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Pain Interference in Chronic Musculoskeletal Pain: Examining a Resilience Model of Dispositional Optimism, Coping Responses, and Mind-Body Practices

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by

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Abstract

Chronic musculoskeletal pain is the leading cause of disability in the United States. Pain interference, or the ways chronic pain negatively interferes with everyday life, is the biggest problem impacting individuals with chronic musculoskeletal pain. Although previous research has targeted risk factors associated with poor health outcomes, the adaptive functioning of some patients with chronic pain highlights a need for research investigating resilience factors. The purpose of this study was to investigate the direct and indirect relationships between resilience factors of optimism, coping responses, and mind-body practices on pain interference for individuals with chronic musculoskeletal pain. Specifically, the resilience model of chronic pain was used to investigate a path leading from dispositional optimism to pain interference through problem-focused and emotion-focused coping responses and engagement in mind-body practices. A subsample of participants from the MIDUS-3 study with an arthritic condition and chronic pain was assessed for each of the resilience factors of interest, and the main outcome variable, pain interference. Results demonstrated that each resilience factor, excluding mind-body practice engagement, was significantly associated with pain interference. Path analysis revealed an indirect effect of optimism on pain interference through emotion-focused coping. Results from this study demonstrate the importance of optimism and its impact on other resilience factors. Future research is needed to determine ways optimism can be targeted through intervention to improve overall quality of life for patients with chronic musculoskeletal pain.

Keywords: Chronic Pain, Arthritis, Resilience, Pain Interference

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Chronic pain is a national health crisis impacting one in five adults in the United States (Dahlhamer et al., 2018). The International Association for the Study of Pain (IASP) and the International Classification of Disease, 11th edition (ICD-11), define chronic pain as recurring or persistent pain lasting at least three months or longer (Treed et al., 2015). Considering the financial impact on our healthcare system and work productivity, chronic pain costs $560 and $635 million yearly, respectively (Gaskin & Richard, 2012). Pain is also the most common reason patients request physician-assisted death, and pain and discomfort are the two most common reasons given by physicians who are most likely to honor these requests (Meier et al., 2003). Chronic musculoskeletal pain accounts for the most prevalent pain conditions (Perrot et al., 2019). The ICD-11 defines secondary chronic musculoskeletal pain as pain from joints and bones caused by diseases of the nervous system, structural musculoskeletal changes, and inflammation from autoimmune or autoinflammatory responses, crystal deposition, or infection (Perrot et al., 2019).

The global prevalence of musculoskeletal pain is estimated to be around 30%, with a range between 13.5 and 47%, and an incidence rate of 8.3% per year (Cimmino et al., 2011). Chronic musculoskeletal pain is also more commonly reported in women than men (Cimas et al., 2018). Previous research has included low back pain and widespread pain with other musculoskeletal disorders; however, these two conditions are now considered sources of primary chronic pain (Treede et al., 2019); therefore, prevalence rates may be slightly skewed toward the higher end given the high incidence of

nonspecific low back pain. The most common joint disorder in the United States, osteoarthritis, is prevalent in 10% of men and 13% of women over the age of 60 (Zhang and Jordan, 2010). A steep increase in the prevalence of osteoarthritis occurs after age 50 (Cross et al., 2014). In 2014, rheumatoid arthritis was prevalent in 0.53 to 0.55% of U.S. adults, with a higher prevalence in females than males (Hunter et al., 2017). Between 2010 and 2012, arthritis affected 52.5 million U.S. adults, and this number is expected to rise to 78.4 million by 2040 due to the growing population of older adults (Barbour et al., 2016).

Pain Interference

Chronic pain causes a significant disruption in everyday activities. For instance, patients with chronic musculoskeletal pain often have poor sleep quality, which is then frequently associated with more pain the following day (Abeler et al., 2021). Another negatively impacted area includes physical functioning, or the ability to perform physical activities throughout the day. Patients with arthritis are less able to complete housework, bend down or climb stairs, and walk without help than those without these pain conditions (Stamm et al., 2016). Social connections are negatively impacted by chronic pain, such that patients with pain are less likely to attend social gatherings, have less contact with their extended family, and become more dependent on familial support in caregiving and daily activities which creates strain in the family system (Dueñas et al., 2016). Due to the significant interference caused in an individual's ability to work, chronic pain is also a leading cause of disability in the United States (Cohen et al., 2021). Overall, the biggest problem facing patients with chronic pain is its significant impact and interference in daily living.

Pain interference is a better predictor of a patient's functioning than pain intensity (Kemani et al., 2016), and researchers have begun replacing pain severity and intensity measures with pain interference measures in major clinical trials (Kroenke et al., 2019). Pain interference can be defined as the degree to which a patient's mental, social, and physical activities are impacted by their pain (Amtmann et al., 2010). High scores on measures of pain interference are generally associated with pain that is more interfering of daily living than lower scores on these measures. Patients with pain have commonly been asked how intense their pain is, or how much their pain hurts, with the use of numeric rating scales or visual analog scales (Schiavenato & Craig, 2010). However, the sole use of measures like this does not fully capture the patient's experience with pain in daily living (Wilson, 2014). One of the most used measures of pain interference, the Brief Pain Inventory, assesses the severity of a patient's pain at its worst, best, and average, along with methods the patient has used to treat their pain and the impact it has had on different areas of functioning (Daut et al., 1983).

Pain interference has been associated with a variety of outcomes and risk factors. For instance, in older adults with chronic pain, having pain in multiple locations that interfered with daily living has been associated with declines in mobility and activities of daily living (Eggermont et al., 2014). In addition, having more pain interference has been shown to be associated with work absence and disability for those with knee osteoarthritis (Laires et al., 2018). Patients with musculoskeletal pain who have more pain interference are also more likely to require high-cost healthcare utilization (Lentz et al., 2019); individuals who present to the emergency room for musculoskeletal pain with more pain interference are also more likely to have low health-related quality of life

(Gagnon et al., 2022). Pain interference has also been shown to be associated with persistent depression and anxiety symptoms in older adults with chronic musculoskeletal pain in one longitudinal study (Rzewuska et al., 2015). Patients with osteoarthritis who persistently use opioids to manage their pain are also more likely to have significant pain interference than patients not using opioids (Shah et al., 2020). Most importantly, patients with different arthritic and musculoskeletal diseases ranked pain interference as one of the most important patient-reported outcomes they believe should be tracked in the management of their disease (Nowell et al., 2021).

Resilience Factors Associated with Pain Interference in Chronic Musculoskeletal Pain

Current research has demonstrated both the importance of pain interference as an outcome of interest for this patient population as well as factors associated with higher pain interference. Much of the existing literature on the experience of chronic pain has focused on psychosocial risk factors of poor mental and physical health outcomes (Edwards et al., 2016); however, recent research has demonstrated that many individuals with chronic pain are able to adapt to the challenges created by their pain and have positive health outcomes (Bartley et al., 2017). Although the existing literature has led to the important development of interventions to address risk factors in patients with high pain interference, future research is needed to determine factors associated with low pain interference in this patient population. Barriers to care including limited access, reduced acceptability, lack of healthcare, and stigma are causes of limitations for traditional psychotherapeutic interventions; however, activities and behaviors associated with resilience offer opportunities for early prevention or mitigation of negative outcomes

which are often more accessible to patients and reduce the utilization of healthcare services (Hassett & Finan, 2016). Additionally, a focus on factors associated with resilient functioning may provide opportunities for reducing the use of opioids to manage pain, which have consistently been shown to be overprescribed and lead to a greater risk of dependence and mortality (Delaney et al., 2020). Considering the significance of pain interference as a primary outcome of interest for patients with musculoskeletal pain, it is of vital importance to identify and understand factors of resilience in this relationship to improve the mental health and quality of life of this patient population.

Resilience has been defined in pain literature as an individual's positive adjustment or adaptability despite dealing with a stressful circumstance caused by pain (Sturgeon & Zautra, 2010). Factors of resilience in patients with chronic musculoskeletal pain are those that have been associated with positive adjustment to the pain experience and reduction of intensity or severity of emotions associated with negative affect. Sturgeon and Zauntra (2010) separate these factors into characteristics of the individual and qualities of the individual's social environment. Below is a summary and critique of this literature, with a specific focus on cognitive and behavioral resilience resources and coping responses.

Optimism

Cognitive factors, and their impact on pain interference, are important to consider for understanding resilience outcomes. Optimism has been examined as a key resource of resilience in chronic musculoskeletal pain. Optimism is defined in the current study as thought processes regarding expectations about outcomes, with individuals high in optimism expecting to be able to positively manage stress and difficulties and have

positive outcomes and those low in optimism expecting negative outcomes with difficulty managing stress (Goodin & Bulls, 2013). In general, more optimistic individuals are less likely to develop coronary heart disease or die from CHD-related health issues, less likely to have a stroke, and more likely to engage in activities that reduce or mitigate risk factors of major diseases (Scheier & Carver, 2018). Researchers examining optimism in cancer patients within the Midlife in the United States study found levels of optimism to be positively associated with health perceptions and positive affect and negatively associated with negative affect (Gallagher et al., 2019). In addition, optimism was also correlated with an increased use of problem-focused coping and a decreased use of emotion-focused coping (Gallagher et al., 2019).

Patients with osteoarthritis who have high levels of optimism have been shown to have lower levels of pain sensitivity, disability, and negative affect (Cruz-Almeida et al., 2013). Optimism has also been found to be positively correlated with coping responses of positive self-statements and increased activity levels among women with rheumatoid arthritis (Kwissa-Gajewska et al., 2014). Others have found optimism to be a significant predictor of post-surgical pain for patients undergoing total knee or hip replacement due to osteoarthritis, with optimism being negatively associated with anxiety and depression measures before surgery (Pinto et al., 2017). Optimism has been found to be negatively associated with pain interference in older women included in a community sample as well as in a sample of patients with multiple types of chronic musculoskeletal pain, including fibromyalgia (Judge et al., 2020; Martinez-Calderon et al., 2020). One issue pertaining to sampling in research examining outcome differences amongst patients with chronic musculoskeletal pain is the inclusion criteria of several types of chronic pain

conditions. The International Association for the Study of Pain has worked with the task force creating the ICD-11 to differentiate pain conditions by primary and secondary chronic pain to make distinctions amongst conditions based on biopsychosocial differences (Treede et al., 2019). Primary chronic pain is also characterized by an overlapping experience of emotional distress. Therefore, previous studies that included primary and secondary chronic pain conditions together may not be accurately examining relationships between variables that are inherently more elevated in some than in others. There also remains a need for research investigating whether optimism is best understood as a protective factor or if its opposite, pessimism, is a more destructive risk factor in health outcomes (Scheier & Carver, 2018).

Coping Responses

Coping is another broadly defined cognitive factor commonly examined in chronic pain outcome research. Coping is defined in the current study as behavioral, emotional, and cognitive efforts to manage stress (Lazarus & Folkman, 1984). There are several coping strategies that have been historically connected to two larger umbrella coping domains: problem-focused coping is defined as methods used to alter a stressful situation while emotion-focused coping is defined as methods used to reduce the emotional distress connected to a stressful situation (Lazarus & Folkman, 1984). Examples of problem-focused coping strategies include active coping (actions taken to find ways around a stressor), planning (thoughts related to problem-solving a stressor), making positive reinterpretations (changing negative thoughts to be more positive), and utilizing social support by seeking assistance or advice for dealing with a stressor (Carver et al., 1989). Alternatively, emotion-focused coping strategies include being focused on

emotions and discussing them openly with others, disengagement from previous goals in association with learned helplessness, and denial of circumstances created by a stressor (Lazarus & Folkman, 1984). In consideration of evidence that some forms of emotion-focused coping could still promote adaptive functioning, researchers have also divided coping strategies into those that promote engagement (actively approaching a stressor and associated emotions) or disengagement (avoidance and escape of a stressor and associated emotions; Carver & Connor-Smith, 2010).

Coping strategies for chronic pain are utilized with the individual perceiving these strategies as enhancing their ability to manage and tolerate the perceptions of pain and their interference in daily life (Turk et al., 2016). Specific strategies that have been identified in patients with chronic pain include denial of pain sensations, diversion of attention from pain sensations, positive and encouraging self-statements, and reinterpretations about pain (Edwards et al., 2016). Historically, patients with chronic pain utilizing emotion-focused coping strategies have been shown to have more severe depression than those utilizing problem-focused coping strategies (Brown et al., 1989), as well as worse functional disability (Keefe & Somers, 2010). In one longitudinal study, positive and encouraging self-statements and reinterpretations about pain were found to significantly improve pain interference in everyday life (De Rooij et al., 2014). In a previous study examining coping responses in patients with rheumatoid arthritis, problem-focused coping responses including active problem-solving and cognitive reinterpretations were associated with better mental and physical health outcomes than emotion-focused coping responses such as emotional expression (Englbrecht et al., 2012). There is a need for further research examining the relationship between

dispositional optimism and various coping responses, as well as their combined impact on pain interference outcomes, in patients with chronic musculoskeletal arthritic pain.

Mind-Body Practices

Mind-body practices and behaviors are defined in the current study as techniques that are intended to improve health through a focus on the interconnection of the mind, brain, behavior, and body (Wahbeh et al., 2008). Examples of mind-body practices include meditation, yoga, and tai chi. Mind-body practices have been found to be associated with maintenance of episodic memory in older adults (Bhattacharyya et al., 2021), improvements in blood pressure for individuals diagnosed with cardiac disease (Younge et al., 2015), and reduction in biomarkers and genetic markers of bodily inflammation (Bower & Irwin, 2016). Mindfulness-based interventions have been found to reduce depressive symptoms for those with chronic pain (Parra-Delgado & Latorre-Postigo, 2013), as well as improve overall engagement in valued activities and symptoms of general anxiety (la Cour & Peterson, 2015). Mindfulness meditation is also associated with reduced pain interference (Senders et al., 2018; Wahbeh, 2018), and improvements in physical and mental quality of life (Banth & Ardebil, 2015). Although these results are promising, many of the studies conducted in this area include small sample sizes and the majority of patients with chronic pain were female.

Another mind-body practice examined in chronic pain outcomes research is yoga. Yoga originated in South Asia and incorporates psychological practices of mindfulness and relaxation with physical postures and activity (Sharma, 2014). Yoga is beneficial for musculoskeletal health by improving posture, muscle endurance and strength, flexibility, and improving cognitive functioning through changes in cognitive appraisals and

improvements in self-efficacy (Francis & Beemer, 2019). Yoga practice in adults with rheumatoid and osteoarthritis is associated with improvements in bodily pain, physical functioning, perceived stress, and depressive symptoms (Moonaz et al., 2015). Chair yoga has also been found to be beneficial for older adults with osteoarthritis, with improvements shown in pain severity and pain interference (Park et al., 2017). Tai chi, a practice similar to yoga, has also been shown to improve pain severity and reduce fear of falling and pain interference for older adults with chronic pain (You et al., 2018). Much like activity pacing, mind-body practices are challenging to quantify and describe, as there are a variety of types and modes of practice, with varying degrees of difficulty and frequency of use. It remains unclear what types of mind-body practice, including duration and level of intensity, provide the most benefit for improvement in anxiety and depression for patients with chronic pain. More research is needed to determine how other resilience resources such as dispositional optimism and coping responses impact engagement in mind-body practices.

Overall, several cognitive and behavioral resilience factors and their impact on pain interference have been discussed and critiqued. Each of these factors contribute in some unique way to improve psychological well-being by minimizing emotional distress, improving self-efficacy and physical functioning, and reducing pain interference in everyday activities and improving overall quality of life. Although current literature has demonstrated the importance of each of these constructs as important sources of resilience individually, there is a gap in the literature in addressing how these variables interact or conflict with each other in their relationships with pain interference. By addressing this gap, research in this area could be used to inform healthcare initiatives

toward identifying patients who may benefit from assessment and improvement of specific resilience resources that may be negatively impacting their coping responses and resources.

Theoretical Models of Chronic Pain

Theoretical models have been created and used to understand and explain experiences in our environment. They allow scientists to make predictions and hypotheses about relationships between various constructs. Many theoretical models have been proposed to explain outcomes for patients with chronic pain. Below is a summary of theoretical models for chronic pain, beginning from a more biological perspective and moving into considerations of psychological aspects associated with the pain experience.

Biopsychosocial Approach to Chronic Pain

One of the most popular theoretical models used to conceptualize the experience of chronic pain is the biopsychosocial model (Gatchel et al., 2007). This model states that an individual's experience of chronic pain cannot solely be described in terms of the biological mechanisms responsible for the perception of pain by the body, but that one must also consider social and psychological factors contributing to the pain experience (Miaskowski et al., 2020). Contributing to the biological factors associated with the biopsychosocial model of chronic pain, the field of epigenetics has been used to identify ways in which the genetic expression of HTR2C, Interleukin 6 (IL-6), and Catechol-O-Methyltrans-Ferase (COMT) are associated with chronic pain (Bevers et al., 2016). In addition, overactivation of the hypothalamic-pituitary-adrenal (HPA) axis stress response and neurotransmitters contribute to the experience of chronic pain, with serotonin and

norepinephrine receptor issues being associated with mood and anxiety symptoms (Bevers et al., 2016).

From a psychological perspective, the biopsychosocial model also takes mental health into consideration in the development and maintenance of chronic pain, which incorporates many of the findings from other psychologically oriented models of chronic pain. Finally, the social lens of the biopsychosocial model incorporates factors of social support, socioeconomic strain, environment, and other contextual factors into the experience of chronic pain (Edwards et al., 2016; Meints & Edwards, 2018). Although the biopsychosocial model of chronic pain is an improvement from past models that do not include variables outside of biological perspectives, the number of variables and pathways included are endless, making it challenging to test in empirical research.

Cognitive-Behavioral Model of Chronic Pain

Functioning as a psychologically oriented theoretical model of chronic pain, the cognitive-behavioral model incorporates the thoughts, feelings, and behaviors of an individual suffering from chronic pain (Turk et al., 1987). Through this model, beliefs about the pain experience are thought to shape the feelings and behaviors of the patient (Jensen et al., 1999). The cognitive-behavioral model of chronic pain has been translated into cognitive behavioral therapy, designed to intervene with distress associated with chronic pain through cognitive restructuring of thoughts and beliefs associated with distressing emotions and maladaptive behaviors. Although this model has been recognized as an improvement from the more reductionist biological models historically theorizing chronic pain, critics have argued that the model is not integrative enough and lacks a specific focus that can be translated across different patients and experiences

(McCracken & Morley, 2014). For example, the specific thoughts and beliefs of one patient may not translate to those of another, or ways in which these thoughts and beliefs might impact certain behaviors of some and not others.

Resilience Model of Chronic Pain

Although the biopsychosocial and cognitive-behavioral models of chronic pain have significantly expanded upon the understanding of negative outcomes commonly experienced by individuals with chronic pain, these models fail to capture factors associated with positive outcomes. The resilience model of chronic pain proposed by Sturgeon and Zautra (2010) specifically outlines pathways leading to resilience, including those of recovery, sustainability, and growth. This model still includes the factors associated with negative outcomes identified in the cognitive-behavioral model, but also sheds light on stable resilience resources, resilience mechanisms, and coping resources (Sturgeon & Zautra, 2010). The resilience outcome of sustainability can be understood as the preservation of valued activities, goals, and engagements for the individual despite pain. Meanwhile, growth is conceptualized in the model as new learning through difficulties caused by pain that allow for better understanding of one's capabilities and limits. Finally, recovery is the return to normal homeostasis following stress associated with the pain experience (Sturgeon & Zautra, 2010). Researchers have recently begun to highlight the importance of resilient resources in addition to risk factors in determining outcomes like physical dysfunction, depression, and pain intensity for patients with low back pain (Slepian et al., 2020).

