Pain from PTSD Episodes: A Systematic Review of Mechanisms, Prevalence, and Clinical Implications

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Abstract

Posttraumatic stress disorder (PTSD) and pain frequently co-occur, yet the specific role of pain during PTSD episodes—such as flashbacks, hyperarousal, and re-experiencing—remains poorly characterized. This systematic review aimed to synthesize evidence on the phenomenology, prevalence, mechanisms, and clinical implications of pain experienced during or triggered by PTSD episodes. We conducted a comprehensive literature search across major electronic databases, selecting original empirical studies and systematic reviews that examined pain specifically associated with PTSD episodes in human participants. Quality assessment was performed using validated tools, and data were synthesized narratively. The results indicate that pain is a prevalent and clinically significant feature of PTSD episodes, with pain flashbacks reported in up to 49% of complex trauma patients and 23% of child abuse survivors. These pain experiences often represent somatosensory re-enactments of trauma-related pain, triggered by cues reminiscent of the original event, and are associated with greater PTSD severity, particularly re-experiencing and hyperarousal symptoms. Mechanistically, classical conditioning emerged as a robust explanation, wherein neutral cues paired with pain during trauma acquire the ability to elicit conditioned pain responses, supported by both self-report and neuroimaging evidence. Mutual maintenance processes were also evident, with pain and PTSD symptoms exacerbating each other over time, and hyperarousal playing a central role in linking pain intensity to functional impairment. Trauma-related pain uniquely predicted poorer PTSD treatment outcomes, mediated by re-experiencing symptoms. Interventions targeting pain catastrophizing showed promise for pain at rest but were insufficient for addressing physical dysfunction. We conclude that pain during PTSD episodes is a distinct phenomenon requiring targeted assessment and integrated treatment approaches. Future research should prioritize longitudinal studies to clarify causal pathways and develop interventions that simultaneously address PTSD episodes and associated pain.

1 Introduction

Posttraumatic stress disorder (PTSD) is a debilitating psychiatric condition that can develop following exposure to a traumatic event, characterized by intrusive re-experiencing, avoidance, negative alterations in cognition and mood, and marked changes in arousal and reactivity (DE, 2013). The lifetime prevalence of PTSD in the general population is estimated to be between 6% and 8%, with substantially higher rates observed in specific populations such as military veterans, survivors of interpersonal violence, and individuals exposed to natural disasters (Galea et al., 2005). While the psychological symptoms of PTSD have been extensively studied, the somatic manifestations of the disorder, particularly pain, have received comparatively less attention. Pain is a complex, multidimensional experience that involves sensory, emotional, and cognitive components, and its relationship with PTSD is bidirectional and multifaceted (Tesarz et al., 2020). Epidemiological studies consistently demonstrate a high comorbidity between chronic pain and PTSD, with prevalence rates of chronic pain in PTSD populations ranging from 15% to 80%, depending on the sample and assessment methods (Siqveland et al., 2017).

The experience of pain during PTSD episodes, however, represents a distinct and underappreciated phenomenon that goes beyond the well-documented comorbidity between chronic pain and PTSD. During a PTSD episode, which may include a flashback, a period of intense hyperarousal, or a re-experiencing event, individuals can report the sudden onset of pain that mirrors the physical sensations experienced during the original trauma (Salomons, Osterman, Gagliese, et al., 2004). This pain is not merely a psychological construct but is often described as a vivid, somatic re-enactment of the traumatic event, complete with specific locations, qualities, and intensities that correspond to the original injury or physical assault. For example, a survivor of a motor vehicle accident might feel the exact sensation of a broken rib during a flashback, or a victim of physical assault might re-experience the pain of a blow to the face. These pain flashbacks are a form of somatosensory re-experiencing, a subtype of intrusive re-experiencing that has been recognized in the literature but remains poorly integrated into mainstream PTSD research and clinical practice (Parise, 2024).

Despite the clinical significance of pain during PTSD episodes, several critical research gaps persist. First, the prevalence of pain flashbacks and other forms of pain during PTSD episodes is not well established, with existing studies using heterogeneous definitions and assessment methods. Second, the underlying mechanisms that link PTSD episodes to the experience of pain are not fully understood. While classical conditioning has been proposed as a primary mechanism, wherein neutral cues present during the trauma become conditioned stimuli capable of eliciting pain responses, the neurobiological and psychological pathways involved remain to be elucidated (Linnman et al., 2011). Third, the clinical implications of pain during PTSD episodes for treatment outcomes are largely unknown. It is unclear whether the presence of pain during episodes predicts poorer response to standard PTSD treatments, such as

trauma-focused cognitive behavioral therapy or eye movement desensitization and reprocessing, and whether integrated treatment approaches that address both PTSD and pain are more effective than sequential or parallel treatments (Otis et al., 2009).
The motivation for this systematic review is to address these gaps by providing a comprehensive synthesis of the existing evidence on pain from PTSD episodes. The significance of this work lies in its potential to inform clinical practice and guide future research. By clarifying the phenomenology, prevalence, mechanisms, and clinical implications of pain during PTSD episodes, we aim to raise awareness among clinicians about this often-overlooked symptom and to highlight the need for targeted assessment and intervention strategies. Furthermore, this review seeks to identify promising avenues for future research, including the development of novel treatments that directly target the intersection of PTSD and pain. The remainder of this paper is organized as follows: Section 2 describes the methodology used for the literature search, study selection, and data extraction. Section 3 presents the results of the review, organized into subsections on research trends, an overview of included studies, pain flashbacks and somatosensory re-experiencing, and mutual maintenance and symptom interplay in clinical samples. Section 4 discusses the findings in the context of existing literature, addresses limitations, and outlines implications for clinical practice and future research. Section 5 concludes the paper with a summary of the key findings and their significance.

