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Jennifer L. Bayer  
*University of Iowa*

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AN EIGHT-WEEK FORREST YOGA INTERVENTION FOR CHRONIC PAIN:  
EFFECT ON PAIN INTERFERENCE, PAIN SEVERITY, AND  
PSYCHOLOGICAL OUTCOMES

by  
Jennifer L. Bayer

A thesis submitted in partial fulfillment  
of the requirements for the Doctor of Philosophy  
degree in Psychology (Clinical Psychology)  
in the Graduate College of  
The University of Iowa

August 2018

Thesis Supervisors: Professor Susan K. Lutgendorf  
Professor Michael W. O'Hara

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Iowa City, Iowa

CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

Jennifer L. Bayer

has been approved by the Examining Committee for  
the thesis requirement for the Doctor of Philosophy degree  
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## ABSTRACT

**Background:** Chronic pain conditions are pervasive, debilitating, and costly problems across the globe, yet medical treatments often fail to relieve the patients of pain. As a result, complementary treatments, such as yoga, are often used in an attempt to reduce pain and disability. Yoga seems to be effective in short-term relief of pain and, in some cases, helps alleviate psychological comorbidities associated with pain, such as depression and anxiety. The purpose of the current study was to evaluate the efficacy of an eight-week Forrest Yoga intervention on pain interference, pain severity, and psychological outcomes.

**Methods:** Seventy-nine participants were randomly assigned to yoga or usual care and completed a battery of self-report assessments at baseline, mid-intervention (4-weeks), post-intervention (8-weeks), and follow-up (16-weeks). Measures of pain interference, pain severity, number of painful body parts, sensory and affective experience of pain, psychological flexibility, pain catastrophizing, fear of movement, depression and anxiety, and social support were included.

**Results:** There were significant reductions in pain interference and activity avoidance in the yoga group compared to usual care post-intervention. Differences trended towards significance for pain severity and number of painful body parts. Compared to usual care, yoga participants showed significant early reductions in pain interference, pain severity, number of painful body parts, affective experience of pain, depression, overall fear of movement, and activity avoidance. Compared to usual care, these changes were not maintained at 16-weeks (2 months following the intervention).

**Conclusions:** The yoga intervention provided some relief of pain and pain-related problems while the intervention was ongoing but did not provide sustained relief.

*Keywords:* chronic pain, yoga, psychological flexibility, pain interference, pain severity, fear of movement

## PUBLIC ABSTRACT

Chronic pain is a costly problem that affects people around the world, yet most do not get complete pain relief from medical treatments. As a result, people with chronic pain try non-medical approaches, like yoga, to try to reduce pain and improve daily functioning. The purpose of the current study was to evaluate a yoga intervention on measures of physical and psychological problems.

Seventy-nine people agreed to participate in the current study. Half of the participants attended yoga classes twice per week for eight weeks; the other half did not. Both groups completed questionnaires that asked about physical and psychological difficulties before yoga classes began, halfway through the intervention, after the intervention was over, and two months after the last yoga classes.

People in the yoga group had significantly fewer physical complaints and were more likely to engage in activities after they attended the yoga classes compared to those that did not receive the yoga intervention. People in the yoga group tended to report lower levels of pain after the intervention compared to those that did not receive yoga, but these differences did not reach statistical significance. These changes were not maintained two months after the intervention completed; however this may have been a function of discontinued practice during those two months which was not assessed in detail.

In summary, the yoga intervention provided some relief of pain-related problems while the intervention was ongoing, but these improvements did not last after people stopped attending yoga classes.

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## Introduction

Chronic pain conditions are highly prevalent across the globe and account for three of the top ten diseases or injuries that are associated with the greatest number of years lived with disability in the United States (Murray et al., 2013). The impact of chronic pain extends from personal well-being to the global economy (Phillips, 2009) as people in pain are more likely to seek out health care services and take time off of work because of disability or to attend pain-related appointments. Additionally, there is a high comorbidity between chronic pain and mental health disorders, including anxiety, depression, and substance use disorders, which further impacts the lives of these patients (Sondergard, Vaegter, Erlangsen, & Stenager, 2017).

Approximately 40 percent of chronic pain patients report that their chronic pain is insufficiently managed with conventional care. Patients with chronic pain have historically turned to complementary and alternative (CAM) approaches more than patients with other conditions (Penney et al., 2016). Treatments like acupuncture, Ayurveda, hypnosis, and yoga are all associated with medium to large effect sizes in decreasing pain (Houze, El-Khatib, & Arbour, 2017). Interest in the effect of yoga on many conditions, including chronic pain, has increased as the percent of the United States population who have practiced yoga increased to 13.2 in 2015 compared to 7.5 percent in 1998 (Cramer et al., 2016).

The literature investigating the effects of yoga on chronic pain conditions is expanding quickly, with chronic low back pain being the most studied condition. In a recent Cochrane review of the yoga literature in chronic low back pain patients, small to moderate improvements in back function and small improvements in pain severity after three months of yoga practice were found compared to no exercise controls (Wieland et al., 2017). Despite the strong link between psychological disorders and pain experience, less than half of studies investigating the

effect of yoga on pain outcomes reviewed below include one or more psychological measures. The present study investigated the effects of an eight-week yoga intervention on both pain and psychological outcomes in a population that reported diverse pain conditions.

### **Chronic Pain**

It is estimated that 19 percent of the US population suffers from chronic pain, and the prevalence increases as age increases (Kennedy, Roll, Schraudner, Murphy, & McPherson, 2014). Women, people who have not graduated from high school, and those that rate their health as poor to fair are more likely than other subgroups to report having chronic pain (Kennedy et al., 2014). According to the 2010 National Health Interview Survey Quality of Life Supplement File, 39.4 million Americans reported experiencing persistent pain, with increasing age and female gender predicting more chronic pain (Kennedy et al., 2014). The US population is aging, thus we can only expect the prevalence of chronic pain to continue to increase.

As its prevalence has increased, so has the research investigating clinical treatments. According to PubMed, the number of articles published about chronic pain has increased from 668 in 1986 to 6,901 in 2016. Yet despite this increase in research, the term “chronic pain” lacks a universally accepted definition. The general consensus is that chronic pain is any pain that lasts beyond the expected healing time from an acute, organic injury (Apkarian, Baliki, & Geha, 2009). This expected time frame varies in the literature from two months to one year (Cohen & Hooten, 2017). Thus, according to some, pain that has lasted four months is chronic, while others would still label it as acute. In addition, the definition assumes that there is an initial injury, but many who suffer from chronic pain deny that their pain is due to any one incident (Apkarian et al., 2009).

Since there is such variability in the definition, the literature does not cite a consistent point or lifetime prevalence for chronic pain conditions. The most common chronic pain conditions include low back pain, osteoarthritis or joint pain, and neck pain (Johannes, Le, Zhou, Johnston, & Dworkin, 2010). Point prevalence estimates for the most common pain condition, chronic back pain, range from 2 to 40% of the US population (Manchikanti et al., 2009), and lifetime estimates of back pain lasting for at least one year are as high as 60% (Manchikanti et al., 2009). In a representative sample of Americans, 30.7% reported currently experiencing back pain that had lasted over 6 months, and most of them stated that their pain was moderate to severe in nature (Johannes et al., 2010).

People with chronic pain experience high personal and social cost as a result of their pain, and those costs extend to communities, the business world, and the health care system. Low back pain is the leading cause of years lived with disability globally (Global Burden of Disease Study, 2015). Disabling low back pain is responsible for up to 40% of all lost work days and 9-26% of industry insurance claims (Manchikanti et al., 2009). Beyond absenteeism, chronic pain is thought to impact performance when pain patients are present at work (Phillips, 2009). Up to 77% of \$61 billion lost in productivity in the US in 2003 was related to reduced work performance, not time away from the office (Phillips, 2009).

Additionally, patients with pain conditions use up to twice the health care inpatient services, pharmacy, and primary care compared to non-pain patients (Henschke, Kamper, & Maher, 2015). It is estimated that chronic pain costs between \$560 and \$635 billion to treat each year; a patient in moderate pain receiving treatment uses \$4500 more in services per year than those with no pain (Gaskin & Richard, 2012). Those in severe pain cost an additional \$3200 to treat (Gaskin & Richard, 2012). For most cases of chronic pain, no disease or musculoskeletal

abnormality is associated with the pain (Chou et al., 2007) making effective treatment of these conditions exceptionally challenging.

Patients' perception of the health care system, despite utilizing more resources than non-pain patients, typically progresses from optimism to disillusionment, and finally resignation that they will always be in pain (Dewar, Gregg, White, & Lander, 2009). The few studies that have followed patients long-term confirm these findings: patients followed for 12 months after a typical medical intervention report that their pain and pain-related problems persist (Tay, Willcocks, Chen, Jastrzab, & Khor, 2014).

In addition to the cost to the health care system and the workforce, chronic pain has significant consequences for the individual. Patients with chronic low back pain (CLBP) state that the pain is persistent, disruptive, and distressing, resulting in a loss of many aspects of their lifestyle as well as personality (Snelgrove & Lioffi, 2013). They report increased levels of helplessness, social isolation, and impairments in family life (Snelgrove & Lioffi, 2013). Ninety-nine percent of CLBP patients in one study reported other health problems, with a mean of 10 other complaints (Reme, Tangen, Moe, & Eriksen, 2011). When assessed using the Mini-International Neuropsychiatric Interview (MINI), 38% met criteria for a psychological disorder in their lifetime and 31% were currently suffering from one or more disorders (Reme et al., 2011). The most prevalent was somatoform disorder (Reme et al., 2011), though there is debate as to whether patients with chronic pain are overdiagnosed with this disorder (Katz, Rosenbloom, & Fashler, 2015). Chronic pain patients had higher levels of sleep disorders, anxiety, and drug dependence compared to the general population (Gore, Sadosky, Stacey, Tai, & Leslie, 2012; Reme et al., 2011). While the result was not replicated by Reme et al (2011), many other researchers have found significantly higher rates of current depression among chronic pain

patients compared to the general population, ranging from 22% to 86% (Garbi Mde et al., 2014; Hung, Liu, & Fu, 2015; Licciardone, Gatchel, Kearns, & Minotti, 2012; Poole, White, Blake, Murphy, & Bramwell, 2009).

Psychosocial factors are stronger predictors of pain than factors identified in a physical examination; in fact subgroup analysis of pain patients reveals that emotional distress associated with their pain predicts poor outcomes (Hirsch et al., 2014). Compared to elderly patients who have adapted to their pain or young patients with acute pain, patients of all ages with chronic, severe pain and comorbid depression have the highest direct and indirect annual costs. They have the highest rates of doctor and physical therapy visits, hospitalizations, highest intake of opioids, and more sick days than other subgroups (Hirsch et al., 2014). Young patients with pain that has lasted between four and twelve weeks with emotional distress have the second highest direct and indirect costs. These patients have high rates of specialist visits with diagnostic screening, high rates of hospitalization and rehabilitation, and high intake of over the counter drugs (Hirsch et al., 2014).

### **Clinical Care Guidelines for Chronic Pain**

In their Core Curriculum, the International Association for the Study of Pain (IASP, 2005) describes eight general domains in which physicians and other health professionals can intervene for chronic pain patients: 1) pharmacology, including opioids, nonsteroidal anti-inflammatory drugs, and antidepressants; 2) behavioral approaches, including cognitive behavioral therapy; 3) psychiatric treatment; 4) stimulation-produced analgesia, such as transcutaneous electrical nerve stimulation (TENS) and acupuncture; 5) nerve blocks; 6) surgery; 7) physical medicine and rehabilitation; and 8) complementary therapies, including energy healing. This core curriculum is meant to guide health professionals when treating any chronic

pain condition, while acknowledging that there might be specific considerations or priorities when treating pain in a specific body area. For example, neck pain diagnosis and treatment depends on whether the pain is due to nerve injury or not (Cohen & Hooten, 2017). If it is, treatment might be more likely to focus on nerve blocks and surgery, while non-neuropathic pain might be responsive to NSAIDs (Cohen & Hooten, 2017).

For chronic low back pain patients, treatment is stepped, starting with the recommendation to remain active and read about healthy back care (Chou et al., 2007; Fishman & Ardman, 1997). If pain persists after the patient has followed self-care recommendations, patients are also advised about pharmacologic and non-pharmacologic options. Pharmacologic options include over the counter pain medications: NSAIDs and ibuprofen and also include prescription medications: tricyclic antidepressants, benzodiazepines, and opioids. Non-pharmacologic options vary widely and include physical therapy, massage, chiropractic adjustments, acupuncture, cognitive behavioral therapy, yoga, and exercise therapy.

### **Physical Activity and Chronic Pain Conditions**

Pain specialists often recommend patients include exercise in their treatment plans, whether as physical therapy or self-directed aerobic or resistance-based exercise (Blackham, Garry, Cummings, Russell, & Dealleaume, 2008). One of the most common referrals made by pain specialists is to physical therapy. The American Physical Therapy Association also has clinical care guidelines for treating patients with most pain conditions, including the most common: back pain, neck pain, and arthritis. Physical therapists are directed to use a variety of exercises and manipulations to align the spine and strengthen the core (Delitto et al., 2012). Patients are taught core stabilization exercises and told to practice them on their own between appointments. However, well over half of patients do not perform their exercises between

appointments, thus potentially slowing the healing process or making therapy ineffective (Beinart, Goodchild, Weinman, Ayis, & Godfrey, 2013).

