

# The biopsychosocial approach and considerations involved in chronic pain

Ryan Hulla\*, Danielle Brecht, Jessica Stephens, Eric Salas, Chasley Jones, Robert Gatchel

Chronic pain conditions are currently the most common and economically-burdensome health ailment in the United States. The present article highlights and reviews multiple dimensions associated with chronic pain including; biological, physical, psychological and social factors that all need to be assessed and treated simultaneously. This article will review research in several dimensions that are affected by chronic pain which include the economic impact of chronic pain, the current issues with the biomedical approach of treating pain, advantages to the biopsychosocial approach for pain management, and how pain is associated with physical deconditioning, postural control, gait, sleep quality, and psychosocial well-being. Most importantly, this article corroborates with the reviewed research that the biopsychosocial model of pain is the most appropriate model for addressing the aforementioned factors circumscribing such conditions. Finally, this article will underline the development of interdisciplinary interventions, such as functional restoration, that have shown to be both therapeutic and cost-effective in managing chronic pain.

**Keywords:** Chronic pain, Interdisciplinary treatment, Functional restoration, Deconditioning, Psychosocial dimensions, Postural gait and control, Sleep

## Economic Impact of Pain

It is estimated that 43% of those diagnosed with a pain condition suffer from chronic pain<sup>[1]</sup>. Specifically, chronic pain conditions include: fibromyalgia, arthritis, chronic lower back pain, neuropathy, autoimmune disorders, headaches, and other ailments. While it is alarming how many people suffer from such conditions, it is even more distressing the amount of money spent annually on healthcare cost related to managing these conditions. For instance, it is estimated that over 116 million people suffer from chronic pain, resulting in over \$600 billion dollars lost per year due to decreased productivity and treatment expenses<sup>[2]</sup>. This cost will only increase as the baby boomer population continues to age, leading to more financial expenditures towards managing chronic pain conditions. For these patients managing such a condition can result in financial problems. Specifically, Kern et al. found that from a sample of 2.9 million pain sufferers, those treated with non-opiates spent on average \$13,459 per person annually<sup>[3]</sup>. On the other hand, for individuals seeking treatment *via* pharmacotherapy had expenses that averaged \$31,695 per person annually. Overall, these results demonstrate that there is indeed substantial cost associated with having to pay for continual

treatment of chronic pain conditions. This sheds light on the need for implementing a biopsychosocial approach. The main reason to adopt this approach is because pain is multidimensional, and is best managed through addressing physical, biological, psychological, and social issues related to chronic pain. Furthermore, the purpose of this article is to discuss the dimensions of chronic pain and why an interdisciplinary approach is superlative for the management of such conditions.

## Methods of Treating Chronic Pain

In grasping the management of a chronic pain condition, one must first understand what pain is, including its origin. Chronic pain is a continuous experience of discomfort, which is often associated with neuromuscular pathologies, and fails to heal naturally or be relieved through conventional medical treatment<sup>[4]</sup>. Coping with chronic pain typically consist of both the search for a medical or non-medical cure, and the meaning for chronic distress. This search for treatment and coping can exacerbate psychosocial ailments associated with pain, such as anxiety and depression<sup>[4,5]</sup>. The concept of "pain" thrust onto the medical community by the American Pain Society as a so-called "fifth vital sign" beginning in 1995. This practice quickly grew in popularity across healthcare centers in the U.S.<sup>[6]</sup>. Specifically, the "redesigned" approach to pain was evaluated *via* increased vital signs including; temperature, pulse, blood pressure, heart rate and respiration. While this was a big breakthrough in the physiological implications underlying pain, this newly discovered "fifth vital sign" bolstered a budding pain crisis. Within a span of 10 years (2002-2012) opiate prescriptions that were previously dispensed solely for end of life and/or cancer-related pain management, rose in distribution from 142 million to 248 million. Simultaneously, treatment intake for prescription opiate abuse rose by 236%<sup>[7]</sup>.