2 Methodology

2.1 Review Protocol

We conducted this systematic review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). A comprehensive literature search was performed across six major electronic databases to identify relevant studies. PubMed was selected as the primary database due to its extensive coverage of biomedical and psychological research, including the intersection of trauma, pain, and psychopathology. Web of Science was chosen for its multidisciplinary scope, which captures studies from the social sciences, neuroscience, and clinical medicine. Scopus was included for its broad coverage of peer-reviewed literature across scientific disciplines, particularly in the health and life sciences. ScienceDirect was selected for its strong collection of full-text articles in psychology and neuroscience. SpringerLink was included to access a wide range of journals and books in behavioral sciences and medicine. Google Scholar was used as a supplementary search engine to capture grey literature and studies not indexed in the other databases, though it was searched last due to its less precise filtering capabilities.
The search strategy was developed using the PEO (Population, Exposure, Outcome) framework to structure the research question. The population was

defined as human participants with a diagnosis of PTSD or clinically significant PTSD symptoms. The exposure was defined as PTSD episodes, including flashbacks, hyperarousal, and re-experiencing events. The outcome was defined as pain, including somatic pain, pain perception, and chronic pain. The following keywords and Boolean operators were used to construct the search string: ("PTSD" OR "posttraumatic stress disorder" OR "post-traumatic stress disorder") AND ("pain" OR "somatic pain" OR "chronic pain" OR "pain perception") AND ("episodes" OR "flashbacks" OR "acute stress" OR "hyperarousal" OR "re-experiencing"). This search string was adapted for each database to accommodate specific syntax requirements. For example, in PubMed, the search string was formatted as: ("PTSD"[MeSH Terms] OR "posttraumatic stress disorder"[All Fields] OR "post-traumatic stress disorder"[All Fields]) AND ("pain"[MeSH Terms] OR "somatic pain"[All Fields] OR "chronic pain"[All Fields] OR "pain perception"[All Fields]) AND ("episodes"[All Fields] OR "flashbacks"[All Fields] OR "acute stress"[All Fields] OR "hyperarousal"[All Fields] OR "re-experiencing"[All Fields]). In Web of Science, the search string was: TS=("PTSD" OR "posttraumatic stress disorder" OR "post-traumatic stress disorder") AND TS=("pain" OR "somatic pain" OR "chronic pain" OR "pain perception") AND TS=("episodes" OR "flashbacks" OR "acute stress" OR "hyperarousal" OR "re-experiencing"). Similar adaptations were made for Scopus, ScienceDirect, and SpringerLink, while Google Scholar was searched using a simplified version of the string due to its character limits.

2.2 Classification of Studies by Thematic Focus

To organize the included studies for synthesis, we categorized them according to their primary thematic focus, reflecting distinct but interrelated dimensions of the relationship between pain and PTSD episodes. The first thematic dimension, termed "Pain Flashbacks and Somatosensory Re-experiencing," encompasses studies that specifically investigate the phenomenon of pain experienced during intrusive re-experiencing events, including the sensory qualities, triggers, and prevalence of such pain. The second thematic dimension, "Mutual Maintenance and Symptom Interplay in Clinical Samples," includes studies that examine the bidirectional relationships between pain and PTSD symptoms over time, particularly in clinical populations where both conditions are present. A third category, "Others," was reserved for studies that did not fit neatly into the first two dimensions but still provided relevant evidence on the broader topic. This classification system allowed us to synthesize findings in a structured manner, highlighting both the unique characteristics of pain during PTSD episodes and the broader systemic interactions between pain and PTSD symptomatology.

2.3 Inclusion and Exclusion Criteria

We established clear inclusion and exclusion criteria to ensure the relevance and methodological rigor of the selected studies. Studies were included if they met all of the following criteria: (1) the study focused on the experience, measurement, or management of pain specifically associated with PTSD episodes, such as flashbacks, hyperarousal, or re-experiencing events; (2) the study was original empirical research, including cross-sectional, cohort, case-control, randomized controlled trials, or qualitative designs, or was a systematic review or meta-analysis; (3) the study was published in a peer-reviewed journal; (4) the study was written in English; and (5) the study involved human participants with a diagnosis of PTSD or clinically significant PTSD symptoms, as determined by validated diagnostic instruments or symptom scales. Conversely, studies were excluded if they met any of the following criteria: (1) the study addressed pain in PTSD only as a secondary or comorbid condition without linking it to PTSD episodes, such as studies of chronic pain in general PTSD populations without episode-specific analysis; (2) the study was a case report, case series, editorial, opinion piece, conference abstract, or dissertation; (3) the study focused exclusively on animal models; (4) the full text was not available after reasonable retrieval efforts, including interlibrary loan requests; or (5) the study had a high risk of bias as determined by a validated quality assessment tool, indicated by insufficient sample size, lack of an appropriate control group, or flawed measurement of pain or PTSD episodes.

2.4 Study Selection Process

The study selection process was conducted in multiple stages, following the PRISMA guidelines for systematic reviews. Two independent reviewers (the authors) screened all retrieved records based on titles and abstracts, with disagreements resolved through discussion or consultation with a third reviewer. The initial database search yielded a total of 229 records. After removing 65 duplicate records, 164 records remained for screening. During the title and abstract screening phase, 117 records were excluded because they did not meet the inclusion criteria, typically because they focused on chronic pain without reference to PTSD episodes, were not empirical studies, or did not involve human participants. This left 47 reports sought for retrieval. Of these, 7 reports could not be retrieved due to unavailability of full text or lack of response from authors, resulting in 40 reports assessed for eligibility through full-text review. During the full-text assessment, 27 reports were excluded for reasons including insufficient focus on pain during PTSD episodes (n = 15), high risk of bias (n = 6), or lack of peer review (n = 6). Ultimately, 13 studies met all inclusion criteria and were included in the final synthesis. The study selection process is illustrated in Figure 1.