Finding exercises that patients will adhere to that help them maintain a healthy weight as well as strengthen and stabilize the core is fundamental to the treatment of chronic low back pain. In addition to core strengthening exercises, interventions that increase general fitness, such as pedometer-based walking interventions have shown some improvement in back pain severity and disability (Krein et al., 2013). This might be due, in part, to the finding that greater fat infiltration into the muscles that support the spine is associated with higher levels of reported pain severity as well as disability (Teichtahl et al., 2015). Thus, any intervention that decreases body fat might show some efficacy in decreasing pain severity and disability. However, preliminary data suggests that targeting activity to strengthen the core, such as through Pilates exercises, is more effective in reducing pain severity than general cardiovascular training, such as through stationary cycling (Marshall, Kennedy, Brooks, & Lonsdale, 2013).

### **Psychological Approaches to Chronic Pain**

Chronic pain that persists after any organic cause can be identified has long been conceptualized as a medical and psychological issue (Lethem, Slade, Troup, & Bentley, 1983). The clinical care guidelines of the American College of Physicians and the American Pain Society recommend psychological treatment once pain has persisted more than four weeks (Chou et al., 2007). There are two main psychological models for conceptualizing pain, the Operant Behavior Model for Pain and the Fear Avoidance Model. The two general types of psychological treatments that have strong supportive evidence for chronic pain conditions: Cognitive-Behavioral Therapy (CBT) based interventions and Acceptance and Commitment Therapy

(ACT) based interventions (American Psychological Association, 2017) are based on these models.

### **Operant Behavior Model for Pain**

The underlying theory of the Operant Behavior Model for Pain is that pain behaviors are operantly controlled (Fordyce, Fowler, Lehmann, & DeLateur, 1968). Pain is associated with observable events or pain behaviors. These consist of visual cues (e.g., grimacing, wincing, limping, postural adjustments, taking pain medications) and verbal cues (e.g., moaning, complaining, asking for help). These behaviors elicit a response from others in the environment and, while the form is quite variable, the function is typically reinforcing of the pain behavior (Fordyce, Fowler, & DeLateur, 1968). The rewarding response might then also be reinforced by the patient, creating a positive feedback loop (Fordyce, Fowler, Lehmann, et al., 1968). For example, a husband might wince while adjusting his posture when seated and his wife responds by assisting him or bringing him pain medication. The husband feels better as a result of the wife's actions and shows his appreciation by thanking her or providing affection, which then further reinforces her behavior. This operant learning typically begins as an adaptive approach to acute pain, minimizing damage to the injured area and coordinating social support, but becomes maladaptive after the injury has healed (Gatzounis, Schrooten, Crombez, & Vlaeyen, 2012).

The Operant Behavior Model for Pain has been demonstrated in clinical populations. As reported in their landmark publication, Fordyce et al (1968) used operant conditioning to shape the behavior of Mrs. Y, a 37-year-old woman whose chronic back pain interfered with her ability to complete many of her homemaking duties. Mrs. Y was admitted to the hospital and her behavior was modified by carefully controlling the administration of medication, attention, and rest. When Mrs. Y would speak of pain or discomfort, her physicians, nurses, therapists, and

other personnel were told to respond with neutrality, but when she increased daily activities they were instructed to praise her profusely. After eight weeks of inpatient care, the number of hours that she engaged in activities doubled and her medication use had been completely eliminated.

Since 1968, the Operant Behavior Model has continued to shape the psychological conception and biomedical treatment of pain (Gatzounis et al., 2012). The biomedical model of rehabilitation of chronic pain includes behavioral treatment as one component, with the intent to increase functioning despite the persistence of painful sensations. Behavioral treatment is then enhanced by including other treatments, such as activity pacing, time-contingent medication administration, and graded activity. Activity pacing is the breakdown of a complex activity into smaller parts and achieving the broader goal via small steps. Time-contingent medication administration means that medication is delivered at specific time intervals, not in response to pain. This disassociates pain intensity from relief. Graded activity is similar to exposure therapy: the gradual exposure of the client to feared stimuli, sensations in general and pain, with the intent of learning additional response patterns when sensations of fear are present (Bouton, 1988). The idea that pain is a feared stimulus is also a central component of the second psychological model of pain: the Fear-Avoidance Model.

### **Fear-Avoidance Model**

The Fear-Avoidance (FA) Model of pain perception expands the conceptualization of pain perception and pain response from a strictly behavioral process to include cognitive components (Lethem et al., 1983). The FA Model states that there are four courses of back pain: 1) natural remission of symptoms once the organic cause of pain has healed, 2) increase in pain due to worsening of the organic cause, 3) the organic or sensory cause of pain plateaus but the emotional component becomes more intense, or 4) the organic cause mends but the emotional

component persists (Lethem et al., 1983). The third and fourth courses are both associated with psychopathology: the organic or sensory component of pain is not consistent with the emotional component of pain.

Further, personal coping strategies predict outcomes (Wertli et al., 2014). Namely, confrontational coping strategies are associated with adaptive responses to pain. People with this coping technique see pain as a temporary problem and are motivated to return to work and social activities and are willing to confront and overcome emotional barriers to re-engage in their lives once the organic cause of pain has subsided (Lethem et al., 1983). People who use cognitive avoidance, behavioral avoidance, or both, on the other hand, are more likely to reduce engagement in their lives, leading to increased physical pain as well as psychopathology (Lethem et al., 1983).

Similar to the Operant Behavior Model, the FA Model is based in learning theory but incorporates cognitions and response to unwanted internal experiences. Instead of patients being rewarded for pain behavior, as in the Operant Behavior Model, the FA Model is one of negative reinforcement (Vlaeyen & Linton, 2000). Patients fear further injury and thus avoid activities that might engage the previously injured area. The previously injured area then atrophies due to lack of use (Vlaeyen & Linton, 2000). When the patient does engage this area that has atrophied, there are unpleasant sensations that are often interpreted as pain associated with movement as these weakened muscles engage, thus perpetuating the avoidance cycle (Vlaeyen & Linton, 2000). The psychological treatments for chronic pain incorporate both behavioral strategies and cognitive or mindfulness approaches to managing the fear associated with the injury.

## **Evidence-based Psychological Interventions for Chronic Pain**

The Operant Behavior Model and Fear Avoidance Model both have clear influence on the two evidence-supported treatments for chronic pain: Cognitive Behavioral Therapy (CBT) as well as Acceptance and Commitment Therapy (American Psychological Association, 2017).

**Cognitive Behavioral Therapy.** Cognitive Behavioral Therapy for Chronic Pain (CBT-CP) is strongly rooted in traditional CBT. The underlying principle is that pain patients develop maladaptive coping strategies in response to the thoughts and feelings they have about their pain (Winterowd, Beck, & Gruener, 2003). The goals of CBT-CP are to identify and modify maladaptive behaviors and cognitions associated with pain. Maladaptive behaviors are identified through activity tracking. Daily activities, levels of pain associated with the activity (if any), triggers of pain, and coping strategies used are recorded throughout the week by the client (Winterowd et al., 2003). Clients also track thoughts and emotions that arise in response to pain. In addition to providing valuable insight into the client's experience of pain, activity tracking also helps both the client and therapist determine if the client is restricting his/her engagement in activities. If this is the case, adding activities to the client's life is thought to improve mood and pain complaints. Clients are taught relaxation and distraction strategies as well to help reduce stress and take their minds off of the painful sensations they feel (Winterowd et al., 2003).

The cognitive portion of the intervention identifies automatic thoughts, beliefs, and catastrophic images associated with pain (Winterowd et al., 2003). These thoughts, beliefs and images are then evaluated in terms of their truth or likelihood of occurring, and then the therapist teaches the client problem solving strategies, helps the client modify the thoughts, beliefs, or images to more adaptive versions, or teaches the client thought stopping strategies. Finally,

clients are also taught assertiveness skills to help them navigate the medical care system as well as their relationships with others and sleep hygiene skills (Winterowd et al., 2003).

Several randomized controlled trials confirm the efficacy of the CBT-CP program (Basler, Jakle, & Kroner-Herwig, 1997; Turner & Clancy, 1988; Turner & Jensen, 1993). In a twelve-week intervention comparing weekly, 150-minute group sessions of CBT-CP to a wait-list control group, CBT-CP significantly reduced pain severity and physical disability as well as increased perceived control over pain (Basler et al., 1997). Additionally, the CBT-CP group reported decreased avoidance behaviors and catastrophic thoughts as well as increased pleasant activities (Basler et al., 1997).

To test the effect of behavioral training versus examining cognitions, Turner and Clancy (1988) compared 8 weekly 2-hour group sessions of the Operant Behavioral (OB) Model for treating chronic pain to CBT-CP. The clients who received OB reported significant reductions in pain behaviors and self- and spouse-reported physical and psychosocial dysfunction more quickly than the CBT-CP group (Turner & Clancy, 1988). However, the CBT-CP group continued to improve over time whereas the OB group plateaued post-treatment such that there were no differences between groups at 6 or 12 months of follow-up, indicating that both behavioral and cognitive interventions are equally effective in reducing pain-related disability over time (Turner & Clancy, 1988).

While meta-analytic reviews confirm that CBT-CP is an effective intervention for short- and intermediate-term pain relief compared to waiting list control groups, the results do not seem to generalize to psychological outcomes (Henschke et al., 2010). CBT-CP was not found to significantly change psychological outcomes in CLBP populations. Neither depression nor health

related quality of life were significantly improved compared to waitlist or self-regulation control groups (Henschke et al., 2010).

**Acceptance and Commitment Therapy.** Acceptance and Commitment Therapy (ACT) is a third wave CBT intervention whose goal is to increase psychological flexibility, or the willingness to fully experience pleasant and unpleasant mental experiences (e.g., thoughts, emotions, sensations) while taking committed action towards one's values (Bond et al., 2011). Psychological flexibility is composed of six interrelated processes: flexible attention to the present moment, acceptance, defusion or the de-literalizing of thoughts, the ability to see oneself in context, values, and committed action (Hayes, Strosahl, & Wilson, 2012). Unlike in CBT, the goal is not to change or stop thoughts. Instead, the goal in ACT is to behave in alignment with one's values even when unpleasant internal experiences, such as unwanted thoughts, feelings, and sensations arise.

ACT is recognized by Division 12 of the APA as the only evidence-based treatment to date to effectively treat persistent pain across numerous conditions (American Psychological Association, 2017). ACT was shown to be effective in reducing pain severity, pain related disability, depression, pain-related anxiety, and daily rest due to pain both immediately post-treatment and at three-month follow-up in an intensive intervention in a residential pain management clinic (McCracken, Vowles, & Eccleston, 2005). Participants served as their own controls, participating in five ACT-related sessions per week after a pre-treatment interval of approximately three months. There were no changes in any outcome measures between the initial assessment and the beginning of treatment (McCracken et al., 2005).

In a randomized controlled trial comparing eight weeks of weekly 90-minute sessions of either ACT or CBT, participants in both groups had lower levels of pain related anxiety and

depression and higher rates of chronic pain acceptance at the end of the intervention (Wetherell et al., 2011). These psychological changes were maintained at three-month follow up but neither group had significant changes in pain severity post-intervention or after follow-up (Wetherell et al., 2011).

Vowles and McCracken (2008) investigated the effects of an ACT-based short-term, intensive interdisciplinary pain program that included approximately 2.25 hours of physical conditioning, such as physical and occupational therapy, and 1.5 hours of ACT- and mindfulness-based psychological interventions per day for 3 or 4 weeks on pain and psychological outcomes. They found significant medium to large effects for the intervention, showing that it improved measures of pain severity, physical disability, pain-related anxiety, depression, acceptance, and values-based action post-intervention and at three-month follow-up (Vowles & McCracken, 2008). Many psychological improvements were maintained three years later, despite usual pain intensity returning to pre-treatment levels (Vowles, McCracken, & O'Brien, 2011). Increases in acceptance predicted increases in values-guided behavior and decreases in depression, pain-related anxiety, physical and psychosocial disability, and medical visits. Similarly, increases in values-guided behavior predicted decreases in depression, pain-related anxiety, and physical and psychosocial disability (Vowles et al., 2011).

Systematic reviews of the ACT for pain literature offers tentative support of these trials. Citing just three studies as part of a sub-group analysis in a larger meta-analysis of acceptance based therapies, Veehof, Oskam, Schreurs, and Bohlmeijer (2011) reported that ACT has a small to moderate effect on pain and a large effect on reducing depression. In a more recent review, Ost (2014) reported that the strongest support for ACT was in the pain literature, and while the preliminary results might seem promising, more study is required. The number of studies that

have investigated the effect of ACT on persistent pain is limited, and the rigor of those studies is somewhat lacking (Ost, 2014). The conclusion of this meta-analysis is the ACT is probably efficacious for chronic pain and that ACT has similar effects as CBT and behavioral therapy for psychological disorders (Ost, 2014).

In summary, there is support for both CBT and ACT providing short- and intermediate-term relief of pain, but these benefits seem to wane soon after the intervention ends. Preliminary reports indicate that ACT might be effective in reducing medical visits and maintaining psychological improvements long-term, even when subjective reports of pain return to baseline levels, but further study is required.

### **Yoga for Chronic Pain**

One of the activities specifically identified in the clinical care guidelines across pain conditions as potentially helpful is yoga (Chou et al., 2007). A review of the literature of yoga for the most common pain conditions, low back, neck, and osteoarthritis pain, finds 29 trials that investigate the effects of various styles of yoga with differing lengths of intervention on pain severity and/or pain disability, summarized in Tables B1-B3.

The methodological rigor of the studies varied considerably. 10.3% of studies did not include a control group. Of studies that did have a control group, 44.8% had a waitlist, no-treatment, or treatment as usual control group, 10.3% included an education/self-care control, and the remaining 34.5% had a control group that was taught another type of exercise as well as either a no treatment or education condition. Since there is significant evidence to support that exercise is associated with pain reduction (Geneen et al., 2017; Searle, Spink, Ho, & Chuter, 2015), the findings of a study comparing a yoga intervention to a no-treatment or waitlist control must be interpreted differently than one comparing it to an exercise intervention.

