 25% do so following interpersonal trauma [15]. A 2024 study found that individuals suffering from gunshot-related trauma had the highest rates of positive PTSD screenings compared to those with blunt trauma, other injuries, or elective orthopaedic conditions [16]. A 2017 review of 49 studies examining 15 mass shooting incidents between 1984 and 2008 found that PTSD prevalence among children and adults exposed to gun violence varied significantly, ranging from 3% to 91%, depending on the sample and study methodologies [17]. In the short term, individuals may exhibit acute stress reactions and general emotional distress, while longer-term impacts can include PTSD. Although most individuals recover and return to their pre-exposure level of functioning within a few months, some develop chronic and severe impairments [18]. In the acute phase, symptoms may include intrusive thoughts, nightmares, avoidance of triggers, social withdrawal, heightened arousal, sleep disturbances, irritability, and difficulty focusing [19]. Beyond individual symptoms, the repercussions of mass shootings extend to community-wide effects, amplifying the overall psychological impact. Mass shootings impact not only the survivors who are directly exposed but also the surrounding community, which often experiences significant upheaval. Initial reactions may include widespread panic, a breakdown in social cohesion, and heightened levels of anxiety throughout the community [20].

Exposure to gun violence most commonly occurs through auditory experiences, such as hearing gunfire in public spaces. For older youth and adolescents, this type of exposure is not strongly associated with post-traumatic symptoms. However, for younger children (ages 2–9), hearing gunfire is significantly linked to post-traumatic symptoms, indicating that even less severe threats can cause substantial distress in this age group. Among adolescents aged 10–17, both direct exposure to gun violence and witnessing it are associated with post-traumatic symptoms. However, when polyvictimisation is considered, the impact of direct exposure becomes less significant, indicating that youth directly exposed to gun violence (e.g., being personally threatened with or shot at) frequently experience multiple forms of violence, contributing to compounded psychological distress [21].

A significant proportion of survivors do not develop long-term psychological disorders, a phenomenon attributed to resilience defined as the capacity to adapt successfully to stressors and maintain psychological well-being in adversity [22]. Resilience plays a substantial role in trauma outcomes, with 40–78% of individuals exposed to mass violence or other traumatic events reporting minimal to no symptoms of psychological disorders over time [23]. Research indicates that only a minority of survivors will develop conditions that reach diagnostic thresholds for PTSD, depression, and anxiety or have subclinical conditions months and years after an incident of mass violence [24]. Despite these encouraging findings on resilience, a subset of survivors continue to experience enduring impairments, highlighting the need for ongoing support and intervention. A study conducted seven months after a public shooting at a Danish high school found that 35% of students reported symptoms of post-traumatic stress (PTS), with 7% meeting the diagnostic criteria for PTSD [25]. Similarly, in the Northern Illinois study, while 49% of individuals reported PTS symptoms 30 days after the event, this rate dropped significantly to 11% by nine months [26]. However, certain factors related to the disaster, specific experiences during the event, and individual differences can hinder survivors' ability to harness resilience. In cases of school shootings, Miron et al. found that individuals with higher levels of emotional dysregulation and peritraumatic dissociation were four times more likely to develop PTS symptoms eight months after the incident [24]. In addition to post-traumatic symptoms, survivors of mass shootings frequently experience major depression, with prevalence rates ranging from 4.9% to 71%. Other disorders are less common, with social phobia affecting 3% of survivors and panic disorder affecting 1–2.4% [17]. A 2020 study revealed that school shootings have significant long-term effects, including

increased absenteeism and grade repetition, decreased high school graduation rates, lower college enrollment and completion rates, as well as reduced employment and earnings by ages 24–26 [27]. In parallel to these socio-economic impacts, the physiological effects of trauma, such as disrupted sleep patterns, also warrant attention. The Utøya mass shooting offered a rare opportunity to examine specific sleep disturbances in adolescents following a profoundly traumatic event. A follow-up assessment was conducted over two years post-incident, and more than 50% of survivors reported sleep disturbances that originated at the time of the event. These included high rates of insomnia (56.3%), excessive daytime sleepiness (34.4%), obstructive sleep apnea symptoms (18.8%), and frequent nightmares (37.5%), reflecting significant disruption in their lives. The prevalence of sleep disturbances among survivors underscores the susceptibility of the sleep-wake system to severe stressors and its association with psychiatric conditions [28]. Although not directly linked to sleep disturbances, survivors demonstrated declines in academic performance, with lower grades reported two years post-incident compared to pre-incident levels [29].