The quality assessment of the included studies was performed using validated tools appropriate to each study design. For cross-sectional and cohort studies, we used the Newcastle-Ottawa Scale (NOS), which assesses selection, com-

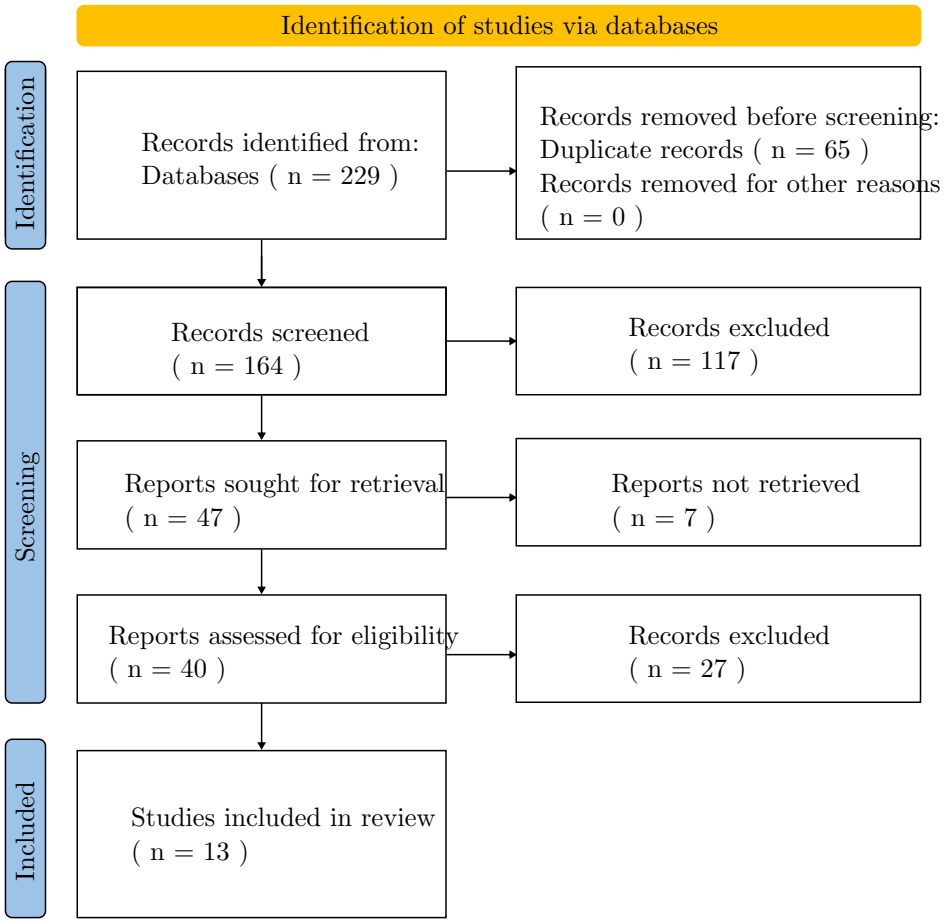

Figure 1: PRISMA flowchart of the study selection process

parability, and outcome domains. For randomized controlled trials, we used the Cochrane Risk of Bias tool (RoB 2), which evaluates bias arising from the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result. For qualitative studies, we used the Critical Appraisal Skills Programme (CASP) qualitative checklist. Each study was rated as having low, moderate, or high risk of bias, and only studies with low or moderate risk of bias were included in the final synthesis. The quality assessment was conducted independently by two reviewers, with discrepancies resolved through consensus.
Several limitations of the study selection process should be acknowledged. First, the restriction to English-language publications may have introduced language bias, potentially excluding relevant studies published in other languages. Second, the exclusion of grey literature, such as dissertations and conference abstracts, may have led to the omission of unpublished findings that could provide additional insights. Third, the focus on peer-reviewed journals may have excluded studies published in non-traditional outlets, though this criterion was intended to ensure a minimum standard of methodological rigor. Fourth, the heterogeneity of assessment methods for both pain and PTSD episodes across studies made it challenging to compare findings directly, and this variability was addressed through narrative synthesis rather than meta-analysis. Finally, the relatively small number of included studies (n = 13) reflects the nascent state of research on this specific topic, and the findings should be interpreted with caution regarding generalizability.

3 Results

3.1 Research Trends

The distribution of publications by year reveals a notable pattern in the evolution of research on pain from PTSD episodes. Before 2017, seven studies were published, indicating that the foundational work in this domain was established over a relatively extended period. This early phase likely focused on establishing the basic phenomenology of pain flashbacks and the comorbidity between PTSD and chronic pain, setting the stage for more targeted investigations. The years 2017 and 2018 saw a modest increase, with one and two publications respectively, suggesting a growing but still limited interest in the topic. A single study appeared in 2020, which may reflect a temporary disruption in research activity due to the global COVID-19 pandemic, as many non-COVID-related studies faced delays or were deprioritized during this period.
The most striking trend emerges in the years 2022 through 2024, which collectively account for seven of the thirteen included studies. Three studies were published in 2023, and two more appeared in 2024, representing a clear acceleration in research output. This recent surge suggests that the scientific community has increasingly recognized the clinical importance of pain during

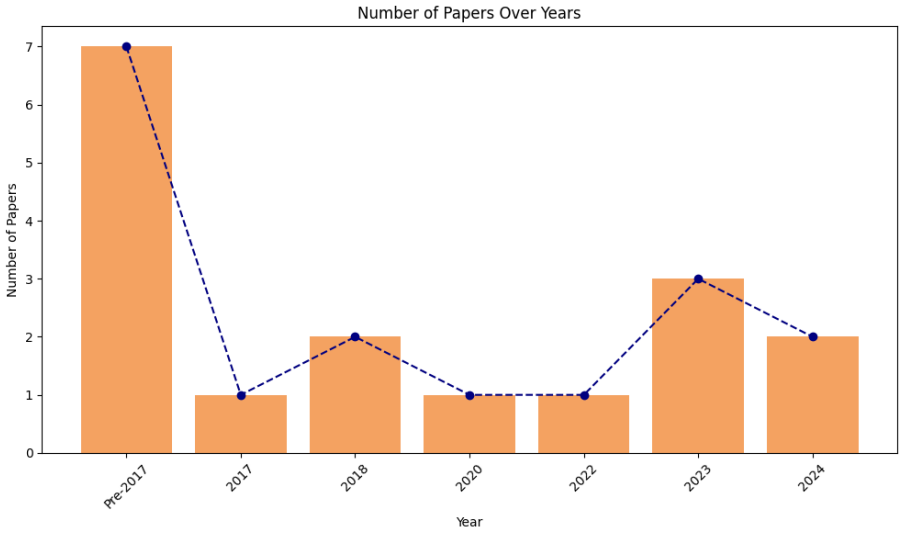

Figure 2: Research trends in the domain of Pain from PTSD episodes

PTSD episodes, perhaps driven by a broader shift toward understanding the somatic manifestations of psychiatric disorders. The concentration of studies in the last three years also indicates that this area of inquiry is maturing, with researchers moving beyond descriptive accounts to investigate mechanisms, treatment implications, and longitudinal relationships. The temporal distribution therefore highlights a field that, while still relatively small, is experiencing a period of rapid growth and diversification, promising further advances in the coming years.