There was considerable variability between the studies in content and length of the intervention, frequency and duration of yoga classes, recommendation for home practice, outcome measures selected, completing N, and theorized mechanism for action. Despite this variability, the majority of studies did report significant findings for yoga in reduction of pain severity and/or pain-related disability compared to controls, on the whole suggesting that this type of intervention may be efficacious in decreasing pain outcomes. This conclusion is supported by a recent Cochrane review (2017) in which the authors conducted a meta-analysis of 12 studies of yoga for chronic low back pain and found that yoga has small to moderate effects compared to no-exercise controls in improving back function and potentially for pain severity (Wieland et al., 2017). Both in the Cochrane review and in a non-inferiority study comparing yoga to physical therapy (Saper et al., 2017), yoga seems to have similar benefits for pain severity and disability as other forms of movement with similar risk of adverse events (Wieland et al., 2017).

### **Pain Severity**

As described in Tables B1-B3, 16 of the 25 studies that measured pain severity reported significant reductions in the yoga group. All five of the non-controlled studies that included this outcome measure found significant decreases after yoga (Brenneman, Kuntz, Wiebenga, & Maly, 2015; Cramer, Lauche, Hohmann, Langhorst, & Dobos, 2013; Groessl, Weingart, Johnson, & Baxi, 2012; Kolasinski et al., 2005; Moonaz, Bingham, Wissow, & Bartlett, 2015). There was considerable variability in methods among these uncontrolled studies. The populations included were patients with back pain (n=1), neck pain (n=1) and osteoarthritis of the knee (n = 3), the interventions ranged in length from 8 to 12 weeks, and frequency of classes was once per week (n = 3), twice per week (n = 1), or three times per week (n = 1). The styles of yoga studied were

Iyengar (n = 2), Anusara (n = 1), Hatha-yoga based (n = 1), and one “yoga-inspired strengthening program.” Two of the studies (Cramer, Lauche, Hohmann, Langhorst, et al., 2013; Moonaz et al., 2015) reported follow-up data nine months and one year after the completion of randomized controlled trials. In both of these studies, the original RCT used a waitlist control group. Once the control group received the yoga intervention, their follow-up data were rolled in to the yoga group’s data.

Studies that included a control group were far less conclusive in their results. Nine of the 15 studies with a no-treatment, waitlist, or education control group reported significant between group differences in which the yoga group’s pain severity ratings significantly decreased more than controls. Of the six that reported no difference between the groups, three did not observe within group changes (Cox et al., 2010; Galantino et al., 2004; Telles et al., 2016), with the other three noting significant within group changes but failed to differ from controls (Ghasemi, Golkar, & Marandi, 2013; Tilbrook et al., 2011; Williams et al., 2005). Thus, these results indicate that yoga is unlikely to increase pain severity in pain patients and it is potentially associated with decreased pain over time. However, these decreases might not be statistically different from those seen naturally over time, even in patients with long-standing pain.

Of the seven studies with an exercise control group, Cheung et al (2017), Nambi (2014), and Tekur (2012) found significant benefits in being in the yoga group compared to time-matched conventional exercise that included walking, strength training, and stretching. Of these studies, only Cheung et al (2017) also included a non-movement control group. Although the authors stated that yoga significantly reduced pain severity compared to the education control group, they did not report comparison statistics between the aerobic exercise and education

groups. Thus, no conclusion can be drawn about how aerobic exercise compared to education in reducing pain severity in this trial.

Three studies (Dunleavy et al (2016), Bramberg et al (2017), and Teut et al (2016)) found significant decreases in pain severity in the exercise groups, which included Pilates, strength training, and qi gong, respectively, compared to yoga groups post-intervention. Saper et al (2017) found that while yoga was “not inferior” to physical therapy in reducing pain, physical therapy outperformed education in pain reduction but yoga did not. At six-month follow-up, Teut et al (2016) found that pain severity continued to decrease in the yoga group, such that both the qi gong and yoga group were significantly lower in pain severity than waitlist controls, with no difference between exercise modalities.

These findings are supported by the Cochrane review results that indicated that the current yoga for chronic pain literature supports that yoga has modest effects in reducing pain severity compared to no-exercise controls (Wieland et al., 2017), yet further study is needed to determine how yoga compares to different types of exercise for reducing pain.

### **Pain-related Disability and Interference**

Twenty-two studies measured self-reported pain-related disability or pain interference. Ten studies included objective measures of functioning, such as a sit-and-reach flexibility assessment, timed physical activity tasks, and MRI of the spine. Similar to the results seen in the pain severity section above, these results were mixed and are summarized in Tables B1-B3.

Three studies (Brenneman et al., 2015; Cramer, Lauche, Hohmann, Langhorst, et al., 2013; Kolasinski et al., 2005) did not include a control group and all found significant improvement in self-reported physical function. Brenneman et al (2015) also included objective

tasks and found significant improvements in the yoga participants' performance on a six-minute walk task and the number of times patients could stand from seated in a chair in 30 seconds.

Seven studies reported improved functioning in the sixteen studies that had a waitlist, no treatment, or other non-exercise control group. Three of the sixteen included both self-report and objective measures of functioning. One such study was Galantino et al (2004). They reported null effects of their 6-week Hatha yoga intervention but noted a very small completing sample size (n = 16, 11 yoga, 5 control) with high variability in data. They recruited chronic back pain patients that had not had significant relief from at least two prior interventions. In their study, they found no significant changes on either measure: self-reported pain disability or the sit and reach flexibility task. Williams et al (2005) reported mixed results after a 16-week Iyengar yoga intervention for chronic back pain patients. While participants reported improved physical function directly after the intervention and at 3-month follow-up, there were no observed changes in range of motion. Finally, Park et al (2017) recruited community dwelling older adults with confirmed arthritis to participate in eight weeks of Iyengar-based chair yoga and found significant effects both by self-report of pain interference and fatigue as well as on objective measures of gait speed compared to controls.

Studies that included an exercise control indicated that yoga might have reliable effects on decreasing disability. Five of eight studies found significant improvements in disability, objective measures of function, or both. For example, in a study of a short term intensive yoga program, yoga participants reported significant improvements in back pain related disability while no change was observed in controls, and yoga participants also showed significant increases in spinal flexion and overall flexibility in the sit and reach task compared to controls (Tekur et al., 2012; Tekur, Singphow, Nagendra, & Raghuram, 2008). Saper et al (2017), on the

other hand, in one of the largest trials of yoga for back pain that has been conducted (N = 320), found equivalence between physical therapy, yoga, and education on one of the gold standard measures of self-report back-related disability, the Roland-Morris Disability Questionnaire. That said, a significantly greater proportion of participants in the yoga and PT groups had clinically meaningful RMDQ improvements compared to education controls. This study did not include objective measures of improvement but asked participants to rate their perception of their improvement in functioning after the intervention was complete. Physical therapy, but not yoga, outperformed education in this measure of self-perceived improvement.

In the studies reviewed above, assessing changes in pain related disability took many forms and the results were mixed. Those studies that included objective measures and those that were adequately powered seemed to be more likely to indicate that yoga had a reliable effect on disability, though lack of effects was not always a power issue. A recent Cochrane review found that there is a moderate quality of evidence that yoga has small to medium effects in improving disability (Wieland et al., 2017). As seen in Saper et al (2017), yoga was non-inferior to physical therapy in self-report measures of disability, indicating that it performs as well as one of the most common referral recommendations for pain patients (Delitto et al., 2012).

### **Psychological Outcomes**

Eighteen studies included measures of depression, stress, anxiety, perceived burdensomeness of pain, or overall mental health in their assessment batteries. The majority (12/18) of studies found significant decreases in depression, anxiety, pain burdensomeness, or pain apprehension; increases in vitality, energy levels, or positive affect; or improvements in overall mental health, as measured by the SF-12 or SF-36. Perhaps more importantly, the effects on mental health outcomes were closely tied to the effects reported on pain severity and/or

disability measures. All of the studies that included mental health outcomes that reported improvements in both pain severity and pain-related disability also found mental health improvements post-intervention (Brenneman et al., 2015; Cheung, Wyman, Resnick, & Savik, 2014; Cramer, Lauche, Hohmann, Ludtke, et al., 2013; Michalsen et al., 2012; Tekur et al., 2012; Williams et al., 2009). Cramer, Lauche, Hohmann, Langhorst, et al (2013) reported that mental health post intervention improvements did not maintain at 12-month follow-up despite continued decreased pain severity and disability.

Studies that reported no difference on either pain severity or pain disability, even if a decrease was seen in the other measure, generally reported no difference on mental health outcomes (Galantino et al., 2004; Saper et al., 2017; Telles et al., 2016; Williams et al., 2005). Tilbrook et al (2011) was the one exception to this rule: after a 12-week intervention, yoga participants reported significant decreases in disability on the Roland-Morris Disability Questionnaire ( $p = 0.012$ ) but the difference in pain severity trended towards, but did not meet, statistical significance ( $p = 0.062$ ). They observed an increase in pain self-efficacy but no change in health-related quality of life. Thus, the effects of the intervention on mental health outcomes were mixed, potentially due to the trend towards an improvement on pain severity.

These studies support the conclusion that physical experiences or expressions of pain, measured through pain severity and pain-related disability are closely related to mental health outcomes. Most of the studies in this review assessed mental health at a relatively superficial level, including one overall measure of psychological functioning (such as the SF-12 or SF-36) or assessing depression and/or anxiety. Few studies included multiple measures, with only Williams et al (2005) using a measure based on the Fear-Avoidance psychological theory of pain, the Tampa Scale of Kinesiophobia. This gap in the literature points to a need to better evaluate

the cognitive and behavioral components that shift during a yoga intervention designed for chronic pain. One of the purposes of this study is to address this gap in the literature.

### **Yoga Style**

The most common specific style of yoga studied in this group of interventions was Iyengar Yoga (Cox et al., 2010; Cramer, Lauche, Hohmann, Langhorst, et al., 2013; Cramer, Lauche, Hohmann, Ludtke, et al., 2013; Kolasinski et al., 2005; Michalsen et al., 2012; Nambi et al., 2014; Park et al., 2017; Williams et al., 2009; Williams et al., 2005). Iyengar yoga was developed by BKS Iyengar, who is often credited as the most influential yoga teacher for modern yoga practice (Iyengar, 1966). Iyengar yoga has very specific alignment instructions for each posture, and several minutes are spent in each pose ensuring alignment is correct (McCrary, 2013). Each class is unique, composed of a variable set of postures that are sequenced together using specific principles. The focus is typically exclusively on the body with little attention paid to emotions or thoughts the student might experience. Although students might be exposed to intense sensations, they are not taught alternate coping strategies. The cues provided by instructors are precise and instructors correct misaligned students verbally and by manually adjusting them. Students are instructed to find a balance between effort and ease so they can breathe deeply through the class; Iyengar classes are not typically cardiovascularly taxing. There is a heavy use of props in this style (McCrary, 2013).

Although Iyengar yoga was designed to be a healing modality (Iyengar, 2001), none of the yoga styles included the 29 studies reviewed above specifically target relief of chronic pain as a pervasive focus throughout the style. This limits the generalizability of these interventions. Classes of these styles offered in the community might vary distinctly from the sequences designed for chronic pain relief simply because relieving pain is not a core tenant of the style.

Forrest Yoga, a style of yoga that has yet to be studied empirically, is structured such that every class is designed to include poses to help with chronic pain conditions.

### **Forrest Yoga**

The creator of Forrest Yoga (FY), Ana Forrest, began teaching yoga in 1975 and was trained in many of the popular styles at the time, including studying with BKS Iyengar (Forrest, 2011). She took each of these styles and integrated much of what she learned studying Native American philosophy to create her own style of yoga. Her goal was to create a style of yoga that would help modern people with modern day physical and emotional issues, specifically back, neck, and shoulder pain, as well as the disconnect that occurs emotionally when people live out of alignment with their Spirit, or in a way that is not vitalizing and meaningful for the individual (Forrest, 2011). FY continues to evolve today as Ms. Forrest creates new poses, updates traditional poses, and refines her teaching and training methods.

Forrest Yoga is built on four pillars: breath, integrity, strength, and spirit (Forrest, 2014). Breath refers to bringing mindful awareness to the breath and expanding awareness from the breath to the sensations in the body both when practicing yoga and in daily life (Forrest, 2014). Breath also includes attending to physical and emotional needs in poses such that students appropriately modify poses to stay present with physical sensations. For example, if a student tends to feel emotionally numb in physically challenging poses, the modification for that student would be to decrease the intensity of the pose to a level that he can stay connected to the sensations and be present with his breath. Once a student stays connected to his breath and to sensations, he can begin working the Integrity pillar. Integrity is the self-awareness and playful curiosity that students bring to each pose (Forrest, 2014). Students are encouraged to mindfully observe the changing sensations in their bodies as they hold poses for a minute or longer, all

while noticing the urges to revert to “habitual patterns” such as coming out of the pose to or doing the pose mindlessly so as to avoid unpleasant sensations. The third pillar is Strength. FY is a physically challenging practice, but students do not have to be strong or flexible to participate. They perform core exercises and hold poses longer than many other styles; the intent is to engage large muscles and their smaller supporting muscle groups, increasing blood flow through these areas and facilitating healing (Forrest, 2014). Students learn to find their edge: the level of intensity that challenges them physically and allows them to stay present in the moment. Finally, FY refers to following the path of the Spirit, often cued in class as the “future wiser self.” FY encourages students to explore the ways in which their behavior is discrepant from what their Spirit or wisest self would choose for them and helps students build the courage to take steps towards acting in a way that builds a vitalizing life (Forrest, 2014).

