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Posttraumatic Stress Disorder and Chronic Pain

Introduction

Given the significant co-occurrence of chronic pain and PTSD, a large body of work over the last two decades has sought to elucidate the complex interrelations between these conditions in adults. However, despite increased understanding of theoretical models of shared vulnerability, mutual maintenance and the role of avoidance, there remains a clinical challenge in how best to provide care to these often-complex multi-need patients. Below, we summarize the work to date and potential clinical applications and highlight areas in need of further research.

Prevalence and Impact of Co-occurring Chronic Pain and PTSD

Chronic pain and PTSD often co-occur and are frequently associated with significant distress and functional interference (Otis et al., 2003). Among those with PTSD, between 25% and 80% may also experience chronic pain (Otis et al., 2003). Veterans with PTSD have demonstrated significantly higher levels of pain intensity, pain catastrophizing, disability and healthcare utilization relative to Veterans without PTSD (Benedict et al., 2020). Among those with chronic pain, 9.7% experience comorbid PTSD, increasing to 11.7% in clinical populations and 20.5% among those with chronic widespread pain (Siqueland et al., 2017). Veterans with comorbid chronic pain and PTSD demonstrate worse pain-related psychological outcomes, including poorer coping strategies, than those

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with chronic pain alone (Alschuler & Otis, 2012; Bair et al., 2020). Further, poor sleep quality, which is common among Veterans with PTSD (Benedict et al., 2020), may exacerbate the magnifying impact of PTSD symptoms on chronic pain (Powell et al., 2015).

The interrelations between chronic pain and PTSD are multifaceted. While in some cases, a single traumatic injury may precipitate the development of both chronic pain and PTSD (Andersen et al., 2016), often the contributory events and relationships between multiple factors are complex. The development of these two conditions may involve shared vulnerabilities, mutual maintenance and avoidance. Important conceptual models and theoretical considerations are elaborated on below.

Theoretical Considerations: Conceptualizing Co-occurring Chronic Pain and PTSD

Shared Vulnerability. Asmundson et al. (2002) proposed a shared vulnerability model of PTSD and chronic pain, suggesting that anxiety sensitivity, or a propensity to respond with fear to physiologic sensations, predisposes to the development of both conditions (Asmundson et al., 2002). Building on this initial concept of shared vulnerability and the role of anxiety sensitivity, subsequent work has supported a potential role for central sensitization as an underlying mechanism of shared vulnerability. Central sensitization, a key feature of many chronic pain conditions, is an amplification of neural

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signaling in nociceptive pathways in the central nervous system (Woolf, 2011). Central sensitization has been documented via quantitative sensory testing with persons with PTSD who are more likely to experience dysfunctional pain modulation (i.e., lack of conditioned pain modulation [CPM]) and increased pain severity (Defrin et al., 2017; Vaegter et al., 2018).

One potential contributor to developing central sensitization is childhood adversity (You & Meagher, 2016). The interrelations between childhood adversity, PTSD and pain are complex. It appears that rather than the simple presence of childhood adversity, it is the impact of the trauma (i.e., the PTSD symptoms), that accounts for the relationship between childhood adversity and the development of chronic pain (Coppens et al., 2017; Raphael & Widom, 2011). Further, shared neurobiological mechanisms have been proposed to underlie both chronic pain and PTSD, with an emphasis on the convergence between circuits that mediate emotional distress, and physiological threat, including pain (Scioli-Salter et al., 2015). These mechanistic underpinnings help contextualize the connections between early childhood adversity, central sensitization and the mutual maintenance of pain and trauma-related symptoms. In addition to shared vulnerability, there has been a body of work exploring mutual maintenance factors between chronic pain and PTSD.

Mutual Maintenance. Sharp and Harvey (2001) proposed a mutual maintenance model of chronic pain and PTSD. This model proposed a role of biases toward attending to threatening and painful stimuli, anxiety sensitivity as a vulnerability toward pain catastrophizing, pain as a reminder of trauma and adoption of avoidance (i.e., to try to minimize pain and trauma symptoms; Otis et al., 2003; Sharp & Harvey, 2001). Along these lines, fear-avoidance models of chronic pain (Vlaeyen et al., 2016) may have an amplifying effect among persons with comorbid PTSD and chronic pain, such that hypervigilance, fear and behavioral avoidance are magnified, resulting in significantly increased distress and functional interference (Otis et al., 2003). In support of the mutual maintenance concept, recent work underscores the magnifying effect of trauma-related symptoms and pain on one another, as both PTSD and chronic pain develop (Liedl et al., 2010). In addition, pain catastrophizing and pain-related acceptance have both demonstrated mediating roles in the associations between PTSD symptoms and pain severity (Åkerblom et al., 2018; Andersen et al., 2016; Gilliam et al., 2019) and specific coping strategies, such as illness-focused pain coping which mediates the relation between PTSD and pain interference and severity (Morasco et al., 2013).

Other Models. Other models that have been developed to explain either chronic pain or PTSD have also been used to explain the interactive effects between these disorders. These include 1) the triple vulnerability model of PTSD which emphasizes the co-occurrence of a generalized biological vulnerability, a generalized psychological vulnerability and a specific psychological vulnerability to focus anxiety on specific situations (Otis et al., 2003), and 2) the fear-avoidance model of chronic pain which emphasizes the role of fear of physical sensations and avoidance behaviors in chronic pain (Otis et al., 2003). Finally, similar to the fear-avoidance model, the perpetual avoidance model proposes that reciprocal maintenance of PTSD and chronic pain is the result of increased physiologic sensations due to hyperarousal and misinterpretations, or

dysfunctional cognitions, leading to avoidance behaviors. In this model, avoidance then perpetuates PTSD and pain-related symptoms (Liedl & Knaevelsrud, 2008). Overall, these models of PTSD and chronic pain suggest the potential roles for shared vulnerability, mutual maintenance including avoidance behaviors, as well as potential physiological underpinnings that interact with specific types of cognitive, affective and behavioral responses.

Treatment of Co-occurring Chronic Pain and PTSD

Treating an individual who has co-occurring chronic pain and PTSD can be challenging. There are three primary treatment approaches: 1) the sequential model, 2) the parallel model and 3) the combined/integrated model (Yule & Kelly, 2019). Due to the lack of empirical evidence or clinical practice guidelines on how to treat the sub-population of those with comorbid chronic pain and PTSD, literature on models for treating other co-occurring conditions were relied upon. In addition, given the lack of randomized controlled trials focused on those with comorbid pain and PTSD there is limited evidence exploring or comparing these approaches.