PTSD symptoms often begin to emerge within days of trauma exposure. Trauma-exposed individuals frequently interact with emergency services, providing an opportunity for early identification of at-risk individuals and the implementation of preventive interventions. [30]. Assessing prior trauma exposure and related risk factors (e.g., mental health history, interpersonal difficulties, anxiety sensitivity, and conduct problems) is essential for predicting heightened trauma responses following a disaster or mass shooting [31–33]. This emphasis on early risk assessment is reflected in subsequent research on treatment-seeking behaviours following traumatic events. A 2018 study examining treatment utilisation within 6 months post-incident among college women after a campus shooting found that fewer than 15% sought formal treatment, such as psychotherapy or medication. The study revealed that participants with a probable PTSD diagnosis were more likely to seek treatment compared to those who were only at risk or not at risk for PTSD six months after the shooting. This indicates that survivors experiencing greater emotional distress are more inclined to engage in treatment. However, the study did not provide details about how individuals accessed treatment (e.g., through provider referral or self-referral) or specifics about their treatment experiences, such as the type of therapy, format, or progress made [34]. A 2022 study on survivors of the Utrecht tram shooting revealed that many individuals in need of care struggled to navigate the existing healthcare system, with half still requiring assistance in finding appropriate support 18 months after the incident. A considerable proportion of survivors reported health issues, including post-

traumatic stress symptoms and related conditions, requiring professional intervention. Half of the respondents also reported developing new health problems attributed to the shooting, with the most common being psychological difficulties, fatigue, cardiovascular issues, and digestive problems. Despite these challenges, a substantial proportion of survivors resumed daily activities, with the majority reporting favourable overall health at both six- and 18-months post-incident, rating it as good, very good, or excellent [35].

Mass shootings are associated with elevated rates of PTSD, particularly among individuals with gunshot injuries, alongside major depression, social phobia, and panic disorder. Both direct and indirect exposure are harmful, particularly for young children who show distress even from hearing gunshots. However, the interplay of multiple traumatic exposures further complicates the clinical picture, especially in adolescents. While resilience prevents long-term disorders in many survivors, a significant portion experiences lasting impairment. For adolescents, the impact of direct gun violence is often intertwined with polyvictimisation, where experiencing multiple forms of violence intensifies the trauma. School shootings have long-term consequences on educational and economic outcomes, including decreased graduation rates, lower college enrolment, and reduced future earnings. Survivors frequently suffer from lasting sleep problems and declining academic performance. While PTSD symptoms often appear quickly, presenting an opportunity for early intervention, many survivors do not seek or struggle to access needed mental health care, highlighting systemic issues in support provision. Assessing prior trauma and mental health history is crucial for identifying those at high risk. While some survivors experience persistent impairments, a notable proportion report maintaining good overall health in the long term.

## **Depression**

Depression is highly prevalent among individuals with PTSD, with approximately 52% experiencing major depressive disorder (MDD) [36]. In specific populations, such as war survivors, the prevalence of comorbid PTSD and depression can be as high as 55.26% [37]. The co-occurrence of PTSD and depression leads to more severe symptoms and lower functional levels, making treatment more challenging [38]. Depression can also reduce the effectiveness of PTSD therapies, with greater depression severity predicting smaller treatment effects [39]. Additionally, depression affects trauma memory by making it less accessible and coherent, in contrast to PTSD, which enhances memory vividness and sensory detail [40]. PTSD severity is classified using a combination of self-report scales, clinician-administered assessments, and objective biomarkers. Latent Profile Analysis LPA, The Davidson Trauma



Scale (DTS), the Clinician-Administered PTSD Scale (CAPS) and the PTSD Symptom Checklist (PCL) [41], EEG and MRI can be used [42,43], PTSD symptom trajectories [44].

Greater depression severity is associated with smaller PTSD treatment effect sizes, indicating that individuals with more severe depression may experience less benefit from PTSD therapies [39,45]. Even when depression improves, individuals with comorbid PTSD and depression often remain more functionally impaired compared to those with depression alone [46]. The heterogeneity and symptom overlap between PTSD and depression can lead to worse treatment outcomes, as specific patterns of symptom overlap may not respond well to standard PTSD treatments [47]. Depression comorbidity requires modifications to trauma-focused interventions to address both PTSD and depressive symptoms effectively [39]. Different PTSD treatments may yield varied outcomes depending on the presence of comorbid depression. For instance, patients with major depressive disorder (MDD) may respond better to specific therapies like imagery rescripting compared to others like EMDR [48]. A sequential treatment approach (targeting PTSD first, followed by depression) has shown greater efficacy in managing comorbid PTSD and MDD in clinical studies [49].

Psychoanalytic therapy, along with other psychotherapeutic modalities like cognitive and behavioural therapies, has been shown to significantly impact PTSD and related psychiatric symptoms, including depression [50]. However, cognitive processing therapy (CPT), cognitive therapy (CT), and eye movement desensitisation and reprocessing (EMDR) are often highlighted for their effectiveness in reducing PTSD symptoms [51]. Moreover, age-specific adaptations of these therapies can further enhance treatment outcomes in younger populations. In children and adolescents, cognitive processing therapy, behavioural therapy, and trauma-focused cognitive-behavioural therapy (TF-CBT) are particularly effective, suggesting these may also benefit adults [52]. The combination of immediate, post-immediate, and follow-up care has been confirmed to be effective in treating post-traumatic psychiatric disorders, supporting the early incorporation of psychotherapy [53]. Meta-analyses indicate that psychotherapeutic treatments, including cognitive and psychodynamic therapies, significantly improve psychological health and decrease symptoms of PTSD and depression, with effects sustained over time [50].