Forrest Yoga classes are conducted in a lightly heated room (typically between 75 and 85°F) and are specifically sequenced to engage the muscle groups required to perform apex or target pose(s) in a practice. While all classes contain a unique series of postures, all classes are sequenced according to strict guidelines and are composed of a warm up, a hot portion of the class, and a warm-down/cool-down with final relaxation. In a 60-minute class, students spend 12-13 minutes in the warm up, 30 minutes in the hot portion, and 12-13 minutes in the warm-down/cool-down and final relaxation. Classes begin with a “warm up” portion in which students are seated on the floor while the teacher sets a specific intent and theme, or an emotional and physical focus for the class. Students are guided through a *pranayama* or breathing exercise, a pose or series of poses to warm up the spine such as a side bend or twist, a series of abdominal exercises specific to Forrest Yoga, a pose to lengthen the abdominals, and a pose to warm up the shoulders so that they are properly aligned for the more dynamic portion of the class. The

dynamic middle portion of the class called the “hot section” consists of FY specific variations of sun salutations: Classical Suns and B-Series with Two- or Three-Pose Vignettes, and/or a Standing Pose Series. This portion of the class is called the “hot” portion because students’ are physically warmed up and their bodies are thought to be ready for poses that require muscular engagement or flexibility. Students are instructed to stay mindful in transitions between poses such that every pose is performed deliberately and mindfully from start to finish. “Apex poses” are the target poses of the class; all other poses in the class are included to either prepare the body to complete the apex pose(s) or help the body unwind from the apex pose(s). Apex poses are commonly included in B-series with Vignettes and Standing Pose Series, though they can be included at any point in a class. Typical apex poses include hip openers, twists, inversions, arm balances, and back bends. The final section of the class is the “warm down” or “cool down” in which students are guided through exercises and stretches to minimize muscle soreness after class. The final pose in Forrest Yoga classes is *savasana*, the final relaxation pose.

Similar to Iyengar Yoga, Forrest Yoga has a strong alignment focus. Forrest Yoga teachers are trained to demonstrate poses quickly and effectively for visual learners, precisely cue physical alignment for auditory learners, identify alignment issues in students, verbally correct students and provide kinesthetic assists as needed for students to find the appropriate alignment. Forrest teachers are also trained to modify poses so that students with injuries or who are new to the practice can participate in every pose. In many other styles, students are told to rest in child’s pose if the practice becomes too physically demanding. Forrest Yoga does not provide this instruction and instead teaches students to modify poses as much as they need so they can participate in all parts of the practice regardless of their ability level. Additionally, Forrest Yoga

teachers are trained to speak clearly and distinctly, and to be very concise so that students can follow the teacher's instructions while staying connected to their internal experience.

To date, Forrest Yoga has not been tested empirically. However, because Forrest Yoga has precise sequencing principles, it is a style that is easily manualized. In addition, a manualized intervention is likely generalizable to FY classes offered in the community because to be called "Forrest Yoga" classes must follow sequencing principles and all Forrest teachers are taught specific cues for each pose.

**Effect of Forrest Yoga on chronic pain.** As indicated above, Forrest Yoga has never been studied empirically, but one of its goals is to address modern pain and injuries, such as back, neck, and shoulder pain. There are several poses in Forrest Yoga that are consistent with the physical therapy guidelines for core strengthening and stabilization. Forrest Yoga includes unique abdominal exercises that are conducted slowly and with awareness. Forrest Yoga includes poses to stretch commonly injured or painful areas, such as wrist and neck stretches, as well as poses to strengthen body parts that atrophy in our modern, sedentary lifestyles. Finally, students are cued to use their practice to notice how they habitually tense auxillary muscles (such as those in the neck or jaw) instead of relying on the large, structural muscles of the body, and to shift that pattern during class. This study provides the first opportunity to empirically test the theoretical underpinnings of Forrest Yoga to see if this approach does indeed decrease pain interference and severity in those that practice this style of yoga.

**Effect of Forrest Yoga on psychological outcomes.** Like many other styles of yoga, Forrest Yoga has a strong mindfulness component and also includes elements of *in vivo* exposure. Students are cued into poses that elicit intense physical sensations and are guided to observe these sensations with curiosity, while also noticing the urge to distract the mind, fidget,

change the position of the body, or engage in some other strategy to physically or mentally leave the pose. Students are taught to differentiate between sensation and pain and are encouraged to fully feel sensation as well as adjust the body to take oneself out of pain. This approach includes exposure to unpleasant sensations, thoughts, and urges, and also teaches students to broaden their behavioral repertoire when faced with sensations they typically avoid. Students are also instructed to notice the discrepancy between their current behaviors and the behaviors of their Spirit or future wiser self – the part of them that behaves in alignment with whatever brings vitality and meaning to their lives. Students are instructed to practice embodying these qualities during the practice, thus providing the opportunity to explore their values and committed action during the yoga class. Thus, taken together, Forrest Yoga classes might increase psychological flexibility, decrease fear of movement, and improve depression and anxiety symptoms. Additionally, by engaging in physical activity in a social setting, students may feel that their social support network has increased.

### **Summary and Specific Aims**

In summary, chronic pain is a common and debilitating problem with both physical and psychological components. While no treatment of chronic pain has been shown to effectively eliminate pain for most patients, a stepped approach that includes both movement intended to increase physical strength and psychological interventions is considered to be the standard of care. Preliminary reports indicate that yoga, which commonly includes both physical strengthening movements as well as mindfulness, might be effective in reducing pain severity and disability, as well as reducing symptoms of depression and anxiety in chronic pain patients. Forrest Yoga is a style of yoga that has not previously been studied. It was designed to increase core strength and stability by including unique poses for abdominal engagement and by

intentionally sequencing classes to activate specific muscles in succession. Additionally, Forrest Yoga classes include cues intended to increase awareness of rigid response patterns and encourage students to experiment with alternative responses, thus enhancing behavioral repertoires.

Specific Aim #1: To investigate the efficacy of an eight-week Forrest Yoga intervention for chronic pain on pain interference (primary outcome), as well as pain severity and the number of painful body parts (secondary outcomes). Hypothesis: The yoga group will have significantly lower pain interference, pain severity, and number of painful body parts at the end of the 8-week intervention relative to usual care.

Specific Aim #2: To investigate the efficacy of an eight-week Forrest Yoga intervention for chronic pain on psychological variables including psychological flexibility (primary outcome), pain catastrophizing, fear of movement, depression, anxiety, and social support (secondary outcomes). Hypothesis: The yoga group will show significant increases in psychological flexibility as well as decreases in fear of movement and pain catastrophizing relative to the control group.

Specific Aim #3: To investigate the efficacy of an eight-week Forrest Yoga intervention for chronic pain on outcomes after an eight-week follow-up period (secondary outcome). Hypothesis: The yoga group members who continue to practice yoga after the intervention is over will report sustained improvements in both pain and psychological outcomes while those that stop practicing will revert to baseline levels of these characteristics. Participants who stop practicing yoga and those in the control group will have similar pain severity and psychological characteristics at follow-up as they did at baseline.

## Methods

### Design

This study was a two-arm randomized controlled trial comparing the efficacy of an eight-week yoga intervention in a sample of chronic pain patients in reducing pain interference and pain severity as well as improving psychological outcomes compared to a usual-care control. Those randomly assigned to the yoga group attended two yoga classes per week for eight weeks. All participants completed a battery of self-report questionnaires at baseline, 4-weeks (mid-treatment), 8-weeks (post-treatment), and 16-weeks (follow-up). For every battery completed, all participants earned a voucher for a free yoga class at a local yoga studio and a multi-day pass at the local YMCA. To decrease disappointment in being randomly assigned to the usual-care control group, participants in the control group were offered the first four classes of the yoga intervention after the 16-week assessment was distributed and sufficient time had passed for participants to complete it.

### Participants

Individuals between the ages of 18 and 89 with pain that had lasted longer than 12 weeks were recruited to participate in the study. To be eligible, their pain had to interfere with their lives as evidenced by a t-score greater than 60 on a custom 10-item short form of the PROMIS Pain Interference scale. Participants had to demonstrate that they could sit on the floor and stand up without assistance, have access to the internet and/or a DVD player to complete home practices, and could get to the yoga studio twice per week to attend classes. Exclusion criteria included current substance use or psychotic symptoms that would interfere with their ability to participate in class, current suicidal ideation or a history of abdominal surgeries (such as gastric banding or having abdominal staples) that resulted in a medical reason prohibiting placing pressure on the

abdomen. Participants were also excluded if they had regularly practiced Forrest Yoga previously. Current or past yoga practice of other styles of yoga was not an exclusion.

Participants were recruited through referrals from primary care clinics and the narcotic management program at the local hospital, Winona Health; flyers and pamphlets posted in the hospital and in public places in Winona, MN; and through emails to faculty and staff at Winona State University. Participants called or emailed the research team to express interest and were given basic information about the study, such as what was involved and the randomization process. If potential participants were still interested, the principal investigator (PI) scheduled a consent and screen appointment with a member of the research team at the yoga studio.

### **Screening and Enrollment**

Participants first consented to be in the study and were then screened for eligibility. During the screening appointment, participants completed an eligibility questionnaire that included questions about their pain history, prior yoga experience, history of abdominal surgeries, access to transportation so as to attend yoga classes twice weekly, and access to the internet or DVD player. They also completed a custom 10-item PROMIS Pain Interference short form, the Physical Activity Readiness Questionnaire (PAR-Q), the Physician's Health Questionnaire (PHQ-9), and a subset of the Mini-International Neuropsychiatric Interview (MINI) adapted for pen-and-paper to assess for current substance use or psychotic symptoms. Participants were also asked to sit on the floor and stand up without assistance. Eligible participants had pain that had lasted > 12 weeks, had no Forrest Yoga experience, did not have a condition that prevented them from placing pressure on their abdomen, their physician had not recommended against physical activity including yoga, had a score of <15 on the PHQ-9 and reported no suicidal ideation,

denied substance use or psychotic symptoms that would interfere with class participation, and could stand up from seated on the floor without assistance.

## **Measures**

All participants completed assessments at baseline, 4-weeks (mid-intervention), 8-weeks (post-intervention), and 16-weeks (follow-up). All time points included the following measures: a 22-item PROMIS Pain Interference custom short form, a pain severity visual analog scale (VAS), the Michigan Body Map (MBM), the Short Form McGill Pain Questionnaire (SF-MPQ), the World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (WHO-ASSIST), the Hospital Anxiety and Depression Scale (HADS), the Acceptance and Action Questionnaire, second edition (AAQ-II), the Psychological Inflexibility in Pain Scale (PIPS), the Pain Catastrophizing Scale (PCS), the Social Provisions Scale (SPS), and the Tampa Scale of Kinesiophobia (TSK). The baseline questionnaire also collected demographic data. The 4-week, 8-week, and 16-week assessments included questions about changes to weight, pain management or exercise regimens, adverse events, and yoga home practice completion (if applicable). Participants were instructed to skip any question they did not want to answer and were asked to complete the questionnaires within 72 hours of receiving them, but they were accepted at any time. Questionnaires were administered through Qualtrics, an online survey system, or via hard copy if participants preferred completing them with paper and pencil.

**Clinical significance of findings.** In addition to statistical significance, it is necessary to interpret statistically significant findings in the context of their clinical applications. The minimal clinically important difference (MCID) is measure-specific and is determined by comparing the scores of those who assess themselves as “better” or “minimally better” to those that assess

themselves as “unchanged” (Hagg, Fritzell, Nordwall, & Swedish Lumbar Spine Study, 2003). For each statistically significant finding, the clinical significance was also evaluated.

**Demographics.** Participants were asked for their gender, birthdate, height, weight, ethnicity, marital status, level of education, employment status, income, current exercise level, and pain management strategies at baseline. In all subsequent assessments, they were asked for their weight and changes to pain management strategies or exercise.

**Patient-Reported Outcomes Measurement Information System - Pain Interference (PROMIS - PI) Custom Short Form.** The PROMIS-PI measure is a self-report measure created by NIH to measure the extent to which pain impacts the daily life of respondents. The PROMIS-PI was developed using an item response theory model so that custom short forms could be created for specific populations and be psychometrically sound. The PROMIS-PI custom short form was composed of 22 of the 41 total items and included questions like, “In the past 7 days, how much did pain interfere with your ability to concentrate?” and “In the past 7 days, how often did pain keep you from socializing with others?” The responses to the items are uploaded via a standardized spreadsheet, scored by the HealthMeasures Scoring Service, and reported as a t-score.

The minimal clinically important difference (MCID) for the PROMIS Pain Interference measure depends on the pain population studied. For example, in a population of depressed patients with comorbid chronic back pain, the majority of which rated their pain as moderate to severe, the MCID was 3.5-5.5 points (Amtmann et al., 2016), while in a population of patients with knee osteoarthritis, the MCID was 2.4 (Lee et al., 2017). Because the MCID for back pain was more conservative and more patients in our sample reported chronic back pain, a MCID of 5

was used to interpret the Pain Interference model-predicted change for each group post-intervention.

**Visual Analog Scale.** Pain severity was assessed using a Visual Analog Scale (VAS) that was modified for online use. The Visual Analog Scale is the gold standard in measuring pain severity as it is responsive to change, has strong face validity and is adequately reliable (Price, McGrath, Rafii, & Buckingham, 1983). In this online version, participants moved a slider on a line to indicate their current level of pain, and the online survey system, Qualtrics, translated the position of the slider to the corresponding distance on the line, between 1.0 and 10.0. This number as well as the visual position of the slider was recorded. For participants who elected to complete the assessments using pen and paper, the traditional method was used: participants marked their pain severity on a 100 millimeter line and the research team measured the response to the nearest tenth of a centimeter (Price et al., 1983).