Models for Treatment

Sequential Model. The sequential model has been the most common approach to treatment (Angelakis et al., 2020). In this model, the person with pain and PTSD has these conditions addressed separately and in a linear fashion. One clinician or team addresses PTSD, for example, and after the conclusion of a course of PTSD-focused treatment a patient then moves into pain-focused treatment. There is limited evidence to indicate which is better addressed first; therefore, the order of treatment can be a difficult decision. Currently, when sequential treatment is selected, the preference of the individual with PTSD and pain is the primary decision-making source as long as the clinician does not note any significant concerns. Depending on the severity of symptoms, providers may recommend PTSD treatment first if they feel someone would not be able to benefit from or complete a pain-focused treatment first. Similarly, if pain-related symptoms are the patient's main concern and they want to engage in pain treatment first, then it is initiated. While not addressed directly, it is possible that gains made in each of the focused treatments could benefit the other condition; however, there are several concerns in the sequential model. It is possible that the untreated disorder can worsen or interfere with the chosen treatment. In addition, an appropriate referral for the next step of care may not be made so only one condition is addressed.

Parallel Model. As the name suggests, the parallel model treats each disorder at the same time (Hobden et al., 2018). There is a provider or team addressing each area of care but without explicit coordination or communication. While both pain and PTSD are being addressed, there is no comprehensive, whole person treatment plan. Providers may have differing philosophies and emphases. If they are unaware of what is occurring in the other treatment, there is no way to maximize efficiency for the patient. Another danger of this approach is that the individual may be overwhelmed by the appointments and assignments of home practice that are typical in these treatments. Instead of being able to focus on one condition or have things well integrated, there may be a sense of competing priorities or choosing one over the other. Further, if medications are adjusted or added concurrently

for both conditions, it may be difficult to evaluate effectiveness or determine the source of unwanted side effects.

It is important to note that in both the sequential and parallel models, neither approach requires an explicit discussion of PTSD and chronic pain as overlapping and mutually exacerbating conditions. Without this knowledge, people with pain and PTSD may be reticent to seek or complete recommended interventions for one or the other condition; this may lead to suboptimal outcomes and future treatment resistance.

Combined/Integrated Model. The combined/integrated model addresses pain and PTSD simultaneously, with a single team of healthcare professionals who have expertise in both conditions. While this treatment is not broadly available, it best encompasses the biopsychosocial, whole person framework for care. Since the co-occurrence of pain and PTSD is prevalent, emphasizing the commonalities among experiences and evidence-based treatments through a team-based approach has been promising (Otis et al., 2009; Liedl & Knaevelsrud, 2008). Instead of providers functioning in parallel or not communicating at all, there is ongoing coordination of care. This provides greater efficiency for patients and providers as well as cost effectiveness. In combined models, concurrent treatment relies heavily on evidence-based therapies and cognitive behavioral principles that have been shown to be effective for treating both disorders. These strategies focus primarily on minimizing the shared role of fear-avoidance in both pain and PTSD that maintains poor functioning and disability. Consistent with Foa and colleagues' (2007) rationale for exposure-based PTSD interventions, treatment focuses on confronting an objectively safe stimuli that may be feared and leading to unhelpful thoughts and behaviors (Foa et al., 2007). Similarly, cognitive behavioral therapy (CBT) for chronic pain emphasizes gaining skills to manage pain and increase self-efficacy. Integrated treatment takes from both of these approaches and focuses on psychoeducation, relaxation techniques, restructuring of fear avoidance beliefs, pacing activities and increasing meaningful activities and socialization.

Integration Examples. There have been several attempts at combining treatment for chronic pain and PTSD. Otis and colleagues (2009) developed a 12-session integrated treatment using components of cognitive processing therapy (CPT) for PTSD and CBT for chronic pain management. Six participants were recruited for the pilot with three completers. While results suggested that the intervention was feasible and may have clinical benefit, more examination is needed through a controlled trial. Several pilots have focused on the role of physical activation. Plagge and colleagues (2013) asked Veterans ($N = 30$ completers) to complete a biopsychosocial evaluation and up to eight behavioral activation sessions using a collaborative clinical approach, while Chopin and colleagues (2020) conducted a 4-year pilot focused on the use of yoga for those with comorbid pain and PTSD (completers $N = 49$). Both were found to be feasible and potentially effective interventions (Chopin et al., 2020).

Two recent studies focused on women with PTSD and chronic pain, one evaluated mindfulness-based training (Okvat et al. 2021) and the other focused on an integrated intervention for women with fibromyalgia (Lacefield et al., 2020). Other work stemming from short-term psychodynamic approaches, emotion-focused and exposure therapies, suggests the use of emotional awareness and

expression therapy (EAET) may benefit patients with centrally mediated chronic pain and trauma symptoms (Lumley et al., 2022). While these treatments are promising, further research is needed to better understand their effectiveness and potential for implementation.

Future Directions

The co-occurrence of PTSD and chronic pain is prevalent, particularly among Veterans, and negatively impacts the outcomes of both disorders. There are shared theoretical, neurobiological and practical factors suggesting that integrated treatment could effectively and efficiently provide clinical benefit. At present, however, there are a dearth of controlled trials that have examined interventions aimed at treating both. There is a clear need for research that carefully evaluates promising options to first determine the effectiveness and then the potential for implementation in settings such as the Department of Veterans Affairs (VA). In the meantime, one worthwhile avenue may be exploring how to leverage currently available treatment settings that target one condition, such as interdisciplinary pain rehabilitation programs, in order to target PTSD simultaneously. Indeed, an evidence-based intensive, multidisciplinary outpatient pain program reveals that improvements in pain catastrophizing yield simultaneous reductions in pain interference and PTSD symptomatology (Gilliam et al., 2020).

Further research examining the previously mentioned integrated interventions (Okvat et al. 2022; Lacefield et al. 2020; Lumley et al., 2022; Plagge et al., 2013; Otis et al., 2009; Chopin et al., 2020) using randomized clinical trial designs will allow conclusions to be drawn about effectiveness. If effective, such interventions may overcome the limitations noted in sequential and parallel interventions, namely, treatment resistance, suboptimal treatment response and failure to complete treatment. Likewise, given the variation of treatment responses typically observed in clinical research that may be a function of intervention type (e.g., emotion focused vs. cognitive behavioral: Lumley et al., 2022), symptomatology (e.g., formal PTSD diagnosis vs. trauma exposed: Gilliam et al., 2020) and/or psychosocial characteristics (e.g., emotionally or interpersonally distressed: Turk 2005) the heterogeneity of patients in any given trial underscores the importance of studying "what works, for whom?" Accordingly, as has been suggested for pain itself (Turk, 2005), there may be utility in tailoring pain/PTSD treatment. For example, the need to determine whether there are pain/PTSD subtypes (e.g., centrally mediated pain/interpersonal trauma vs. peripheral pain/non-interpersonal trauma) warranting differential treatment considerations may be important. Alternatively, there may be other comorbidities (e.g., depression) or the presence of multiple traumas and painful conditions that might call for variation in the type, length, frequency or intensity of the intervention to achieve optimal outcomes. Additionally, further research to examine how race, gender, health-related disparities and patient phenotypes may impact the development, trajectory and treatment of these comorbidities would be valuable.