4 3.2 Overview of Included Studies

Table 1 presents the main characteristics of the included studies. The extracted information included study identification, study design, population, sample size, pain measure, ptsd measure and key findings on pain-ptsd link, where applicable.

The included studies varied in terms of their study designs, populations, and pain/PTSD measurement approaches, etc. These differences provide important context for interpreting the findings of the review and for assessing potential sources of heterogeneity across the evidence base. Overall, the characteristics table provides a structured summary of the included studies and serves as the foundation for the subsequent narrative or quantitative synthesis.

Table 1. Characteristics of Included Studies

	STUDY DESIGN
(Bartoszek et al., 2017)	Longitudinal study
(Beckham et al., 1997)	Cross-sectional study
(Cho et al., 2011)	Archival data analysis
(Franke et al., 2022)	Classical conditioning experiment with a memory-triggerin
(Liedl et al., 2009)	
(Macdonald et al., 2018)	cross-sectional
(Sager et al., 2020)	Longitudinal cohort study with assessments at 6, 12, and 1
(Salomons, Osterman, Gagliese, & Katz, 2004)	
(Tsur & Katz, 2023)	Cross-sectional survey
(Tsur, 2023)	Cross-sectional study using community-based and clinical s
(Tsur, 2024)	Cross-sectional survey
(Whalley et al., 2007)	case report
(Åkerblom et al., 2023)	Network analysis

4.1 Pain Flashbacks and Somatosensory Re-experiencing: Phenomenology, Prevalence, and Mechanisms

The phenomenon of pain experienced during intrusive re-experiencing episodes, commonly termed "pain flashbacks," represents a distinct form of somatosensory memory in which individuals vividly re-experience the physical pain sensations that accompanied their original traumatic event. This subsection synthesizes the available evidence on the phenomenology, prevalence, and underlying mechanisms of pain flashbacks, drawing primarily from studies that have specifically investigated this symptom cluster. The findings are summarized in Table 2, which provides a comprehensive overview of the key characteristics and results from the included studies that directly address pain flashbacks and somatosensory re-experiencing.

Table 2. Summary of Studies on Pain Flashbacks and Somatosensory Re-experiencing

	PAIN FLASHBACK DEFINITION
(Tsur, 2023)	Intrusive pain symptoms experienced as re-experiencing of
(Tsur, 2024)	Intrusive pain symptoms as re-experiencing of trauma-relat
(Whalley et al., 2007)	Flashbacks as visual, auditory, olfactory, or tactile re-living
(Franke et al., 2022)	Pain experienced without nociceptive input, emerging as a
(Macdonald et al., 2018)	A re-experiencing of pain felt at the time of a traumatic ev
(Salomons, Osterman, Gagliese, & Katz, 2004)	A somatosensory memory mechanism where patients' pain
(Tsur & Katz, 2023)	Intrusive pain symptoms as re-experiencing of trauma-relat

The reported prevalence of pain flashbacks varies considerably across studies, depending on the population examined and the assessment methods employed. In the study by (Macdonald et al., 2018), which assessed pain flashbacks over a two-year period in a sample of 166 patients referred to a psychological trauma service in the UK, pain flashbacks were classified as present in

49% of this complex trauma sample. This remarkably high prevalence underscores the clinical significance of this phenomenon in populations with extensive trauma histories. In contrast, studies examining community-based samples and survivors of child abuse reported more moderate prevalence rates of approximately 8.9% in community samples and 23.1% among child abuse survivors (Tsur, 2023) (Tsur, 2024) (Tsur & Katz, 2023). These differences suggest that pain flashbacks are particularly common in clinical populations with severe, repeated, or early-life trauma, though they are by no means exclusive to such groups. Furthermore, a consistent finding across these studies is that pain flashbacks are positively associated with the extent of pain experienced during the original traumatic event. (Macdonald et al., 2018) explicitly found that pain flashbacks were positively associated with the degree of pain at the time of trauma, and (Tsur, 2023) and (Tsur, 2024) reported that participants who experienced pain flashbacks reported more pain during child abuse, with the location of the flashback pain corresponding to the body areas injured during the trauma.

From a mechanistic perspective, classical conditioning has emerged as a robust explanatory framework for understanding how pain can be re-experienced in the absence of ongoing nociceptive input. The experimental study by (Franke et al., 2022) directly tested this hypothesis by subjecting 65 participants to a classical conditioning paradigm in which painful electrocutaneous stimulation and aversive film clips served as unconditioned stimuli, paired with neutral pictures depicting contextual details from the films as conditioned stimuli. One day later, participants were re-exposed to the conditioned stimuli during a memory-triggering task. The results demonstrated that pain-signaling conditioned stimuli elicited more self-reported pain and greater responses in the neurological pain signature (NPS) than no-pain-signaling cues. Of particular importance, these conditioned pain responses persisted during the re-exposure phase, with self-reported pain responses remaining evident in the neutral film condition and NPS responses persisting in the aversive film condition. Moreover, participants with stronger conditioned pain responses showed a greater probability and severity of experiencing spontaneous pain intrusions during daily life, as recorded in an e-diary. This study provides the most direct experimental evidence to date that neutral cues paired with pain during trauma acquire the ability to elicit conditioned pain responses, thereby offering a plausible mechanism for the occurrence of pain flashbacks in PTSD.