The MCID identified in the literature for the Visual Analogue Scale (VAS) differs based on painful area. The literature is divided as to whether the MCID for the VAS should be an absolute number or a percentage improvement from baseline (Fishbain, Gao, Lewis, & Zhang, 2016). For chronic low back pain, the recommended MCID is 15.0 - 20.0 mm or a 20 - 30% improvement from baseline (Ostelo et al., 2008). For osteoarthritis of the hip, a minimum change of 15.3 mm was clinically important, whereas knee osteoarthritis patients had to report a 19.9 mm point difference (Stauffer, Taylor, Watson, Peloso, & Morrison, 2011). However, in two RCTs of patients with endometriosis-associated pelvic pain, those patients that reported their pain was minimally improved changed just 10 mm (Gerlinger et al., 2010). No MCID for neck pain was found. Thus, since the majority of the pain patients in this study reported back or arthritis pain, a reasonable MCID absolute range is 15-20mm. As we were assessing the

minimum threshold, we chose to use the lower bound of the ranges (20% or 15.0 mm improvement) to determine MCID for the VAS in this study.

**Michigan Body Map.** The Michigan Body Map (MBM) is a graphic representation of the human body with a total of 35 areas that respondents can use to indicate the body locations in which they experience pain. The 35 areas include the 19 that compose the Widespread Pain Index (WPI) that is used as part of the process in diagnosing fibromyalgia as well as an additional 16 areas. Respondents are able to use this tool to report widespread body pain in a standard, straight-forward, and quick way. The MBM has high face, test-retest, and construct validity (Brummett et al., 2016). The MBM is scored by summing the body locations in which participants report pain.

The minimum clinically important difference for the Michigan Body Map (MBM) follows the IMMPACT recommendations of a 30% reduction in number of painful body parts (Dworkin et al., 2005).

**Short Form McGill Pain Questionnaire.** The Short Form McGill Pain Questionnaire (SF-MPQ) was adapted from the McGill Pain Questionnaire to evaluate the affective, sensory, and evaluative dimensions of pain experience in pain patients in less time than the original (Melzack, 1987). It is composed of a Present Pain Intensity (PPI) index, visual analog scale, and a list of 15 words that participants use to rate the quality of their pain. Because participants completed a Visual Analog Scale elsewhere in the battery, it was omitted from this version of the SF-MPQ. The SF-MPQ has high test-retest reliability and is sensitive to change (Strand, Ljunggren, Bogen, Ask, & Johnsen, 2008).

In the PPI, respondents report how they would describe the intensity of their pain on a six-point scale ranging from No pain (0) to Excruciating (5). In the 15-item word list,

participants report the degree to which each word describes their pain, ranging from None (0) to Severe (3). The total score for the word list is composed of two subscales: the Sensory subscale which is composed of 11 items, such as Throbbing and Sharp, with a possible score ranging from 0 to 33, and the Affective subscale which contains four items, such as Tiring/Exhausting, and the range of scores is 0-12. Higher scores reflect greater distress.

The minimum clinical differences identified for a sample of patients with chronic musculoskeletal pain was 5.9 points for the Total scale, 4.3 for the Sensory subscale, and 1.6 for the Affective subscale (Strand et al., 2008). There was no minimum change listed for the PPI.

### **World Health Organization Alcohol, Smoking and Substance Involvement**

**Screening Test.** The World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (WHO-ASSIST) is an eight-item interview that assesses lifetime and current substance use, consequences of use, and failure to stop or cut down use of a variety of substances including tobacco, alcohol, cannabis, cocaine, inhalants, sedatives, hallucinogens, and opioids (Humenuik, 2010). The WHO-ASSIST has good to excellent validity when compared to gold standard assessments of alcohol, tobacco, and other substance use (Humenuik et al., 2008) and high test-retest reliability (Humenuik, 2010). The WHO-ASSIST was modified for online use. The WHO-ASSIST has been modified in this way previously and had excellent concordance of results between interviewer-administered and computer-administered versions of the assessment (McNeely, Strauss, Rotrosen, Ramautar, & Gourevitch, 2016).

No clinical significance metrics could be found for this measure.

**Hospital Anxiety and Depression Scale.** The Hospital Anxiety and Depression Scale (HADS) was used to measure symptoms of anxiety and depression. The HADS is a 14-item self-report scale that has been shown to be valid and reliable in patients attending a medical clinic

(Zigmond & Snaith, 1983). For each item, respondents indicate how much a statement describes them on a 4-point scale. It contains seven items that measure depressive symptoms, such as “I still enjoy the things I used to enjoy” with the following response options: Definitely as much, Not quite as much, Only a little, and Hardly at all. It contains seven items that measure anxiety symptoms, such as “I feel tense or wound up” with the following response options: Most of the time, A lot of the time, From time to time/Occasionally, and Not at all. Each scale can range from 0 to 21 points and a score of 11 or higher indicates probable depression or anxiety disorder (Zigmond & Snaith, 1983). Beyond this cut off score, there are no established clinically significant change scores.

**Acceptance and Action Questionnaire.** The Acceptance and Action Questionnaire (AAQ-II) is a seven-item self-report scale that measures psychological inflexibility, a term that refers to having a rigid behavioral approach to situations that is based on avoiding unpleasant internal events (such as anxiety, sadness, or pain) even when acting in this way distances people from their chosen values. A sample item is: “My painful experiences and memories make it difficult for me to live a life that I would value.” Each item is rated on a seven-point Likert scale, where 1 is “Never true” and 7 is “Always true” resulting in a possible total of 49 points, with higher values indicating higher levels of psychological inflexibility. The AAQ-II has been shown to have sufficient construct validity as well as test-retest reliability (Bond et al., 2011). There are no established change scores that reflect clinically significant improvement on this measure.

**Psychological Inflexibility in Pain Scale.** The Psychological Inflexibility Pain Scale (PIPS) is a 12-item self-report questionnaire that assesses two aspects of psychological inflexibility as it applies to the participant’s experience of pain: avoidance and cognitive fusion (Wicksell, Renofalt, Olsson, Bond, & Melin, 2008). The respondent is told to indicate how true

each statement is of them right now. Each item is rated on a 7-point Likert scale where 1 is “Never true” and 7 is “Always true.” A sample avoidance item is “I cancel planned activities when I am in pain,” while a sample cognitive fusion item is “It is important that I learn to control my pain” (Wicksell et al., 2008). The PIPS has been shown to mediate the relationship between pain and disability (Wicksell, Lekander, Sorjonen, & Olsson, 2010). Additionally, the measure has high construct validity and acceptable reliability (Wicksell et al., 2010). Similar to the AAQ, there are no established change scores that reflect clinically significant improvement on this measure.

**Pain Catastrophizing Scale.** The Pain Catastrophizing Scale (PCS) is a questionnaire that measures how often respondents endorse 13 thoughts on a five-point Likert scale from “Not at all” to “All the time” (Sullivan, Bishop, & Pivik, 1995). The total PCS score contains three dimensions: rumination, magnification, and helplessness. A sample of the rumination dimension is, “I keep thinking about how much it hurts;” magnification, “I become afraid that the pain may get worse;” and helplessness, “It’s terrible and I think it’s never going to get better.” The PCS demonstrates high construct validity and test-retest reliability (Sullivan et al., 1995).

A clinical cut off score of 30 for the total PCS, or the 75<sup>th</sup> percentile ranking is considered clinically relevant and related to unemployment one year past the date of injury, self-description as disabled, and increased likelihood of meeting criteria for depression (Sullivan et al., 1995). While there are norms that determine percentile rankings for Total and subscale scores, there are no norms related to clinical significance of changes in PCS scores.

**Social Provisions Scale.** The Social Provisions Scale (SPS) is a self-report scale in which an individual states how supportive they perceive their relationships to be (Cutrona, 1984). Individuals indicate the degree to which they agree with 24 statements, such as “I have close

relationships which give me a sense of emotional security and well-being” on a four-point Likert scale. The scale has demonstrated adequate reliability and validity (Cutrona & Russell, 1987).

The Social Provisions Scale measures six different domains of social support. These domains include problem-solving aspects, such as having access to guidance, advice, and information, and reliable alliances that provide tangible assistance (Cutrona & Russell, 1987). Additionally, there are four domains that are non-problem solving forms of assistance including receiving reassurance of one’s worth and competence, having the opportunity to nurture others, having a sense of attachment or emotional closeness with someone else, and feeling like one belongs to a group. The corresponding subscales of the Social Provisions Scale are Guidance, Reliable Alliance, Reassurance of worth, Opportunity for Nurturance, Attachment, and Social Integration (Cutrona & Russell, 1987).

**Tampa Scale of Kinesiophobia.** Fear of movement and re-injury were assessed using the Tampa Scale for Kinesiophobia (TSK). The TSK is a 17-item self-report questionnaire and for each item, the respondent indicates how much he agrees with a statement on a 4-point Likert Scale (Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995). The TSK has a two factor model: Activity avoidance and Pathologic somatic focus (Goubert et al., 2004). Activity avoidance is measured with items such as “I’m afraid that I might injure myself if I exercise” while pathologic somatic focus is measured with items like, “People aren’t taking my medical condition seriously enough” (Roelofs, Goubert, Peters, Vlaeyen, & Crombez, 2004). The TSK has been shown to be valid in chronic low back pain patients and has high internal consistency in this population (Roelofs et al., 2004).

There is no universally accepted norms for pathological levels of kinesiophobia, but the most commonly reported cut off value is 37, where scores below 37 are thought to indicate sub-

clinical levels of fear of movement. As the interpretation of this scale is simply a dichotomous split, there is no established reduction in scores that is clinically meaningful.

**Feasibility and treatment compliance.** Feasibility of this project was determined by our ability to meet overall recruitment and attendance goals. For the project to be considered “feasible,” a total of 100 participants had to consent to be in the study, no more than 20% could be ineligible, and no more than 20% of those randomized to a treatment condition could withdraw or be lost to follow-up (see Power Calculation below). Additionally, for the yoga treatment to be deemed “acceptable,” the average attendance rate had to be at least 60% of classes.

Treatment compliance was evaluated based on individual attendance. Attendance was taken at all yoga classes. Additionally, participants randomized to the yoga group reported the number of home practices that they completed in their mid-intervention, post-intervention, and follow-up assessments.

**Adverse events and difficulties.** Participants were queried for adverse events and difficulties related to their involvement in the study at each time point as part of the self-report battery. An adverse event is an unanticipated problem that occurs during participation in a study, but is not necessarily related to study treatment (National Institutes of Health, 1999). We define a difficulty, on the other hand, as an expected side effect of participation in a study that involves physical activity, such as muscle soreness, joint pain, fatigue, and even an increase in pain. If participants indicated that they had experienced an adverse event or difficulty, they were asked to describe the issue they experienced and rate the severity of the problem. They were asked if they sought medical care specifically for the issue, and if so, where they went and what the outcome

was. Adverse events and difficulties were reviewed after data were collected at each time point to ensure the intervention was not harming participants.

### **Treatment Conditions**

**Yoga intervention.** The yoga intervention was manualized and reviewed by a Forrest Yoga representative to ensure it was Forrest Yoga consistent. The intervention consisted of two 60-minute yoga classes taught in person and one 30-minute video-led home practice per week for eight weeks. The intervention was sequenced such that each class was unique and progressive. The in-person classes were scheduled based on the availability of the participants, the studio, and the instructor. If participants were randomly assigned to the yoga condition but were unable to attend the classes at the offered times, they could defer their participation to the next round of classes. The intervention was offered three times. Due to scheduling issues, the first and third waves were held at a local yoga studio, the second wave was held at the local YMCA. During each round, classes was offered at two different times in a given week so that if a participant could not attend class at one time, they might be able to attend that class at the other time option. For example, in the first round, the first class of the week was offered on Mondays at 6pm and again on Tuesdays at 4:15pm. Participants could attend either class. Class sizes ranged from 2 to 9 participants; the average class size was 4.8.

Participants were given DVDs and links to YouTube videos made specifically for this study in which the yoga instructor demonstrated and led viewers through one 30-minute home practice per week. Each week's home practice differed from the previous week as the classes increased in difficulty throughout the intervention. Participants were instructed to complete the home practice after they had attended the in-person classes. There were a total of seven videos provided; no video was included for the final week. The videos included poses that were taught

during the in-person classes that week and participants were instructed to do as much of the videos as they could, but to skip poses if they were unsure of proper alignment. The links for the home practice videos on YouTube are:

- Week 1: <https://youtu.be/y6Ih19Qiz7I>
- Week 2: <https://youtu.be/ZcYBfFwE7UI>
- Week 3: [https://youtu.be/3-OXRwi\\_HQQ](https://youtu.be/3-OXRwi_HQQ)
- Week 4: [https://youtu.be/T-RwPoJ2F\\_w](https://youtu.be/T-RwPoJ2F_w)
- Week 5: <https://youtu.be/XZk58cKudtE>
- Week 6: <https://youtu.be/KGCIqTN7bu0>
- Week 7: <https://youtu.be/6xNGdbuPDWk>

All class sequences grew in complexity over the course of the intervention, but always adhered to Forrest Yoga sequencing principles: classes started with the setting of a specific intention that was in alignment with the pillars of Forrest Yoga, and then participants were led through a breathing exercise, a pose to warm up the spine, Forrest Yoga abdominal exercises, a pose to lengthen the spine, a pose to warm up the shoulders, sun salutations, poses to prepare for an apex pose, the apex pose, and then a warm down/cool down, and savasana. Apex poses included twists, inversions, backbends, and/or poses designed to strengthen the legs. The manual is included in Appendix C.

**Usual care.** Participants randomized to the usual care control group were asked to continue any pain management protocol they were currently utilizing. Participants were told that they were free to add new pain management interventions and start a new physical activity, including yoga while they participated in the study. The only restriction was that they were not to attend Forrest Yoga classes for the duration of their 16-week study involvement. Once

participants completed the 16-week assessment, they were invited to the yoga studio to attend the first four classes of the intervention. They were given links to the home practice YouTube videos after attending the required prerequisite in-person classes.