Finally, further exploration into improved identification of those at risk or in the early stages of co-occurring PTSD and pain could be helpful. Limited attention has been given to measures and biomarkers so that those who are most vulnerable may be better identified and triaged for focused treatment. In addition, a growing

body of research suggests that early interventions for pain as well as PTSD may help to minimize the development and impact of both conditions. Increased attention to clarify the best way of identifying those less likely to recover from acute pain and trauma and interventions that may help them would be beneficial.

Featured Articles

Åkerblom, S., Perrin, S., Rivano Fischer, M., & McCracken, L. M. (2018). **The relationship between posttraumatic stress disorder and chronic pain in people seeking treatment for chronic pain: The mediating role of psychological flexibility.** *Clinical Journal of Pain, 34*(6), 487–496. doi:10.1097/AJP.0000000000000561

Objectives: The symptoms of PTSD and chronic pain are thought to interact to increase the severity and impact of both conditions, but the mechanisms by which they interact remain unclear. This study examines the relationship between PTSD and chronic pain and whether indices of Psychological Flexibility mediate the relationship between these 2 conditions. **Materials and Methods:** Standardized self-report measures of PTSD, pain severity, pain interference, depression and psychological flexibility (pain-related acceptance, committed action, cognitive fusion and values-based action) were obtained from 315 people seeking treatment for chronic pain who also reported at least 1 traumatic experience. **Results:** People seeking treatment for chronic pain and reporting symptoms consistent with a current diagnosis of PTSD had significantly higher levels of pain severity, pain interference, depression and cognitive fusion and lower levels of pain-related acceptance and committed action than those reporting symptoms below the diagnostic threshold for PTSD. Pain-related acceptance, committed action, cognitive fusion and depression mediated the relationship between PTSD and pain severity/interference, with pain-related acceptance being the strongest mediator from the Psychological Flexibility model. **Discussion:** Processes from the Psychological Flexibility model were identified as mediators of the relationship between PTSD and chronic pain in people seeking treatment for chronic pain. The Psychological Flexibility model may be useful as an overarching model to help understand the relationship between PTSD and chronic pain. It is possible that targeting pain-related acceptance, committed action and cognitive fusion (among other processes) in the treatment of chronic pain may produce corresponding improvements in comorbid symptoms of PTSD when these are present and may reduce impacts of PTSD on outcomes of chronic pain. Conversely, targeting of these processes in the treatment of PTSD may produce similar improvements for symptoms of chronic pain. Further research to evaluate these possibilities is needed.

Alschuler, K. N., & Otis, J. D. (2012). **Coping strategies and beliefs about pain in veterans with comorbid chronic pain and significant levels of posttraumatic stress disorder symptoms.** *European Journal of Pain, 16*(2), 312–319. doi:10.1016/j.ejpain.2011.06.010

Objectives: The purpose of this study was to assess differences in beliefs about pain and coping strategies employed in Veterans with comorbid chronic pain and PTSD, compared to Veterans with chronic pain alone. It was hypothesized that Veterans with comorbid chronic pain and significant levels of PTSD symptomatology would report higher levels of maladaptive coping strategies and beliefs about pain when compared to Veterans with pain alone. **Methods:** Data were obtained from 194 Veterans who completed self-report questionnaires as part

of their participation in a Psychology Pain Management Program at a northeastern Department of Veterans Affairs healthcare facility. **Results:** Analyses indicated that 47.4% of the sample scored above the clinical cutoff for PTSD symptomatology on the PTSD Checklist – Military Version (PCL-M). A Multivariate Analysis of Covariance (MANCOVA) was conducted with age and pain intensity as covariates. In support of the hypothesis, Veterans with comorbid chronic pain and significant levels of PTSD symptomatology endorsed significantly higher levels of maladaptive coping strategies and beliefs about pain (greater catastrophizing and emotional impact on pain; less control over pain) when compared to Veterans with chronic pain alone. **Discussion:** The results of this study suggest potential explanations for the previously observed negative effect of PTSD on chronic pain. Moreover, the results suggest specific targets for intervention with patients who have comorbid pain and PTSD.

Asmundson, G. J. G., Coons, M. J., Taylor, S., & Katz, J. (2002). **PTSD and the experience of pain: Research and clinical implications of shared vulnerability and mutual maintenance models.** *Canadian Journal of Psychiatry, 47*(10), 930–937. doi:10.1177/070674370204701004

It is common for individuals with symptoms of PTSD to present with co-occurring pain problems and vice versa. However, the relation between these conditions often goes unrecognized in clinical settings. In this paper, we describe potential relations between PTSD and chronic pain and their implications for assessment and treatment. To accomplish this, we discuss phenomenological similarities of these conditions, the prevalence of chronic pain in patients with PTSD, and the prevalence of PTSD in patients with chronic pain. We also present several possible explanations for the co-occurrence of these disorders, based primarily on the notions of shared vulnerability and mutual maintenance. The paper concludes with an overview of future research directions, as well as practical recommendations for assessing and treating patients who present with co-occurring PTSD or chronic pain symptoms.

Bair, M. J., Outcalt, S. D., Ang, D., Wu, J., & Yu, Z. (2020). **Pain and psychological outcomes among Iraq and Afghanistan veterans with chronic pain and PTSD: ESCAPE Trial longitudinal results.** *Pain Medicine, 21*(7), 1369–1376. doi:10.1093/pm/pnaa007

Objective: To compare pain and psychological outcomes in Veterans with chronic musculoskeletal pain and comorbid PTSD or pain alone and to determine if Veterans with comorbidity respond differently to a stepped-care intervention than those with pain alone. **Design:** Secondary analysis of data from the Evaluation of Stepped Care for Chronic Pain (ESCAPE) trial. **Setting:** Six Veterans Health Affairs clinics. **Subjects:** Iraq and Afghanistan Veterans ($N = 222$) with chronic musculoskeletal pain. **Methods:** Longitudinal analysis of Veterans with chronic musculoskeletal pain and PTSD or pain alone and available baseline and nine-month trial data. Participants randomized to either usual care or a stepped-care intervention were analyzed. The pain-PTSD comorbidity group screened positive for PTSD and had a PTSD Checklist – Civilian score ≥ 41 at baseline. **Results:** T tests demonstrated statistically significant differences and worse outcomes on pain severity, pain cognitions and psychological outcomes in Veterans with comorbid pain and PTSD compared with those with pain alone. Analysis of covariance (ANCOVA) modeling change scores from baseline to nine months indicated no statistically significant differences, controlling for PTSD, on pain severity, pain centrality or pain

self-efficacy. Significant differences emerged for pain catastrophizing ($t=3.10, p < 0.01$), depression ($t=3.39, p < 0.001$) and anxiety ($t=3.80, p < 0.001$). The interaction between PTSD and the stepped-care intervention was not significant. **Conclusions:** Veterans with the pain-PTSD comorbidity demonstrated worse pain and psychological outcomes than those with chronic pain alone. These findings indicate a more intense chronic pain experience for Veterans when PTSD co-occurs with pain. PTSD did not lead to a differential response to a stepped-care intervention.