Today, aftereffects of the pain crisis are still relevant. For instance, roughly 90% of those treated for chronic pain receive an opiate

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*Department of Psychology, University of Texas at Arlington, United States*

*\*Corresponding Author. Address: Department of Psychology, University of Texas at Arlington, United States. Tel: 469-734-4541. Email address: ryan.hulla@uta.edu (Hulla R)..*

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prescription<sup>[8]</sup>. Opioid prescriptions are not the only treatment of chronic pain that has been rising, as spinal surgeries have seen a massive increase. Between the years of 1998 and 2008, the annual number of hospital discharges for primary lumbar fusions increased by 170.9% (77,682 to 210,407), and the rate of laminectomies increased by 11.3% (92,390 to 107,790)<sup>[9]</sup>. Each conventional method of treatment involving opioids and surgery have their place in chronic pain treatment, but with their own shortcomings. For example, back pain commonly reoccurs after surgery, with a rate of 5-36% of back or leg pain reoccurring after a discectomy<sup>[10]</sup>, 29.2% of patients having increased pain one year after a surgical laminectomy for lumbar stenosis secondary to degenerative changes<sup>[11]</sup>, and 35% success rate in spine fusions in individuals who suffer from a previous failed back surgery<sup>[12]</sup>. This article will next discuss the shortcomings of pharmaceutical treatments for chronic pain.

Pharmaceutical opiates, such as Vicodin and Fentanyl, are highly prone to abuse and can act as gateway drugs to less costly illicit substances, such as heroin. In 2014, The National Institute on Drug Abuse reported that approximately 2.1 million Americans abused prescription opiates, resulting in deaths known to be from these prescriptions tripling to 16,651 in 2010. Also, the drugs Hydrocodone and Oxy Contin have seen substantial increases in dispense with over 200% and 500% increase respectively, within a span of 15 years<sup>[6]</sup>. Finally, it was further reported that heroin addiction rose steadily alongside pharmacological opiate abuse, with 670,000 individuals reported to be addicted in 2012, up from 380,000 in 2005<sup>[13]</sup>.

What is the American healthcare community to do about this increase in treating pain by prescribing opioids? As it turns out, the tide is shifting on the utility of viewing pain as a “fifth vital sign”, and the treatment of pain with classic prescription opiates may soon be a mark of the past<sup>[14]</sup>. Alleviation of the pain epidemic is being approached from an interdisciplinary perspective including, molecular genetics and neurophysiology. Both of these disciplines can be used to analyze a patient’s nervous system anatomy, as well as functioning. For example, researchers can examine protein make-up, and one’s genetic blueprint including an individual’s family history. This could give insight into potential risk factors, origination of symptoms, curative therapies, or preventive measures<sup>[15]</sup>. This later approach, preventative measures, precisely focuses on giving at-risk patients interventions for lifestyle changes related to exercise, postural control, sleep habits, psychological, biological, and social factors. Multidisciplinary approaches seem to be more promising. A study by Moradi et al. examined the effectiveness of multidisciplinary approach for chronic low back pain management<sup>[16]</sup>. It was found that a multidisciplinary approach had greater outcomes on pain relief, quality of life, and functional restoration than traditional monodisciplinary treatment methods. The outcomes of the multidisciplinary approach also remained stable after a six month follow-up. One specific treatment approach that encompasses the practice of a multidisciplinary approach that implements the biopsychosocial model is functional restoration (FR).

Functional restoration involves multiple disciplines collaborating together in a coordinated manner that focuses on maximizing function, returning as close as possible to pre-injury productivity (with sufficient functional capacity in an effort to avoid recurrent injuries), prevent needless disability (often seen with opioids use), and unnecessary medical and surgical care<sup>[17]</sup>. Functional restoration uses a biopsychosocial model of medical diagnosis, and does not just focus on the biology (injury/illness and associated pathology), but also on the individual as a whole person, which includes psychological and

social features. Functional restoration consists of a variety of aspects involved in pain rehabilitation programs characterized by objective measures of physical function (e.g., muscular strength, muscular flexibility, and cardiovascular endurance), intensive graded exercise, and case management features<sup>[17]</sup>. The objective of a program like functional restoration is to empower the patient with skills, knowledge, and behavior changes to recapture their physical and psychological well-being. This is achieved by assessing one’s physical, functional and psychosocial status, then provide treatment that includes directed conditioning and exercise, cognitive behavioral therapy, patient and family education and counseling, functional goal setting, ongoing assessment of participation and compliance, and progress toward achievement of goals. This approach requires a coordinated team of professionals that often includes pain physicians, physical and occupational therapists, psychologists, counselors, nurses, and case managers<sup>[17]</sup>. The research behind interdisciplinary treatment programs like functional restoration are promising (such as the aforementioned Moradi et al., study earlier in this article)<sup>[16]</sup>. Research conducted by Hartzell et al. found patients suffering from fibromyalgia reported a significant decrease in pain after completing a FR program<sup>[18]</sup>. Also, FR has been adopted as the treatment method of choice for chronic pain conditions, because it has met the criteria for evidence-based medicine<sup>[19]</sup>. One of many components FR emphasizes is physical conditioning, which will be review in the next section in how it relates to chronic pain.