The concept of somatosensory memory further complements the conditioning account by emphasizing the sensory-specific nature of pain flashbacks. (Salomons, Osterman, Gagliese, & Katz, 2004) proposed that the similarity between patients' pain symptoms and the pain they experienced during the trauma, coupled with the triggering of these symptoms by traumatic cues and the associated emotional arousal and avoidance responses, strongly suggests the involvement of a somatosensory memory mechanism. This perspective is supported by the case report of a survivor of the July 7th 2005 London bombings who was diagnosed with PTSD and experienced painful flashbacks (Whalley et al., 2007). The case provides further evidence that somatosen-

sory re-experiencing of pain memories is possible, demonstrating that such experiences are not merely psychological constructs but are vivid, embodied re-enactments of past physical sensations. The convergence of evidence from experimental, epidemiological, and case-report studies thus strongly supports the existence of pain flashbacks as a genuine and clinically relevant phenomenon. The finding that pain flashbacks are correlated with a higher risk of chronic pain in trauma-exposed samples (Tsur, 2023) (Tsur, 2024) (Tsur & Katz, 2023) suggests that these intrusive pain experiences may not only be a symptom of PTSD but could also serve as a pathway through which trauma leads to persistent pain conditions, a hypothesis that warrants further longitudinal investigation.

4.2 Mutual Maintenance and Symptom Interplay in Clinical Samples

Beyond the specific phenomenon of pain flashbacks, a substantial body of research has examined the broader, bidirectional relationships between pain and PTSD symptoms as they unfold over time in clinical populations. This line of inquiry, often framed within the mutual maintenance model, posits that pain and PTSD symptoms exert reciprocal exacerbating effects on one another, creating a self-perpetuating cycle that contributes to functional decline and poor treatment outcomes. The studies included in this subsection collectively provide evidence for the interplay between specific PTSD symptom clusters and pain, with a particular emphasis on the role of re-experiencing and hyperarousal symptoms in mediating these relationships. Table 3 provides a comprehensive summary of the studies that have directly examined mutual maintenance and symptom interplay in clinical samples.

Table 3. Summary of Studies on Mutual Maintenance and Symptom Interplay in Clinical Samples

	SAMPLE CHARACTERISTICS
(Bartoszek et al., 2017)	99 treatment-seeking veterans
(Beckham et al., 1997)	129 Vietnam combat veterans with PTSD
(Cho et al., 2011)	142 chronic pain patients with a history of trauma
(Liedl et al., 2009)	Not specified in abstract
(Åkerblom et al., 2023)	Three trauma-exposed groups: adults with chronic pain and PTSD symptoms (n=
(Sager et al., 2020)	123 veterans with oral-digestive cancers

The most direct evidence for mutual maintenance processes comes from longitudinal studies that have tracked the co-evolution of pain and PTSD symptoms over time. In a sample of 99 treatment-seeking veterans, (Bartoszek et al., 2017) conducted a longitudinal study examining whether trauma-related and trauma-unrelated pain differentially predicted reexperiencing symptoms and whether reexperiencing symptoms mediated the relationship between pain intensity and posttreatment avoidance, numbing, and hyperarousal (ANH) symptoms. The results revealed a striking dissociation: among veterans with

trauma-related pain, pain intensity uniquely corresponded to greater post-treatment reexperiencing symptoms (b = 1.09), and was indirectly predictive of ANH symptoms through the reexperiencing symptoms (b = 1.93). However, veterans with trauma-unrelated pain evidenced no associations between pain intensity and reexperiencing (b = 0.04) or ANH symptoms (b = 0.06). These findings suggest that trauma-related pain is an especially potent driver of PTSD symptom persistence, acting through a specific pathway whereby pain intensity amplifies reexperiencing, which in turn contributes to the broader PTSD symptom profile. The longitudinal design of this study strengthens the case for a causal direction from pain to PTSD symptoms, rather than mere correlation. Furthermore, the finding that trauma-related, but not trauma-unrelated, pain predicted reexperiencing symptoms is consistent with the classical conditioning model, as trauma-related pain is more likely to be associated with trauma cues that can trigger conditioned responses.
The role of hyperarousal as a central node linking pain to other PTSD symptoms and functional impairment has been highlighted by multiple studies. (Cho et al., 2011) analyzed archival data from 142 chronic pain patients with a history of trauma and found that pain intensity had significant indirect effects on daily functioning through both hyperarousal and pain avoidance. Moreover, hyperarousal had significant indirect effects on daily functioning through pain avoidance, suggesting a sequential pathway: elevated pain triggers hyperarousal symptoms, which then lead to avoidant coping strategies aimed at minimizing pain and preventing re-experiencing, but the prolonged use of such strategies ultimately contributes to a decline in daily functioning. This finding aligns with the mutual maintenance model, as it demonstrates how pain and PTSD symptoms can cyclically reinforce one another to produce functional disability. The study by (Liedl et al., 2009) provided further support for this framework by demonstrating that the relationship between acute pain and 12-month pain was mediated by arousal symptoms at 3 months, indicating that hyperarousal is not merely a correlate of pain but actively contributes to the transition from acute to chronic pain among trauma-exposed individuals.
Network analysis has offered a nuanced perspective on how specific PTSD symptom clusters relate to pain, while also accounting for the influence of comorbid depression and anxiety. (Åkerblom et al., 2023) examined relations between PTSD symptom clusters and pain in three distinct trauma-exposed clinical groups: adults seeking treatment for chronic pain with current PTSD symptoms, trauma-affected refugees seeking treatment for PTSD and chronic pain, and individuals identified at admission to the emergency ward after whiplash injury. When depression and anxiety were included in the network models, no within-group differences were identified for the links between pain and any of the PTSD clusters in the chronic pain and refugee groups, suggesting that these relationships may be largely driven by general distress rather than specific PTSD symptom dimensions. However, in the whiplash group, hyperarousal was more strongly related to pain than re-experiencing, avoidance, and numbing, and between-group comparisons revealed a more pro-

nounced relationship between hyperarousal and pain in the whiplash group compared to the other two samples. This between-group difference may reflect the specific context of whiplash, where the traumatic event (a motor vehicle collision) directly produces physical pain that is then subject to hypervigilance and sensitization, creating a tighter coupling between hyperarousal and pain than in samples where the pain condition is more chronic and psychologically embedded. The finding that hyperarousal is particularly relevant to pain in the acute aftermath of trauma is consistent with the mediational pathway identified by (Liedl et al., 2009), where arousal symptoms at 3 months mediated the link between acute and chronic pain, suggesting a sensitive period during which hyperarousal plays a crucial role in pain chronification.