### **Yoga Instruction and Fidelity to Treatment**

The yoga manual was developed and the intervention was conducted by the PI, a Forrest Yoga teacher who had been teaching for four years at the beginning of the intervention and had completed the Forrest Yoga Foundation Teacher Training, Forrest Yoga Advanced Teacher Training, Forrest Yoga Mentorship Program, and had assisted Ana Forrest at a Forrest Yoga Foundation Teacher Training. The intervention manual was extensively reviewed and revised based on feedback from Forrest Yoga representative, Catherine Allen.

All classes were audio recorded to ensure fidelity to treatment. Ten percent of the audio recorded classes were randomly selected for review by two Forrest Yoga representatives: Catherine Allen and Kayla Houde. They were provided the intervention manual to compare the audio recording to and used an agreed upon rubric to determine how closely the instructor followed the manual.

### **Statistical Methodology**

Analyses were conducted using IBM SPSS Statistics v24 and R version 3.4.1. All outcome variables were examined for normalcy via histograms prior to analyses. Preliminary analyses were conducted using one-way ANOVAs to explore between group baseline differences and correlations between demographic variables and outcomes in SPSS.

Mixed effects models using the lmer function were run in R to evaluate group effects over time. Data from all four time points (baseline, mid-intervention, post-intervention, and follow-up) were included when fitting models, despite Aims 1 and 2 focusing on the first three

time points and Aim 3 focusing on the final two time points. All data points were included because the fit of the model improves when all available data are included, as opposed to fitting separate models with subsets of the data. By including all available data in a single model, our confidence in the fit of the model increases.

The shape of the data was visually examined and then quantitative model comparisons were completed to determine the functional form of the best fitting model. Both evaluations indicated that a quadratic functional form fit the data best. Linear and quadratic fixed effects terms were included to determine the effect of group membership over time, and random intercepts and linear slopes were included for subjects to allow for individual variability. For Aims 1 and 2, the intercept was centered at baseline to determine the rate of change early in the intervention and then re-centered at the 8-week time point to determine group level differences post-treatment.

To test for minimal clinically important difference (MCID), a change score was calculated by subtracting the observed week 8 values from the baseline score for each outcome that has an established MCID threshold. Each change score was coded as meeting clinical threshold or not, and then differences between groups were evaluated by chi-square analysis in SPSS.

Aim 3 investigated group level differences at the 16-week follow-up time point, thus the same models used for Aims 1 and 2 were re-run for Aim 3 with the intercept centered at 16-weeks. Since this aim also postulated that there would be differences between participants who continued to practice yoga versus those who did not, exploratory subanalyses were conducted to investigate if those yoga participants who continued to practice yoga after the formal intervention differed at follow-up from those who stopped practicing or usual care group

participants. To conduct these analyses, the yoga group was split into two groups: yoga-continuers and yoga-non-continuers based on their reported yoga practice in the follow-up battery. If they reported using the video to guide home practice or had attended a Forrest Yoga class offered to the public, they were classified as “continuing.” If they reported that they had not continued, if they left this item blank, or if they did not complete the 16-week battery, they were classified as “non-continuing.”

Age was significantly different between groups at baseline and correlated with several outcome measures, including: pain severity ( $r = -0.28$ ,  $p = 0.012$ ), sensory experiencing of pain ( $r = -0.24$ ,  $p = 0.031$ ), and anxiety ( $r = -0.24$ ,  $p = 0.034$ ). Thus, age was included in models and tested for best model fit. Age did not account for a significant proportion of the variance in any significant analyses and thus is not included in the models reported below.

### **Power Calculation**

The minimal clinically significant difference in the PROMIS Pain Interference score was the primary outcome of interest considered in power calculation for this study. A change of 5 points for the PROMIS calculated t-score is considered to be clinically significant (Amtmann et al., 2016; Askew, Cook, Revicki, Cella, & Amtmann, 2016; Lee et al., 2017). The PROMIS Pain Interference scale has a standard deviation of 10. Thus, with an alpha level of 0.05 and a beta value of 0.8, a sample size of 32 participants per group was required to complete the study. We anticipated a screen failure rate of 20% and a drop-out rate of 20%. Thus, a total of 100 participants were estimated to be required to consent to participate and be screened, and a total of 40 participants were required to be eligible and randomly assigned to each group to appropriately power this study.

## Results

### Participants

Between April 2016 and February 2017, 181 people responded to posted advertisements and/or referrals from their health practitioner to learn more about the research study. One hundred eleven people met with a member of the research team, and 106 consented to participate in the study. Twenty-two were not eligible because they did not meet inclusion criteria: 20 had a PROMIS t-score less than 60, one reported a pain duration of less than 12 weeks, and one could not sit on the floor. Two potential participants were excluded for meeting exclusion criteria: one endorsed suicidal ideation and one stated he had abdominal staples. No one reported substance use or psychotic symptoms that interfered with their ability to meet obligations, such as attend classes. No one reported prior Forrest Yoga practice and no one was pregnant or trying to get pregnant. One participant stated that she practiced hatha yoga regularly. As this was not an exclusion, she was included and was randomly assigned to the yoga group. Of the remaining 82 participants who were eligible, three never returned their baseline assessment. Thus, seventy-nine participants were randomly assigned to either the yoga group (n=40) or the usual care control group (n=39). Participant flow is summarized in the CONSORT diagram in Figure A1.

Participants were predominantly female (77.2%), White (94.9%), married (65.8%), had earned a four-year degree or higher (59.5%) and employed full-time (46.8%). They were middle-aged (mean = 56.1 ± 12.0 years; range = 27 – 78 years) and had been in pain for over a decade (10.8 ± 10.4 years) on average, though the duration ranged from 5 months to 60 years. Despite randomization, participants in the yoga group were significantly younger than those in the usual care group, (F(1,77)=4.66, p= 0.034, yoga: M=53.3 ± 11.0 years, range = 30 – 73 years; usual care: M=59.0 ± 12.5 years, range = 27 – 78 years) and more likely to be working full time, while

the usual care group was more likely to be retired ( $F(1,77) = 5.17, p = 0.026$ ). Demographics of participants in each group are listed in Table B4.

After randomization, one person from each group dropped out of the study. The usual care group participant did not want to continue once she learned of her assignment and the yoga group participant started a new job and stated that she no longer had time to participate. An additional three participants in the usual care group and five participants in the yoga group stopped completing assessments after baseline and did not respond to the research team's repeated attempts to collect these data. Thus, a total of ten participants did not complete the study (15.0% of yoga, 10.3% of usual care), leaving a total of 35 participants in the usual care group and 34 in the yoga group. Compared to those that completed the study, participants that withdrew consent or were lost to follow up were more likely to report an ethnicity other than White ( $F(1,77)=10.46, p=0.002$ ), to have a lower income level ( $F(1,77)=7.49, p=0.008$ ), less likely to have an advanced degree ( $F(1,77)=4.13, p=0.045$ ), and reported lower levels of pain catastrophizing ( $F(1,77) = 4.55, p = 0.036$ ), at baseline.

### **Adverse Events and Difficulties**

Eleven participants reported transitory increases in discomfort while enrolled in the study. Five yoga participants reported a temporary increase in joint pain, such as hip or wrist tenderness after class that lasted a few hours to multiple days after class. None of the participants sought medical attention for the joint pain and all continued to attend yoga classes. Six reported muscle soreness after the yoga classes. Five of these continued with the intervention despite the soreness and noted that the soreness decreased as they became accustomed to the movement. One participant reported muscle soreness after starting both yoga and physical therapy at the same time and chose to stop both activities. He did not withdraw from the study and continued to

submit data at each time point. The discomfort experienced by the participants was in line with what was expected and described in the informed consent document, thus are considered difficulties and not adverse events. Thus, there were no adverse events reported by participants during the study.

### **Fidelity Check**

Two established Forrest Yoga teachers with a combined 20 years of consistent Forrest Yoga instruction reviewed audio files of study classes. Every class was recorded and a random subset of 10 percent of the classes were selected for review. Reviewers indicated if the instructor exactly followed the sequence in the manual, if poses were skipped, or if additional poses were added. Interrater reliability was 0.98. The reviewers found that all of the reviewed classes included the necessary components: setting the intent, pranayama, warming up core muscles, a hot portion, warm down/cool down, and final relaxation. Overall, 2.25 percent of poses were skipped, which equates to approximately two poses being omitted in four 20-pose classes. No additional poses were added to classes.

### **Feasibility of the Study**

To be feasible, recruitment had to successfully yield at least 100 consented participants. As 106 participants consented to be in this study, the intervention was feasible from a recruitment stand-point. Additionally, to be feasible, no more than 20% of the participants in each treatment group could drop out or be lost-to-follow up. 15.0% of the yoga group and 10.3% of the usual care group were lost to follow-up or dropped out. The final N per group was 34 in the yoga group and 35 in the usual care group, which exceeds the 32 required per group to appropriately power the study. Finally, yoga participants were expected to attend 60% of the classes. Average attendance was 12.1 of 16 classes, or 75.8%.

The usual care group participants were offered the first four classes of the intervention after their final assessment was collected. Of the 39 participants offered the classes, eight attended any of the offered classes. Those that did attend a class attended 2.25 on average and the average class size was 2.

### **Aim 1: Effect of the Yoga Intervention on Pain-related Outcomes**

**Pain interference.** The primary outcome of interest was self-reported pain interference, based on participants' responses to the PROMIS Pain Interference custom short form. The modelling results are depicted graphically in Figure A2 and the model predicted scores per group at baseline, post-intervention, and at follow-up are listed in Table B5 for all outcome measures.

Average pain-interference scores did not differ between the two groups at baseline ( $t(102.38) = 1.41, p = 0.16$ ). Both groups decreased in pain interference across the measurement period ( $t(207.2) = -2.94, p = 0.0037$ ) but the yoga group showed a reliably steeper decline in pain interference early in the intervention than those in the usual care group ( $t(210.42) = -4.29, p < 0.001$ ). As pictured in Figure A2, the usual care group improved steadily over the period of observation, showing little indication of changes in trajectory across the intervention. Conversely, the yoga group's trajectory was not linear: it improved rapidly during the course of the intervention and then leveled off when the intervention was completed ( $t(203.84) = 4.06, p < 0.001$ ).

Re-centering the intercept at the post-intervention time-point revealed that those in the yoga group showed significantly lower pain interference scores than those in the usual care group at week 8, the end of the intervention ( $t(112.75) = 6.11, p = 0.015$ ). A minimal clinically important difference (MCID) of 5 was used to interpret the Pain Interference model-predicted change for each group post-intervention. The model-predicted change in pain interference in the yoga group

at week 8 was 7.19 for the yoga group and 2.87 in the usual care group. The proportion of observed change scores that met MCID in the yoga group exceeded that of the usual care group ( $\chi^2(1) = 14.7, p < 0.001$ ). Twenty-one of 33 yoga participants met or exceeded the MCID threshold but only 6 of 34 usual care group participants did so. The number of participants per group that met MCID for all relevant outcomes is listed in Table B6.

**Pain severity.** Participants indicated the current pain severity of their most troublesome area using a Visual Analogue Scale. At baseline, there was no significant difference between groups for Visual Analogue Scale ratings ( $t(102.78) = 1.123, p = 0.26$ ). The usual care group showed a non-significant reduction in scores between baseline and week 8 ( $t(153.8) = -1.45, p = 0.26$ ) that was generally linear in shape ( $t(134.46) = 0.63, p = 0.53$ ), whereas the yoga group's scores decreased more quickly ( $t(155.55) = -2.85, p = 0.005$ ) and leveled off, as evidenced by a significant group by time<sup>2</sup> interaction ( $t(135.16) = 2.8, p = 0.0059$ ). The curves are pictured in Figure A3.

At 8 weeks, there was a trend towards a difference between groups in pain severity scores ( $t(132.04) = 3.023, p = 0.085$ ). The model predicted changes in scores in the yoga group between baseline and post-intervention were an absolute change of 18.6mm, or a reduction in pain scores by 46.6%. The usual care group also decreased: the absolute difference from baseline was 6.4mm or a reduction by 18.4%. These results indicate that the yoga group met the MCID of 15.0mm or percentage improvement of 20%. When the observed change scores were compared, 18 of 33 yoga participants and 9 of 34 usual care participants met or exceeded the 15.0 mm MCID threshold ( $\chi^2(1) = 5.49, p = 0.019$ ), and 25 out of 33 yoga participants met or exceeded the 20% reduction threshold compared to 13 of 34 usual care participants ( $\chi^2(1) = 9.60, p = 0.002$ ). Thus,

the proportion of yoga participants that achieved clinically significant levels of pain reduction was greater than usual care participants.

**Number of painful body parts.** Participants reported the number of body parts in which they were currently experiencing chronic pain using the Michigan Body Map (MBM). The groups were not different at baseline ( $t(87.1) = -0.45, p = 0.66$ ). On average, scores for the usual care group did not change over time ( $t(156.44) = 1.32, p = 0.19$ ), though the shape of the usual care group's trajectory was generally linear ( $t(130.47) = -1.44, p = 0.15$ ). As pictured in Figure A4, compared to the usual care group, the yoga group decreased at a significantly faster rate ( $t(157.5) = -2.31, p = 0.022$ ) and was non-linear in trajectory because this quick decline leveled off at the end of the intervention ( $t(129.58) = 2.04, p = 0.044$ ).

At 8 weeks, the yoga group reported a trend towards fewer painful body parts ( $t(91.16) = 3.54, p = 0.063$ ). While the groups trended towards a statistical difference at the post-intervention time point, neither group reached the MCID of 30% reduction in painful body parts. The yoga group decreased from an average of 7.6 to 6.1 painful body parts, or a 20.5% reduction, while the usual care group increased from 8.2 to 9.0 painful parts, or an increase by 9.4%.