Within the resilience model of chronic pain, Sturgeon and Zautra (2010) postulate that resilience resources like dispositional optimism are positively associated with

engagement in positive behaviors. An example of these positive behaviors may be engagement in mind-body practices like mindfulness, yoga, and tai-chi. Additionally, research in other patient populations has shown that optimism is associated with an increase in the use of problem-focused coping responses, while lower levels of optimism are associated with increased use of emotion-focused coping responses (Gallagher et al., 2019). Although the Sturgeon and Zautra model does not specifically indicate the direction of effect for the relationship between coping responses and engagement in mind-body practices, recent research has shown that training in mindfulness meditation is associated with increased use of problem-focused coping strategies in cancer survivors (Gok Metin et al., 2019). Thus, it may be true that the opposite relationship is true as well, with use of problem-focused coping responses being positively associated with engagement in mind-body practices.

Statement of the Problem

Chronic musculoskeletal pain is a national health crisis, with rates expected to increase exponentially in the coming years as the population continues to age. Pain causes significant interference in everyday activities, including sleep, household chores and general physical functioning, within social relationships, and disability and time off work. Researchers and patients agree that pain interference is a significant problem facing this patient population, and that future clinical research should focus on this measure as an important outcome of interest. Previous research has focused predominantly on risk factors contributing to worse pain interference, including pain catastrophizing, avoidance of activity, and negative affect. However, an increasing body of literature is demonstrating that some patients with arthritis and other forms of chronic

musculoskeletal pain are able to continue to live out their lives in meaningful ways, with minimal pain interference. Thus, it is vital to not only focus on risk factors when examining chronic pain health outcomes, but also factors contributing to resilient functioning. Optimism, coping responses, and mind-body practices are just a few factors that have individually been found to be associated with a resilience model of chronic pain. However, more research is needed to understand how these constructs interact with one another, and whether some contribute to less pain interference than others. By understanding whether these specific factors of interest together have a main or interacting effect on pain interference, assessment measures can be used in healthcare initiatives to identify patients most at risk of significant pain interference.

Current Study and Hypotheses

The purpose of this study was to investigate the relationships and interactions between dispositional optimism, coping responses, and mind-body practices, and pain interference through a resilience model of chronic pain for patients with chronic arthritic musculoskeletal pain. Although these variables have previously been examined separately in their association with pain interference, there is limited research identifying their interactive effect on pain interference for patients with chronic musculoskeletal pain. The first aim involved examining descriptive statistics of all study variables, including dispositional optimism, coping responses, engagement in mind-body practices, and pain interference. Specific covariates related to participant demographics were also examined and identified. Examined covariates included age, sex, and overlapping comorbid medical conditions. Research has demonstrated that older adults tend to have better acceptance of pain and catastrophize less about their pain than younger patients

(Murray et al., 2021). Additionally, more women are diagnosed with rheumatoid arthritis than men (Myasoedova et al., 2020). Finally, as research has demonstrated that many patients with type 2 diabetes develop osteoarthritis later in life, overlapping comorbid chronic medical conditions were also examined as a potential covariate (Schett et al., 2013). Final covariates included age and total number of comorbid chronic conditions. Relationships between the study variables were then examined, through the path outlined in Sturgeon and Zautra's (2010) resilience model of chronic pain. This path includes the resilience resource of dispositional optimism leading to coping responses, followed by behavioral responses such as involvement and use of mind-body practices. This project aimed to examine the specific direct paths between the main variables of interest, as well as mediated paths in the outcome of pain interference. All hypotheses are shown in Figure 1. The present study hypothesized that:

Hypothesis 1a: Optimism would be positively associated with engagement in problem-focused coping responses.

***Hypothesis 1b*:** Optimism would be negatively associated with engagement in emotion-focused coping responses.

***Hypothesis 2*:** Optimism would be positively associated with engagement in mind-body practices.

Hypothesis 3: Problem-focused coping responses would be positively associated with engagement in mind-body practices.

Hypothesis 4: Emotion-focused coping responses would be negatively associated with engagement in mind-body practices.

Hypothesis 5: Problem-focused coping responses would be negatively associated with pain interference.

Hypothesis 6: Emotion-focused coping responses would be positively associated with pain interference.

Hypothesis 7: Engagement in mind-body practices would be negatively associated with pain interference.

Hypothesis 8: Indirect, or mediated paths within the model would be examined, with 95% confidence intervals used with bootstrapping.

Method

Participants

The present study includes 527 adults with chronic musculoskeletal pain participating in the third wave of the Midlife in the United States study (MIDUS-3). MIDUS is a national, longitudinal study examining behavioral, social, and psychological factors associated with the health and well-being of non-institutionalized English-speaking adults in the United States. Inclusion criteria for the current study included participants: between the ages of 25 and 74; English-speaking; non-institutionalized; positive endorsement of a musculoskeletal condition characterized by an inflammatory, autoimmune, or autoinflammatory response such as arthritis, rheumatism, or other bone or joint disease; and positive endorsement of chronic pain characterized as pain that has persisted beyond the time of normal healing, lasting anywhere from a few months to many years. Specifically, participants were included if they responded “yes” to the question, “In the past twelve months, have you experienced or been treated for any of the following – Arthritis, Rheumatism, or other bone or joint disease?” This specific question

was chosen to ensure participants had a medical diagnosis consistent with the IASP definition of secondary chronic pain, or pain that is caused by an underlying condition. In addition, only participants who responded "yes" to the previous arthritis question and "yes" to the question, "Do you have chronic pain, that is, do you have pain that persists beyond the time of normal healing and has lasted anywhere from a few months to many years" were included. These questions were selected to capture the presence of chronic pain in addition to an underlying musculoskeletal condition. Participants endorsing a musculoskeletal condition, but not chronic pain were excluded as only those endorsing chronic pain were asked questions about the main dependent variable of interest, pain interference. To ensure racial and ethnic representativeness, specific metropolitan areas were oversampled. In a recent manuscript using a patient sample with chronic pain from MIDUS-3 (Boone & Kim, 2019), participant ages ranged between 39 and 93 years old, 58.6% identified as male and 41.4% as female, and 89.6% identified as White.

Procedures

Approval for the current study's use of MIDUS-3 data was obtained by the Institutional Review Board at the University of Missouri – St. Louis, (IRB #2095462). Data and documentation from the original MIDUS study are openly available to the public on the Inter-university Consortium for Political and Social Research (ICPSR) webpage. The ICPSR is an international consortium of over 750 research organizations and universities. Full datasets, codebooks, and study documentation of the MIDUS study are accessible for download and use on the ICPSR webpage. Participants from the original MIDUS study were recruited with the use of random digit dialing. More specifically, telephone numbers in the United States were used for random digit dialing,

with oversampling in five major cities (Radler & Ryff, 2010). Consenting participants were then asked to complete a thirty-minute phone interview as well as two self-administered questionnaires assessing well-being and health in midlife among adults in America. Additional details about the procedures of the original data collection from MIDUS-1 and MIDUS-2 are included in Appendix A. The MIDUS-3 study consisted of 3,294 participants, which included over 46% of the originally recruited MIDUS-1 participants. Each wave included participant demographic information, gender, age, race, ethnicity, marital status, and education level. Surveys included variables related to physical health, mental health, life satisfaction, personal beliefs, finances, neighborhood, social networks, sexuality, discrimination, religion and spirituality, and childhood history. The telephone interview and two self-administered questionnaires were merged, processed, cleaned, and transformed by MIDUS using naming conventions and coding provided within the downloadable package on ICPSR. The data includes item-level data as well as total scores of study measures, with appropriate management of reverse-coded items. The data were then downloaded by the principal investigator of the current study and additional variables were created to easily identify MIDUS-3 participants endorsing both an arthritic condition and chronic pain (inclusion criteria). Once these participants (N = 527) were identified, a separate dataset file was created to separate these data from the rest of the MIDUS-3 participants.

Measures

Demographic Questionnaire

Items related to participant demographics for the current study included participant sex, age, ethnicity, education level, employment status, and marital status.

Participants were also asked several questions about whether they experienced or were treated for chronic health conditions, including diabetes, hypertension, and neurological disorders during the previous twelve months. A list of all demographic questions and items from the main study variables can be found in Appendix B.

Pain Interference

Pain interference, defined as the degree to which an individual's pain impacts their mental, social, and physical activities (Amtmann et al., 2010), was measured using the five interference questions from the Brief Pain Inventory Short Form (Daut et al., 1983). The Brief Pain Inventory is one of the most commonly used measures to assess pain, and the specific interference-related questions can specifically be used to assess areas of functioning impacted by pain (Daut et al., 1983). The pain interference questions from the Brief Pain Inventory assess the degree to which chronic pain has interfered with sleep, general activity, mood, relationships with other people, and enjoyment during the previous week. Participants responded to whether their chronic pain interfered in these areas on a ratio rating scale from 0 (not at all) to 10 (completely). A mean of the five areas of pain interference was calculated, with higher scores representing a higher degree of pain interference. The Brief Pain Inventory has been found to have strong internal consistency, structural validity, and criterion-convergent validity, with a Cronbach's alpha for the interference subscale of 0.95 for patients with arthritis (Jumbo et al., 2021). The shortened 5-item pain interference questions commonly used from the Brief Pain Inventory have also been shown to demonstrate strong internal consistency, with a Cronbach's α of 0.95 from a study of chronic pain participants (Brown et al., 2018).

Cronbach's α was 0.91 for the 5-item pain interference questions from the Brief Pain Inventory for the current study.

Optimism

Optimism, defined as positive thought processes and expectations to be able to effectively manage stress and difficulties with positive outcomes (Goodin & Bulls, 2013), was assessed with the Life-Orientation Test-Revised (Scheier et al., 1994). The Life-Orientation Test-Revised includes two subscales with three questions each, with one subscale designed to measure dispositional optimism and the other subscale designed to assess pessimism. The three items from the optimism subscale include "In uncertain times, I usually expect the best;" "I'm always optimistic about my future;" and "I expect more good things to happen to me than bad." Pessimism items include "If something can go wrong for me, it will;" "I hardly ever expect things to go my way;" and "I rarely count on good things happening to me." Participants responded to each item using a 5-point Likert nominal scale from "A lot agree" to "A lot disagree." Scores were created by taking the sum of each subscale, with items from the pessimism subscale being reverse-coded. Higher scores on the scale represent higher optimism, with scores being available for the optimism subscale, the pessimism subscale, and the sum of both subscales for an overall dispositional optimism scale. The LOT-R has been demonstrated to have acceptable internal consistency among patients with rheumatoid arthritis, with a Cronbach's α of 0.86 (Xu et al., 2017). It has also been demonstrated to have adequate test-retest reliability, with $r = 0.68$ at four months, $r = 0.60$ at twelve months, $r = 0.56$ at twenty-four months, and $r = 0.79$ at twenty-eight months (Scheier et al., 1994). The Cronbach's alpha for the 6-item overall optimism scale within the entire MIDUS-3

sample was .80. Cronbach's α was 0.81 for the optimism scale for this subsample of MIDUS-3 participants with chronic musculoskeletal pain in the current study.

Coping Responses

Coping responses, defined as behavioral, emotional, and cognitive efforts to manage stress (Lazarus & Folkman, 1984), were assessed using the Coping Orientation to Problems Experienced (COPE) scale (Carver et al., 1989). The COPE scale includes several nominal subscales which are combined to create two main subscales assessing problem-focused coping and emotion-focused coping. The problem-focused coping subscale includes twelve items from the "Positive Reinterpretation and Growth," "Active Coping," and "Planning" subscales. Conversely, the emotion-focused coping subscale includes twelve items from the "Focus on and venting of emotion," "Denial," and "Behavioral disengagement" subscales. Items from the problem-focused coping scale include "I try to grow as a person as a result of the experience," "I concentrate my efforts on doing something about it," "I do what has to be done, one step at a time," and "I try to come up with a strategy about what to do." Items from the emotion-focused coping scale include "I get upset and let my emotions out," "I refuse to believe that it has happened," and "I give up trying to reach my goal." Participants responded to statements within each of the subscales with responses of "A lot," "A medium amount," "Only a little," and "Not at all." The Cronbach's alpha for the problem-focused coping scale for the entire MIDUS-3 sample was .90 and .83 for the emotion-focused coping scale. Cronbach's α was 0.89 for the problem-focused coping scale and 0.81 for the emotion-focused coping scale for this subsample of MIDUS-3 participants with chronic musculoskeletal pain in the current study.

Mind-Body Practices

Mind-body practices, defined as techniques intended to improve health through the interconnection of the mind, brain, behavior, and body, were assessed with the creation of a two-item questionnaire by the current study principal investigator, selected from a list of MIDUS-3 nontraditional interventions assessed in the self-administered questionnaire. The original MIDUS-3 study did not include a questionnaire specifically assessing for the utilization of mind-body practices. These questions chosen by the principal investigator captured two of the most commonly utilized and researched mind-body practices: meditation and yoga. Past research has demonstrated that individuals most likely to utilize these specific forms of mind-body practices are those suffering from musculoskeletal pain (Bertisch et al., 2009). Specifically, the following questions were used to capture engagement in mind-body practices: "In the past 12 months, either to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance your wellness, or to prevent the onset of illness, how often did you use relaxation or meditation techniques?" and "In the past 12 months, either to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance your wellness, or to prevent the onset of illness, how often did you use exercise or movement therapy (yoga, Pilates, tai chi, Feldenkrais, etc.)?" Participants responded to both questions using a 5-point nominal Likert scale with responses of "A lot," "Often," "Sometimes," "Rarely," and "Never." The two items were then reverse-coded so that high scores would represent more engagement while lower scores represent less engagement in these practices. An additional item was created to represent the mean of the responses to both questions to determine overall involvement in mind-body practices.

The split-half reliability (Spearman-Brown coefficient; r_s) was 0.48 for these mind-body practice questions.

Data Analysis Plan

Descriptive statistics, including means, standard deviation, kurtosis, and skew of all variables were examined in SPSS. Additional analyses were conducted in R to screen for outliers and covariates within the dataset. Significant covariates were assessed for final analyses, including age, sex, and overlapping comorbid chronic conditions. Final covariates included age and total number of chronic conditions. In addition to the skew and kurtosis of study variables, specifically relevant assumptions of analyses were examined, including normality, linearity, and multicollinearity. As outlined by the APA Publications and Communications Board Task Force Report (Appelbaum et al., 2018), this study first specified an initial path model grounded in theory, followed by estimation of the model, model fit assessment using model fit indices, model re-specification based on modification indices, and reporting of results.

Model fit was evaluated as outlined by Bauer and Curran (2023), with fit indices indicative of having a good fit including a non-significant chi-square test statistic, a CFI value greater than 0.95, a TLI value greater than 0.95, a RMSEA value less than 0.05, and a SRMR value less than 0.08. The initial estimation of the model was examined for its overall fit with the data; however, the results of the path analysis model and support for hypotheses were not interpreted until the model fit indices were indicative of an appropriate fit of the model. The most common method for addressing poorly fitting structural equation models is by freeing individual parameters within the model which are consistent with and guided by theory and that would demonstrate a significant reduction

in the chi-square estimation, repeating this process until an adequately fitting model is identified (Hoyle, 2023). Modification indices represent the change expected in the fit of a model after removing a restriction on a given parameter. It has been recommended to consider removing restrictions on specific parameters with modification indices of 3.84 or greater (Hoyle, 2023).

Planned Analyses

Path analysis in structural equation modeling was conducted in R using the lavaan package (Rosseel, 2012) to examine all hypotheses. The model depicted in Figure 1 was utilized to test all study hypotheses. Model fit was assessed using Standardized Root Mean Square Residual (SRMR < .05), Comparative Fit Index (CFI > .95), and Root Mean Square Error of Approximation (RMSEA < .05). Issues created by relevant covariates required certain modifications to the model. To address missing data, full information maximum likelihood was used. Full information maximum likelihood has been demonstrated to be more efficient and unbiased in comparison to other methods of managing missing data, including listwise and pairwise deletion (Enders & Bandalos, 2001). Mediation analyses to examine indirect effects were also conducted using 95% confidence intervals with bootstrapping.

H1a: The relationship between optimism and problem-focused coping was examined by assessing path h1a in Figure 1.

H1b: The relationship between optimism and emotion-focused coping was examined by assessing path h1b in Figure 1.

H2: The relationship between optimism and engagement in mind-body practices was examined by assessing path h2 in Figure 1.

H3: The relationship between problem-focused coping and engagement in mind-body practices was examined by assessing path h3 in Figure 1.

H4: The relationship between emotion-focused coping and engagement in mind-body practices was examined by assessing path h4 in Figure 1.

H5: The relationship between problem-focused coping and pain interference was examined by assessing path h5 in Figure 1.

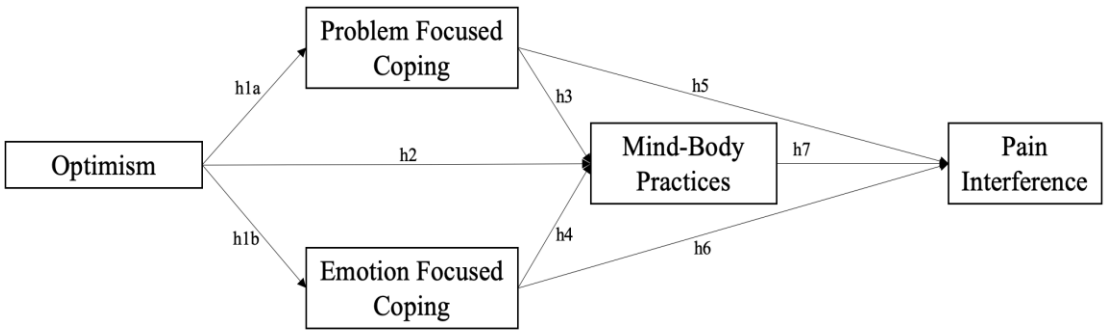
H6: The relationship between emotion-focused coping and pain interference was examined by assessing path h6 in Figure 1.

H7: The relationship between engagement in mind-body practices and pain interference was examined by assessing path h7 in Figure 1.

H8: Indirect, or mediated paths within the model were examined, with 95% confidence intervals used with bootstrapping.

Figure 1

Conceptual Model for Hypothesized Relations Between Study Variables



A Priori Expectations for Indirect Paths

It was expected that the relationship between optimism and pain interference would be mediated by problem-focused coping, emotion-focused coping, and mind-body practices. Specifically, it was expected that the relationship between optimism and pain

interference would be best understood through the pathway of problem-focused coping, emotion-focused coping, and mind-body practices.