The study by (Beckham et al., 1997) provided an early examination of the relationship between reexperiencing symptoms and pain in a sample of 129 Vietnam combat veterans with PTSD. The results showed that MMPI-2 hypochondriasis scores and B PTSD symptoms, which correspond to reexperiencing symptoms, were significantly related to pain disability, overall pain index, and current pain level. This finding suggests that reexperiencing is not merely associated with pain flashbacks but is also linked to more generalized pain outcomes, including disability and pain intensity. The relationship between reexperiencing and pain may be driven by the somatosensory nature of reexperiencing, as discussed in the previous subsection, but it also points to a broader interplay wherein the emotional and cognitive components of trauma memories influence pain perception and pain-related disability. The combination of these findings with more recent evidence suggests that both reexperiencing and hyperarousal symptoms play distinct but interconnected roles in the mutual maintenance of pain and PTSD, with reexperiencing being particularly relevant for trauma-related pain and hyperarousal serving as a general amplifier of pain perception and a mediator of the transition to chronic pain.

Finally, the study by (Sager et al., 2020) extended the mutual maintenance model to a unique population: veterans with cancer who were experiencing PTSD symptoms from both combat and cancer-related stressors. In this longitudinal study of 123 veterans with oral-digestive cancers, individuals with both combat and cancer-related PTSD symptoms at six months had 8.49 times higher odds of experiencing chronic pain. This finding is particularly striking because it demonstrates a cumulative, additive effect of multiple traumatic stressors on pain outcomes. The odds ratio of 8.49 is substantially higher than what would be expected from the additive combination of two independent risk factors, suggesting a synergistic interaction wherein the presence of PTSD symptoms from two different sources amplifies the risk of chronic pain beyond the sum of its parts. Changes in cancer-related PTSD symptom clusters of hyperarousal and emotional numbing were observed over time, with a statistically significant quadratic function increasing at 18 months, indicating that these symptoms may worsen as the cancer survivorship experience unfolds and potentially trigger or exacerbate pain. This study highlights the importance of considering cumulative trauma burden when assessing the relationship between PTSD and pain, as the interplay between multiple traumatic

stressors may create a particularly high-risk profile for chronic pain development.

5 Discussion

The present systematic review synthesizes the available evidence on the experience of pain during PTSD episodes, revealing a phenomenon that is both clinically prevalent and mechanistically distinct from the broader comorbidity between chronic pain and PTSD. Taken together, the findings consistently demonstrate that pain experienced during PTSD episodes, particularly in the form of pain flashbacks, represents a genuine somatosensory re-experiencing phenomenon that affects a substantial proportion of trauma survivors. Across diverse study populations, including community samples, child abuse survivors, complex trauma patients, and combat veterans, pain flashbacks are reported in 8.9% to 49% of individuals (Macdonald et al., 2018) (Tsur, 2023) (Tsur, 2024), with higher prevalence rates observed in clinical samples with more severe trauma histories. These prevalence figures underscore that pain during PTSD episodes is not an uncommon or idiosyncratic symptom but rather a clinically significant feature that warrants systematic assessment in both research and practice.

The synthesis of mechanistic evidence across multiple study designs converges on classical conditioning as a robust explanatory framework for understanding how neutral cues present during trauma can acquire the capacity to elicit conditioned pain responses. The experimental study by (Franke et al., 2022) provides the most direct support for this mechanism, demonstrating that participants with stronger conditioned pain responses showed a greater probability and severity of experiencing spontaneous pain intrusions during daily life. This finding bridges the gap between laboratory-based conditioning paradigms and real-world symptom experiences, offering a compelling account of how pain can be re-experienced in the absence of ongoing nociceptive input. Furthermore, the convergence of this experimental evidence with the somatosensory memory perspective (Salomons, Osterman, Gagliese, & Katz, 2004) and the detailed phenomenological accounts from clinical case reports (Whalley et al., 2007) creates a coherent narrative: pain flashbacks are vivid, embodied re-enactments of trauma-related pain that are triggered by conditioned cues and maintained through associative learning processes. This integration across methodological approaches strengthens the evidentiary basis for recognizing pain during PTSD episodes as a distinct clinical phenomenon rather than a mere psychological metaphor.

A critical pattern that emerges across the included studies is the specificity of the relationship between trauma-related pain and PTSD symptomatology. The longitudinal study by (Bartoszek et al., 2017) revealed a striking dissociation wherein trauma-related pain intensity uniquely predicted greater post-treatment reexperiencing symptoms, whereas trauma-unrelated pain showed no such associations. This finding carries profound theoretical and clinical

implications. From a theoretical standpoint, it suggests that the association between pain and PTSD is not a generalized consequence of having any pain condition alongside a trauma history but is instead specifically tied to the semantic and sensory overlap between current pain and the original traumatic experience. This specificity is consistent with the classical conditioning model, wherein trauma-related pain is more likely to share cues and qualities with the original trauma, thereby serving as a more potent conditioned stimulus. From a clinical perspective, this finding implies that simply treating pain as a generic comorbid symptom may be insufficient for patients whose pain is directly linked to their trauma history. Instead, clinicians should assess the relationship between the patient's current pain and their traumatic experiences, as this trauma-related pain may require specialized treatment approaches that address the associative learning processes underlying its maintenance.