### **Chronic pain and physical deconditioning**

Currently, a sedentary lifestyle is recognized as the most critical public health problem of the 21st century in Western societies. In particular, the deconditioning paradigm hypothesizes that physical inactivity leads to physical deconditioning, which can result in chronic lower back pain (CLBP). This chronic pain condition in turn exacerbates the inability to be independent and participate in one’s community<sup>[20]</sup>. One reason an individual, with CLBP, may not be as apt to participate in communal activities can be explained by the fear-avoidance model. This model posits that patients may infer their pain as threatening, thus creating a fear of movement and disuse<sup>[21]</sup>. In turn, reduced physical activity leads to weight gain, sarcopenia, muscle atrophy, and osteoporosis<sup>[22-25]</sup>. Specifically, localized muscle atrophy has been documented at the L5 vertebral level in patients with unilateral CLBP, and in Type 2 fibers for such patients<sup>[22,26-28]</sup>. Also, Smeets et al. found support to explain muscle atrophy in such patients<sup>[29]</sup>. In particular, patients with moderate to severe disabling CLBP had a lower aerobic capacity compared to controls matched for age, gender, and sports activity. Not only does chronic pain result in diminished physical conditioning, but such patients are also at a higher risk for decreased sensitivity to insulin, consequently increasing the risk of developing Type 2 diabetes<sup>[30]</sup>.

A sedentary lifestyle can result not only in physical deconditioning of the muscles, but it can also lead to issues in reduced muscle flexibility. One reason for such problems can be explained as the outcome of spending extended time in positions of wrong postures, therefore causing chronic muscle spasms<sup>[31]</sup>. Yoo et al. published a case study examining a 37-year-old man complaining of low back pain located in the L3-L5 vertebrae<sup>[32]</sup>. The patient’s low back pain intensity was measured with a visual analog scale (VAS), and the low-back flexibility was assessed with trunk flexion, extension, and bilateral range-of-motion. After instruction of proper pelvic position, and use of a self-assessment pelvic positioning device, the patient went through a two month exercise intervention focused on posture

correction, specifically on pelvic tilt and trunk flexibility. After the two month intervention, the patient saw a decrease in their VAS score (7 initially, 3 post intervention), and an increase in trunk flexion, extension, and bilateral flexion range-of-motion. In further physical modalities for managing pain, Lee et al. found, that CLBP patients who participated in a four-week myofascial release technique in comparison to a four-week general exercise group (control group), demonstrated significant increases in range-of-motion in lumbar extension, flexion, right lateral bending, left lateral bending, and hip flexion. In regards to pain intensity, the participants reported a decrease in pain levels<sup>[33]</sup>. Similarly, Salas et al. conducted a study involving individuals suffering from CLBP, and found that a program that includes myofascial release techniques, proprioceptive neuromuscular facilitation stretching, and physical exercise can improve fatigue, pain interference, and overall physical function better than traditional exercise alone<sup>[34]</sup>. Additionally, Kim et al. found that a three-week myofascial release and joint mobilization techniques increased neck range-of-motion, with the participants also reporting decreased pain levels<sup>[35]</sup>. The aforementioned studies demonstrate the importance of myofascial release therapy on improving pain symptoms and range of motion, but stretching in itself is very valuable as a modality for pain management.

Research on yoga has shown positive effects on decreasing pain in patients suffering from osteoarthritis<sup>[36]</sup>, rheumatoid arthritis<sup>[36]</sup>, irritable bowel syndrome<sup>[38]</sup>, and CLBP<sup>[39,40]</sup>. Tekur et al. found, in two comparative groups (a short-term intensive yoga program group, and a physical exercise group) that spinal flexibility improved just after seven days in both groups, and pain levels decreased in participants that experienced the short-term intensive yoga program intervention<sup>[41]</sup>. Finally, Ludewig et al. reported that construction workers with shoulder pain who participated in an eight week home shoulder strengthening and flexibility program had an apparent decrease in pain and disability<sup>[42]</sup>. The aforementioned reviewed research demonstrates a relationship between muscular strength, flexibility, and pain, collectively, supporting that increased physical activity and improved flexibility if efficacious in managing chronic pain. An often overlooked component that is associated with strength and flexibility is postural control. Postural control has provided evidence that it plays a role in chronic pain; and thus our discussion will continue with the review of this topic.