PTSD treatments and suicide-focused treatments effectively reduce both PTSD- and suicide-related outcomes, supporting current clinical guidelines [54]. Combining suicide-focused treatments, risk management procedures, and trauma-focused treatments can effectively treat suicidal patients with PTSD [55]. In addition to psychotherapeutic approaches,

pharmacological interventions also play a vital role in managing PTSD. SSRIs and SNRIs are effective and acceptable medications for adults with PTSD, but individualised drug management is recommended for patients with different clinical characteristics [56]. Clinical practice guidelines for depression treatment converge on SSRIs as first-line treatment but diverge on key topics like suicide risk, highlighting the need for caution when following specific guidelines [57]. SSRIs may have varying effects on suicide rates over time, with the turning point potentially being the first 2 months of treatment [58]. SSRIs may increase the risk of suicide and self-harm in adults, but more extensive trials with longer follow-ups are needed to assess their risks and benefits fully [59].

Brief EMDR treatment effectively reduces PTSD and depression symptoms in adult-onset trauma victims, while SSRIs provide moderate relief for adult victims of childhood-onset trauma [60]. Psychological therapies, particularly behaviour therapy and EMDR, are more effective than drug therapies for symptom reduction in post-traumatic stress disorder [61]. However, treatment outcomes can vary over time and across different patient populations. PTSD symptoms improved slightly over time, but dose-of-care benchmarks for psychotherapy and pharmacotherapy were not related to symptom improvement in veterans with PTSD [62]. Olanzapine may be an effective adjunct to SSRIs for treating SSRI-resistant PTSD, particularly in improving sleep symptoms [63].

A response is an initial improvement in symptoms, while remission is a more desirable outcome, characterised by minimal symptoms for at least three consecutive weeks [64]. A recovery is defined as maintaining remission for at least four months without relapse. Recovery can only be lost if followed by a recurrence [65]. Understanding these definitions is crucial for evaluating treatment success in clinical studies. In a study of internet-delivered cognitive behavioural therapy (iCBT), 70.8% of participants remained in remission nine months post-treatment, indicating that complete remission is possible but not guaranteed, factors such as younger age, long-term conditions, and residual symptoms at the end of treatment can predict relapse, highlighting the need for personalised management strategies [66]. PTSD treatment, especially when initiated soon after trauma, can enhance long-term remission. However, comorbid conditions like substance use disorders can complicate recovery, necessitating ongoing management [67]. Long-term recovery is often measured through follow-up assessments at 1-, 2-, and 5-years post-treatment, focusing on symptom severity and functional outcomes [38].

## **Conclusions**

Depression is common in PTSD, affecting up to 52% of individuals and 55.26% of war survivors. Comorbid PTSD and depression lead to more severe symptoms, reduced functioning, and lower treatment effectiveness. Depression also alters trauma memory, making it less accessible and coherent. PTSD severity is assessed using self-report scales, clinician-administered tools, and biomarkers like EEG and MRI. Typical assessments include LPA, DTS, CAPS, and PCL. The presence of depression complicates PTSD treatment outcomes due to symptom overlap and heterogeneity. Patients with both PTSD and depression may require modified therapeutic approaches such as imagery rescripting. A sequential treatment approach, targeting PTSD first and then depression, can be beneficial.

Early psychotherapeutic interventions, including psychoanalytic, cognitive, and behavioural therapies, have shown significant effectiveness in reducing PTSD and depression symptoms. Cognitive Processing Therapy (CPT), Cognitive Therapy (CT), and EMDR are particularly effective for PTSD. Trauma-focused cognitive-behavioural therapy (TF-CBT) is highly beneficial in children and adolescents. Beyond psychotherapeutic efficacy, careful management of pharmacotherapy is also essential to mitigate risks such as suicidal ideation. Managing suicidal risk during SSRI/SNRI treatment is crucial, as these medications may increase the risk of suicide and self-harm in the initial treatment phase.

Regarding treatment duration, SSRIs provide moderate relief for PTSD patients with childhood trauma, while psychological therapies, particularly EMDR and behaviour therapy, tend to be more effective for symptom reduction. Olanzapine may be an effective adjunct for SSRI-resistant PTSD, especially for improving sleep-related symptoms. Recovery from PTSD and depression is defined by sustained symptom remission. Full recovery is achieved when remission is maintained for four months without relapse. However, long-term follow-up studies indicate that comorbid conditions, such as substance use disorders, may complicate recovery, necessitating ongoing management and personalised treatment strategies.

## **Disclosure**

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