The mutual maintenance literature synthesized in this review reveals a complex interplay between pain and specific PTSD symptom clusters, particularly reexperiencing and hyperarousal. The evidence consistently indicates that pain does not merely coexist with PTSD but actively contributes to the persistence and exacerbation of PTSD symptoms through distinct pathways. The mediation findings from (Bartoszek et al., 2017) demonstrate that trauma-related pain intensity operates through reexperiencing symptoms to predict broader PTSD symptom profiles, suggesting a cascade wherein pain amplifies intrusive memories, which in turn fuel avoidance, numbing, and hyperarousal. Simultaneously, the studies examining hyperarousal (Cho et al., 2011) (Liedl et al., 2009) (Åkerblom et al., 2023) indicate that this symptom cluster serves as a central mediator linking pain to functional impairment and to the transition from acute to chronic pain. The network analysis by (Åkerblom et al., 2023) adds further nuance by showing that the relationship between hyperarousal and pain is particularly pronounced in the acute aftermath of trauma, as observed in the whiplash group, suggesting that there may be a critical window during which hyperarousal plays a decisive role in pain chronification. These findings collectively point toward a dynamic model in which reexperiencing and hyperarousal symptoms play complementary roles: reexperiencing is more closely tied to the specific content and quality of trauma-related pain, whereas hyperarousal acts as a general amplifier of pain perception and a driver of functional decline.

The implications of these findings for clinical practice are substantial. First, the high prevalence of pain flashbacks, particularly in complex trauma populations, underscores the need for routine assessment of this symptom. Standard PTSD diagnostic instruments, such as the Clinician-Administered PTSD Scale (CAPS) or the PTSD Checklist (PCL), do not explicitly inquire about pain during flashbacks, meaning that this symptom may be systematically overlooked in clinical settings. We recommend that clinicians incorporate specific questions about whether patients experience physical pain during their intrusive memories, including the location, quality, intensity, and duration of such pain, and whether it corresponds to pain experienced during the original traumatic event. Second, the evidence that trauma-related pain uniquely predicts

poorer PTSD treatment outcomes (Bartoszek et al., 2017) suggests that the presence of pain flashbacks may be a prognostic indicator that warrants integrated treatment approaches. Trauma-focused therapies that do not address the somatic components of reexperiencing may be less effective for patients with prominent pain flashbacks, as these patients may require interventions that specifically target the conditioned pain responses that maintain their symptoms. Third, the mutual maintenance findings imply that treating PTSD and pain in isolation may be suboptimal, as improvements in one domain may be undermined by persisting symptoms in the other. Integrated treatment models that simultaneously address PTSD episodes and associated pain, such as the combined cognitive-behavioral approach for PTSD and chronic pain (Otis et al., 2009), may be particularly beneficial for patients with trauma-related pain.

Several methodological limitations of this review should be acknowledged when interpreting the findings. First, the literature search, while comprehensive, was restricted to English-language publications and peer-reviewed journals, which may have introduced language bias and publication bias. Relevant studies published in other languages or in grey literature sources, such as dissertations and conference proceedings, may have been excluded, potentially limiting the comprehensiveness of the evidence base. Second, the relatively small number of included studies (n = 13) reflects the nascent state of research on this specific topic, and the findings should therefore be considered preliminary rather than definitive. The small evidence base also precluded a meta-analytic synthesis, as the heterogeneity in study designs, populations, and assessment methods made it inappropriate to pool effect sizes statistically. Third, the quality assessment revealed variability in methodological rigor across the included studies, with some studies relying on retrospective self-report measures of pain during trauma and pain flashbacks, which are susceptible to recall bias. Prospective studies that capture pain experiences close to the time of occurrence, such as ecological momentary assessment, are needed to confirm the retrospective findings. Fourth, many of the included studies used cross-sectional designs, which limit causal inference. While the longitudinal studies (Bartoszek et al., 2017) (Liedl et al., 2009) provide some evidence for temporal precedence, the possibility of reverse causation or unmeasured confounding cannot be fully ruled out. Fifth, the populations studied were predominantly Western and included many military veterans and women with child abuse histories, which may limit the generalizability of the findings to other cultural contexts and trauma types, such as natural disasters, combat in non-Western settings, or refugee trauma.

The findings of this review point to several productive avenues for future research. There is a clear need for large-scale, longitudinal, prospective studies that track pain flashbacks and other forms of pain during PTSD episodes over extended periods, using validated, standardized assessment instruments. Such studies should aim to establish the natural history of pain flashbacks, including their onset, duration, frequency, and remission, as well as their relationship to the development of chronic pain conditions. Methodologically,

future research should move beyond retrospective self-report and incorporate more objective and real-time assessment methods, such as ecological momentary assessment (EMA) using smartphone-based diaries to capture pain flashbacks as they occur, and physiological measures such as heart rate variability, skin conductance, and functional neuroimaging to examine the neural correlates of pain during intrusive reexperiencing. The experimental conditioning paradigm developed by (Franke et al., 2022) holds particular promise as a model for investigating the mechanisms of pain flashbacks, and future studies could extend this paradigm by examining whether individual difference factors, such as trauma history, pain catastrophizing, or anxiety sensitivity, moderate the strength of conditioned pain responses. There is also a pressing need for research on treatment interventions that directly target pain during PTSD episodes. While some evidence suggests that interventions targeting pain catastrophizing may be beneficial for pain at rest (Otis et al., 2009), these approaches may be insufficient for addressing the conditioned pain responses that underlie pain flashbacks. Future studies should explore whether extinction-based interventions, such as exposure therapy that specifically targets the somatic components of trauma memories, can reduce the frequency and intensity of pain flashbacks. Additionally, given the central role of hyperarousal in the mutual maintenance of pain and PTSD, interventions that target hyperarousal symptoms, such as breathing retraining, heart rate variability biofeedback, or pharmacological agents that reduce autonomic arousal, may have downstream benefits for pain outcomes. Understudied areas include the role of pain flashbacks in specific trauma populations, such as survivors of sexual assault, refugees, and individuals exposed to terrorism, as well as the impact of pain during PTSD episodes on quality of life, occupational functioning, and interpersonal relationships. Neuroimaging studies examining the neural circuits underlying pain flashbacks, particularly the interaction between the insula, amygdala, and prefrontal cortex, could provide valuable insights into the brain mechanisms of this phenomenon and identify potential neural targets for intervention. Finally, there is a need for greater attention to the developmental trajectory of pain flashbacks, particularly in children and adolescents exposed to trauma, as early intervention may prevent the consolidation of maladaptive pain memories and the development of chronic pain conditions later in life.