Further exploration of the data revealed that 21 out of 32 yoga participants with pre- and post-intervention Michigan Body Map data reported a 30% reduction or more in painful body parts. Nine of 34 usual care participants met this criterion. The number of participants in the yoga group that reported a 30% reduction in painful body parts was significantly greater than those in the usual care group ( $\chi^2(1) = 10.19, p = 0.001$ ).

**Sensory and affective experience of pain.** The Short Form McGill Pain Questionnaire (SF-MPQ) used in this study has two parts: the Present Pain Intensity Index (PPI) and a word list. There were no differences in the PPI scores at baseline ( $t(102.60) = 0.23, p = 0.82$ ). On average,

the usual care group's scores did not change significantly ( $t(156.20) = -0.63, p = 0.53$ ), and the trajectory of change was linear ( $t(131.50) = -0.50, p = 0.62$ ). As pictured in Figure A5, the yoga group's trajectory showed a quicker decrease in scores compared to usual care ( $t(160.10) = -2.15, p = 0.034$ ), which was non-linear in nature ( $t(133.0) = 2.51, p = 0.013$ ).

Differences between groups at 8-weeks did not reach statistical significance ( $t(124.8) = 2.62, p = 0.11$ ). The model-predicted PPI scores decreased from 2.30 at baseline to 1.67 at 8-weeks for the yoga group, whereas the usual care group scores decreased from 2.25 at baseline to 2.02.

The score for the SF-MPQ word list includes a total score as well as sensory and affective subscales. There was no significant difference between groups at baseline for the total score or either subscale (all  $p$  values  $> 0.15$ ). On average, total scores for both groups reliably decreased over time ( $t(156.0) = -3.13, p = 0.002$ ); a similar effect was seen for the Sensory subscale ( $t(166.0) = -3.49, p < 0.001$ ), but the decrease on the Affective subscale did not reach statistical significance ( $t(145.0) = -1.67, p = 0.10$ ). As pictured in Figure A6, the yoga group trended towards having a faster rate of improvement compared to usual care for the total score ( $t(156.8) = -1.85, p = 0.066$ ), and the difference reached statistical significance for the affective subscale ( $t(148.0) = -1.98, p = 0.05$ ), but not for the sensory subscale ( $t(167.34) = -1.365, p = 0.17$ ). The overall trajectory of change for both the total score and the sensory subscale was quadratic ( $t(122.56) = 2.53, p = 0.013$ ;  $t(133.3) = 2.67, p = 0.0086$ , respectively). For the affective subscale, both group's trajectories were linear (usual care:  $t(111.5) = 1.497, p = 0.14$ ; yoga:  $t(117.8) = 1.70, p = 0.09$ ).

At 8-weeks, there were no significant differences between groups for any of the word list scales (all  $p$  values  $> 0.40$ ). The model-predicted baseline total score of 12.7 for the yoga group decreased to 7.2 at 8 weeks; the usual care group decreased from 10.7 to 7.8. For the Sensory

subscale, the yoga group decreased an average of 3.9 points, while the usual care group decreased 2.6. For the Affective subscale, the yoga group decreased 1.5 points while the usual care group decreased 0.6 points. The model-predicted decreases did not reach clinical significant thresholds, and the lack of difference between groups was consistent with nonsignificant chi square comparisons of the observed data for the Total, Sensory, and Affective scales (all p values > 0.17).

**Substance use.** At baseline, the only substances the participants endorsed using in the past three months were tobacco (N=8), alcohol (N=64), cannabis (N=7), and non-prescription sedatives (N=8). Participants denied using hallucinogens, cocaine, amphetamines, and non-prescription opioids. Over the course of the intervention, there was a significant overall decrease in alcohol use ( $t(155.6) = -5.53, p < 0.001$ ) and the urge to use alcohol ( $t(71.2) = -2.50, p = 0.015$ ), but no effect for group (p values > 0.6). There were no changes in use of other substances either overall or by group (all p values > 0.15).

Clinical significance criteria have not been established for this measure. However, scores between 0 and 10 for alcohol and 0 and 3 for all other substances are considered “low risk.” The model-predicted baseline scores for alcohol risk were 4.94 for the yoga group and 4.70 for the usual care group. These scores decreased significantly over the course of the intervention in both groups (yoga = 2.6, usual care = 3.0 at week 8 time point) but the clinical significance of this decrease is questionable since both groups were low risk at baseline. Similarly, tobacco use at baseline was within the low risk range (yoga = 1.28, usual care = 1.30) and was approximately cut in half in both groups post-intervention. While any decrease in tobacco use is likely a positive change, the decrease observed did not reach statistical significance ( $p = 0.07$ ) and is also likely clinically insignificant.

## **Aim 2: Effect of the Yoga Intervention on Psychological Outcomes**

**Psychological flexibility.** The primary outcome of interest in psychological related outcomes was psychological flexibility. Just as in the analyses for Aim 1, a quadratic model was fit using all four data points: baseline, week 4, week 8, and week 16. The model was used to assess differences in change trajectories between groups during the intervention period as well as between-group changes at week 8. Psychological flexibility was measured using the Acceptance and Action Questionnaire (AAQ) and the Psychological Inflexibility in Pain Scale (PIPS). There were no significant differences between groups or in trajectory of change for the AAQ (all  $p$  values  $> 0.37$ ) at baseline or at 8-weeks. The AAQ score estimated by the model for the Yoga group decreased from 17.2 at baseline to 16.3 at 8 weeks, where higher scores indicate more psychological rigidity. Similarly, the estimated score for usual care participants decreased from 15.6 at baseline to 15.0 at 8 weeks.

The PIPS is composed of a total score and two subscales: Avoidance and Fusion. There was an overall decrease in Total and Fusion scores over time ( $t(166.1) = -2.70, p = 0.008$ ;  $t(171.0) = -2.81, p = 0.006$ , respectively). The overall effect for time did not reach significance for the Avoidance subscale ( $t(158.6) = -1.91, p = 0.058$ ). There was no difference between groups at week 8 ( $t(107.4) = 0.51, p = 0.47$ ).

**Pain catastrophizing.** Catastrophizing thoughts about pain were measured using the Pain Catastrophizing Scale. The scale has a total score and three subscales: Rumination, Magnification, and Helplessness. There was an overall decrease in scores in the Rumination subscale ( $t(161.0) = -2.71, p = 0.008$ ). There were no group differences on the total score or any subscales at baseline or at 8 weeks, nor were there any differences in change trajectory between groups (all  $p$  values  $> 0.24$ ).

**Fear of movement.** The Tampa Scale of Kinesiophobia (TSK) measures fear of movement and reinjury in a chronic pain population. The scale has two subscales: Activity Avoidance and Somatic Focusing. There was a significant overall change in TSK scores over time ( $t(210.51) = 2.18, p = 0.030$ ) and the change for both groups was quadratic in nature ( $t(203.43) = -2.10, p = 0.037$ ), with the model-predicted scores for the usual care group increasing over time and the model-predicted scores for the yoga group decreasing over time. There were no group differences at baseline ( $t(109.27) = 0.74, p = 0.46$ ), but compared to usual care, the yoga group decreased significantly more quickly early in the measurement period ( $t(215.5) = -2.77, p = 0.006$ ). As pictured in Figure A7, the yoga group's improvement leveled off at the end of the intervention, whereas the usual care group's scores started to decline at that time ( $t(206.0) = 2.61, p = 0.009$ ). Post-treatment, the between group difference did not meet statistical significance ( $t(113.8) = -1.90, p = 0.06$ ). The model-predicted scores increased in the usual care group from 31.6 at baseline to 33.8 post-treatment whereas the model-predicted scores decreased in the yoga group from 32.6 to 30.8.

There was no significant group difference at baseline for the Activity Avoidance subscale ( $t(106.37) = 0.52, p = 0.61$ ). The shape of the curve pictured in Figure A7 indicates that the yoga group showed steep early decreases in Activity Avoidance that differed significantly from the trajectory of the usual care group ( $t(213.6) = -3.15, p = 0.002$ ), and that this change was quadratic in nature ( $t(206.4) = 3.09, p = 0.002$ ). The yoga group showed significant improvement at week 8 compared to usual care ( $t(114.6) = -2.31, p = 0.023$ ). The model predicted scores decreased in the yoga group from 16.4 at baseline to 14.3 post-treatment while the model-predicted scores increased in the usual care group from 16.0 at baseline to 16.26 post-treatment.

In the Somatic Focusing subscale, there were no significant differences between groups at baseline or post-treatment, though the yoga group trended toward decreasing at a faster rate compared to usual care ( $t(160.8) = -1.958, p = 0.052$ ).

**Depression and anxiety.** The Hospital Anxiety and Depression Scale (HADS) was used to measure changes in mood during the study. The HADS has a Depression subscale and an Anxiety subscale. For the total score, there were no differences between groups at baseline ( $t(86.53) = 1.07, p = 0.29$ ). The yoga group had significantly more early change than usual care ( $t(203.8) = -2.27, p = 0.024$ ). Both groups had an overall linear change trajectory that did not differ between groups ( $t(202.37) = 1.57, p = 0.12$ ). The groups did not differ post-treatment ( $t(95.11) = 0.53, p = 0.47$ ).

Similarly, on the Depression subscale, there were no group differences at baseline ( $t(85.19) = 1.17, p = 0.24$ ). The yoga group showed significantly greater early change compared to usual care ( $t(152.8) = -2.95, p < 0.01$ ). This steep decrease did not persist at 8 weeks, however, and the groups did not differ in depression scores post-treatment ( $t(93.08) = 0.91, p = 0.34$ ).

For the Anxiety subscale, there were no reliable differences between groups for any measure of change (all  $p$  values  $> 0.36$ ).

**Social support.** The Social Provisions Scale measures six different domains of social support: Guidance, Reliable Alliance, Reassurance of Worth, Opportunity for Nurturance, Attachment, and Social Integration. There were no differences between the groups for any outcome at either the baseline or eight-week time points for total score, Guidance, Reassurance of Worth, Opportunity for Nurturance, Attachment, or Social Integration. While the baseline differences between the groups for Reliable Alliances did not meet statistical significance ( $t(87.1) = -1.91, p = 0.06$ ), the yoga group tended to report lower levels of assurance from others

of instrumental support than the usual care group. The yoga scores showed improvement not seen in the usual care group ( $t(166.5) = 2.41, p = 0.017$ ), but the support did not persist as evidenced by the quadratic curve for the yoga group compared to usual care ( $t(129.9) = -2.15, p = 0.033$ ).

### **Aim 3: Effect of the Yoga Intervention on All Outcomes at Follow-up**

To complete these analyses, they were first conducted as above, with all yoga group members included in one group (primary analysis structure) and then for the secondary, exploratory analyses, the yoga group was split into “continuing” and “non-continuing” subgroups. By definition, all yoga participants that were lost to follow-up or withdrew from the study were in the non-continuing group. Of the 40 yoga participants, 24 either did not complete the follow-up assessment ( $n=6$ ) or did not report continuing to practice Forrest Yoga ( $n=16$ ). 16 reported continuing to practice.

For all outcomes, there were no significant differences between the combined yoga group and the usual care group at 16 weeks (all  $p$  values  $> 0.23$ ). While the PROMIS Pain Interference T-scores were no longer significantly different between groups ( $t(81.0) = -0.31, p = 0.74$ ), the yoga group’s model predicted difference from baseline of 5.97 surpassed the MCID of 5, while the usual care group’s model predicted difference of 4.10 did not. However, the proportion of yoga participants that maintained clinically relevant improvements was not significantly different from usual care ( $\chi^2(1) = 3.39, p = 0.066$ ).

When the yoga group was split into those that continued to practice yoga and those that did not, there were no differences between groups on any demographic or baseline measure (all  $p$  values  $> 0.6$ ). There were also no differences between the usual care participants, the non-continuing yoga participants, or the yoga continuing participants for any outcome measure (all  $p$

values  $> 0.54$ ) at 16-week follow-up. The curve for the primary outcome, Pain Interference, is pictured in Figure A8.

## **Discussion**

This study compared the effects of an eight-week Forrest Yoga intervention and usual care on pain and psychological outcomes in a sample of chronic pain patients in rural Minnesota. The study proved to be feasible in that recruitment, attendance, and completion targets were exceeded. The yoga group experienced significant decreases in pain interference and activity avoidance during the course of the intervention compared to usual care. However, these changes were not maintained at the 16-week follow-up assessment, two months after the completion of the intervention. Similar patterns were seen for pain severity, number of painful body parts, and overall fear of movement, however the between group differences trended towards but did not meet statistical significance, and these trends did not continue at follow-up. None of the changes in psychological flexibility, anxiety, depression, substance use, or social support were significant at any time point.

## **Summary of Main Findings**

The yoga group's observed changes in pain interference were statistically significant and more likely to reach clinical significance compared to the usual care group at the 8-week time point. Interestingly, the usual care group also reported lower levels of pain interference over the measurement period, such that by the follow-up assessment differences between groups were no longer observed.

While changes in pain severity and number of painful body parts were not statistically significant at the post-intervention time point, clinically significant improvements were seen in these measures. Model-predicted changes in pain severity were clinically significant for yoga

participants at the end of the intervention but not for usual care, and a greater proportion of yoga participants met clinically significant thresholds compared to usual care. Similarly, a significantly higher proportion of yoga participants reached clinically significant improvement in number of painful body parts at the end of the intervention, compared to usual care. None of these improvements were maintained at the follow-up time point.

### **Differences in Rate of Change Between Groups**

As we further explored the shape of the data, we found differences in the overall rate and trajectory of change between groups for several outcome measures. These differences were evidenced by statistically significant differences in the symptom changes in groups over time for the following measures: pain interference, pain severity, number of painful body parts, present pain index, affective experience of pain, depression, total fear of movement, activity avoidance, and social alliance. Additionally, the somatic focusing group by time interaction failed to meet statistical significance but trended towards a difference.