Results

Sample Characteristics and Outliers

Of the 3,683 individuals participating in the original MIDUS-3 study, 527 met criteria for the current study. Specifically, 527 participants endorsed having experienced or been treated for arthritis, rheumatism, or other bone or joint disease as well as having experienced chronic pain lasting longer than a few months. A review of variable frequencies revealed that certain variables had a large amount of missing data, which can be found in Table 1. Specifically, 31.3% of the sample refused to indicate their current employment status, 6% had missing data for the optimism scale, 1.5% for both the problem-focused and emotion-focused coping scales, 4.4% had missing data for engagement in mind-body practices, and 5.5% did not respond to questions pertaining to overall pain interference. Participants seemed less likely to respond to questions pertaining to the degree to which their pain interfered with their mood and interpersonal relationships, as well as their level of engagement in mind-body practices such as meditation, tai-chi, or yoga.

Table 1

Missing Data

Variables	Total Missing *n(%)*
Age	0 (0%)
Sex	0 (0%)
Education	1 (0.2%)
Optimism Total	6 (1.1%)
Optimism	6 (1.1%)
Pessimism	6 (1.1%)

Problem-Focused Coping	8 (1.5%)
Emotion-Focused Coping	8 (1.5%)
Mind-Body Practices	23 (4.4%)
Exercise/Movement	10 (1.9%)
Relaxation/Meditation	22 (4.2%)
Pain Interference Total	29 (5.5%)
Activity	12 (2.3%)
Mood	21 (4.0%)
Relations	19 (3.6%)
Sleep	18 (3.4%)
Enjoyment	15 (2.8%)

N = 527

Four multivariate outliers were identified, with Mahalanobis distances greater than the critical value of 18.47 for the four main predictor variables (Penny, 1996). These elevated values were due to one participant having high problem-focused coping and high pain interference, one having high problem-focused coping and emotion-focused coping, one having low problem-focused coping and pain interference, and one having high emotion-focused coping and pain interference. Considering this small number of outliers, (*n* = 4, 0.8% of the original sample), and given their critical values being above 18.47, these four cases were deleted from the dataset. Thus, the final sample consisted of 523 participants.

Demographics

The mean age was 66.89 (*SD* = 11.00) and ranged from 44 to 93 years old. A total of 36.3% of the sample identified as male and 63.7% identified as female. Approximately 88.5% reported their ethnicity as White, 2.9% as Black and/or African American, 2.1% as Native American or Alaska Native Aleutian Islander/Eskimo, 0.2% as Asian, 0.2% as Native Hawaiian or Pacific Islander, 5.2% as Other, 0.2% reported that they did not know, and 0.8% refused to respond. Additionally, 95.8% of participants identified as Not Spanish/Hispanic, 1.7% as Mexican, 1.0% as Mexican American, 0.2% as Puerto Rican,

0.6% as Other, 0.6% reported that they did not know, and 0.1% refused to respond. Approximately 33.6% of participants indicated that they were either working or self-employed while 2.3% reported being permanently disabled. A full list of sample characteristics can be found in Table 2.

Table 2

Sample characteristics (N = 523)

Variables	*n*	%
Age (years)	*M* = 66.89	*SD* = 11.00
Sex (Male)	190	36.3
Chronic Conditions Total	*M* = 3.71	*SD* = 2.70
Race/Ethnicity		
White	463	88.5
Black/African American	15	2.9
Native American/Alaska Native	11	2.1
Asian	1	0.2
Native Hawaiian/Pacific Islander	1	0.2
Other	27	5.2
Don’t Know	1	0.2
Refused	4	0.8
Education		
Less than high school	47	9.0
High school graduate or equivalent	154	29.4
Some college	102	19.5
Associate’s degree or vocational school	50	9.6
Bachelor’s degree	84	16.1
Some graduate school	14	2.7
Master’s degree	51	9.8
Ph.D., Ed.D., M.D., or other prof. degree	20	3.8
Don’t know	1	0.2
Marital Status		
Married	317	60.6
Separated	7	1.3
Divorced	92	17.6
Widowed	81	15.5
Never married	24	4.6
Refused	2	0.4
Employment Status		
Working now	145	27.7
Self-employed	31	5.9

Looking for employment	7	1.3
Temporarily laid off	1	0.2
Retired	135	25.8
Homemaker	14	2.7
Maternity or sick leave	1	0.2
Permanently disabled	12	2.3
Other	14	2.7
Don't know	2	0.4
Inappropriate	161	30.8

Descriptive Statistics

Several participants did not complete the Life-Orientation Test-Revised (*n* = 6), the COPE scale (*n* = 8), or the Brief Pain Inventory (*n* = 29). Additionally, several participants also refused to indicate their engagement in mind-body practices (*n* = 23), with 21.6% of participants endorsing engagement in exercise or movement therapy and 26.6% of participants endorsing engagement in relaxation or meditation techniques. The mean Life-Orientation Test-Revised score was 22.51 (*SD* = 4.79). The mean COPE scale problem-focused coping score was 37.42 (*SD* = 5.90) and the mean emotion-focused coping score was 22.91 (*SD* = 5.74). The mean engagement in mind-body practices score was 4.41 (*SD* = 0.92). The mean pain interference score was 3.92 (*SD* = 2.65), with pain interfering the most with activity (M = 4.72, *SD* = 3.02), followed by enjoyment (M = 4.38, *SD* = 3.27), sleep (M = 4.35, *SD* = 3.23), mood (M = 3.48, *SD* = 2.94), and relations (M = 2.65, *SD* = 2.96). Descriptives for each of the main study variables, including mean, standard deviation, skew, and kurtosis can be found in Table 3.

Table 3

Descriptives for Main Study Variables

Variables	*M (SD)*	Skewness	Kurtosis
Problem-Focused Coping	37.42 (5.90)	-0.35	-0.16
Emotion-Focused Coping	22.91 (5.74)	0.65	0.67

Optimism Total	22.51 (4.79)	-0.50	-0.06
Mind-Body Practices	1.59 (0.92)	1.53	1.54
Exercise/Movement	1.54 (1.13)	1.93	2.36
Relaxation/Meditation	1.64 (1.15)	1.62	1.32
Pain Interference	3.92 (2.65)	0.40	-0.75
Activity	4.72 (3.02)	0.02	-1.02
Mood	3.48 (2.94)	0.52	-0.75
Relations	2.65 (2.96)	0.88	-0.40
Sleep	4.35 (3.23)	0.14	-1.22
Enjoyment	4.38 (3.27)	0.22	-1.19

Note. *N* = Number; *M* = Mean; *SD* = Standard Deviation; *Problem-Focused Coping/Emotion-Focused Coping* = COPE Scale; *Optimism/Pessimism* = Life-Orientation Test-Revised; *Mind-Body Practices* = Mean of 2 Questions Indicating Engagement in Exercise Therapy & Meditation Practices; *Pain Interference* = Mean of 5 Pain Interference Subscales

Correlations of Covariates of Interest

The potential covariates of age, sex, and comorbid chronic medical conditions were examined as they related to optimism, problem-focused coping, emotion-focused coping, mind-body practices, and pain interference. Correlations between the main study variables and continuous covariates are shown in Table 4. Participant age was significantly related to optimism, $r(515) = 0.091$, $p < 0.05$, at a small effect size, so that as participant age increased, so too did levels of optimism. However, participant age was not significantly related to problem-focused coping, $r(513) = 0.05$, $p = 0.23$. There was a significant relationship between participant age and emotion-focused coping, $r(513) = 0.09$, $p < 0.05$, with a small effect size, so that as participant age increased, so too did levels of emotion-focused coping. Age was also significantly related to pain interference, $r(492) = -0.14$, $p < 0.01$, so that as age increased, levels of pain interference decreased. There was not a significant relationship between participant age and engagement in mind-body practices, $r(498) = -0.085$, $p = 0.06$. In addition to optimism, emotion-focused coping, and pain interference, participant age was also correlated with multimorbidity,

$r(521) = 0.09$, $p < 0.05$, at a small effect size, so that as participant age increased, so too did the number of chronic illnesses.

There was a significant relationship between participant degree of multimorbidity and optimism, $r(515) = -0.20$, $p < 0.001$, with a small effect size, so that as the number of chronic illnesses participants reported having increased, optimism levels decreased. Multimorbidity was also significantly correlated with problem-focused coping, $r(513) = -0.12$, $p < 0.01$, at a small effect size, so that as multimorbidity increased, problem-focused coping decreased. There was a significant relationship between multimorbidity and emotion-focused coping, $r(513) = 0.16$, $p < 0.001$, at a small effect size, so that as multimorbidity increased, so too did emotion-focused coping. Multimorbidity was significantly related to pain interference, $r(492) = 0.37$, $p < 0.001$, at a moderate effect size, so that as multimorbidity increased, so too did pain interference. There was no relationship between multimorbidity and engagement in mind-body practices, $r(498) = 0.05$, $p = 0.31$. Compared to males ($M = 21.46$), females had significantly higher emotion-focused coping ($M = 23.74$), $t(421.66) = -4.53$, $p < 0.001$. Compared to males ($M = 1.39$), females also reported engaging in more mind-body practices ($M = 1.70$), $t(467.46) = -3.93$, $p < 0.001$. There was no significant difference between males and females with regard to pain interference $t(361.74) = -0.348$, $p = 0.728$, optimism $t(403.69) = -1.122$, $p = 0.263$, or problem-focused coping $t(412.88) = -0.714$, $p = 0.476$. Overall, the covariates of interest that were included in the path analysis model were age and multimorbidity (or total number of chronic conditions), given their significant correlational relationship with pain interference.

Correlations Between Main Study Variables

Optimism was significantly correlated with problem-focused coping, $r(508) = 0.45$, $p < 0.001$, at a moderate effect size, so that as optimism increased, problem-focused coping also increased. Conversely, optimism was significantly negatively correlated with emotion-focused coping, $r(508) = -0.34$, $p < 0.001$, at a moderate effect size, so that as optimism increased, emotion-focused coping decreased. Optimism was also significantly correlated with engagement in mind-body practices, $r(492) = 0.16$, $p < 0.001$, at a small effect size, so that as optimism increased, engagement in mind-body practices increased. Finally, optimism was also significantly negatively correlated with pain interference, $r(486) = -0.37$, $p < 0.001$, at a moderate effect size, so that as optimism increased, pain interference decreased.

Problem-focused coping was significantly correlated with emotion-focused coping, $r(513) = -0.14$, $p < 0.01$, at a small effect size, so that as problem-focused coping scores increased, emotion-focused coping scores decreased. There was also a significant relationship between problem-focused coping and engagement in mind-body practices, $r(491) = 0.21$, $p < 0.001$, at a small effect size, so that as problem-focused coping increased, engagement in mind-body practices also increased. Problem-focused coping was significantly correlated with pain interference, $r(489) = -0.21$, $p < 0.001$, at a small effect size, so that as problem-focused coping increased, pain interference decreased. Emotion-focused coping was also significantly correlated with pain interference, $r(489) = 0.25$, $p < 0.001$, at a small effect size, so that as emotion-focused coping increased, pain interference increased. There was no relationship between engagement in mind-body practices and emotion-focused coping, $r(491) = -0.012$, $p = 0.792$, or between

engagement in mind-body practices and pain interference, $r(471) = -0.031$, $p = 0.497$. Correlations among study variables for the entire sample can be found in Table 4, with correlations among study variables for men and women in Table 5.

Table 4

Correlations Among Study Variables for the Entire Sample

Variable	*M (SD)*	1	2	3	4	5	6	7
1. Age	66.89 (11.00)	1						
2. Chronic Conditions Total	3.71 (2.70)	0.093*	1					
3. Optimism	22.51 (4.79)	0.091*	-0.201***	1				
4. Problem-Focused Coping	37.42 (5.90)	0.052	-0.115**	0.445***	1			
5. Emotion-Focused Coping	22.91 (5.74)	0.093*	0.164***	-0.342***	-0.140**	1		
6. Mind-Body Practice Engage.	1.59 (0.92)	-0.085	0.046	0.156***	0.212***	0.012	1	
7. Pain Interference	3.92 (2.65)	-0.143**	0.369***	-0.369***	-0.214***	0.254***	-0.031	1

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Table 5

Correlations Among Study Variables (Males on lower half, N = 190; Females on upper half, N = 333)

Variable	*M (SD)*	1	2	3	4	5	6	7	*M (SD)*
1. Age	66.79 (10.62)	1	0.112*	0.042	0.009	0.078	-0.125*	-0.146**	66.95 (11.23)
2. Conditions	3.17 (2.80)	0.060	1	-0.184***	-0.078	0.063	-0.028	0.382***	4.02 (2.60)
3. Optimism	22.20 (4.70)	0.183*	-0.256***	1	0.418***	-0.323***	0.223***	-0.374***	22.69 (4.83)
4. PF Coping	37.18 (5.64)	0.137	-0.196**	0.494***	1	-0.109*	0.254***	-0.117*	37.56 (6.05)
5. EF Coping	21.46 (5.29)	0.128	0.280***	-0.428***	-0.232**	1	-0.076	0.201***	23.74 (5.83)
6. MBP Engage.	1.39 (0.73)	0.006	0.136	-0.019	0.093	0.117	1	-0.073	1.70 (1.00)
7. Pain Int.	3.87 (2.65)	-0.139	0.353***	-0.363***	-0.396**	0.370***	0.062	1	3.95 (2.65)

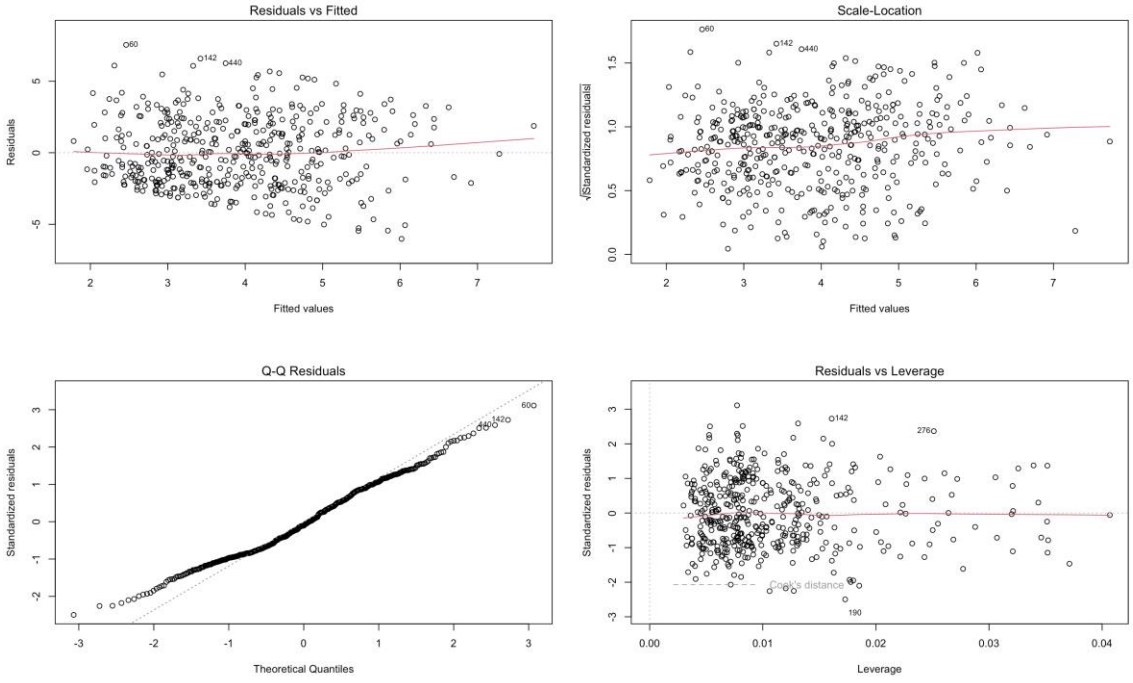
Note. *$p < .05$, **$p < .01$, ***$p < .001$

Path Analysis Assumptions

The assumptions of normality, linearity, and multicollinearity were examined prior to path analysis. Results demonstrated that each of these assumptions were met and can be viewed in Figure 2. The two items assessing engagement in mind-body practices demonstrated a skew of 1.59. As a result, attempts were made to transform this construct with the use of square root transformations, a data transformation technique commonly utilized for data with positive skew (Tabachnick & Fidell, 2018). However, square root transformations did not result in a significant change in the skew of the engagement in mind-body practices construct. Nonetheless, path analyses are robust to data distribution concerns (Tabachnick & Fidell, 2018), and analyses were conducted with all other assumptions being met.

Figure 2

Assumptions of Path Analysis

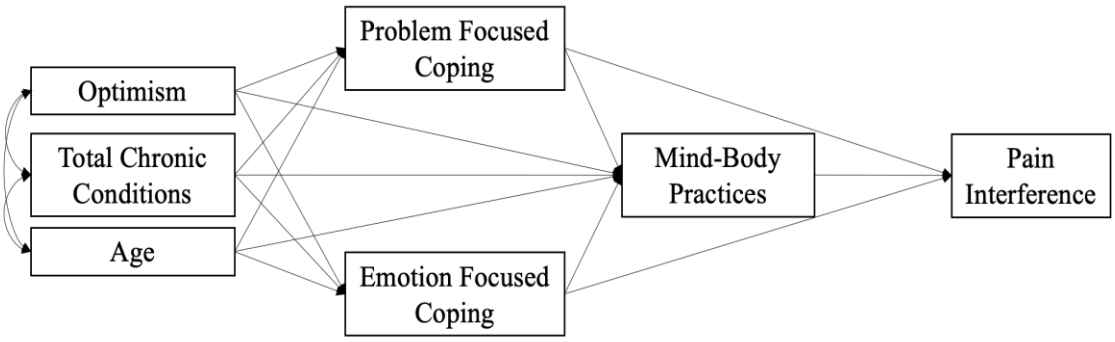


Main Analyses

Several variables were examined as potential covariates given their relation to other study variables. Specifically, because of their significant correlation with pain interference, total number of comorbid chronic conditions and age were included in the model as covariates. Although there were significant differences between males and females for emotion-focused coping and mind-body practices, sex was not included in the model as a covariate because there were no significant differences between the two groups regarding the main outcome variable of interest, pain interference. Total number of chronic conditions and age were entered into the path analysis model, along with optimism, as exogenous variables. The overall model adjusted for covariates can be viewed in Figure 3.