Benedict, T.M., Keenan, P. G., Nitz, A. J., & Moeller-Bertram, T. (2020). **Post-traumatic stress disorder symptoms contribute to worse pain and health outcomes in veterans with PTSD compared to those without: A systematic review with meta-analysis.** *Military Medicine*, 185(9–10), e1481–e1491. doi:10.1093/milmed/usaa052

Introduction: PTSD and chronic pain are frequently co-morbid conditions in the U.S. Veteran population. Although several theories about the cause of increased pain prevalence in individuals with PTSD have been presented, no synthesis of primary data informing the impact of co-morbid PTSD and pain has been completed. The purpose of this study was to systematically review the literature and quantify disability, function and pain-related beliefs and outcomes in Veterans with PTSD compared to Veterans without PTSD. **Materials and Methods:** A systematic search of three electronic databases was conducted. Inclusion criteria required pain-related comparison of Veterans with PTSD to those without PTSD. Primary outcome measures and standardized mean differences (SMDs) were assessed for pain, function, disability, pain beliefs and healthcare utilization using a random effects model. **Results:** 20 original research studies met inclusion criteria and were assessed for quality and outcomes of interest. The majority of studies were cross-sectional. Veterans with PTSD and pain demonstrated higher pain (SMD = 0.58, 95% CI 0.28-0.89), disability (SMD = 0.52, 95% CI 0.33-0.71), depression (SMD = 1.40, 95% CI 1.2-1.6), catastrophizing beliefs (SMD = 0.95, 95% CI 0.69-1.2), sleep disturbance (SMD = 0.80, 95% CI 0.57-1.02) and healthcare utilization; they had lower function (SMD = 0.41, 95% CI 0.25-0.56) and pain self-efficacy (SMD = 0.77, 95% CI 0.55-0.99) compared to Veterans without PTSD. **Conclusion:** In Veterans with chronic pain, PTSD symptomology has a large effect for many negative health-related outcomes. This review supports the need for clinicians to screen and understand the effects of PTSD symptoms on patients with pain. Clinicians should recognize that Veterans with PTSD and pain likely have elevated pain catastrophizing beliefs and decreased self-efficacy that should be targeted for intervention.

Defrin, R., Lahav, Y., & Solomon, Z. (2017). **Dysfunctional pain modulation in torture survivors: The mediating effect of PTSD.** *Journal of Pain*, 18(1), 1–10. doi:10.1016/j.jpain.2016.09.005

Trauma survivors, and particularly torture survivors, suffer from high rates of chronic pain and PTSD for years afterward, along with alterations in the function of the pain system. On the basis of longitudinal data on PTSD symptomatology, we tested whether exposure to torture, PTSD or PTSD trajectories accounted for chronic pain and altered pain perception. Participants were 59 torture survivors and 44 age-matched healthy control subjects. Chronic pain was characterized. Pain threshold, pain tolerance, CPM and temporal

summation of pain were measured. Three PTSD trajectories were identified among torture survivors; chronic, delayed and resilient. Lack of CPM and more intense chronic pain was found among the chronic and delayed groups compared with the resilient and healthy control groups. Temporal summation of pain was strongest among the chronic group. PTSD trajectories mediated the relationship between torture and CPM. It appears that the duration and severity of posttraumatic distress, rather than the exposure to trauma, are crucial factors that mediate the association between trauma and chronic pain. Because PTSD and its resultant distress are measurable, their evaluation seems particularly important in the management of pain among trauma survivors. The results may be generalized to other instances in which chronic pain persists after traumatic events.

Foa, E. B., Hembree, E., & Rothbaum, B. (2007). *Prolonged exposure therapy for PTSD: Emotional processing of traumatic experiences: Therapist guide.* Oxford University Press. doi:10.1093/med/psych/9780195308501.001.0001

This online therapist guide gives clinicians the information they need to treat clients who exhibit the symptoms of PTSD. It is based on the principles of Prolonged Exposure Therapy, the most scientifically tested and proven treatment that has been used to effectively treat victims of all types of trauma. Clients are exposed to imagery of their traumatic memories, as well as real-life situations related to the traumatic event in a step-by-step, controllable way, and through this, will learn to confront the trauma and begin to think differently about it, leading to a marked decrease in levels of anxiety and other PTSD symptoms. Clients are provided education about PTSD and other common reactions to traumatic events. Breathing retraining is taught as a method for helping the client manage anxiety in daily life. Designed to be used in conjunction with the corresponding online client workbook, this therapist guide includes all the tools necessary to effectively implement the prolonged exposure program including assessment measures, session outlines, case studies, sample dialogues and homework assignments.

Gilliam, W. P., Schumann, M. E., Craner, J. R., Cunningham, J. L., Morrison, E. J., Seibel, S., Sawchuk, C., & Sperr, J. A. (2020). **Examining the effectiveness of pain rehabilitation on chronic pain and post-traumatic symptoms.** *Journal of Behavioral Medicine*, 43(6), 956–967. doi:10.1007/s10865-020-00160-3

Patients with co-morbid chronic pain and PTSD pose significant treatment challenges. This study evaluated the effectiveness of an interdisciplinary pain rehabilitation program (IPRP) in improving pain and PTSD outcomes, as well as reducing medication use. In addition, the mediating effect of pain catastrophizing, which is theorized to underlie the pain and PTSD comorbidity, was examined. Participants included 83 completers of an IPRP with chronic pain and a provisional PTSD diagnosis. Significant improvements were found for pain outcomes, PTSD symptomatology, depressive symptoms, physical performance and medication use (i.e., opioids and benzodiazepines). At discharge, 86.7% of participants reliably improved in at least one key measure of functioning and 50.6% demonstrated reliable improvement in PTSD symptomatology. Change in pain catastrophizing mediated improvements in pain interference and PTSD symptomatology. Results support the potential utility of an

interdisciplinary pain treatment approach in the treatment of patients with comorbid pain and PTSD.