6 Conclusion

This systematic review synthesizes the evidence on pain experienced during PTSD episodes, confirming that pain flashbacks represent a distinct and clinically significant phenomenon characterized by somatosensory re-enactments of trauma-related pain. Our synthesis reveals that these experiences are prevalent across diverse trauma populations, with rates reaching 49% in complex trauma samples, and are mechanistically grounded in classical conditioning processes wherein neutral cues acquire the capacity to elicit conditioned pain

responses. The evidence further demonstrates that trauma-related pain uniquely predicts poorer PTSD treatment outcomes through reexperiencing symptoms, while hyperarousal serves as a central mediator linking pain to functional impairment and the transition from acute to chronic pain.
The theoretical implications of these findings challenge the traditional conceptualization of PTSD as primarily a psychological disorder, instead highlighting the fundamental role of somatic memory in trauma re-experiencing. Clinically, our results underscore the necessity of routine assessment for pain flashbacks in PTSD evaluations and advocate for integrated treatment approaches that simultaneously address conditioned pain responses and PTSD symptomatology. Future research should prioritize longitudinal studies employing ecological momentary assessment to capture pain flashbacks in real-time, experimental paradigms examining extinction-based interventions for conditioned pain responses, and neuroimaging investigations of the neural circuits underlying somatosensory re-experiencing. Such work will be essential for developing targeted interventions that address this overlooked yet impactful dimension of posttraumatic psychopathology.

References

DE, B. (2013). Diagnostic and statistical manual of mental disorders. *DSM)*.

Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic reviews*.

Tesarz, J., Baumeister, D., Andersen, T., & Vaegter, H. (2020). Pain perception and processing in individuals with posttraumatic stress disorder: A systematic review with meta-analysis. *Pain reports*.

Siqveland, J., Hussain, A., Lindstrøm, J., Ruud, T., et al. (2017). Prevalence of posttraumatic stress disorder in persons with chronic pain: A meta-analysis. *Frontiers in Psychiatry*.

Salomons, T., Osterman, J., Gagliese, L., et al. (2004). Pain flashbacks in posttraumatic stress disorder. *The Clinical Journal of Pain*.

Parise, V. (2024). *Sensory dysregulation in post traumatic stress disorder* (tech. rep.). macsphere.mcmaster.ca.

Linnman, C., Zeffiro, T., Pitman, R., & Milad, M. (2011). An fmri study of unconditioned responses in post-traumatic stress disorder. *Biology of Mood Anxiety Disorders*.

Otis, J., Keane, T., Kerns, R., Monson, C., et al. (2009). The development of an integrated treatment for veterans with comorbid chronic pain and posttraumatic stress disorder. *Pain Medicine*.

Page, M., McKenzie, J., Bossuyt, P., et al. (2021). The prisma 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71.

Bartoszek, G., Hannan, S., Kamm, J., et al. (2017). Trauma-related pain, re-experiencing symptoms, and treatment of posttraumatic stress disorder: A longitudinal study of veterans. *Journal of Traumatic Stress*.

Beckham, J., Crawford, A., Feldman, M., et al. (1997). Chronic posttraumatic stress disorder and chronic pain in vietnam combat veterans. *Journal of Psychosomatic Research*.

Cho, S., Heiby, E., McCracken, L., Moon, D., & Lee, J.-H. (2011). Daily functioning in chronic pain: Study of structural relations with posttraumatic stress disorder symptoms, pain intensity, and pain avoidance. *The Korean Journal of Pain*, *24*, 13–21.

Franke, L., Miedl, S., Danböck, S., Grill, M., et al. (2022). Neuroscientific evidence for pain being a classically conditioned response to trauma-and pain-related cues in humans. *Pain*.

Liedl, A., O'Donnell, M., Creamer, M., Silove, D., McFarlane, A. C., Knaevelsrud, C., & Bryant, R. A. (2009). Support for the mutual maintenance of pain and post-traumatic stress disorder symptoms. *Psychological Medicine*, *40*, 1215–1223.

Macdonald, B., Salomons, T., Meteyard, L., & Whalley, M. (2018). Prevalence of pain flashbacks in posttraumatic stress disorder arising from exposure to multiple traumas or childhood traumatization. *Canadian Journal of Pain*, *2*, 48–56.

Sager, Z. S., Wachen, J. S., Naik, A. D., & Moye, J. (2020). Post-traumatic stress disorder symptoms from multiple stressors predict chronic pain in cancer survivors. *Journal of Palliative Medicine*, *23*, 1191–1197.

Salomons, T., Osterman, J., Gagliese, L., & Katz, J. (2004). Pain flashbacks in posttraumatic stress disorder. *The Clinical Journal of Pain*, *20*, 83–87.

Tsur, N., & Katz, C. (2023). Pain flashbacks: The role of intrusive pain symptoms in posttraumatic chronic pain. *European Psychiatry*, *66*, S112–S112.

Tsur, N. (2023). Pain flashbacks: Exploration of intrusive pain symptoms following child abuse. *Children and Youth Services Review*.

Tsur, N. (2024). The link between trauma and chronic pain: Exploring the role of pain flashbacks in chronic pain following interpersonal trauma. *The Journal of Pain*.

Whalley, M., Farmer, E., & Brewin, C. (2007). Pain flashbacks following the july 7th 2005 london bombings. *Pain*.

Åkerblom, S., Cervin, M., Nordin, L., Andersen, T., Thøgersen, M. H., & Perrin, S. (2023). Relations between ptsd symptom clusters and pain in three trauma-exposed samples with pain. *Scandinavian Journal of Pain*, *23*, 483–493.