Figure 3

Path Analysis Model with Covariates Total Chronic Conditions and Age



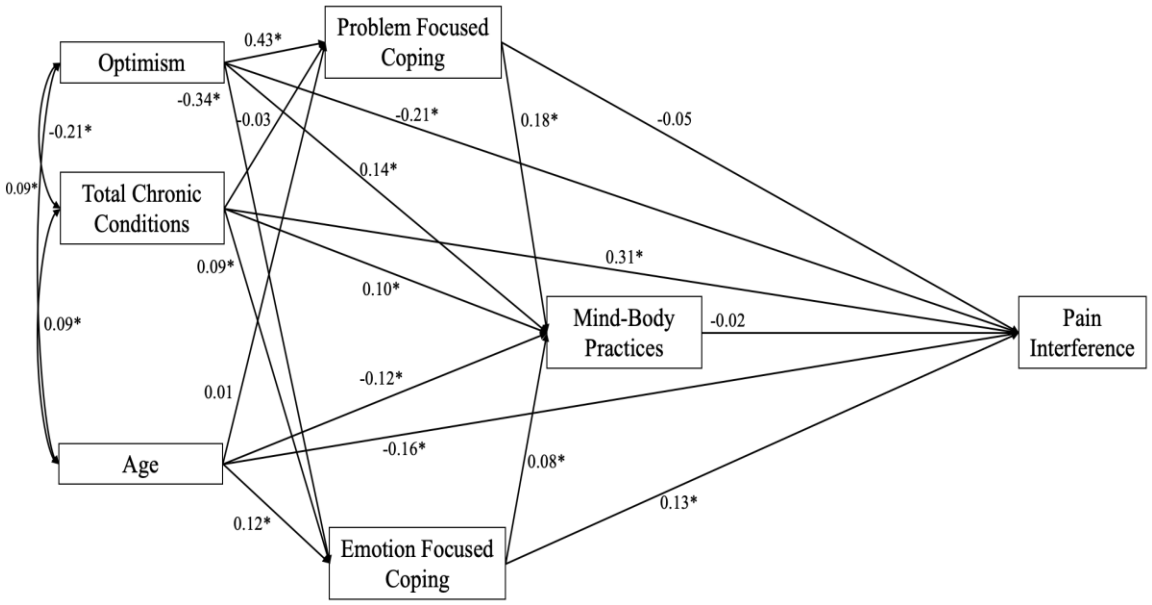
The path model from Figure 3 was tested using the lavaan package in R, (Rosseel, 2012); however, in consideration of model fit indices, the model did not adequately fit the data, $\chi^2(4) = 97.69$, $p < 0.001$, CFI = 0.74, TLI = -0.18, RMSEA = 0.21, SRMR = 0.07. Thus, these data were not a good fit for the originally hypothesized model. Modification indices were then examined within R using the lavaan package. Specifically, the

modification indices for the parameters between total number of chronic conditions and pain interference (*MI* = 51.88), between age and pain interference (*MI* = 12.84), and between optimism and pain interference (*MI* = 33.90) were the most elevated. In light of prior research identifying significant relationships between multimorbidity and pain interference, age and pain interference, and optimism and pain interference, these modifications to the model are grounded in theoretical considerations. Thus, guided by theory and past research, an additional model (Figure 4) was created to account for the direct effect of optimism, as well as the covariate relationships with total number of chronic conditions and age on pain interference.

The path model shown in Figure 4 was then tested with lavaan. Fit indices for this final model were indicative of good overall fit with the data, as defined by Hu and Bentler (1999), $\chi^2(1) = 0.088$, $p = 0.766$, CFI = 1.00, TLI = 1.05, RMSEA < 0.001, SRMR = 0.002. The R^2 for each variable indicated that the model predicted 19.6% of the variance for problem-focused coping, 14.2% of the variance for emotion-focused coping, 7.7% of the variance for mind-body practice engagement, and 25.7% of the variance for pain interference. Additionally, the likelihood ratio test (LRT) was used to determine if the revised, nested model from Figure 4 fit the data better than the model from Figure 3 (Hoyle, 2023). Results from the significant likelihood ratio test indicated that the nested model did, in fact, fit the data better, $\Delta\chi^2(3) = 97.60$, $p < 0.001$. Figure 4 shows the standardized path coefficients for variables in the model, with coefficients with asterisks representing significant paths.

Figure 4

Nested Path Analysis Model with Recommended Modification Indices Accounting for Effects of Optimism, Total Chronic Conditions, and Age on Pain Interference



Note. * = significant path coefficients.

Hypothesis Testing

The originally hypothesized path analysis model did not provide an adequate fit for the data in this sample. As a result, it was not appropriate to interpret the parameters from that originally hypothesized path model. Findings from the path analysis of the final nested model (Figure 4), including unstandardized beta, standard error of unstandardized beta, standardized beta, and 95% confidence intervals of the direct and indirect effects can be found in Table 6. The main effect of optimism on problem-focused coping was statistically significant, $\beta = 0.43$, 95% CI [0.430, 0.652], $p < 0.001$. Having an optimistic mindset was positively associated with the use of problem-focused coping strategies, thus supporting hypothesis 1a. The relationship between optimism and emotion-focused coping was also significant, $\beta = -0.34$, 95% CI [-0.506, -0.282], $p < 0.001$. Optimism was

negatively associated with the use of emotion-focused coping strategies, supporting hypothesis 1b. The main effect of optimism on engagement in mind-body practices was statistically significant, $\beta = 0.14$, 95% CI [0.012, 0.052], $p < 0.01$. Having an optimistic mindset was positively associated with engagement in mind-body practices, thus supporting hypothesis 2. The relationship between problem-focused coping and mind-body practice engagement was significant, $\beta = 0.18$, 95% CI [0.015, 0.045], $p < 0.001$. The use of problem-focused coping strategies was positively associated with engagement in mind-body practices, supporting hypothesis 3.

Table 6

Parameter Estimates for Path Analysis Model

Parameter	*B (SE)*	*β*	*p*	95% Confidence Interval
Main Effects				
Optimism → PFC	**0.54(0.05)**	**0.43**	**<0.001**	**[0.430, 0.652]**
Optimism → EFC	**-0.41(0.05)**	**-0.34**	**<0.001**	**[-0.506, -0.282]**
Optimism → MBP	**0.03(0.01)**	**0.14**	**<0.01**	**[0.012, 0.052]**
Optimism → Pain	**-0.12(0.03)**	**-0.21**	**<0.001**	**[-0.158, -0.046]**
PFC → MBP	**0.03(0.007)**	**0.18**	**<0.001**	**[0.015, 0.045]**
EFC → MBP	**0.01(0.007)**	**0.08**	**<0.05**	**[0.001, 0.030]**
PFC → Pain	-0.02(0.02)	-0.05	0.172	[-0.069, 0.013]
EFC → Pain	**0.06(0.02)**	**0.13**	**<0.01**	**[0.019, 0.101]**
MBP → Pain	-0.05(0.12)	-0.02	0.662	[-0.282, 0.194]
Covariates				
CC Total → PFC	-0.07(0.09)	-0.03	0.425	[-0.284, 0.154]
CC Total → EFC	**0.19(0.09)**	**0.09**	**<0.01**	**[0.076, 0.455]**
CC Total → MBP	**0.04(0.02)**	**0.10**	**<0.01**	**[0.009, 0.072]**
CC Total → Pain	**0.30(0.04)**	**0.31**	**<0.001**	**[0.252, 0.421]**
Age → PFC	0.006(0.02)	0.01	0.779	[-0.044, 0.045]
Age → EFC	**0.06(0.02)**	**0.12**	**<0.01**	**[0.009, 0.109]**
Age → MBP	**-0.01(0.004)**	**-0.12**	**<0.01**	**[-0.018, -0.003]**
Age → Pain	**-0.04(0.01)**	**-0.16**	**<0.001**	**[-0.059, -0.020]**

Covariances				
Optimism ↔ CC Total	**-2.65(0.58)**	**-0.21**	**<0.001**	**[-3.781, -1.513]**
Optimism ↔ Age	**4.84(2.32)**	**0.09**	**<0.05**	**[0.288, 9.382]**
CC Total ↔ Age	**2.75(1.30)**	**0.09**	**<0.05**	**[0.198, 5.304]**

Note. Bolded rows indicate significant findings at $p < 0.05$. PFC = Problem-Focused Coping, EFC = Emotion-Focused Coping, MBP = Mind-Body Practices, Pain = Pain Interference, CC Total = Chronic Conditions Total

The main effect of emotion-focused coping on engagement in mind-body practices was statistically significant, $\beta = 0.08$, 95% CI [0.001, 0.030], $p < 0.05$. The use of emotion-focused coping strategies was positively associated with engagement in mind-body practices, an opposite relationship proposed in original hypothesis 4. Hypothesis 5 was not supported, as the main effect of problem-focused coping strategies on pain interference was not statistically significant. Hypothesis 6 was supported, as the use of emotion-focused coping strategies was positively associated with pain interference, $\beta = 0.13$, 95% CI [0.019, 0.101], $p < 0.01$. Hypothesis 7 was not supported, as the relationship between engagement in mind-body practices and pain interference was not statistically significant. The originally hypothesized path analysis model and significant paths can be found in Figure 5, and a listing of each supported or rejected hypothesis, as a result of modifications to the model, can be found in Table 7.

Table 7

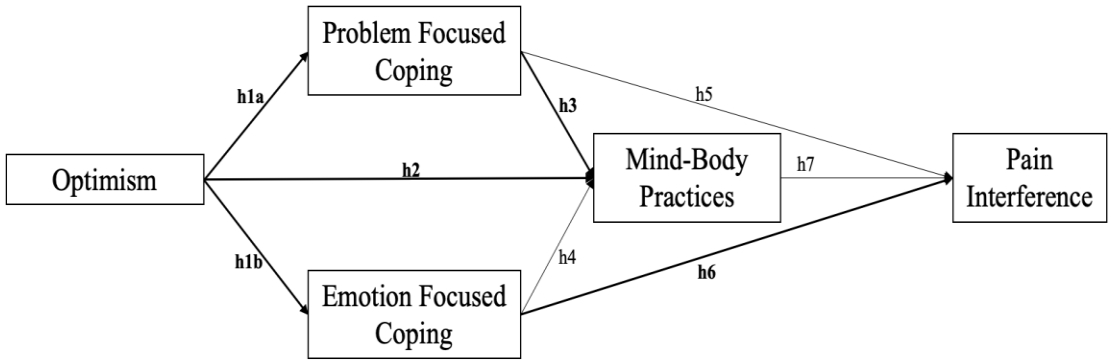
Supported and Rejected Hypotheses

Hypothesis	Finding
Hypothesis 1a	Supported
Hypothesis 1b	Supported
Hypothesis 2	Supported
Hypothesis 3	Supported
Hypothesis 4	Rejected
Hypothesis 5	Rejected
Hypothesis 6	Supported
Hypothesis 7	Rejected

Note. These hypotheses were examined with the use of the modified path analysis model, as the originally hypothesized path model did not provide an appropriate fit for the data.

Figure 5

Original Hypothesized Path Analysis Model of Study Variables



Note. Bolded paths represent supported whereas nonbolded represent rejected hypotheses.

There was a significant main effect of illness comorbidity and emotion-focused coping, $\beta = 0.09$, 95% CI [0.076, 0.455], $p < 0.01$, such that having more chronic illnesses was positively associated with the use of emotion-focused coping strategies. There was a significant main effect of illness comorbidity and mind-body practice engagement, $\beta = 0.10$, 95% CI [0.009, 0.072], $p < 0.01$. Having more chronic illnesses was positively associated with engagement in mind-body practices. There was a significant main effect of illness comorbidity and pain interference, $\beta = 0.31$, 95% CI [0.252, 0.421], $p < 0.001$, such that having more chronic illnesses was positively associated with pain interference.

Participant age had a significant main effect on emotion-focused coping, $\beta = 0.12$, 95% CI [0.009, 0.109], $p < 0.01$, engagement in mind-body practices, $\beta = -0.12$, 95% CI [-0.018, -0.003], $p < 0.01$, and pain interference, $\beta = -0.16$, 95% CI [-0.059, -0.020], $p < 0.001$. Participant age was positively associated with the use of emotion-focused coping

strategies, negatively associated with engagement in mind-body practices, and negatively associated with pain interference. There was not a significant main effect of illness comorbidity, β = -0.03, 95% CI [-0.284, 0.154], p = 0.425. Participant age did not have a significant effect on the use of problem-focused coping strategies, β = 0.01, 95% CI [-0.044, 0.045], p = 0.779. There was significant covariance between optimism and chronic illness comorbidity, β = -0.21, 95% CI [-3.781, -1.513], p < 0.001, optimism and participant age, β = 0.09, 95% CI [0.288, 9.382], p < 0.05, and chronic illness comorbidity and participant age, β = 0.09, 95% CI [0.198, 5.304], p < 0.05.

Indirect Paths

Hypothesis 8 was then addressed, with the examination of indirect, or mediated paths within the model with the use of 95% confidence intervals used with bootstrapping. Refer to Table 6 for a full report of all indirect path test statistics. Of note, it was originally hypothesized that the relationship between optimism and pain interference would be mediated by problem-focused coping, emotion-focused coping, and mind-body practices. First, the indirect effect of optimism on pain interference through emotion-focused coping was statistically significant, *B(SE)* = -0.024(0.009), 95% CI [-0.042, -0.007], p < 0.01. Optimism was negatively associated with the use of emotion-focused coping strategies, which was then positively associated with pain interference. There was also a significant direct effect between optimism and pain interference, *B(SE)* = -0.105(0.029), 95% CI [-0.158, -0.046], p < 0.001.

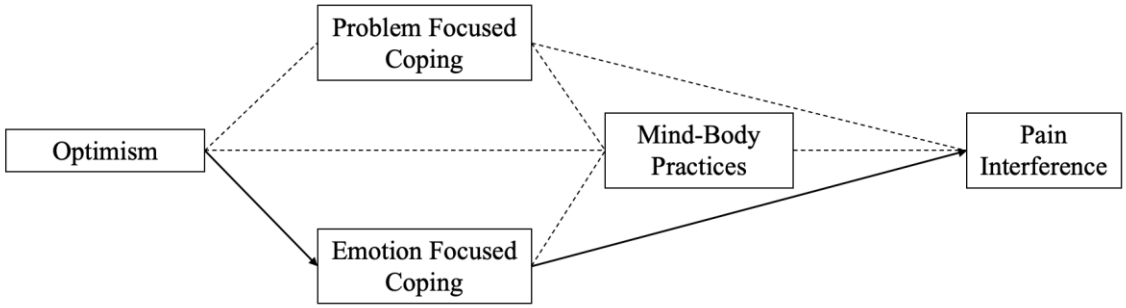
The indirect effect of optimism on pain interference through problem-focused coping and mind-body practices was not significant, *B(SE)* = -0.001(0.002), CI [-0.005, 0.003], p = 0.678. The indirect effect of optimism on pain interference through problem-

focused coping also was not significant, *B(SE)* = -0.015(0.011), CI [-0.039, 0.007], *p* = 0.180. The indirect effect of optimism on pain interference through emotion-focused coping and mind-body practices was not statistically significant, *B(SE)* < 0.001(0.001), CI [-0.001, 0.002], *p* = 0.701. Finally, the indirect effect of optimism on pain interference through mind-body practices was not statistically significant, *B(SE)* = -0.002(0.004), 95% CI [-0.010, 0.006], *p* = 0.687.

Overall, the effect of optimism on pain interference was mediated by emotion-focused coping strategies, such that optimism was negatively associated with the use of emotion-focused coping strategies which was then positively associated with more pain interference. These findings partially support the a priori predictions made regarding mediation effects within the model; however, the relationship between optimism and pain interference was not found to be mediated by problem-focused coping, emotion-focused coping, and mind-body practice use together. The originally proposed path model with supported and unsupported mediation paths can be found in Figure 6.

Figure 6

Indirect Mediation Effects in the Originally Hypothesized Path Analysis Model



Note. Solid-lined paths represent significant mediation effects within the model, with dotted-lined paths representing non-significant mediation effects.

Discussion

The purpose of this study was to investigate a resilience model of chronic pain for patients with chronic arthritic musculoskeletal pain, including relationships between dispositional optimism, coping responses, mind-body practices, and pain interference. This was the first known study to examine interactive and indirect effects between these study variables and pain interference for individuals with chronic musculoskeletal pain. The results provide strong support for the effects of dispositional personality traits like optimism on engagement in certain coping responses, including those commonly associated with problem-focused as well as emotion-focused coping. There is also support informing the role and impact of these variables on engagement with mind-body practices intended to promote or improve overall physical health and well-being.

Sample Characteristics

Overall, this sample of individuals endorsing chronic musculoskeletal pain had pain interference scores falling in the mild range. In another study examining pain interference in older adults with osteoarthritis, participants also reported pain interference in the mild-moderate range (Murphy et al., 2016). A study examining pain interference among patients with single-site and multisite musculoskeletal pain found patients with multisite pain to have significantly higher pain interference than those with single-site pain, and also found a significant association between pain interference and comorbid chronic conditions such as peripheral artery disease, diabetes, and depression (Koren et al., 2022). These findings are consistent with those of the current study, with participants' pain interference being significantly associated with their total number of chronic conditions. Additionally, Koren and colleagues (2022) also found pain interference to be

rated highest in activity-related functioning and lowest in relationship-related functioning, consistent with the current sample's pain interference scores in each respective area. These researchers speculated that their sample of older adults may have been less involved in family dynamics, as well as had fewer obligations and expectations given their age range which may result in pain interfering less in this area than it might in younger patients. It is also possible that the pain interference scores being in the mild range for the current study's participants was related to where they were recruited, as patients being recruited in treatment centers might be expected to report more pain interference than individuals in the community.

In comparison to other samples of patients with chronic musculoskeletal pain or osteoarthritis, the current study's sample reported higher levels of dispositional optimism (Cruz-Almeida et al., 2013; Martinez-Calderon et al., 2020). It is possible that this finding may also be related to recruitment location, with individuals presenting in treatment centers possibly being less optimistic after having trialed other means of addressing their pain. Consistent with previous research, participants of the current study also utilized problem-focused coping strategies more than emotion-focused coping strategies (Keefe et al., 2004). Finally, the current study utilized a two-item measure created by the principal investigator to examine participants' level of engagement in mind-body practices. Although the responses to this measure cannot be compared to other study samples, the current study reported between either never having used these practices or rarely using them over a twelve-month period.

Relationships Between Covariates and Main Study Variables

The present study's finding that dispositional optimism tends to be higher in older adults than younger adults is consistent with findings from previous research (You et al., 2009). Additionally, previous research has also aligned with the findings of the current study with older adults being more likely to engage in emotion-focused coping strategies than younger adults (Galiana et al., 2020), as well as older adults having more multimorbid chronic conditions than younger adults (Chowdhury et al., 2023). However, despite older adults being more likely to engage in emotion-focused coping strategies and having higher rates of multimorbid chronic conditions than younger adults, there was an inverse relationship between age and pain interference, such that younger adults tended to have higher rates of pain interference than older adults. This is an interesting finding, as previous research has indicated that pain becomes more disabling as we age (Thomas et al., 2004), given the greater likelihood of multiple chronic conditions among older adults in comparison to younger adults. It has been suggested that older adults expect to experience pain as part of a "normal" process of aging, a belief that may be protective from psychological distress in older age (Molton & Terrill, 2014). This could lend support to the idea that older adults expect increasing pain symptoms throughout their lifespan and are thus able to view their pain as being less interfering of their everyday lives. Another study did not find a significant difference in pain interference scores between younger and older adults with chronic pain (You et al., 2022).

In addition to age, the total number of chronic medical conditions (multimorbidity) was also a covariate that was significantly associated with several main study variables. Specifically, multimorbidity was positively associated with emotion-

focused coping and pain interference, and negatively associated with optimism and problem-focused coping. There is limited research investigating the relationship between dispositional optimism and multimorbidity. However, previous research has demonstrated that having higher levels of optimism has been shown to be protective against cardiovascular events (Rozanski et al., 2019), associated with better management of diabetes (Zhao et al., 2019), as well as having decreased incidence of cognitive impairment in older adults (Gawronski et al., 2016). Therefore, the existing literature is consistent with the view that higher levels of optimism are generally associated with protection from major chronic illnesses individually. The association between disease incidence and reported pain symptoms has been well established (Butchart et al., 2009; Scherer et al., 2016), in that the more chronic conditions an individual has been diagnosed with, the more pain symptoms they report experiencing. Patients with arthritis and other comorbid chronic illnesses in one study were found to have more pain interference than patients without multimorbidity (Zhang, 2021).