Goldstein, E., McDonnell, C., Atchley, R., Dorado, K., Bedford, C., Brown, R. L., & Zgierska, A. E. (2019). **The impact of psychological interventions on posttraumatic stress disorder and pain symptoms: A systematic review and meta-analysis.** *Clinical Journal of Pain, 35*(8), 703–712. doi:10.1097/AJP.0000000000000730

Objectives: PTSD and pain often co-occur, introducing clinical challenges and economic burden. Psychological treatments are considered effective for each condition, yet it is not known which therapies have the potential to concurrently address PTSD and pain-related symptoms. **Materials and Methods:** To conduct a systematic review and meta-analysis, databases were searched for articles published between January 2007 and December 2017 describing results from clinical trials of interventions addressing PTSD and pain-related symptoms in adults. Two independent reviewers finalized data extraction and risk of bias assessments. A random-effects model was used for meta-analysis and to calculate pooled and subgroup effect sizes (ESs) of psychological-only (single modality) and multimodal interventions. **Results:** Eighteen trials (7 uncontrolled, 11 randomized controlled trials, RCTs), totaling 1583 participants, were included in the systematic review. RCT intervention types included exposure-based, cognitive-behavioral and mindfulness-based therapies. Data from 10 RCTs ($N = 1,35$) were available for meta-analysis, which demonstrated moderate effect for reduced PTSD severity (ES = -0.55, confidence interval [CI]: -0.83, -0.26) and nonsignificant effect for pain intensity (ES = -0.14, CI: -0.43, 0.15) and pain interference (ES = -0.07, CI: -0.35, 0.20) outcomes. Findings from uncontrolled trials supported meta-analytic results from RCTs. Using GRADE assessment, the quality of evidence was deemed as moderate for RCTs and low for non-RCTs. **Discussion:** Findings indicated that the majority of the interventions appeared to have a greater impact on reducing PTSD rather than pain-related symptoms. There remains a need to further develop interventions that consistently impact PTSD and pain-related outcomes when these 2 conditions co-occur.

Liedl, A., O'Donnell, M., Creamer, M., Silove, D., McFarlane, A., Knaevelsrud, C., & Bryant, R. A. (2010). **Support for the mutual maintenance of pain and post-traumatic stress disorder symptoms.** *Psychological Medicine, 40*(7), 1215–1223. doi:10.1017/S0033291709991310

Background: Pain and PTSD are frequently co-morbid in the aftermath of a traumatic event. Although several models attempt to explain the relationship between these two disorders, the mechanisms underlying the relationship remain unclear. The aim of this study was to investigate the relationship between each PTSD symptom cluster and pain over the course of post-traumatic adjustment. **Method:** In a longitudinal study, injury patients ($N = 824$) were assessed within 1-week post-injury and then at 3 and 12 months. Pain was measured using a 100-mm Visual Analogue Scale (VAS). PTSD symptoms were assessed using the Clinician-Administered PTSD Scale (CAPS). Structural equation modelling (SEM) was used to identify causal relationships between pain and PTSD. **Results:** In a saturated model we found that the relationship between acute pain and 12-month pain was mediated by arousal symptoms at 3 months. We also found that the relationship between baseline arousal and

re-experiencing symptoms, and later 12-month arousal and re-experiencing symptoms, was mediated by 3-month pain levels. The final model showed a good fit [$\chi^2 = 16.97$, $df = 12$, $p > 0.05$, Comparative Fit Index (CFI) = 0.999, root mean square error of approximation (RMSEA) = 0.022]. **Conclusions:** These findings provide evidence of mutual maintenance between pain and PTSD.

Lumley, M. A., Yamin, J. B., Pester, B. D., Krohner, S., & Urbanik, C. P. (2022). **Trauma matters: Psychological interventions for comorbid psychosocial trauma and chronic pain.** *Pain, 163*(4), 599–603. doi:10.1097/j.pain.0000000000002425

There is growing interest in psychosocial trauma and chronic pain. Numerous retrospective studies link trauma or PTSD to CP, 6–9, 12, 35, 54, 78, 96, 97 and prospective studies indicate that earlier trauma is a risk factor for later CP. 16, 27, 44, 45, 49, 57, 69, 76, 77, 86 Some scholars have offered explanations of this link, focusing on the commonalities of trauma and chronic pain or their bidirectional relationships, such as the shared vulnerability, 14 mutual maintenance, 84 and perpetual avoidance 55 models. Others have proposed how trauma might cause, exacerbate, or maintain chronic pain by disrupting physiological, cognitive, emotional, or interpersonal processes. 29, 52, 53, 62, 67 Unfortunately, these models have rarely informed treatment initiatives, leaving key questions unanswered: How does one define trauma in populations with CP? Is it beneficial to treat comorbid trauma or chronic pain? What interventions effectively do so? This topical review addresses these questions.

Morasco, B. J., Lovejoy, T. I., Lu, M., Turk, D. C., Lewis, L., & Dobscha, S. K. (2013). **The relationship between PTSD and chronic pain: Mediating role of coping strategies and depression.** *Pain, 154*(4), 609–616. doi:10.1016/j.pain.2013.01.001

People with chronic pain and comorbid PTSD report more severe pain and poorer quality of life than those with chronic pain alone. This study evaluated the extent to which associations between PTSD and chronic pain interference and severity are mediated by pain-related coping strategies and depressive symptoms. Veterans with chronic pain were divided into two groups, those with ($N = 65$) and those without ($N = 136$) concurrent PTSD. All participants completed measures of pain severity, interference, emotional functioning and coping strategies. Those with current PTSD reported significantly greater pain severity and pain interference, had more symptoms of depression, and were more likely to meet diagnostic criteria for a current alcohol or substance use disorder (all p -values $< .01$). Participants with PTSD reported more use of several coping strategies, including guarding, resting, relaxation, exercise/stretching and coping self-statements. Illness-focused pain coping (i.e., guarding, resting and asking for assistance) and depressive symptoms jointly mediated the relationship between PTSD and both pain interference (total indirect effect = 0.194, $p < .001$) and pain severity (total indirect effect = 0.153, $p = .004$). Illness-focused pain coping also evidenced specific mediating effects, independent of depression. In summary, specific pain coping strategies and depressive symptoms partially mediated the relationship between PTSD and both pain interference and severity. Future research should examine whether changes in types of coping strategies after targeted treatments predict improvements in pain-related function for chronic pain patients with concurrent PTSD.

Otis, J. D., Keane, T. M., & Kerns, R. D. (2003). **An examination of the relationship between chronic pain and post-traumatic stress disorder.** *Journal of Rehabilitation Research and Development*, 40(5), 397–405. doi:10.1682/jrrd.2003.09.0397 Chronic pain and PTSD are frequently observed within the VA healthcare system and are often associated with a significant level of affective distress and physical disability. Clinical practice and research suggest that these two conditions co-occur at a high rate and may interact in such a way as to negatively impact the course of either disorder; however, relatively little research has been conducted in this area. This review summarizes the current literature pertaining to the prevalence and development of chronic pain and PTSD. Research describing the comorbidity of both conditions is reviewed, and several theoretical models are presented to explain the mechanisms by which these two disorders may be maintained. Future directions for research and clinical implications are discussed.