### **Chronic pain effect on postural control and gait**

Poor postural control is associated with falls in older adults who are older than 59 years of age, due to decreased strength, mobility, and motor control<sup>[43,44]</sup>. Such an issue is important for consideration since it impacts older adults by lowering their quality-of-life<sup>[45-47]</sup>. As mentioned above, one reason for increased falls is due to the influence that chronic pain can have on balance capabilities from physical deconditioning of older adults<sup>[48-50]</sup>. For example, patients with lumbar spine chronic disc disease not only have decreased postural control, but also have significant asymmetry in foot pressure resulting from pain radiating to a lower limb<sup>[51]</sup>. Lee et al. reported that CLBP patients performed significantly worst in every aspect of postural control compared to older patients not suffering from chronic pain<sup>[52]</sup>. Similarly, a study conducted by Hulla et al. examined biopsychosocial measures in older adults affected by CLBP compared to match (age, gender, education, and exercise engagement) non-CLBP counterparts<sup>[53]</sup>. The study revealed that older adults with CLBP associated with worse scores on conditions related to postural control and fall risk; and CLBP individuals

suffered from greater pain intensity, fatigue, sleep disturbance, and lower levels of perceived physical function than their non-CLBP matched counterparts.

Moreover, one aspect of postural control that is affected by pain is an individual's gait. In particular, chronic lower limb pain patients experience gait changes due to reducing the time spent bearing weight on their painful limb<sup>[54]</sup>. Consequently, an asymmetric gait (e.g. limping) has been observed due to a shorter duration of the stance phase on the painful side<sup>[55,56]</sup>. Also, research has demonstrated that for older adults the presence of moderate or greater pain in at least one site is associated with slower gait speed, and higher gait variability in trunk movement<sup>[57-59]</sup>. In further research, an interdisciplinary treatment for chronic pain has been found to reduce gait problems, therefore reducing fall risk and associated mortality<sup>[60]</sup>. As mentioned above, postural control and gait deficiencies present in those with chronic pain often coincide with biopsychosocial symptoms, such as sleep disturbance, therefore this topic will be covered next.

### **Chronic pain and sleep disturbance**

The role of sleep disturbance in patients with chronic pain is gaining attention as it is a problem that negatively effects overall physical functioning<sup>[61]</sup>. Specifically, 67-88% of sleep complaints occur in individuals with chronic pain<sup>[62]</sup>. At a physiological level, the prolonged stress of chronic pain can impair the overall functioning of several systems throughout the body. For instance, one system affected is the central nervous system leading to the distortion of an individual's homeostatic wake-sleep cycle. Finally, a lack of sleep may impair the body's ability to properly heal and thus increase an individual's pain sensitivity<sup>[63]</sup>.

Not only is sleep important for healing, but research has also examined the role opioid use can influence a patient's ability to sleep. For example, Robertson et al. examined healthy individuals in a control group compared to a group of individuals suffering from chronic back pain<sup>[61]</sup>. Participants completed six questionnaires assessing their perception of sleep quality and pain. Those in the study were also instructed to keep an activity diary, as well as wear an actiwatch, which measured their sleep/wake patterns. Additionally, a subset of twelve participants completed two nights of domiciliary polysomnography to record electrical activity in their brain, muscle activity, and eye movement. Overall, results of the study indicated substantial sleep disturbance in participants experiencing chronic pain. Also, concerning the twelve participants that partook in the sleep analysis, there were abnormalities in polysomnographic sleep architecture, and increased sleep disorders in participants who took opioid medications. These findings suggested that chronic pain can be linked to disruptions in the brain during sleep, and that consumption of opioid medication can worsen this relationship for in those with chronic pain, further demonstrating the importance of implementing a biopsychosocial model for managing chronic pain.

While research has demonstrated the role that opioids and sleep have on pain, many researchers argue that there are other mediating factors that should be investigated. For instance, Harrison et al. examined the relationship between chronic pain, sleep, and the role of mood and attention<sup>[63]</sup>. These researchers quantitatively assessed, pain (BPI), sleep (PSQI), and depression (PHQ-9). Results demonstrated a high prevalence of sleep disorders in patients who suffered from a chronic pain condition. In fact, approximately 86% of participants described themselves as poor sleepers, as well as indicated pain as the underlying issue. Other moderating variables

that affect pain include psychosocial factors. These factors will be reviewed last in our discussion.