Participant sex was also explored as a covariate, with findings indicating that females engaged in more emotion-focused coping strategies and mind-body practices than males. These findings support previous research in which women have been found to engage in mind-body practices like meditation, yoga, and tai-chi more than men (Upchurch & Johnson, 2019). Additionally, research has generally demonstrated that women tend to use emotion-focused coping strategies more than men (Brougham et al., 2009). In particular, women have been found to utilize more self-blame emotion-focused coping strategies, which were also found to be associated with elevated trait anxiety symptoms (Kelly et al., 2008). In a separate study examining psychological adaptation

during the Covid-19 pandemic, women were found to utilize more emotion-focused coping strategies like seeking out emotional support, distraction, and acceptance than men, while men tended to utilize denial and substance use (Cholankeril et al., 2023).

Relationships Between Main Study Variables

The originally hypothesized path model did not provide an adequate fit to the current study's data. Following the guidance of Hoyle (2023), recommended modification indices above the cut-off of 3.84 were examined and changes were made to the path model that were guided by theory. Specifically, the restrictions on the parameters between age and pain interference, total number of chronic conditions and pain interference, and optimism and pain interference were removed, creating a nested model. These changes were guided by past research demonstrating optimism to be directly and negatively related to pain interference for fibromyalgia and musculoskeletal pain (Judge et al., 2020; Martinez-Calderon et al., 2020). Additionally, previous research has also demonstrated that older adults are more likely to be diagnosed with multiple chronic conditions, with each condition having its own individual and cumulative impact on nociception and physical limitations (Blyth & Noguchi, 2017). Therefore, the recommended changes to the model as indicated by their elevated modification indices were supported by past research and theoretical relationships between the study constructs. The hypothesized relationships between study constructs were then examined with the nested path model.

Regarding relationships between the main study variables, optimism was found to have significant associations with problem-focused coping, emotion-focused coping, engagement in mind-body practices, and pain interference. Within the path analysis

model, optimism was found to have a significant main effect on problem-focused coping strategies, emotion-focused coping strategies, and engagement in mind-body practices, thus supporting hypotheses 1a, 1b, and 2, respectively. Overall, individuals with chronic musculoskeletal pain with high levels of optimism utilized problem-focused coping strategies more, utilized emotion-focused coping strategies less, and were more engaged in mind-body practices than individuals low in optimism. There is limited research examining whether higher levels of optimism can be tied to greater engagement in mind-body practices. However, individuals with higher levels of optimism have been found to engage in health-promoting behaviors like avoiding smoking, exercising, and eating more fruits and vegetables than individuals lower in optimism. One study demonstrated that more optimistic individuals were more willing to engage in complementary and alternative medicine, such as mind-body practices (Smith et al., 2008). Therefore, it could be deduced that these same individuals may be more likely to engage in other health-promoting activities such as yoga or tai-chi.

Consistent with previous research, higher levels of optimism were also associated with less pain interference in the current study. In a recent study, researchers found that patients with chronic pain who had higher levels of optimism also reported experiencing significantly less pain interference than those with lower levels of optimism during the Covid-19 pandemic (Wilson et al., 2022). With regard to coping strategies, a study conducted with individuals diagnosed with Parkinson's Disease found that optimism was positively correlated with both emotion-focused coping and problem-focused coping strategies (Anzaldi & Shifren, 2019). However, these findings may be due to how methods of coping were categorized through confirmatory factor analysis, as Anzaldi and

Shifren (2019) separated items by three factors to include problem-focused coping, emotion-focused coping, and avoidant coping for the COPE scale. The avoidance coping factor included items commonly categorized into emotion-focused coping strategies, such as self-distraction and venting. This differing categorization of coping strategies is a common trend amongst researchers in this area of literature and represents a limitation of the current study, as the ability to make generalizations about constructs is complicated.

The use of emotion-focused coping strategies was also positively associated with pain interference, thus providing support for hypothesis 6. Again, this finding may be related to the way in which the current study defined emotion-focused coping, as the literature is mixed on findings related to pain intensity and pain interference. For instance, in a recent online study with participants endorsing chronic pain, greater use of emotional approach coping, a specific emotion-focused coping strategy involving processing emotions, was significantly associated with lower pain intensity and pain interference for women only (Ziadni et al., 2020). In a separate study examining coping strategies, pain, and depressive symptoms among individuals with multiple sclerosis, researchers found low active and adaptive coping and high avoidant coping to moderate the effect of pain on depressive symptoms (Bradson et al., 2022). These researchers also used the COPE scale for their study; however, they categorized items from the scale differently from the traditional emotion-focused and problem-focused coping constructs. In addition to emotion-focused coping being significantly associated with pain interference, these coping strategies were also significantly associated with engagement in mind-body practices for the current study. However, the significant relationship between emotion-focused coping and engagement in mind-body practices was positive,

which is the opposite of what was proposed with hypothesis 4. It is possible that this relationship is displaying the positive aspects of emotion-focused coping, by one's attempt to tend to a problem by regulating their emotional response to it by engaging in health behaviors like mindfulness or yoga (Stanisławski, 2019). This is in opposition to the original theoretical use of problem-focused coping, which is thought to be tending to a problem causing distress by changing or altering it. By thinking of problem-focused coping in this way, it would make sense why attempting to solve a problem in this way would not encourage an individual to engage in another activity like mind-body practices.

Interestingly, although the relationship between emotion-focused coping and pain interference was supported, there was not a significant relationship between problem-focused coping and pain interference. Thus, hypothesis 5 was not supported. This finding conflicts with what is typically reported in the literature, with one study demonstrating that coping responses similar to those considered problem-focused coping were associated with lower pain ratings and better physical functioning for individuals with Parkinson's disease (Prell et al., 2021). It is possible that a factor of problem-focused coping that was included in this study but not in Prell and colleagues' study (Planning) contributed to these different outcomes. Although the COPE scale demonstrated adequate internal consistency for the current study, several newer scales assess coping strategies that are more commonly utilized by individuals with chronic pain. For instance, the Pain Coping Questionnaire examines coping with eight subscales including seeking social support, information seeking, positive self-statements, problem-solving, externalizing, internalizing/catastrophizing, cognitive distraction, and behavioral distraction (Reid et al., 1998).

Another surprising finding was that engagement in mind-body practices was not significantly associated with lower pain interference. Therefore, hypothesis 7 was not supported. In an intervention study examining the effects of chair yoga versus a health education program in individuals with osteoarthritis, researchers found that those in the chair yoga group had lower pain interference than those in the health education program (Park & Herron, 2021). Another study examining differences between a tai chi program and a separate exercise program for older adults with chronic multi-site pain demonstrated that tai chi was associated with significantly greater reductions in pain severity and interference when compared to the separate exercise program (You et al., 2018). A key point between these other studies and the current study is that the current study relied on self-reported use of these mind-body practices as opposed to a specific, structured, and standardized intervention incorporating these techniques.

Potential Pathways of Influence

Finally, hypothesis 8 was explored through the examination of indirect effects within the model. Individuals who were more optimistic reported less emotion-focused coping strategies, which was then related to less pain interference. This finding demonstrates the importance of dispositional optimism as a core factor of resilience in pain outcomes. The significant direct effect between dispositional optimism and pain interference also demonstrates the importance of this finding. Specifically, individuals who were more optimistic had significantly lower ratings of pain interference in comparison to those who were less optimistic, or more pessimistic. This is consistent with previous research demonstrating the predictive effect of optimism on pain interference (Martinez-Calderon et al., 2020).

Although this study was able to identify one important indirect effect between resilience factors related to pain interference, it is worth noting the paths within the model that were not significant. Specifically, although the indirect effect of optimism on pain interference through emotion-focused coping strategies was significant, the indirect effect of optimism on pain interference through problem-focused coping was not significant. Additionally, the indirect effects of optimism on pain interference through each individual coping strategy (problem-focused and emotion-focused) and engagement in mind-body practices were not significant. In sum, there are important relationships within the model to demonstrate the importance and interactions of these resilience factors; however, the underlying proposed path by which they might interact was not supported by the current study's design.

Limitations

Although the results of the present study provide valuable information about the importance and interaction of different factors of resilience, certain limitations should be mentioned. One particular limitation of the current study includes the method of assessment of study constructs. Specifically, the secondary data used for analyses in the current study were collected during a single time point of the MIDUS study; thus, this cross-sectional design allows for only correlational relationships to be examined between variables and not causational relationships indicated by a longitudinal study design. Additionally, participant level of engagement in mind-body practices was measured with the use of a two-item questionnaire created by the principal investigator of the current study, which had a Spearman-Brown coefficient of only 0.48. The suggested, acceptable Spearman-Brown coefficient and Cronbach's alpha range for assessment measures is

between 0.70 and 0.95 (Nunnally & Bernstein, 1994); therefore, this two-item measure is well below this cut-off. Additionally, these two items are particularly lengthy, asking participants if they have engaged in these activities "to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance wellness, or to prevent the onset of illness." It is possible that these items being so lengthy could have been distracting or confusing for participants, with several qualifying conditions for which the practices could be used.

Another limitation of the current study includes the limited evaluation of pain functioning among participants. The experience of chronic pain can be assessed in a variety of ways, including an individual's self-report of pain severity, location, intensity, and variability of pain over time (Fillingim et al., 2016). Although patients are most commonly asked how intense their pain is, individuals in the current study were not asked questions about pain severity or intensity. Additionally, the questions about pain interference used in the current study did not assess the degree to which participants' pain interfered with their physical activity level or ability to work. These questions could have provided information about disability status or other areas where pain can interfere with everyday living.

In general, these data were also significantly skewed. Attempts were made during the data analysis process to try to improve the normality of study variables; however, none of these attempts offered significant improvement to skew values or the findings from the path analysis computation. Again, this skew may be, in part, explained by the method by which certain constructs were assessed, especially mind-body practice engagement. These non-normal data may have led to an inappropriate or impaired

understanding of true relationships between study variables, especially the impact that behaviors truly have on pain interference amongst individuals with chronic musculoskeletal pain.

These data were collected between 2013 and 2014, which could have considerable implications for the constructs being investigated. For instance, research from the National Health Survey demonstrated that the use of certain mind-body therapies like tai-chi, qigong, and yoga increased from 5.8% in 2002 to 14.5% in 2017 among adults in the United States (Wang et al., 2019). In addition, because the original MIDUS study began in 1995 and continued through this current study's data from phase 3, several of the measures chosen in 1995 are now outdated, and more appropriate ways of assessing these important constructs have been created. For instance, although there are many studies supporting the COPE scale's various coping mechanisms for general life stressors, it does not capture the full range of coping skills commonly utilized by individuals suffering from chronic pain. This includes concepts like perceived self-efficacy, pain catastrophizing, and pain-specific acceptance.

Finally, the findings of this study may not be generalizable to the broader population. Over 88% of the participants from this study's sample identified as White. Researchers estimate that over half of America will be non-White identifying by 2044 (Colby & Ortman, 2015). Hispanic-identifying patients with rheumatoid arthritis have higher disease activity than Whites, and African Americans are less likely to have remission of symptoms than Whites (Greenberg et al., 2013); therefore, it is becoming increasingly important to understand the impact of protective factors such as psychological flexibility on chronic pain outcomes for racial and ethnic minorities. Thus,

more research is needed to examine the strength and association of these relationships for individuals of minoritized backgrounds.

Implications and Future Directions

Despite the limitations described above, there are several important implications for the findings of the current study. Future research should also attempt to replicate this study, especially to determine whether the path model with adequate fit for the current study sample is generalizable to other patient populations. These findings highlight the importance of dispositional optimism as a factor that is strongly associated with other factors of resilience in the lives of patients with chronic musculoskeletal pain. Optimism was significantly associated with age, multimorbidity, problem-focused coping, emotion-focused coping, engagement in mind-body practices, and pain interference. Considering that research has shown that dispositional optimism can be increased in individuals (Malouff & Schutte, 2017), future research should focus on ways to improve optimism specifically in individuals with chronic pain through intervention. Longitudinal research tracking these changes in optimism and its effect on pertinent outcome variables could further elucidate potential causal relationships.

In consideration of the limitations mentioned regarding methods of assessment for this study's constructs, future research should examine whether the proposed path analysis explaining the relationship between study variables would improve with measures more specifically designed for patients with chronic pain. It is possible that assessing for additional factors related to mind-body practice engagement, such as modifiable psychological and physical attributes through the use of these techniques,

might demonstrate associations with pain interference in ways that this study did not identify. Additionally, the various coping strategies assessed through the COPE scale have been categorized into several different subscales across the literature, making it challenging to compare and generalize research findings. Future research would benefit from identifying core coping strategies commonly used by individuals with chronic pain, (self-efficacy, pain catastrophizing, pain acceptance, etc.), to be able to examine relationships between study variables and make comparisons across studies regarding the true mechanisms of action on outcomes like pain interference.

Another important finding from the current study was the indirect relationship between optimism and pain interference through emotion-focused coping. This finding provides support for interventions targeting improvement of coping skills which can then be used to improve engagement in health behaviors, especially when working with patients that may be struggling with lower levels of optimism. Future research should examine the generalizability of these findings to determine whether this is true for other health behaviors including adherence to medication management or activities that could also be used to improve mental and physical health symptoms.

Conclusion

This study provides evidence for the importance of psychological factors of resilience, specifically dispositional optimism and emotion-focused coping strategies on overall pain interference for individuals diagnosed with a form of chronic musculoskeletal pain. Optimism, problem-focused coping, and emotion-focused coping were all found to be significantly associated with pain interference. Additionally, path analysis demonstrated ways in which these constructs directly and indirectly impact each

other. The results of this study should be used to inform future clinical and empirical research by emphasizing the importance of psychological and behavioral factors of resilience in our understanding of pain interference in musculoskeletal disorders contributing to chronic pain.

References

Abeler, K., Bergvik, S., Sand, T., & Friborg, O. (2021). Daily associations between sleep and pain in patients with chronic musculoskeletal pain. *Journal of Sleep Research*, *30*(4), e13237. https://doi.org/10.1111/jsr.13237

Amtmann, D., Cook, K. F., Jensen, M. P., Chen, W.-H., Choi, S., Revicki, D., Cella, D., Rothrock, N., Keefe, F., & Callahan, L. (2010). Development of A Promis Item Bank to Measure Pain Interference. *Pain*, *150*(1), 173–182. https://doi.org/10.1016/j.pain.2010.04.025

Anzaldi, K., & Shifren, K. (2019). Optimism, pessimism, coping, and depression: A study on individuals with Parkinson's Disease. *International Journal of Aging & Human Development*, *88*(3), 231–249. https://doi.org/10.1177/0091415018763401

Appelbaum, M., Cooper, H., Kline, R. B., Mayo-Wilson, E., Nezu, A. M., & Rao, S. M. (2018). Journal article reporting standards for quantitative research in psychology: The APA Publications and Communications Board task force report. *American Psychologist*, *73*(1), 3–25. https://doi.org/10.1037/amp0000191

Banth, S., & Ardebil, M. D. (2015). Effectiveness of mindfulness meditation on pain and quality of life of patients with chronic low back pain. *International Journal of Yoga*, *8*(2), 128–133. https://doi.org/10.4103/0973-6131.158476

Barbour, K. E. (2016). Prevalence of Severe Joint Pain Among Adults with Doctor-Diagnosed Arthritis—United States, 2002–2014. *MMWR. Morbidity and Mortality Weekly Report*, *65*. https://doi.org/10.15585/mmwr.mm6539a2

Bartley, E. J., Palit, S., & Staud, R. (2017). Predictors of osteoarthritis pain: The

importance of resilience. *Current Rheumatology Reports*, *19*(9). Scopus. https://doi.org/10.1007/s11926-017-0683-3

Bauer, D., & Curran, P. (2023). *Free Introduction to Structural Equation Modeling* [MOOC]. CenterStat. https://centerstat.org/structural-equation-modeling/

Bertisch, S. M., Wee, C. C., Phillips, R. S., & McCarthy, E. P. (2009). Alternative mind-body therapies used by adults with medical conditions. *Journal of Psychosomatic Research*, *66*(6), 511–519. https://doi.org/10.1016/j.jpsychores.2008.12.003

Bevers, K., Watts, L., Kishino, N., & Gatchel, R. (2016). The biopsychosocial model of the assessment, prevention, and treatment of chronic pain. *US Neurology*, *12*, 98. https://doi.org/10.17925/USN.2016.12.02.98

Bhattacharyya, K. K., Hueluer, G., Meng, H., & Hyer, K. (2021). Movement-based mind-body practices and cognitive function in middle-aged and older adults: Findings from the Midlife in the United States (MIDUS) study. *Complementary Therapies in Medicine*, *60*, 102751. https://doi.org/10.1016/j.ctim.2021.102751

Blyth, F. M., & Noguchi, N. (2017). Chronic musculoskeletal pain and its impact on older people. *Best Practice & Research Clinical Rheumatology*, *31*(2), 160–168. https://doi.org/10.1016/j.berh.2017.10.004

Boone, D., & Kim, S. Y. (2019). Family strain, depression, and somatic amplification in adults with chronic pain. *International Journal of Behavioral Medicine*, *26*(4), 427–436. https://doi.org/10.1007/s12529-019-09799-y

Bower, J. E., & Irwin, M. R. (2016). Mind-body therapies and control of inflammatory biology: A descriptive review. *Brain, Behavior, and Immunity*, *51*, 1–11. https://doi.org/10.1016/j.bbi.2015.06.012

Bradson, M. L., Cadden, M. H., Guty, E. T., Riegler, K. E., Thomas, G. A., Graham-Engeland, J. E., & Arnett, P. A. (2022). Coping style moderates the effect of pain on depression symptoms in Multiple Sclerosis. *Archives of Clinical Neuropsychology*, *37*(7), 1515–1526. https://doi.org/10.1093/arclin/acac025

Brougham, R. R., Zail, C. M., Mendoza, C. M., & Miller, J. R. (2009). Stress, sex differences, and coping strategies among college students. *Current Psychology*, *28*(2), 85–97. https://doi.org/10.1007/s12144-009-9047-0

Brown, G. K., Nicassio, P. M., & Wallston, K. A. (1989). Pain coping strategies and depression in rheumatoid arthritis. *Journal of Consulting and Clinical Psychology*, *57*(5), 652–657. https://doi.org/10.1037//0022-006x.57.5.652

Brown, T. T., Partanen, J., Chuong, L., Villaverde, V., Chantal Griffin, A., & Mendelson, A. (2018). Discrimination hurts: The effect of discrimination on the development of chronic pain. *Social Science & Medicine (1982)*, *204*, 1–8. https://doi.org/10.1016/j.socscimed.2018.03.015

Butchart, A., Kerr, E. A., Heisler, M., Piette, J. D., & Krein, S. L. (2009). Experience and management of chronic pain among patients with other complex chronic conditions. *The Clinical Journal of Pain*, *25*(4), 293–298. https://doi.org/10.1097/AJP.0b013e31818bf574

Carver, C. S., & Connor-Smith, J. (2010). Personality and coping. *Annual Review of Psychology*, *61*, 679–704. https://doi.org/10.1146/annurev.psych.093008.100352

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267–283. https://doi.org/10.1037//0022-3514.56.2.267

Cholankeril, R., Xiang, E., & Badr, H. (2023). Gender differences in coping and psychological adaptation during the Covid-19 pandemic. *International Journal of Environmental Research and Public Health, 20*(2), 993. https://doi.org/10.3390/ijerph20020993

Chowdhury, S. R., Das, D. C., Sunna, T. C., Beyene, J., & Hossain, A. (2023). Global and regional prevalence of multimorbidity in the adult population in community settings: A systematic review and meta-analysis. *EClinicalMedicine, 57*. https://doi.org/10.1016/j.eclinm.2023.101860

Cimas, M., Ayala, A., Sanz, B., Agulló-Tomás, M. S., Escobar, A., & Forjaz, M. J. (2018). Chronic musculoskeletal pain in European older adults: Cross-national and gender differences. *European Journal of Pain*, *22*(2), 333–345. https://doi.org/10.1002/ejp.1123

Cimmino, M. A., Ferrone, C., & Cutolo, M. (2011). Epidemiology of chronic musculoskeletal pain. *Best Practice & Research Clinical Rheumatology*, *25*(2), 173–183. https://doi.org/10.1016/j.berh.2010.01.012

Cohen, S. P., Vase, L., & Hooten, W. M. (2021). Chronic pain: An update on burden, best practices, and new advances. *The Lancet*, *397*(10289), 2082–2097. https://doi.org/10.1016/S0140-6736(21)00393-7

Colby, S.L., & Ortman, J.M. (2015). Projections of the size and composition of the U.S. population: 2014 to 2060. U.S. Census Bureau.