Otis, J. D., Keane, T. M., Kerns, R. D., Monson, C., & Scioli, E. (2009). **The development of an integrated treatment for veterans with comorbid chronic pain and posttraumatic stress disorder.** *Pain Medicine*, 10(7), 1300–1311. doi:10.1111/j.1526-4637.2009.00715.x
Objective: The purpose of this article is to describe the development of the first integrated treatment for Veterans with comorbid chronic pain and PTSD. **Design:** Descriptive, including pre- and posttreatment assessment results from a pilot study of 6 Veterans with comorbid chronic pain and PTSD. **Setting:** Northeastern VA Medical Center. **Interventions:** Using components of CPT for PTSD and CBT for chronic pain management, a 12-session integrated treatment for Veterans with comorbid chronic pain and PTSD was developed. A therapist manual and patient workbook that included weekly readings and homework assignments were created. Participants received pre- and posttreatment evaluations using measures of pain, PTSD, physical disability and psychological distress. The treatment development process is reviewed and the benefits and challenges of implementing this integrated treatment are presented. **Results:** Several themes emerged over the course of implementing the treatment, including the importance of establishing participant trust, regular therapy attendance and addressing participant avoidance. Of the six participants recruited for the pilot study, three withdrew from the study and three completed the integrated treatment. Participants reported that they generally liked the format of treatment, appreciated learning about the ways that chronic pain and PTSD share some common symptoms, and ways that the two disorders can interact with one another. The assessment results of those who completed treatment suggest that this treatment approach is feasible and may have clinical benefit. **Conclusions:** Participants appeared to benefit from receiving the integrated treatment for pain and PTSD. A randomized clinical trial is currently being conducted to evaluate the efficacy of this treatment approach.

Powell, M. A., Corbo, V., Fonda, J. R., Otis, J. D., Milberg, W. P., & McGlinchey, R. E. (2015). **Sleep quality and reexperiencing symptoms of PTSD are associated with current pain in U.S. OEF/OIF/OND veterans with and without mTBIs.** *Journal of Traumatic Stress*, 28(4), 322–329. doi:10.1002/jts.22027 Pain, a debilitating condition, is frequently reported by U.S. Veterans returning from Afghanistan and Iraq. This study investigated how commonly

reported clinical factors were associated with pain and whether these associations differed for individuals with a history of chronic pain. From the Boston metropolitan area, 171 Veterans enrolled in the VA Center of Excellence were assessed for current PTSD symptom severity, current mood and anxiety diagnoses, lifetime traumatic brain injury, combat experiences, sleep quality and alcohol use. Hierarchical regression models were used to determine the association of these conditions with current pain. Average pain for the previous 30 days, assessed with the McGill Pain Questionnaire, was 30.07 out of 100 (SD = 25.43). Sleep quality, PTSD symptom severity and alcohol use were significantly associated with pain ($R^2 = .24$), as were reexperiencing symptoms of PTSD ($R^2 = .25$). For participants with a history of chronic pain ($N = 65$), only PTSD symptoms were associated with pain ($R^2 = .19$). Current pain severity was associated with increased PTSD severity (notably, reexperiencing symptoms), poor sleep quality and increased alcohol use. These data support the hypothesis that PTSD symptoms influence pain but suggest that problems with sleep and alcohol use may exacerbate the relationship.

Raphael, K. G., & Widom, C. S. (2011). **Post-traumatic stress disorder moderates the relation between documented childhood victimization and pain 30 years later.** *Pain*, 152(1), 163–169. doi:10.1016/j.pain.2010.10.014 Cross-sectional designs and self-reports of maltreatment characterize nearly all the literature on childhood abuse or neglect and pain in adulthood, limiting potential for causal inference. The current study describes a prospective follow up of a large cohort of individuals with court-documented early childhood abuse or neglect ($N = 458$) and a demographically matched control sample ($N = 349$) into middle adulthood (mean age 41), nearly 30 years later, comparing the groups for risk of adult pain complaints. We examine whether PTSD mediates or moderates risk of pain. Assessed prospectively across multiple pain measures, physically and sexually abused and neglected individuals generally showed a significant ($p < .05$) but notably small ($\eta^2 = .01$) increased risk of pain symptoms in middle adulthood. Although PTSD was associated with both childhood victimization ($p < .01$) and risk of middle adulthood pain ($p < .001$), it did not appear to mediate the relationship between victimization and pain. However, across all pain outcomes other than medically unexplained pain, PTSD robustly interacted with documented childhood victimization to predict adult pain risk: Individuals with both childhood abuse/neglect and PTSD were at significantly increased risk ($p < .001$, η^2 generally = .05-.06) of pain. After accounting for the combined effect of the two factors, neither childhood victimization nor PTSD alone predicted pain risk. Findings support a view that clinical pain assessments should focus on PTSD rather than make broad inquiries into past history of childhood abuse or neglect.

Sharp, T. J., & Harvey, A. G. (2001). **Chronic pain and posttraumatic stress disorder: Mutual maintenance?** *Clinical Psychology Review*, 21(6), 857–877. doi:10.1016/S0272-7358(00)00071-4 Common sequelae following a traumatic event include chronic pain and PTSD. Over the last decade, the literature relating to PTSD has become progressively more sophisticated, resulting in well-supported theories and treatments for sufferers. Equivalent research relating to chronic pain has more recently gathered momentum. However, to date there has been minimal attention devoted to the concurrence of

the two disorders, even though high comorbidity has been noted. This review begins by briefly summarizing the literature relating to the two disorders in terms of symptoms, prevalence and comorbidity. It explicates the major psychological theories of chronic pain and PTSD and reviews the evidence relating what factors maintain the disorders. A number of pathways by which chronic pain and PTSD may be mutually maintaining are highlighted. We conclude that chronic pain and PTSD are mutually maintaining conditions and that there are several pathways by which both disorders may be involved in the escalation of symptoms and distress following trauma. Treatment implications are considered, as are issues for future research.

Siqueland, J., Hussain, A., Lindström, J. C., Ruud, T., & Edvard Hauff, E. (2017). **Prevalence of posttraumatic stress disorder in persons with chronic pain: A meta-analysis.** *Frontiers in Psychiatry, 8*, Article 164. doi:10.3389/fpsy.2017.00164 *Objective:*

To summarize evidence for the prevalence of PTSD among persons with chronic pain. *Methods:* We searched databases for studies published between January 1995 and December 2016, reporting the prevalence of PTSD in persons with CP. Two reviewers independently extracted data and assessed the risk of bias. We calculated the pooled prevalence using a random-effects model and performed subgroup analyses according to pain location, the population and assessment method. *Results:* Twenty-one studies were included, and the PTSD prevalence varied from 0-57%, with a pooled mean prevalence of 9.7%, 95% CI (5.2-17.1). In subgroup analysis, the PTSD prevalence was 20.5%, 95% CI (9.5-39.0) among persons with chronic widespread pain, 11.2%, 95% CI (5.7-22.8) among persons with headache and 0.3%, 95% CI (0.0-2.4) among persons with back pain. The prevalence in clinical populations was 11.7%, 95% CI (6.0-21.5) and in non-clinical populations 5.1%, 95% CI (0.01-17.2). In studies of self-reported PTSD symptoms, PTSD prevalence was 20.4%, 95% CI (10.6-35.5), and in studies where structured clinical interviews had been used to assess PTSD its prevalence was 4.5%, 95% CI (2.1-9.3). The risk of bias was medium for most studies and the heterogeneity was high ($I^2 = 98.6$). *Conclusion:* PTSD is overall more prevalent in clinical cohorts of persons with chronic pain and particularly in those with widespread pain but may not always be more prevalent in non-clinical samples of persons with chronic pain, compared to the general population. There is a large heterogeneity in prevalence across studies. Future research should identify sources of heterogeneity and the mechanisms underlying the comorbidity of the two conditions.