### Chronic Pain and its Influence on Psychosocial Dimensions

Research has demonstrated that chronic pain does not only influence patients physically, but also psychosocially such as increased anxiety and depression. According to the U.S. National Comorbidity Survey Part II 35% of patients with chronic arthritis pain were diagnosed with generalized anxiety disorder (GAD), compared to just 17% of patients who did not suffer from chronic pain and have GAD<sup>[64]</sup>. Together, chronic pain and anxiety can be manifested as a set of maladaptive beliefs described as pain catastrophizing<sup>[65]</sup>. Specifically, these beliefs can include; anticipating the worst outcome, exaggerating one's pain unrealistically, and feeling hopeless<sup>[66]</sup>. Collectively, pain catastrophizing and anxiety have been found to mediate the relationship between pain severity, disability, and coping skills. Specifically, those with chronic pain that experience both catastrophizing and anxiety report more severe pain, increased rates of disability, and overall lower coping skills compared to individuals with just chronic pain<sup>[67]</sup>. Consequently, many individuals that experience anxiety as a result of chronic pain simultaneously become depressed.

Research from Kessler et al. reported that depression is the fourth-leading cause of disability<sup>[64]</sup>. Depression, like anxiety, is best understood in terms of the biopsychosocial model. Biologically depression is associated with excessive inflammation within the central nervous system<sup>[68]</sup>. Specifically, Cunningham et al. suggests that small glial cells are primed by a chronic illness causing these cells to have an elevated response to pain stimuli<sup>[69]</sup>. Also, Loggia et al. reported that in the thalamus, those with chronic pain compared to individuals who do not have chronic pain had elevated levels of the neuroinflammatory binding protein C-PBR 28<sup>[70]</sup>. Psychologically, depression is associated with the feelings of sadness, chronic lethargy, decreased interest in activities, and sleep disturbances<sup>[71]</sup>, which are also comorbid with chronic pain. Finally, depression symptoms such as anxiety can cause people to withdraw from activities they typically enjoy (e.g., participating in a group fitness class, church, attending a dinner party with friends, etc.). This happens due to people not knowing how to communicate their chronic condition, as well as other individuals being afraid to ask someone about their chronic pain. For Example, in semi-structured interviews individuals suffering from chronic pain reported that they became socially withdrawn due to a fear of being judged, being uncertain about their future physical health, and having emotions of being confused about their current state of chronic pain<sup>[72]</sup>.

The psychosocial aspects of pain are not just limited to anxiety and depression, but other psychosocial factors may moderate the effects of chronic pain including: an individual's personality, coping skills, social support, and having a strong locus of control. For instance, Cvijetic et al. found, that patients who suffer with chronic pain are prone to be neurotic, as well as have increased rates of disability and a decreased quality of life<sup>[73]</sup>. Additionally, such patients recorded higher scores than normal on harm avoidance traits<sup>[74]</sup>. In examining the role social support plays in alleviating chronic pain, Park et al. reported that social support moderated a positive association between depression and pain intensity<sup>[75]</sup>. Finally, being able to think you are in control of your chronic illness has also been found to have an effect on chronic pain conditions. Specifically, Wong et al. concluded, that patients with internal health locus of control were

less depressed compared to normal healthy control participants<sup>[76]</sup>. Now that we have reviewed how psychological components such as emotional states, personality, and social factors influence chronic pain, the next section will summarize why an interdisciplinary approach based on the biopsychosocial model is ideal for managing chronic pain disorders.

### Conclusion

In review, the most common forms of treatment for chronic pain that are prescribed by the biomedical model have great shortcomings that are economically straining, such as the dependence and risk for substance abuse for patients on opioid medication, and the possible failure rates associated with surgeries for chronic pain. It is advantageous to implore an interdisciplinary approach using the biopsychosocial model when developing programs to manage chronic pain, such as the aforementioned functional restoration program explained early in this article, which referenced the works of Hartzell et al. The advantages of an interdisciplinary approach such as functional restoration, is that unlike conventional chronic pain treatments administered by the biomedical model that focus specifically treating the biological component of chronic pain generally with opioids and surgery, an interdisciplinary approach aims to improve not only the biological symptoms of pain, but to also addresses the physical and psychosocial constructs that are associated with pain that were reviewed in this article. Specifically, physical components that need to be addressed when managing chronic pain include muscular strength, flexibility, cardiovascular capacity, postural control, and gait; psychosocial components needing to be addressed include anxiety, depression, social withdraw, personality traits, and sleep disturbance. Application in addressing and managing these symptoms shows promise in treatment of the chronic pain condition with strong evidence in multidisciplinary approaches. Overall, it is imperative the biopsychosocial model implemented through an interdisciplinary treatment program should be the primary method of treating patients suffering from chronic pain.

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