Cross, M., Smith, E., Hoy, D., Nolte, S., Ackerman, I., Fransen, M., Bridgett, L., Williams, S., Guillemin, F., Hill, C. L., Laslett, L. L., Jones, G., Cicuttini, F., Osborne, R., Vos, T., Buchbinder, R., Woolf, A., & March, L. (2014). The global

burden of hip and knee osteoarthritis: Estimates from the global burden of disease 2010 study. *Annals of the Rheumatic Diseases*, *73*(7), 1323–1330. https://doi.org/10.1136/annrheumdis-2013-204763

Cruz-Almeida, Y., King, C. D., Goodin, B. R., Sibille, K. T., Glover, T. L., Riley, J. L., Sotolongo, A., Herbert, M. S., Schmidt, J., Fessler, B. J., Redden, D. T., Staud, R., Bradley, L. A., & Fillingim, R. B. (2013). Psychological profiles and pain characteristics of older adults with knee osteoarthritis. *Arthritis Care & Research*, *65*(11), 1786–1794. https://doi.org/10.1002/acr.22070

Dahlhamer, J. (2018). Prevalence of Chronic Pain and High-Impact Chronic Pain Among Adults—United States, 2016. *MMWR. Morbidity and Mortality Weekly Report*, *67*. https://doi.org/10.15585/mmwr.mm6736a2

Daut, R. L., Cleeland, C. S., & Flanery, R. C. (1983). Development of the Wisconsin Brief Pain Questionnaire to assess pain in cancer and other diseases. *Pain*, *17*(2), 197–210. https://doi.org/10.1016/0304-3959(83)90143-4

Delaney, L. D., Clauw, D. J., & Waljee, J. F. (2020). The management of acute pain for musculoskeletal conditions: The challenges of opioids and opportunities for the future. *The Journal of Bone and Joint Surgery. American Volume*, *102 Suppl 1*, 3–9. https://doi.org/10.2106/JBJS.20.00228

De Rooij, A., De Boer, M. R., Van Der Leeden, M., Roorda, L. D., Steultjens, M. P. M., & Dekker, J. (2014). Cognitive mechanisms of change in multidisciplinary treatment of patients with chronic widespread pain: A prospective cohort study. *Journal of Rehabilitation Medicine*, *46*(2), 173–180. Scopus. https://doi.org/10.2340/16501977-1252

Dueñas, M., Ojeda, B., Salazar, A., Mico, J. A., & Failde, I. (2016). A review of chronic pain impact on patients, their social environment and the health care system. *Journal of Pain Research*, *9*, 457–467. https://doi.org/10.2147/JPR.S105892

Edwards, R. R., Dworkin, R. H., Sullivan, M. D., Turk, D. C., & Wasan, A. D. (2016). The Role of Psychosocial Processes in the Development and Maintenance of Chronic Pain. *The Journal of Pain*, *17*(9, Supplement), T70–T92. https://doi.org/10.1016/j.jpain.2016.01.001

Eggermont, L. H. P., Leveille, S. G., Shi, L., Kiely, D. K., Shmerling, R. H., Jones, R. N., Guralnik, J. M., & Bean, J. F. (2014). Pain characteristics associated with the onset of disability in older adults: The maintenance of balance, independent living, intellect, and zest in the elderly Boston study. *Journal of the American Geriatrics Society*, *62*(6), 1007–1016. Scopus. https://doi.org/10.1111/jgs.12848

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*, *8*(3), 430–457. https://doi.org/10.1207/S15328007SEM0803_5

Englbrecht, M., Gossec, L., DeLongis, A., Scholte-Voshaar, M., Sokka, T., Kvien, T. K., & Schett, G. (2012). The impact of coping strategies on mental and physical well-being in patients with rheumatoid arthritis. *Seminars in Arthritis and Rheumatism*, *41*(4), 545–555. https://doi.org/10.1016/j.semarthrit.2011.07.009

Fillingim, R. B., Loeser, J. D., Baron, R., & Edwards, R. R. (2016). Assessment of chronic pain: Domains, methods, and mechanisms. *The Journal of Pain*, *17*(9 Suppl), T10-20. https://doi.org/10.1016/j.jpain.2015.08.010

Francis, A. L., & Beemer, R. C. (2019). How does yoga reduce stress? Embodied cognition and emotion highlight the influence of the musculoskeletal system. *Complementary Therapies in Medicine*, *43*, 170–175. https://doi.org/10.1016/j.ctim.2019.01.024

Gagnon, R., Perreault, K., Guertin, J. R., Berthelot, S., Achou, B., & Hébert, L. J. (2022). Health-related quality of life of patients presenting to the emergency department with a musculoskeletal disorder. *ClinicoEconomics and Outcomes Research*, *14*, 91–103. Scopus. https://doi.org/10.2147/CEOR.S348138

Galiana, L., Tomás, J. M., Fernández, I., & Oliver, A. (2020). Predicting well-being among the elderly: The role of coping strategies. *Frontiers in Psychology*, *11*, 616. https://doi.org/10.3389/fpsyg.2020.00616

Gallagher, M. W., Long, L. J., Richardson, A., & D'Souza, J. M. (2019). Resilience and coping in cancer survivors: The unique effects of optimism and mastery. *Cognitive Therapy and Research*, *43*(1), 32–44. https://doi.org/10.1007/s10608-018-9975-9

Gaskin, D. J., & Richard, P. (2012). The economic costs of pain in the United States. *The Journal of Pain*, *13*(8), 715–724. https://doi.org/10.1016/j.jpain.2012.03.009

Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N., & Turk, D. C. (2007). The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin*, *133*(4), 581–624. https://doi.org/10.1037/0033-2909.133.4.581

Gawronski, K. A. B., Kim, E. S., Langa, K. M., & Kubzansky, L. D. (2016). Dispositional optimism and incidence of cognitive impairment in older adults.

Psychosomatic Medicine, *78*(7), 819–828. https://doi.org/10.1097/PSY.0000000000000345

Gok Metin, Z., Karadas, C., Izgu, N., Ozdemir, L., & Demirci, U. (2019). Effects of progressive muscle relaxation and mindfulness meditation on fatigue, coping styles, and quality of life in early breast cancer patients: An assessor blinded, three-arm, randomized controlled trial. *European Journal of Oncology Nursing*, *42*, 116–125. https://doi.org/10.1016/j.ejon.2019.09.003

Goodin, B. R., & Bulls, H. W. (2013). Optimism and the experience of pain: Benefits of seeing the glass as half full. *Current Pain and Headache Reports*, *17*(5), 329. https://doi.org/10.1007/s11916-013-0329-8

Greenberg, J. D., Spruill, T. M., Shan, Y., Reed, G., Kremer, J. M., Potter, J., Yazici, Y., Ogedegbe, G., & Harrold, L. R. (2013). Racial and ethnic disparities in disease activity in patients with rheumatoid arthritis. *The American Journal of Medicine*, *126*(12), 1089–1098. https://doi.org/10.1016/j.amjmed.2013.09.002

Hassett, A. L., & Finan, P. H. (2016). The role of resilience in the clinical management of chronic pain. *Current Pain and Headache Reports*, *20*(6), 39. https://doi.org/10.1007/s11916-016-0567-7

Hoyle, R. H. (2023). *Handbook of structural equation modeling*. Guilford Press.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hunter, T. M., Boytsov, N. N., Zhang, X., Schroeder, K., Michaud, K., & Araujo, A. B. (2017). Prevalence of rheumatoid arthritis in the United States adult population in healthcare claims databases, 2004–2014. *Rheumatology International*, *37*(9), 1551–1557. https://doi.org/10.1007/s00296-017-3726-1

Jensen, M. P., Romano, J. M., Turner, J. A., Good, A. B., & Wald, L. H. (1999). Patient beliefs predict patient functioning: Further support for a cognitive-behavioural model of chronic pain. *Pain*, *81*(1), 95–104. https://doi.org/10.1016/S0304-3959(99)00005-6

Judge, S. T., Clasey, J. L., Crofford, L. J., & Segerstrom, S. C. (2020). Optimism and pain interference in aging women. *Annals of Behavioral Medicine*, *54*(3), 202–212. https://doi.org/10.1093/abm/kaz040

Jumbo, S. U., MacDermid, J. C., Kalu, M. E., Packham, T. L., Athwal, G. S., & Faber, K. J. (2021). Measurement properties of the brief pain inventory-short form (BPI-SF) and revised short McGill pain questionnaire version-2 (SF-MPQ-2) in pain-related musculoskeletal conditions: A systematic review. *The Clinical Journal of Pain*, *37*(6), 454–474. https://doi.org/10.1097/AJP.0000000000000933

Keefe, F. J., & Somers, T. J. (2010). Psychological approaches to understanding and treating arthritis pain. *Nature Reviews. Rheumatology*, *6*(4), 210–216. https://doi.org/10.1038/nrrheum.2010.22

Kelly, M. M., Tyrka, A. R., Price, L. H., & Carpenter, L. L. (2008). Sex differences in the use of coping strategies: Predictors of anxiety and depressive symptoms. *Depression and Anxiety*, *25*(10), 839–846. https://doi.org/10.1002/da.20341

Kemani, M. K., Zetterqvist, V., Kanstrup, M., Holmström, L., & Wicksell, R. K. (2016). A validation of the pain interference index in adults with long-standing pain. *Acta Anaesthesiologica Scandinavica*, *60*(2), 250–258. https://doi.org/10.1111/aas.12599

Koren, Y., Leveille, S. G., & You, T. (2022). Brief pain inventory pain interference subscale: Assessing interference with daily living activities in older adults with multisite musculoskeletal pain. *Frontiers in Pain Research*, *3*. https://doi.org/10.3389/fpain.2022.897725

Kroenke, K., Krebs, E. E., Turk, D., Von Korff, M., Bair, M. J., Allen, K. D., Sandbrink, F., Cheville, A. L., DeBar, L., Lorenz, K. A., & Kerns, R. D. (2019). Core outcome measures for chronic musculoskeletal pain research: Recommendations from a veterans health administration work group. *Pain Medicine (Malden, Mass.)*, *20*(8), 1500–1508. https://doi.org/10.1093/pm/pny279

Kwissa-Gajewska, Z., Olesińska, M., & Tomkiewicz, A. (2014). Optimism, pain coping strategies and pain intensity among women with rheumatoid arthritis. *Reumatologia*, *52*(3), 166–171. Scopus. https://doi.org/10.5114/reum.2014.44086

la Cour, P., & Petersen, M. (2015). Effects of mindfulness meditation on chronic pain: A randomized controlled trial. *Pain Medicine (Malden, Mass.)*, *16*(4), 641–652. https://doi.org/10.1111/pme.12605

Laires, P. A., Canhão, H., Rodrigues, A. M., Eusébio, M., Gouveia, M., & Branco, J. C. (2018). The impact of osteoarthritis on early exit from work: Results from a population-based study. *BMC Public Health*, *18*(1). Scopus. https://doi.org/10.1186/s12889-018-5381-1

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Pub. Co.

Lentz, T. A., Harman, J. S., Marlow, N. M., Beneciuk, J. M., Fillingim, R. B., & George, S. Z. (2019). Factors associated with persistently high-cost health care utilization for musculoskeletal pain. *PLoS ONE, 14*(11). Scopus. https://doi.org/10.1371/journal.pone.0225125

Malouff, J. M., & Schutte, N. S. (2017). Can psychological interventions increase optimism? A meta-analysis. *The Journal of Positive Psychology*, *12*(6), 594–604. https://doi.org/10.1080/17439760.2016.1221122

Martinez-Calderon, J., Flores-Cortes, M., Clavero-Cano, S., Morales-Asencio, J. M., Jensen, M. P., Rondon-Ramos, A., Diaz-Cerrillo, J. L., Ariza-Hurtado, G. R., & Luque-Suarez, A. (2020). The role of positive psychological factors in the association between pain intensity and pain interference in individuals with chronic musculoskeletal pain: A cross-sectional study. *Journal of Clinical Medicine, 9*(10), 3252. https://doi.org/10.3390/jcm9103252

McCracken, L. M., & Morley, S. (2014). The psychological flexibility model: A basis for integration and progress in psychological approaches to chronic pain management. *The Journal of Pain: Official Journal of the American Pain Society*, *15*(3), 221–234. https://doi.org/10.1016/j.jpain.2013.10.014

Meier, D. E., Emmons, C.-A., Litke, A., Wallenstein, S., & Morrison, R. S. (2003). Characteristics of patients requesting and receiving physician-assisted death. *Archives of Internal Medicine, 163*(13), 1537–1542. https://doi.org/10.1001/archinte.163.13.1537

Meints, S. M., & Edwards, R. R. (2018). Evaluating psychosocial contributions to chronic pain outcomes. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, *87*(Pt B), 168–182. https://doi.org/10.1016/j.pnpbp.2018.01.017

Miaskowski, C., Blyth, F., Nicosia, F., Haan, M., Keefe, F., Smith, A., & Ritchie, C. (2020). A biopsychosocial model of chronic pain for older adults. *Pain Medicine*, *21*(9), 1793–1805. https://doi.org/10.1093/pm/pnz329

Molton, I. R., & Terrill, A. L. (2014). Overview of persistent pain in older adults. *American Psychologist*, *69*(2), 197–207. https://doi.org/10.1037/a0035794

Moonaz, S. H., Bingham, C. O., Wissow, L., & Bartlett, S. J. (2015). Yoga in sedentary adults with arthritis: Effects of a randomized controlled pragmatic trial. *Journal of Rheumatology*, *42*(7), 1194–1202. Scopus. https://doi.org/10.3899/jrheum.141129

Murphy, S. L., Schepens Niemiec, S., Lyden, A. K., & Kratz, A. L. (2016). Pain, fatigue, and physical activity in osteoarthritis: The moderating effects of pain- and fatigue-related activity interference. *Archives of Physical Medicine and Rehabilitation*, *97*(9, Supplement), S201–S209. https://doi.org/10.1016/j.apmr.2015.05.025

Murray, C. B., Patel, K. V., Twiddy, H., Sturgeon, J. A., & Palermo, T. M. (2021). Age differences in cognitive-affective processes in adults with chronic pain. *European Journal of Pain (London, England)*, *25*(5), 1041–1052. https://doi.org/10.1002/ejp.1725

Myasoedova, E., Davis, J., Matteson, E. L., & Crowson, C. S. (2020). Is the epidemiology of rheumatoid arthritis changing? Results from a population-based

incidence study, 1985–2014. *Annals of the Rheumatic Diseases*, *79*(4), 440–444. https://doi.org/10.1136/annrheumdis-2019-216694

Nowell, W. B., Gavigan, K., Kannowski, C. L., Cai, Z., Hunter, T., Venkatachalam, S., Birt, J., Workman, J., & Curtis, J. R. (2021). Which patient-reported outcomes do rheumatology patients find important to track digitally? A real-world longitudinal study in ArthritisPower. *Arthritis Research and Therapy*, *23*(1). Scopus. https://doi.org/10.1186/s13075-021-02430-0

Nunnally, J., Bernstein, L. (1994). *Psychometric theory*. McGraw-Hill

Park, J., & Herron, C. (2021). Effects of a movement-based mind-body intervention in managing symptoms in older adults with osteoarthritis: Gender, age, and living arrangement differences. *Alternative and Complementary Therapies*, *27*(3), 111–123. https://doi.org/10.1089/act.2021.29326.jpa

Park, J., McCaffrey, R., Newman, D., Liehr, P., & Ouslander, J. G. (2017). A pilot randomized controlled trial of the effects of chair yoga on pain and physical function among community-dwelling older adults with lower extremity osteoarthritis. *Journal of the American Geriatrics Society*, *65*(3), 592–597. https://doi.org/10.1111/jgs.14717

Parra-Delgado, M., & Latorre-Postigo, J. M. (2013). Effectiveness of mindfulness-based cognitive therapy in the treatment of fibromyalgia: A randomized trial. *Cognitive Therapy and Research*, *37*(5), 1015–1026. https://doi.org/10.1007/s10608-013-9538-z

Penny, K. I. (1996). Appropriate critical values when testing for a single multivariate

outlier by using the Mahalanobis distance. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, *45*(1), 73–81. https://doi.org/10.2307/2986224

Perrot, S., Cohen, M., Barke, A., Korwisi, B., Rief, W., Treede, R.-D., & IASP Taskforce for the classification of chronic pain. (2019). The IASP classification of chronic pain for ICD-11: Chronic secondary musculoskeletal pain. *Pain*, *160*(1), 77–82. https://doi.org/10.1097/j.pain.0000000000001389

Pinto, P. R., McIntyre, T., Araújo-Soares, V., Costa, P., Ferrero, R., & Almeida, A. (2017). A comparison of predictors and intensity of acute postsurgical pain in patients undergoing total hip and knee arthroplasty. *Journal of Pain Research*, *10*, 1087–1098. https://doi.org/10.2147/JPR.S126467

Prell, T., Liebermann, J. D., Mendorf, S., Lehmann, T., & Zipprich, H. M. (2021). Pain coping strategies and their association with quality of life in people with Parkinson's disease: A cross-sectional study. *PLoS ONE*, *16*(11), e0257966. https://doi.org/10.1371/journal.pone.0257966

Radler, B., T. (2014). The midlife in the United States (MIDUS) series: A national longitudinal study of health and well-being. *Open Health Data*, *2*(1), e3. https://doi.org/10.5334/ohd.ai

Radler, B. T., & Ryff, C. D. (2010). Who Participates? Longitudinal Retention in the MIDUS National Study of Health and Well-Being. *Journal of Aging and Health*, *22*(3), 307–331. https://doi.org/10.1177/0898264309358617