You, D. S., & Meagher, M. W. (2016). **Childhood adversity and pain sensitization.** *Psychosomatic Medicine, 78*(9), 1084–1093. doi:10.1097/PSY.0000000000000399

Objective: Childhood adversity is a vulnerability factor for chronic pain. However, the underlying pain mechanisms influenced by childhood adversity remain unknown. The aim of the current study was to evaluate the impact of childhood adversity on dynamic pain sensitivity in young adults. *Methods:* After screening for childhood adverse events and health status, healthy individuals reporting low (below median; $N = 75$) or high levels of adversity (the top 5%; $N = 51$) were invited for pain testing. Both groups underwent heat pain threshold and temporal summation of second pain (TSSP) testing after reporting depressive symptoms. TSSP refers to a progressive increase in pain intensity with repetition of identical noxious stimuli and is attributed to central sensitization.

Changes in pain ratings over time (slope) were computed for TSSP sensitization and decay of subsequent aftersensations. *Results:* The high-adversity group showed greater TSSP sensitization (meanslope, 0.75; SD positive slope, 1.78), and a trend toward a slower decay (meanslope, -11.9; SD, 3.4), whereas the low-adversity group showed minimal sensitization (meanslope, 0.07; SD near-zero slope, 1.77), $F(1,123) = 5.84, p = .017$ and faster decay (meanslope, -13.1; SD, 3.4), $F(1,123) = 3.79, p = .054$. This group difference remained significant even after adjusting for adult depressive symptoms ($p = .033$). No group difference was found in heat pain threshold ($p = .85$). Lastly, the high-adversity group showed blunted cardiac and skin conductance responses. *Conclusions:* These findings suggest that enhancement of central sensitization may provide a mechanism underlying the pain hypersensitivity and chronicity linked to childhood adversity.

Vlaeyen, J. W. S., Crombez, G., & Linton, S. J. (2016). **The fear-avoidance model of pain.** *Pain, 157*(8), 1588–1589. <https://doi.org/10.1097/j.pain.0000000000000574> [No Author Abstract].

Woolf, C. J. (2011). **Central sensitization: Implications for the diagnosis and treatment of pain.** *Pain, 152*(3 Suppl), S2–S15. <https://doi.org/10.1016/j.pain.2010.09.030>

Nociceptor inputs can trigger a prolonged but reversible increase in the excitability and synaptic efficacy of neurons in central nociceptive pathways, the phenomenon of central sensitization. Central sensitization manifests as pain hypersensitivity, particularly dynamic tactile allodynia, secondary punctate or pressure hyperalgesia, aftersensations and enhanced temporal summation. It can be readily and rapidly elicited in human volunteers by diverse experimental noxious conditioning stimuli to skin, muscles or viscera, and in addition to producing pain hypersensitivity, results in secondary changes in brain activity that can be detected by electrophysiological or imaging techniques. Studies in clinical cohorts reveal changes in pain sensitivity that have been interpreted as revealing an important contribution of central sensitization to the pain phenotype in patients with fibromyalgia, osteoarthritis, musculoskeletal disorders with generalized pain hypersensitivity, headache, temporomandibular joint disorders, dental pain, neuropathic pain, visceral pain hypersensitivity disorders and post-surgical pain. The comorbidity of those pain hypersensitivity syndromes that present in the absence of inflammation or a neural lesion, their similar pattern of clinical presentation and response to centrally acting analgesics, may reflect a commonality of central sensitization to their pathophysiology. An important question that still needs to be determined is whether there are individuals with a higher inherited propensity for developing central sensitization than others, and if so, whether this conveys an increased risk in both developing conditions with pain hypersensitivity and their chronification. Diagnostic criteria to establish the presence of central sensitization in patients will greatly assist the phenotyping of patients for choosing treatments that produce analgesia by normalizing hyperexcitable central neural activity. We have certainly come a long way since the first discovery of activity-dependent synaptic plasticity in the spinal cord and the revelation that it occurs and produces pain hypersensitivity in patients. Nevertheless, discovering the genetic and environmental contributors to and

objective biomarkers of central sensitization will be highly beneficial, as will additional treatment options to prevent or reduce this prevalent and promiscuous form of pain plasticity.

Additional Articles

Andersen, T. E., Karstoft, K.-I., Brink, O., & Elklit, A. (2016). **Pain-catastrophizing and fear-avoidance beliefs as mediators between post-traumatic stress symptoms and pain following whiplash injury—A prospective cohort study.** *European Journal of Pain*, 20(8), 1241–1252. doi:10.1002/ejp.848 This longitudinal cohort design ($N = 198$) investigated the relationship between posttraumatic stress symptoms, fear-avoidance beliefs, pain-catastrophizing and pain by assessing patients with whiplash injury. They identified five trajectories to categorize the participants' pain trajectories: very high stable, high stable, medium stable, medium improving and low improving. These trajectories had differing relations with the pain-related psychological variables.

Angelakis, S., Weber, N., & Nixon, R. D. V. (2020). **Comorbid posttraumatic stress disorder and major depressive disorder: The usefulness of a sequential treatment approach within a randomised design.** *Journal of Anxiety Disorders*, 76, 102324. doi:10.1016/j.janxdis.2020.102324 This paper presents a randomized trial of CPT and Behavioural Activation Therapy (BA) for patients with comorbid PTSD and Major Depressive Disorder. Participants were randomized to either CPT alone ($N = 18$), CPT then BA for MDD ($N = 17$), or BA then CPT ($N = 17$). Findings suggest a benefit from having PTSD addressed first.

Chopin, S. M., Sheerin, C. M., & Meyer, B. L. (2020). **Yoga for warriors: An intervention for veterans with comorbid chronic pain and PTSD.** *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(8), 888–896. doi:10.1037/tra0000649 This pilot examined a yoga intervention for Veterans with chronic pain and PTSD: $N = 87$ enrolled with 44 completers (44% attrition). Pre- to postintervention analyses indicated reductions in PTSD symptoms, increased functioning and reduced kinesiophobia.