Reid, G. J., Gilbert, C. A., & McGrath, P. J. (1998). The pain coping questionnaire: Preliminary validation. *Pain*, *76*(1), 83–96. https://doi.org/10.1016/S0304-3959(98)00029-3

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*, 1–36. https://doi.org/10.18637/jss.v048.i02

Rozanski, A., Bavishi, C., Kubzansky, L. D., & Cohen, R. (2019). Association of Optimism with cardiovascular events and all-cause mortality. *JAMA Network Open*, *2*(9), e1912200. https://doi.org/10.1001/jamanetworkopen.2019.12200

Rzewuska, M., Mallen, C. D., Strauss, V. Y., Belcher, J., & Peat, G. (2015). One-year trajectories of depression and anxiety symptoms in older patients presenting in general practice with musculoskeletal pain: A latent class growth analysis. *Journal of Psychosomatic Research*, *79*(3), 195–201. Scopus. https://doi.org/10.1016/j.jpsychores.2015.05.016

Scheier, M. F., & Carver, C. S. (2018). Dispositional optimism and physical health: A long look back, a quick look forward. *The American Psychologist*, *73*(9), 1082–1094. https://doi.org/10.1037/amp0000384

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*(6), 1063–1078. https://doi.org/10.1037//0022-3514.67.6.1063

Scherer, M., Hansen, H., Gensichen, J., Mergenthal, K., Riedel-Heller, S., Weyerer, S., Maier, W., Fuchs, A., Bickel, H., Schön, G., Wiese, B., König, H.-H., van den Bussche, H., & Schäfer, I. (2016). Association between multimorbidity patterns and chronic pain in elderly primary care patients: A cross-sectional observational study. *BMC Family Practice*, *17*, 68. https://doi.org/10.1186/s12875-016-0468-1

Schett, G., Kleyer, A., Perricone, C., Sahinbegovic, E., Iagnocco, A., Zwerina, J.,

Lorenzini, R., Aschenbrenner, F., Berenbaum, F., D'Agostino, M.-A., Willeit, J., & Kiechl, S. (2013). Diabetes is an independent predictor for severe osteoarthritis: Results from a longitudinal cohort study. *Diabetes Care*, *36*(2), 403–409. https://doi.org/10.2337/dc12-0924

Schiavenato, M., & Craig, K. D. (2010). Pain assessment as a social transaction: Beyond the "gold standard." *The Clinical Journal of Pain*, *26*(8), 667–676. https://doi.org/10.1097/AJP.0b013e3181e72507

Senders, A., Borgatti, A., Hanes, D., & Shinto, L. (2018). Association between pain and mindfulness in multiple sclerosis. *International Journal of MS Care*, *20*(1), 28–34. https://doi.org/10.7224/1537-2073.2016-076

Shah, D., Zhao, X., Wei, W., Gandhi, K., Dwibedi, N., Webster, L., & Sambamoorthi, U. (2020). A longitudinal study of the association of opioid use with change in pain interference and functional limitations in a nationally representative cohort of adults with osteoarthritis in the United States. *Advances in Therapy*, *37*(2), 819–832. https://doi.org/10.1007/s12325-019-01200-4

Sharma, M. (2014). Yoga as an alternative and complementary approach for stress management: A systematic review. *Journal of Evidence-Based Complementary & Alternative Medicine*, *19*(1), 59–67. https://doi.org/10.1177/2156587213503344

Slepian, P. M., Ankawi, B., & France, C. R. (2020). Longitudinal analysis supports a fear avoidance model that incorporates pain resilience alongside pain catastrophizing. *Annals of Behavioral Medicine*, *54*(5), 335–345. https://doi.org/10.1093/abm/kaz051

Smith, B. W., Dalen, J., Wiggins, K. T., Christopher, P. J., Bernard, J. F., & Shelley, B.

M. (2008). Who is willing to use complementary and alternative medicine? *Explore (New York, N.Y.)*, *4*(6), 359–367. https://doi.org/10.1016/j.explore.2008.08.001

Stamm, T. A., Pieber, K., Crevenna, R., & Dorner, T. E. (2016). Impairment in the activities of daily living in older adults with and without osteoporosis, osteoarthritis and chronic back pain: A secondary analysis of population-based health survey data. *BMC Musculoskeletal Disorders*, *17*(1), 139. https://doi.org/10.1186/s12891-016-0994-y

Stanisławski, K. (2019). The coping circumplex model: An integrative model of the Structure of coping with stress. *Frontiers in Psychology*, *10*, 694. https://doi.org/10.3389/fpsyg.2019.00694

Sturgeon, J. A., & Zautra, A. J. (2010). Resilience: A new paradigm for adaptation to Chronic pain. *Current Pain and Headache Reports*, *14*(2), 105–112. https://doi.org/10.1007/s11916-010-0095-9

Tabachnick, B., & Fidell, L. (2018). *Using Multivariate Statistics* (7th edition). Pearson.

Thomas, E., Peat, G., Harris, L., Wilkie, R., & Croft, P. R. (2004). The prevalence of pain and pain interference in a general population of older adults: Cross-sectional findings from the North Staffordshire Osteoarthritis Project (NorStOP). *Pain*, *110*(1–2), 361–368. https://doi.org/10.1016/j.pain.2004.04.017

Treede, R.-D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers, S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Korwisi, B., Kosek, E., Lavand'homme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., … Wang, S.-J. (2019). Chronic pain as a symptom or a disease: The IASP

Classification of Chronic Pain for the International Classification of Diseases (ICD-11). *PAIN*, *160*(1), 19–27. https://doi.org/10.1097/j.pain.0000000000001384

Treede, R.-D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers, S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Kosek, E., Lavand'homme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., Smith, B. H., … Wang, S.-J. (2015). A classification of chronic pain for ICD-11. *Pain*, *156*(6), 1003–1007. https://doi.org/10.1097/j.pain.0000000000000160

Turk, D. C., Fillingim, R. B., Ohrbach, R., & Patel, K. V. (2016). Assessment of psychosocial and functional impact of chronic pain. *The Journal of Pain*, *17*(9 Suppl), T21-49. https://doi.org/10.1016/j.jpain.2016.02.006

Turk, D. C., Meichenbaum, D., & Genest, M. (1987) *Pain and Behavioral Medicine: A cognitive-behavioral perspective*. Guilford Press.

Upchurch, D. M., & Johnson, P. J. (2019). Gender differences in prevalence, patterns, purposes, and perceived benefits of meditation practices in the United States. *Journal of Women's Health*, *28*(2), 135–142. https://doi.org/10.1089/jwh.2018.7178

Wahbeh, H., Elsas, S.-M., & Oken, B. S. (2008). Mind-body interventions: Applications in neurology. *Neurology*, *70*(24), 2321–2328. https://doi.org/10.1212/01.wnl.0000314667.16386.5e

Wang, C. (Chunyun), Li, K., Choudhury, A., & Gaylord, S. (2019). Trends in yoga, tai chi, and qigong use among US adults, 2002–2017. *American Journal of Public Health*, *109*(5), 755–761. https://doi.org/10.2105/AJPH.2019.304998

Wilson, M. (2014). Integrating the concept of pain interference into pain management. *Pain Management Nursing*, *15*(2), 499–505. https://doi.org/10.1016/j.pmn.2011.06.004

Wilson, J. M., Colebaugh, C. A., Flowers, K. M., Edwards, R. R., & Schreiber, K. L. (2022). Profiles of risk and resilience in chronic pain: Loneliness, social support, mindfulness, and optimism coming out of the first pandemic year. *Pain Medicine: The Official Journal of the American Academy of Pain Medicine*, *23*(12), 2010–2021. https://doi.org/10.1093/pm/pnac079

Xu, N., Zhao, S., Xue, H., Fu, W., Liu, L., Zhang, T., Huang, R., & Zhang, N. (2017). Associations of perceived social support and positive psychological resources with fatigue symptom in patients with rheumatoid arthritis. *PloS One*, *12*(3), e0173293. https://doi.org/10.1371/journal.pone.0173293

You, J., Fung, H. H. L., & Isaacowitz, D. M. (2009). Age differences in dispositional optimism: A cross-cultural study. *European Journal of Ageing*, *6*(4), 247. https://doi.org/10.1007/s10433-009-0130-z

You, T., Ogawa, E. F., Thapa, S., Cai, Y., Zhang, H., Nagae, S., Yeh, G. Y., Wayne, P. M., Shi, L., & Leveille, S. G. (2018). Tai Chi for older adults with chronic multisite pain: A randomized controlled pilot study. *Aging Clinical and Experimental Research*, *30*(11), 1335–1343. https://doi.org/10.1007/s40520-018-0922-0

You, D. S., Ziadni, M. S., Hettie, G., Darnall, B. D., Cook, K. F., Von Korff, M. R., & Mackey, S. C. (2022). Comparing perceived pain impact between younger and older adults with high impact chronic pain: A cross-sectional qualitative and

quantitative survey. *Frontiers in Pain Research*, *3*. https://doi.org/10.3389/fpain.2022.850713

Younge, J. O., Gotink, R. A., Baena, C. P., Roos-Hesselink, J. W., & Hunink, M. M. (2015). Mind–body practices for patients with cardiac disease: A systematic review and meta-analysis. *European Journal of Preventive Cardiology*, *22*(11), 1385–1398. https://doi.org/10.1177/2047487314549927

Zhang, W. (2021). Predicting symptom severities in middle-aged and older adults with arthritis and multimorbidity. *Innovation in Aging*, *5*(Suppl 1), 185. https://doi.org/10.1093/geroni/igab046.705

Zhang, Y., & Jordan, J. M. (2010). Epidemiology of Osteoarthritis. *Clinics in Geriatric Medicine*, *26*(3), 355–369. https://doi.org/10.1016/j.cger.2010.03.001

Zhao, F., Suhonen, R., Katajisto, J., & Leino-Kilpi, H. (2019). Factors associated with subsequent diabetes-related self-care activities: The role of social support and optimism. *Nursing Open*, *7*(1), 195–205. https://doi.org/10.1002/nop2.379

Ziadni, M. S., You, D. S., Johnson, L., Lumley, M. A., & Darnall, B. D. (2020). Emotions matter: The role of emotional approach coping in chronic pain. *European Journal of Pain (London, England)*, *24*(9), 1775–1784. https://doi.org/10.1002/ejp.1625

Figure 1

Conceptual Model for Hypothesized Relations Between Study Variables

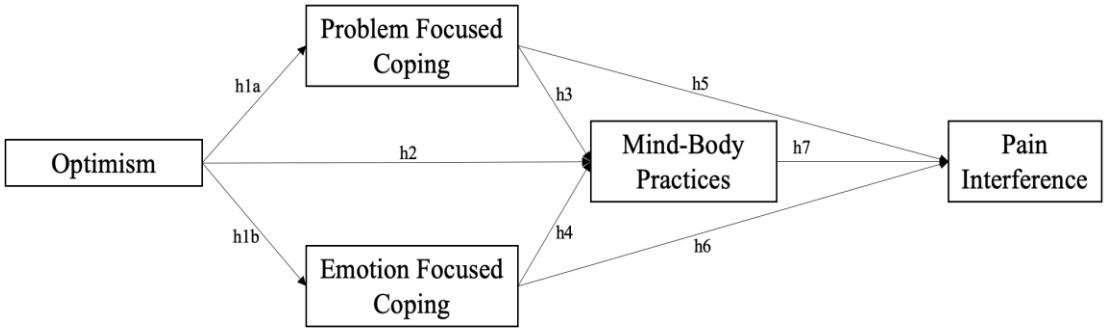


Figure 2

Assumptions of Path Analysis

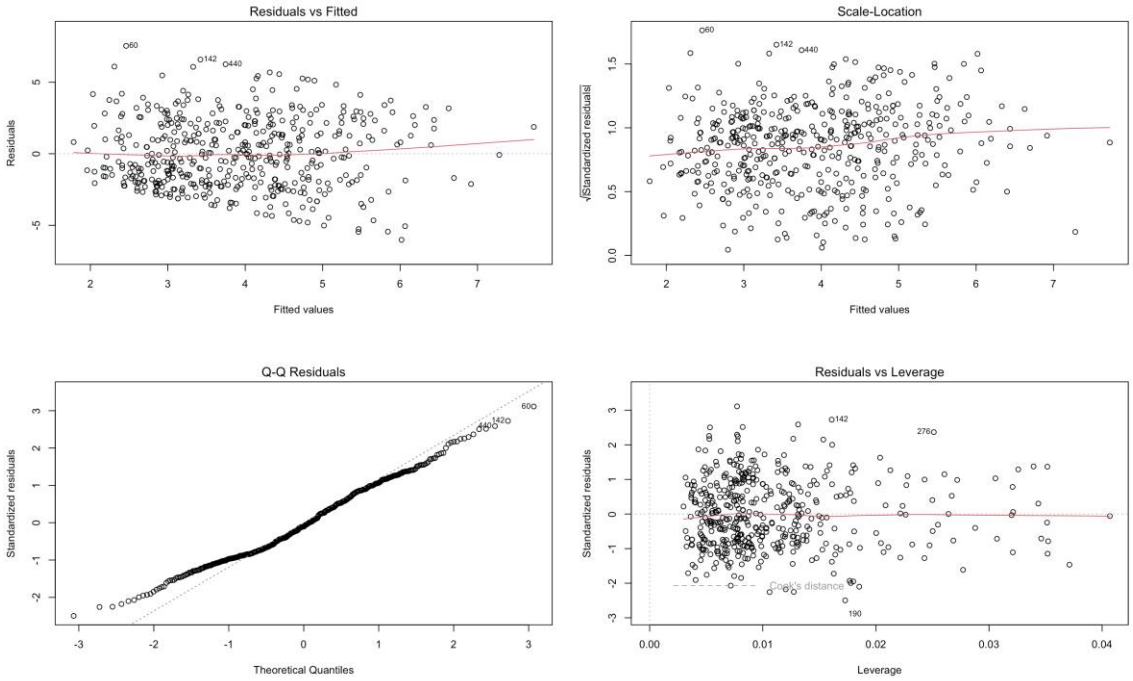


Figure 3

Path Analysis Model with Covariates Total Chronic Conditions and Age

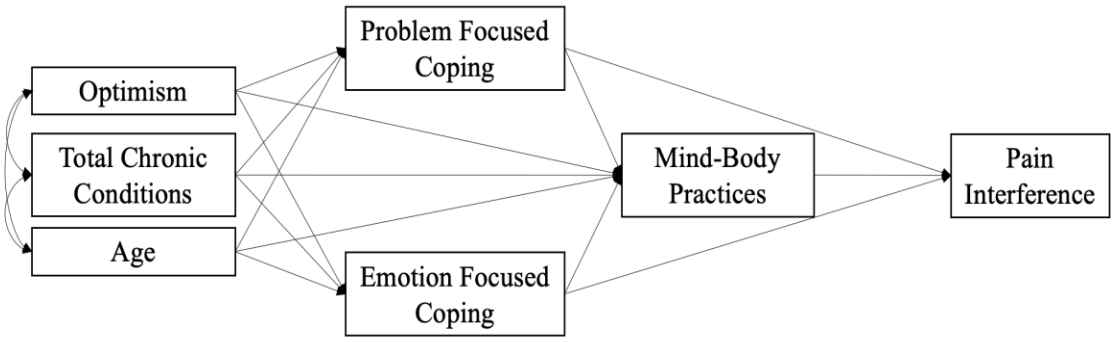
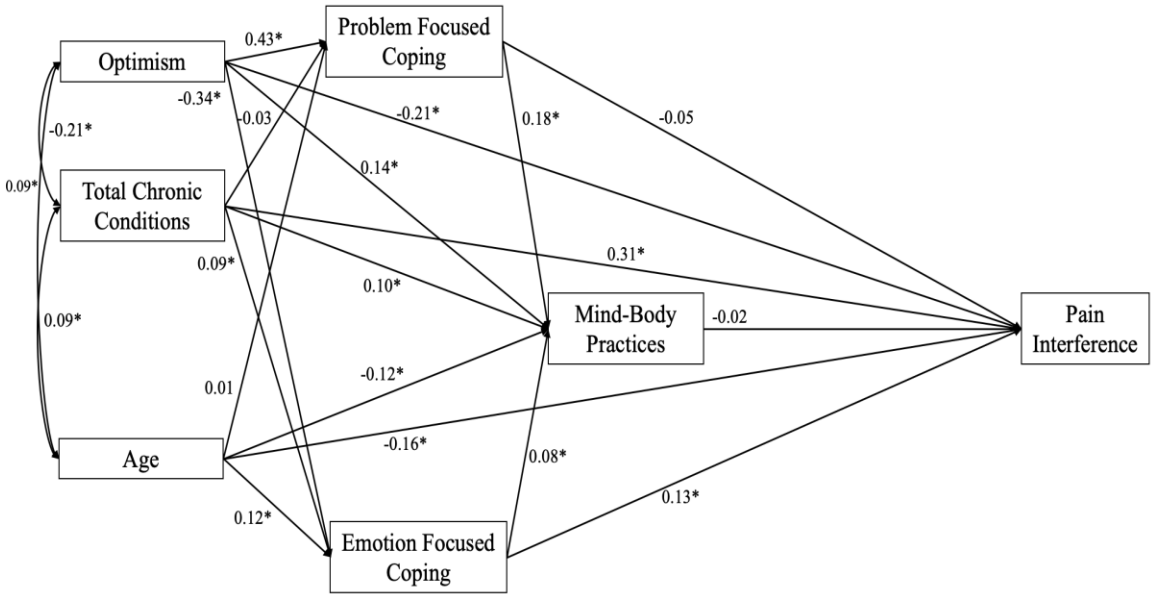


Figure 4

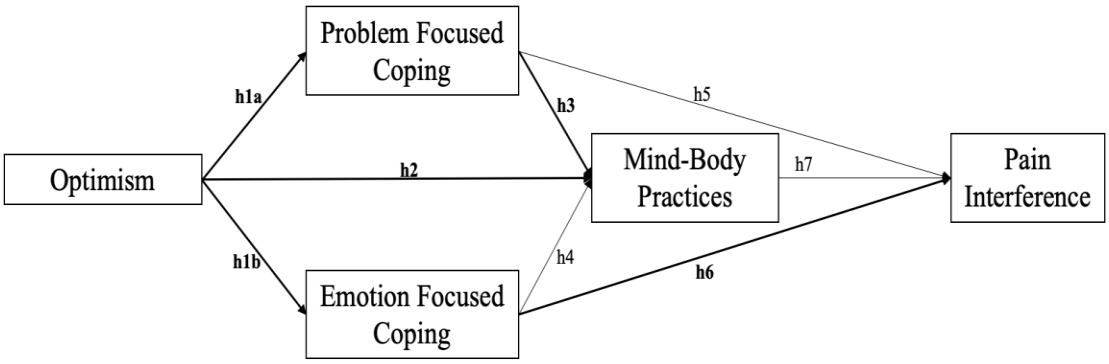
Nested Path Analysis Model with Recommended Modification Indices Accounting for Effects of Optimism, Total Chronic Conditions, and Age on Pain Interference



Note. * = significant path coefficients.

Figure 5

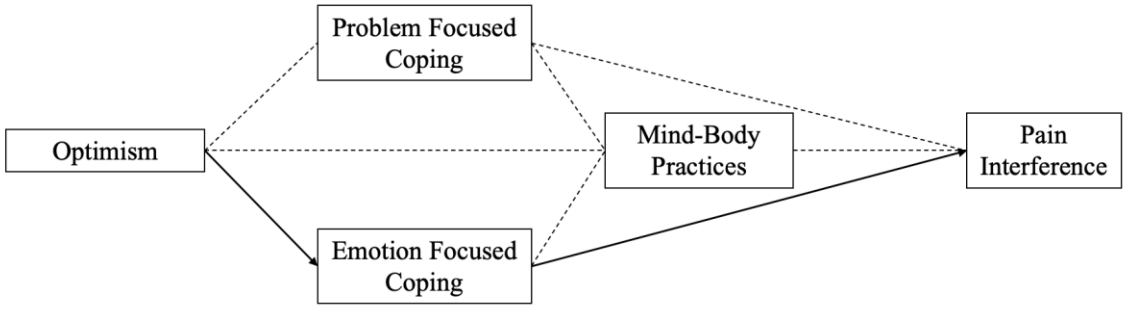
Original Hypothesized Path Analysis Model of Study Variables



Note. Bolded paths represent supported whereas nonbolded represent rejected hypotheses.

Figure 6

Indirect Mediation Effects in the Originally Hypothesized Path Analysis Model



Note. Solid-lined paths represent significant mediation effects within the model, with dotted-lined paths representing non-significant mediation effects.

Table 1

Missing Data

Variables	Total Missing *n(%)*
Age	0 (0%)
Sex	0 (0%)
Education	1 (0.2%)
Optimism Total	6 (1.1%)
Optimism	6 (1.1%)
Pessimism	6 (1.1%)
Problem-Focused Coping	8 (1.5%)
Emotion-Focused Coping	8 (1.5%)
Mind-Body Practices	23 (4.4%)
Exercise/Movement	10 (1.9%)
Relaxation/Meditation	22 (4.2%)
Pain Interference Total	29 (5.5%)
Activity	12 (2.3%)
Mood	21 (4.0%)
Relations	19 (3.6%)
Sleep	18 (3.4%)
Enjoyment	15 (2.8%)

N = 527

Table 2

Sample characteristics (N = 523)

Variables	*n*	%
Age (years)	*M* = 66.89	*SD* = 11.00
Sex (Male)	190	36.3
Chronic Conditions Total	*M* = 3.71	*SD* = 2.70
Race/Ethnicity		
White	463	88.5
Black/African American	15	2.9
Native American/Alaska Native	11	2.1
Asian	1	0.2
Native Hawaiian/Pacific Islander	1	0.2
Other	27	5.2
Don't Know	1	0.2
Refused	4	0.8
Education		
Less than high school	47	9.0
High school graduate or equivalent	154	29.4
Some college	102	19.5
Associate's degree or vocational school	50	9.6
Bachelor's degree	84	16.1
Some graduate school	14	2.7
Master's degree	51	9.8
Ph.D., Ed.D., M.D., or other prof. degree	20	3.8
Don't know	1	0.2
Marital Status		
Married	317	60.6
Separated	7	1.3
Divorced	92	17.6
Widowed	81	15.5
Never married	24	4.6
Refused	2	0.4
Employment Status		
Working now	145	27.7
Self-employed	31	5.9
Looking for employment	7	1.3
Temporarily laid off	1	0.2
Retired	135	25.8
Homemaker	14	2.7
Maternity or sick leave	1	0.2
Permanently disabled	12	2.3
Other	14	2.7
Don't know	2	0.4

Inappropriate	161	30.8

Table 3

Descriptives for Main Study Variables

Variables	*M (SD)*	Skewness	Kurtosis
Problem-Focused Coping	37.42 (5.90)	-0.35	-0.16
Emotion-Focused Coping	22.91 (5.74)	0.65	0.67
Optimism Total	22.51 (4.79)	-0.50	-0.06
Mind-Body Practices	1.59 (0.92)	1.53	1.54
Exercise/Movement	1.54 (1.13)	1.93	2.36
Relaxation/Meditation	1.64 (1.15)	1.62	1.32
Pain Interference	3.92 (2.65)	0.40	-0.75
Activity	4.72 (3.02)	0.02	-1.02
Mood	3.48 (2.94)	0.52	-0.75
Relations	2.65 (2.96)	0.88	-0.40
Sleep	4.35 (3.23)	0.14	-1.22
Enjoyment	4.38 (3.27)	0.22	-1.19

Note. N = Number; *M* = Mean; *SD* = Standard Deviation; *Problem-Focused Coping/Emotion-Focused Coping* = COPE Scale; *Optimism/Pessimism* = Life-Orientation Test-Revised; *Mind-Body Practices* = Mean of 2 Questions Indicating Engagement in Exercise Therapy & Meditation Practices; *Pain Interference* = Mean of 5 Pain Interference Subscales

Table 4

Correlations Among Study Variables for the Entire Sample

Variable	*M (SD)*	1	2	3	4	5	6	7
1. Age	66.89 (11.00)	1						
2. Chronic Conditions Total	3.71 (2.70)	0.093*	1					
3. Optimism	22.51 (4.79)	0.091*	-0.201***	1				
4. Problem-Focused Coping	37.42 (5.90)	0.052	-0.115**	0.445***	1			
5. Emotion-Focused Coping	22.91 (5.74)	0.093*	0.164***	-0.342***	-0.140**	1		
6. Mind-Body Practice Engage.	1.59 (0.92)	-0.085	0.046	0.156***	0.212***	0.012	1	
7. Pain Interference	3.92 (2.65)	-0.143**	0.369***	-0.369***	-0.214***	0.254***	-0.031	1

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Table 5

Correlations Among Study Variables (Males on lower half, N = 190; Females on upper half, N = 333)

Variable	*M (SD)*	1	2	3	4	5	6	7	*M (SD)*
1. Age	66.79 (10.62)	1	0.112*	0.042	0.009	0.078	-0.125*	-0.146**	66.95 (11.23)
2. Conditions	3.17 (2.80)	0.060	1	-0.184***	-0.078	0.063	-0.028	0.382***	4.02 (2.60)
3. Optimism	22.20 (4.70)	0.183*	-0.256***	1	0.418***	-0.323***	0.223***	-0.374***	22.69 (4.83)
4. PF Coping	37.18 (5.64)	0.137	-0.196**	0.494***	1	-0.109*	0.254***	-0.117*	37.56 (6.05)
5. EF Coping	21.46 (5.29)	0.128	0.280***	-0.428***	-0.232**	1	-0.076	0.201***	23.74 (5.83)
6. MBP Engage.	1.39 (0.73)	0.006	0.136	-0.019	0.093	0.117	1	-0.073	1.70 (1.00)
7. Pain Int.	3.87 (2.65)	-0.139	0.353***	-0.363***	-0.396**	0.370***	0.062	1	3.95 (2.65)

Note. *$p < .05$, **$p < .01$, ***$p < .001$

Table 6

Parameter Estimates for Path Analysis Model

Parameter	*B (SE)*	*β*	*p*	95% Confidence Interval
Main Effects				
Optimism → PFC	**0.54(0.05)**	**0.43**	**<0.001**	**[0.430, 0.652]**
Optimism → EFC	**-0.41(0.05)**	**-0.34**	**<0.001**	**[-0.506, -0.282]**
Optimism → MBP	**0.03(0.01)**	**0.14**	**<0.01**	**[0.012, 0.052]**
Optimism → Pain	**-0.12(0.03)**	**-0.21**	**<0.001**	**[-0.158, -0.046]**
PFC → MBP	**0.03(0.007)**	**0.18**	**<0.001**	**[0.015, 0.045]**
EFC → MBP	**0.01(0.007)**	**0.08**	**<0.05**	**[0.001, 0.030]**
PFC → Pain	-0.02(0.02)	-0.05	0.172	[-0.069, 0.013]
EFC → Pain	**0.06(0.02)**	**0.13**	**<0.01**	**[0.019, 0.101]**
MBP → Pain	-0.05(0.12)	-0.02	0.662	[-0.282, 0.194]
Covariates				
CC Total → PFC	-0.07(0.09)	-0.03	0.425	[-0.284, 0.154]
CC Total → EFC	**0.19(0.09)**	**0.09**	**<0.01**	**[0.076, 0.455]**
CC Total → MBP	**0.04(0.02)**	**0.10**	**<0.01**	**[0.009, 0.072]**
CC Total → Pain	**0.30(0.04)**	**0.31**	**<0.001**	**[0.252, 0.421]**
Age → PFC	0.006(0.02)	0.01	0.779	[-0.044, 0.045]
Age → EFC	**0.06(0.02)**	**0.12**	**<0.01**	**[0.009, 0.109]**
Age → MBP	**-0.01(0.004)**	**-0.12**	**<0.01**	**[-0.018, -0.003]**
Age → Pain	**-0.04(0.01)**	**-0.16**	**<0.001**	**[-0.059, -0.020]**
Covariances				
Optimism ↔ CC Total	**-2.65(0.58)**	**-0.21**	**<0.001**	**[-3.781, -1.513]**
Optimism ↔ Age	**4.84(2.32)**	**0.09**	**<0.05**	**[0.288, 9.382]**
CC Total ↔ Age	**2.75(1.30)**	**0.09**	**<0.05**	**[0.198, 5.304]**

Note. Bolded rows indicate significant findings at $p < 0.05$. PFC = Problem-Focused Coping, EFC = Emotion-Focused Coping, MBP = Mind-Body Practices, Pain = Pain Interference, CC Total = Chronic Conditions Total

Table 7

Supported and Rejected Hypotheses

Hypothesis	Finding
Hypothesis 1a	Supported
Hypothesis 1b	Supported
Hypothesis 2	Supported
Hypothesis 3	Supported
Hypothesis 4	Rejected
Hypothesis 5	Rejected
Hypothesis 6	Supported
Hypothesis 7	Rejected

Appendix A

Secondary Data Source

Data collected by the Midlife in the United States (MIDUS) study were utilized in the present study for several reasons. The MIDUS sample includes participants from all over the United States, with a range of diversity and life experiences representative of the overall population. MIDUS includes a large sample of participants with arthritic pain, a patient population that can be challenging to recruit. Additionally, the multidisciplinary team of researchers involved in the study allowed for the inclusion of variables examining the lives of those with arthritis from different perspectives. These variables include resilience mechanisms of psychological well-being and purpose in life, coping resources such as mindfulness and mind-body practices, and vulnerability mechanisms like somatic amplification and negative affect. Although these variables have previously been examined from a singular perspective, the use of MIDUS data allows for an examination of multiple levels of the model of resilience. Data from the third wave of the MIDUS study (MIDUS-3) collected between 2013 and 2014 was selected for the present study, as it is the most recent assessment of study variables and includes new optimism and coping variables relevant to resilience of life with chronic pain.

Procedures for Obtaining Permission to Use Data

Data and documentation from the original MIDUS study are openly available to the public on the Inter-university Consortium for Political and Social Research (ICPSR) webpage. ICPSR is an international consortium of over 750 research organizations and universities. The webpage operated by this consortium provides access to over 250,000 social and behavioral research files. Full datasets, codebooks, and study documentation of the MIDUS study are easily accessible for download and use on the ICPSR webpage, in addition to a listing of existing

published manuscripts with the use of the MIDUS data. This present study will seek approval for the use of MIDUS-3 data from the University of Missouri – St. Louis' Institutional Review Board.

Procedure of Original Data Collection

Participants of the original MIDUS study were recruited in 1995 via random digit dialing (RDD) to create a nationally representative sample (Radler, 2014). Eligibility criteria required participants to be between the ages of 25 and 74, English-speaking, and non-institutionalized. RDD respondents were asked to participate in a survey conducted by Harvard Medical School assessing health and well-being during midlife for American adults. Consenting participants completed two self-administered questionnaires and a phone interview at each of MIDUS' study waves. Participants who completed the self-administered questionnaires and phone interview were then also eligible to participate in four additional projects: a cognitive assessment, biomarker collection, brain imaging, and an 8-day stress diary (Radler, 2014).

The first wave of the study (MIDUS-1) was completed in 1995 and 1996, while the second (MIDUS-2) and third waves (MIDUS-3) took place between 2004-2006 and 2013-2014 respectively. Participants who were successfully consented and contacted were able to participate in each wave, with new samples being recruited to account for study attrition. MIDUS-1 consisted of 7,108 participants with a mean age of 46.4 years. MIDUS-2 consisted of 4,963 participants, with roughly 70% of the originally recruited sample from MIDUS-1. For a subset of participants in each wave, non-survey data was collected related to daily stress, biomarkers, cognitive functioning, and neuroscience.

Appendix B

Demographic Questions

1. Respondent's sex:
    a. Male
    b. Female
2. Respondent's calculated age at MIDUS-3 Project 1 phone interview:
3. What are your main racial origins – that is, what race or races are your parents, grandparents, and other ancestors?
    a. White
    b. Black and/or African American
    c. Native American or Alaska Native Aleutian Islander/Eskimo
    d. Asian
    e. Native Hawaiian or Pacific Islander
    f. Other (Specify)
    g. Don't Know
4. Are you of Spanish, Hispanic or Latino descent, that is, Mexican, Mexican American, Chicano, Puerto Rican, Cuban, or some other Spanish origin?
    a. Not Spanish/Hispanic
    b. Mexican
    c. Mexican American
    d. Puerto Rican
    e. Cuban
    f. Other Spanish (specify)
    g. Don't Know
5. What is the highest grade of school or year of college you completed?
    a. No school/some grade school (1-6)
    b. Eighth grade/junior high school (7-8)
    c. Some high school (9-12 no diploma/no GED)
    d. GED
    e. Graduated from high school
    f. 1 to 2 years of college, no degree yet
    g. 3 or more years of college, no degree yet
    h. Grad. from 2-year college, vocational school, or assoc. degree
    i. Graduated from a 4- or 5-year college, or Bachelor's deg.
    j. Some graduate school
    k. Master's degree
    l. Ph.D., Ed.D., M.D., DDS, LLB, LLD, JD, or other professional deg.
    m. Don't know
6. What about your current employment situation – Are you working now for pay, self-employed, looking for work, temporarily laid off, retired, a homemaker, a full-time or part-time student, or something else?
    a. Working now
    b. Self-employed
    c. Looking for work/unemployed

    d. Temporarily laid off
    e. Retired
    f. Homemaker
    g. Full-time student
    h. Part-time student
    i. Maternity or sick leave
    j. Permanently disabled
    k. Other
    l. Don’t know
7. In the past twelve months, have you experienced or been treated for any of the following – Arthritis, Rheumatism, or other bone or joint diseases?
    a. Yes
    b. No
8. Do you have chronic pain, that is do you have pain that persists beyond the time of normal healing and has lasted anywhere from a few months to many years?
    a. Yes
    b. No

Mind-Body Practice Engagement Questions

1. In the past 12 months, either to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance your wellness, or to prevent the onset of illness, how often did you use – RELAXATION OR MEDITATION TECHNIQUES?
    1 A Lot
    2 Often
    3 Sometimes
    4 Rarely
    5 Never
2. In the past 12 months, either to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance your wellness, or to prevent the onset of illness, how often did you use – EXERCISE OR MOVEMENT THERAPY (YOGA, PILATES, TAI CHI, FELDENKRAIS, ETC.)?
    1 A Lot
    2 Often
    3 Sometimes
    4 Rarely
    5 Never

Life Orientation Test

Optimism

A. In uncertain times, I usually expect the best.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

C. I'm always optimistic about my future.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

F. I expect more good things to happen to me than bad.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

Pessimism

B. If something can go wrong for me, it will.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

D. I hardly ever expect things to go my way.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

E. I rarely count on good things happening to me.
    1 – A Lot Agree
    2 – A Little Agree
    3 – Neither Agree or Disagree
    4 – A Little Disagree
    5 – A Lot Disagree

COPE Scale

Problem-Focused Coping

Positive Reinterpretation and Growth:

- I try to grow as a person as a result of the experience.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I try to see it in a different light, to make it seem more positive.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I look for something good in what is happening.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I learn something from the experience.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Active Coping:

- I concentrate my efforts on doing something about it.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I take additional action to try to get rid of the problem.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I take direct action to get around the problem.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I do what has to be done, one step at a time.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Planning:

- I make a plan of action.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I try to come up with a strategy about what to do.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I think about how I might best handle the problem.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I think hard about what steps to take.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Emotion-Focused Coping

Focus on and Venting of Emotion:

- I get upset and let my emotions out.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I get upset, and am really aware of it.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I let my feelings out.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I feel a lot of emotional distress and find myself expressing those feelings a lot.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Denial:

- I say to myself "this isn't real."
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I refuse to believe that it has happened.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I pretend that it hasn't really happened.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I act as though it hasn't even happened.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Behavioral Disengagement:

- I admit to myself that I can't deal with it, and quit trying.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I give up trying to reach my goal.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I give up the attempt to get what I want.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all
- I reduce the amount of effort I'm putting into solving the problem.
  - 1 – A Lot
  - 2 – A medium amount
  - 3 – Only a little
  - 4 – Not at all

Brief Pain Inventory

A. During the past week, how much did your pain interfere with – YOUR GENERAL ACTIVITY?
   0 – Not At All
   1 –
   2 –
   3 –
   4 –
   5 –
   6 –
   7 –
   8 –
   9 –
   10 – Completely
B. During the past week, how much did your pain interfere with – YOUR MOOD?
   0 – Not At All
   1 –
   2 –
   3 –
   4 –
   5 –
   6 –
   7 –
   8 –
   9 –
   10 – Completely
C. During the past week, how much did your pain interfere with – YOUR RELATIONS WITH OTHER PEOPLE?
   0 – Not At All
   1 –
   2 –
   3 –
   4 –
   5 –
   6 –
   7 –
   8 –
   9 –
   10 – Completely
D. During the past week, how much did your pain interfere with – YOUR SLEEP?
   0 – Not At All
   1 –
   2 –
   3 –
   4 –

5 –
6 –
7 –
8 –
9 –
10 – Completely

E. During the past week, how much did your pain interfere with – YOUR ENJOYMENT OF LIFE?
   0 – Not At All
   1 –
   2 –
   3 –
   4 –
   5 –
   6 –
   7 –
   8 –
   9 –
   10 – Completely

Chronic Conditions Total

In the past twelve months, have you experienced or been treated for any of the following?

a. Asthma, Bronchitis, or Emphysema
b. Tuberculosis
c. Other lung problems
d. Sciatica, Lumbago, or recurring backache
e. Persistent skin trouble (e.g., eczema)
f. Thyroid disease
g. Hay fever
h. Recurring stomach trouble, indigestion, or diarrhea
i. Urinary or bladder problems
j. Being constipated all or most of the time
k. Gall bladder trouble
l. Persistent foot trouble (e.g., bunions, ingrown toenails)
m. Trouble with varicose veins requiring medical treatment
n. AIDS or HIV infection
o. Lupus or other autoimmune disorders
p. Persistent trouble with your gums or mouth
q. Persistent trouble with your teeth
r. High blood pressure or hypertension
s. Alcohol or drug problems
t. Migraine headaches
u. Chronic sleeping problems
v. Diabetes or high blood sugar
w. Multiple sclerosis, epilepsy, or other neurological disorders
x. Stroke