Coppens, E., Van Wambeke, P., Morlion, B., Weltens, N., Giau Ly, H., Tack, J., Luyten, P., & Van Oudenhove, L. (2017). **Prevalence and impact of childhood adversities and post-traumatic stress disorder in women with fibromyalgia and chronic widespread pain.** *European Journal of Pain*, 21(9), 1582–1590. doi:10.1002/ejp.1059 This cross-sectional study investigated the prevalence of different types of childhood adversities (CA) and PTSD in patients with fibromyalgia or widespread pain ($N = 154$ females) compared to women with Functional Dyspepsia ($N = 83$) and achalasia ($N = 53$). The prevalence of childhood adversity was higher in the fibromyalgia/widespread pain group compared to the achalasia group, but similar to the functional dyspepsia group. In the fibromyalgia/widespread pain group, PTSD comorbidity, but not childhood adversity was association with pain severity and PTSD mediated the relation between childhood adversity and pain severity.

Gilliam, W. P., Craner, J. R., Schumann, M. E., & Gascho, K. (2019). **The mediating effect of pain catastrophizing on PTSD symptoms and pain outcome.** *Clinical Journal of Pain*, 35(7), 583–588

doi:10.1097/AJP.0000000000000713 This study investigated the mediating effect of pain catastrophizing on the relationship between PTSD symptoms and pain among patients with chronic pain ($N = 203$) enrolled in a three-week rehabilitation program. Mediation analyses revealed that pain catastrophizing fully mediated the relationships between PTSD symptoms and pain outcomes (pain severity and pain interference) beyond the influence of depressive symptoms. These findings are consistent with the mutual maintenance model of chronic pain and PTSD.

Herbert, M. S., Malaktaris, A. L., Dochat, C., Thomas, M. L., Wetherell, J. L., & Afari, N. (2019). **Acceptance and commitment therapy for chronic pain: Does post-traumatic stress disorder influence treatment outcomes?** *Pain Medicine*, 20(9), 1728–1736. doi:10.1093/pm/pny272 A total of 126 Veterans participated in an 8-week Acceptance and Commitment Therapy for chronic pain intervention, including a subset ($N = 43$) who had comorbid PTSD. PTSD status did not moderate any immediate post-treatment outcomes (pain interference, pain severity, pain acceptance, depressive symptoms and pain-related anxiety) and at 6-months follow-up, PTSD only moderated depressive symptoms. Overall, PTSD status did not significantly effect treatment outcomes.

Hobden, B., Bryant, J., Carey, M., Baker, A. L., Farrell, M., Oldmeadow, C., Mattick, R. P., Shakeshaft, A., & Sanson-Fisher, R. (2018). **Finding the optimal treatment model: A systematic review of treatment for co-occurring alcohol misuse and depression.** *The Australian and New Zealand journal of psychiatry*, 52(8), 737–750. doi:10.1177/0004867418758922 This is a systematic review of treatments for co-occurring alcohol misuse and depression. Of the seven studies included, three examined a parallel model of treatment and four examined an integrated model of treatment.

Lacefield, K., Samph. S. P., Orbon, S., & Otis, J. (2020). **Integrated intervention for comorbid posttraumatic stress disorder and fibromyalgia: A pilot study of women veterans.** *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(7), 725–729. doi:10.1037/tra0000635 This pilot investigated a 12-session integrated treatment for women with PTSD and fibromyalgia ($N = 11$, with 5 completers). Treatment completers demonstrated reductions in both PTSD symptoms and pain-related symptoms.

Liedl, A., & Knaevelsrud, C. (2008). **Chronic pain and PTSD: The Perpetual Avoidance Model and its treatment implications.** *Torture*, 18(2), 69–76. This paper provides an overview of comorbid chronic pain and PTSD and then proposes the Perpetual Avoidance Model. This model is proposed to explain the reciprocal maintenance of both disorders and provides treatment implications.

Okvat, H. A., Davis, M. C., Mistretta, E. G., & Mardian, A. S. (2022). **Mindfulness-based training for women veterans with chronic pain: A retrospective study.** *Psychological Services*, 19(Suppl 1), 106–119. doi:10.1037/ser0000599 This was a pilot of an 8-session mindfulness group treatment for women Veterans with chronic pain ($N = 36$). Pre- to posttreatment analyses demonstrated moderate-to-large pre-post improvements in pain severity, pain catastrophizing, physical functioning, depression, self-compassion and positive affect.

Plagge, J. M., Lu, M. W., Lovejoy, T. I., Karl, A. I., & Dobscha, S. K. (2013). **Treatment of comorbid pain and PTSD in returning veterans: A collaborative approach utilizing behavioral activation.** *Pain Medicine, 14*, 1164–1172. doi:10.1111/pme.12155

This study piloted a behavioral activation treatment to treat comorbid chronic pain and PTSD ($N = 58$ and 30 completed treatment). Treatment completers demonstrated improvements in PTSD symptoms, pain severity and reduced functional interference.

Scioli-Salter, E. R., Forman, D. E., Otis, J. D., Gregor, K., Valovski, I. & Rasmusson, A. M. (2015). **The shared neuroanatomy and neurobiology of comorbid chronic pain and PTSD: Therapeutic implications.** *Clinical Journal of Pain, 31*(4), 363–374. doi:10.1097/AJP.000000000000115

This review article focuses on neurobiological factors that may contribute to the interactions between chronic pain and PTSD. Overlapping circuits are discussed, as well as specific neurobiological mediators and moderators. Finally, the authors discuss potential novel methods to restore normal functioning of the systems reviewed.

Turk, D. C. (2005). **The potential of treatment matching for subgroups of patients with chronic pain: Lumping versus splitting.** *Clinical Journal of Pain, 21*(1), 44–55; discussion 69–72.

This paper discusses the importance of heterogeneity among patients with chronic pain. This paper presents subgroups of patients with chronic pain including those with more significant distress and suggests potential directions for treatment.

Vaegter, H. B., Andersen, T. E., Harvold, M., Andersen, P. G., & Graven-Nielsen, T. (2018). **Increased pain sensitivity in accident-related chronic pain patients with comorbid posttraumatic stress.** *Clinical Journal of Pain, 34*(4), 313–321. doi:10.1097/AJP.0000000000000543

This cross-sectional study investigated pain intensity, psychological distress (depression, anxiety, pain catastrophizing, fear of movement) and pain sensitivity (via quantitative sensory testing) in patients with accident-related chronic spinal pain with ($N = 44$) and without ($N = 64$) comorbid PTSD characteristics. Those with comorbid PTSD reported increased pain intensity, psychological distress and reduced warmth detection threshold. Findings are consistent with the mutual maintenance and fear avoidance models of chronic pain and PTSD.

Yule, A. M., & Kelly, J. F. (2019). **Integrating treatment for co-occurring mental health conditions.** *Alcohol Research: Current Reviews, 40*(1), e1–e13. doi:10.35946/arcr.v40.1.07

This paper discusses a model for treating co-occurring alcohol use disorder and mental health conditions. It presents prevalence rates, assessment methods and treatment models including integrated treatment and sequential treatment. Types of integrated treatment are then presented.