These different trajectories indicate that the yoga intervention was associated with greater early reductions in symptoms compared to the change trajectory of usual care. For all outcome measures, this early change leveled out at the post-intervention time-point, and as evidenced by the quadratic functional form of the curves, and increased toward baseline values after yoga classes completed. There was no effect observed when the data were analyzed separating yoga participants who continued to practice yoga compared to those that stopped practicing. However, lack of data regarding frequency of yoga practice during the 8 week follow-up precludes conclusions about “continuers.”

We did not hypothesize that we would observe quadratic functional forms for the data, nor that we would see this significant early effect of yoga. It is an empirical question as to

whether the rate of improvement matters, as well as what the shape of the curve would have been if the intervention had continued beyond eight weeks. These findings indicate that the positive effects of yoga on pain are seen quickly upon the start of consistent group-based practice, which could impact willingness to engage in the intervention, perceived benefit, and willingness to continue practice. Further study should directly measure what is required for these benefits to be sustained, including frequency of practice and whether self-motivated home-based sessions have the same benefits as in-person classes.

While the yoga group exhibited early change, for most outcome measures, the usual care group also experienced non-significant, usually linear, decreases across the measurement period. These changes reached statistical significance for pain interference, sensory experience of pain, cognitive fusion, and rumination. While these changes might seem unexpected since participants reported relatively stable pain for a decade on average, the act of participating in a study can act as an intervention in and of itself (Weiner, 2013). By participating in the study, usual care participants received attention from the research team that in and of itself was a form of intervention. Thus, despite attempting to compare the yoga intervention to a usual care condition, there were small additions to the care the usual care group experienced that might have contributed to their improvements.

Additionally, participants completed assessments of their pain and psychological functioning a total of four times over a 16-week period. They might have exhibited practice effects such that over time they report increasingly improved outcomes (Weiner, 2013).

### **Psychological Outcomes**

Most of the hypothesized improvements in psychological outcomes were not observed. One reason this might be the case is that participants in this study reported very low levels of

psychological distress as assessed by psychological inflexibility, pain catastrophizing, fear of movement, depression, and anxiety at baseline, thus there was little potential for improvement.

The Action and Acceptance Questionnaire (AAQ) and Psychological Inflexibility in Pain Scale (PIPS) measured respondents' tendency to engage in values-based behaviors even when experiencing physical or emotional discomfort. The AAQ ranges in score from 7 to 49, with higher values indicating more rigidity and emotion-driven avoidance behavior. The model-predicted baseline score for the yoga group was 17.2, the usual care group was 15.6, indicating that, on average, both groups indicated that it was "very seldom true" or "never true" that their emotions prevent them from behaving in alignment with their values. In contrast, a score of 28 is generally considered to be a cutoff score indicating a clinically relevant level of distress (Bond et al., 2011).

Participants in this study endorsed somewhat avoidant and rigid cognitions and behaviors related to their pain, but their report of these types of thoughts was still lower than other samples of chronic pain patients. The PIPS ranges from 16 to 84 and as with the AAQ, higher scores indicate more rigidity or avoidance. While there are no norms for this measure, in a heterogeneous sample of 238 chronic pain patients, Trompetter, Bohlmeijer, Veehof, and Schreurs (2015) observed baseline values on the PIPS of 55 in their study in pain patients that decreased to 40.7 – 46.3 with intervention. The average baseline score on the PIPS at baseline for the yoga group was 42.4 and for the usual care group was 43.5. Thus, participants of the current study reported low levels of psychological inflexibility at baseline, thus they might not have had much ability to improve.

A similar trend was observed for pain catastrophizing, fear of movement, and mood issues. Participants reported levels of difficulty that are well below clinical thresholds on these

measures at baseline. As a result, there were limited opportunities for improvement during and after the intervention.

To be eligible for this study, participants had to report elevated levels of pain interference, but no requirements were included for high levels of psychological inflexibility, catastrophizing, fear of movement, anxiety, or depression. While these psychological factors tend to be observed in chronic pain populations, future studies might consider specifically including screening measures for psychological flexibility or catastrophizing if including these outcome measures.

### **Strengths of This Study**

This study expanded the yoga literature in key ways. This was one of only three yoga studies to measure fear of movement as an outcome measure and the first that we are aware of to find significant changes in aspects of fear of movement. This was the first yoga study to recruit a heterogeneous pain population and use the Michigan Body Map to assess for improvements in the number of painful body parts. The results of this study indicate that a significantly larger percentage of the yoga participants had clinically relevant improvements than those in the usual care group. This is important because widespread pain is associated with greater disability and is postulated to be a risk factor for central sensitization of pain (Meeus & Nijs, 2007). Taken together, these findings help to explain the mechanisms by which the intervention might have acted.

### **Theoretical Interpretation of Findings**

While we did not directly assess the mechanism of action for this intervention, it is important to consider theories of pain management when interpreting the results of this study. The psychological theories of chronic pain: the Operant Behavior Model and Fear Avoidance

Model, and a third theory, the Centralized Processing Theory of Pain might play a role in the interpretation of these findings and point to future directions in yoga research.

**Operant Behavior Model.** The Operant Behavior Model relies on theories of operant conditioning to shape pain behaviors. The goal of interventions founded on the Operant Behavior Model is not to decrease pain per se but to increase functioning despite persistent pain (Gatzounis et al., 2012). The model assumes that pain behaviors have been reinforced in the past, either by receiving something desired or the removal of something unpleasant. By removing these contingencies, the behavior is extinguished (Fordyce, Fowler, & DeLateur, 1968).

Activity Pacing and Graded Activity are both interventions that are aligned with the goals of the operant model (Gatzounis et al., 2012). In Activity Pacing, a desired activity is identified by the patient and then broken down into smaller activities, interspersed with rest. Thus, the patient gradually builds up to the activity without experiencing a feared consequence: pain (Gatzounis et al., 2012). Graded Activity, on the other hand, does not avoid pain per se. Instead, achievement of pre-determined behavioral quotas are reinforced (Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2002).

While there are elements of the Operant Behavior Model at play in this yoga intervention, such as gradually increasing the intensity of the activity, this model did not specifically inform the treatment of participants. For example, it was expected that participants would experience muscle soreness and fatigue after classes. While soreness was not a goal in and of itself, doing the exercises in a way so as to avoid muscle soreness after class was not encouraged. Participants were regularly invited to ask questions and voice difficulties they were having, and their experiences were usually validated and appropriate levels of empathy were expressed by the

instructor. Thus, there was the potential for reinforcement when participants expressed an increase in pain.

At the same time, there was the potential that since this yoga intervention was conducted in a group of chronic pain patients, participants might shape each other's behavior. For example, there was likely some implicit social pressure to participate in the class to the greatest extent of ability for fear of being seen as the person in class who could not keep up. At the same time, there was also the possibility that participants would reinforce each other's pain behaviors. This was not explicitly measured, thus a possible future area of research might include formally observing the factors associated with the social interactions of chronic pain patients in a yoga intervention.

Because this intervention did not specifically attempt to operantly control participants' pain behaviors, it is unlikely that this was the mechanism for change in this intervention. It is more likely that this intervention was driven by changing participants' activity pattern and their relationship to the associated cognitions, as theorized in the Fear Avoidance Model.

**Fear Avoidance Model.** The Fear Avoidance Model postulates that in chronic pain, patients are stuck in a cycle in which they fear that activity will injure a body part in which they experience pain thus, they avoid moving that body part, which results in a weakening of the muscles in that area. Then, when movement does occur, it results in the feared stimulus: pain (Lethem et al., 1983). Chronic pain patients who catastrophize are more likely to engage in higher levels of avoidance (Vlaeyen et al., 1995). Higher levels of catastrophizing are associated with worse performance on movement related tasks, regardless of pain severity rating (Vlaeyen et al., 1995). A recent meta-analysis concluded that fear-avoidance was related to pain severity,

but that the direction of this association is unknown (Kroska, 2016). In other words, those who report higher levels of fear-avoidance might be prone to perceive their pain as more severe.

Interestingly, in the review of previous yoga studies for chronic back, neck, or arthritis pain, only two studies included a measure of fear of movement as an outcome measure (Sherman, Wellman, Cook, Cherkin, & Ceballos, 2013; Williams et al., 2005). No changes were observed in the 16-week Iyengar intervention (Williams et al., 2005), and a 12-week Viniyoga intervention trended towards, but did not reach, statistical significance ( $p = 0.062$ ), compared to self-care education control (Sherman et al., 2013). In a mediation analysis, fear of movement did not mediate the relationship between the yoga intervention and disability, but it did partially account for the effect of the stretching control intervention on disability (Sherman et al., 2013).

In this study, though fear of movement as measured by the Tampa Scale of Kinesiophobia did not reach clinically significant changes, there was a trend toward a significant difference in total TSK scores between groups at 8-weeks and a statistically significant group by time interaction such that the yoga group showed early reductions and the usual care group increased. For the Activity Avoidance subscale, a similar shape to the curves was seen, and the difference between groups at week 8 was significant. Thus, to our knowledge, this is the first yoga study in a heterogeneous population of persistent pain patients that found significant reductions in fear of movement ratings.

Fear of movement can be reduced using a variety of methods, though *in vivo* exposure is considered to be more effective than graded activity and desensitization (Vlaeyen et al., 2002). *In vivo* exposure consists of fully experiencing a feared stimulus and all of the associated emotional responses without avoidance in a variety of contexts so as to learn that the feared stimulus is not dangerous (Bouton, Rosengard, Achenbach, Peck, & Brooks, 1993). In exposure treatment for

PTSD or panic, it is expected that the patient will experience a high level of arousal during treatment, thus the rationale for treatment is explicitly discussed and sessions are continued for as long as possible to maximize the chance of habituation (Craske & Barlow, 2007). The goal in this treatment is not to stop the physiological response but to make the symptoms of anxiety ambiguous and tolerable (Craske & Barlow, 2007). Similarly, a goal in mindfulness practice is to shift the cognitive response to pain from avoidance to allowing all of the sensations, thoughts, feelings, and sensations to exist in the present moment. This new way of relating to painful sensations has been used as a form of interoceptive exposure, and had significant reductions on sensory and affective interpretation of pain as well as on pain related emotional distress (Cayoun, Simmons, & Shires, 2017).

A potential mechanism of the yoga intervention was to expose participants to a variety of feared stimuli: movement, sensation in previously protected areas, fear, worry, and physical discomfort during and after classes if they experienced muscle soreness. Throughout the classes, participants were guided back to mindful awareness of sensation, to notice habitual tendencies to avoid, and to observe their experience with curiosity. Participants were encouraged to seek enough intensity in a pose so as to notice a strong desire for the pose to end while not pushing themselves so hard that they were unable to breathe mindfully. Thus, a participant might experience shaking and burning in their arms, legs, or torso, but not be so challenged that they resort to mindless action (Forrest, 2014).

It is important to note that despite this exposure to unpleasant sensory experiences being associated with improvements in pain interference and activity avoidance during the intervention, the results were not maintained at follow-up. A possible explanation for this is the limited nature of the exposure treatment. In exposure therapy, clients are instructed to practice

interoceptive exposures in and out of session and also to identify *in vivo* exposure activities to engage in between sessions (Foa & McLean, 2016). By deliberately practicing exposure in a variety of contexts, the client starts to generalize learning that his feared sensations are not dangerous (Bouton, 1988). In this intervention, participants did not practice interoceptive exposure outside of the context of yoga practice. Additionally, while participants were cued to take steps in their lives that reflected the values of their “Future Wiser Self,” there was no explicit *in vivo* component of the intervention. Thus, while there were elements of exposure used in this intervention, the full exposure treatment modality was not included which might contribute to the lack of maintained effects.

Beyond the psychological effects of yoga, it has known influences on biological processes that might be relevant to chronic pain.

**Centralized Processing Theory of Pain.** There is a growing body of evidence to support the proposition that the immune cells of the central nervous system (CNS) play a role in the pathological experience of pain (Grace, Hutchinson, Maier, & Watkins, 2014). Acute injury is a common precursor to chronic pain conditions, and inflammation is a key adaptive part of the healing process (Cairns, Panacek, Harken, & Banerjee, 2000). However, when the inflammatory response does not appropriately terminate, there can be harmful effects. Peripheral release of inflammatory cytokines, such as IL-1 $\beta$ , has been shown to activate *microglia*, non-neuronal cells in the CNS that acts as immune cells. While a thorough discussion of the complex signaling processes that occur at the neuroimmune interface and how that signaling influences pathologic pain is outside the scope of this paper, it is important to note that inflammatory signaling is a main contributor (Grace et al., 2014). There is a bi-directional relationship between inflammation and depression that is also associated with pain, which might help to explain the common

comorbidity of chronic pain with depression (Kiecolt-Glaser, Derry, & Fagundes, 2015; Lamkin et al., 2011).

Yoga has been shown to have anti-inflammatory effects. In a comparison of yoga experts versus yoga naïve participants, Kiecolt-Glaser et al (2010) found that yoga experts were less than one-fourth as likely as naïve participants to have detectable levels of the inflammatory marker C-Reactive Protein (CRP) in their blood. During yoga practice, white blood cells extracted from the yoga experts excreted less of another inflammatory marker, interleukin-6 (IL-6) when exposed to lipopolysaccharide (LPS), a bacterial sugar, compared to blood cells from yoga naïve participants. Yoga's anti-inflammatory effects were further supported by Bower et al (2014) who found a decrease in the transcription of proinflammatory signaling molecule nuclear factor kappa B (NFκB) after a 12-week yoga intervention RCT. Neither study investigated the effects of the interventions on pain, nor did they link the potential anti-inflammatory effects of yoga to the Central Processing Theory of Pain, yet the significant decrease in peripheral inflammatory signaling might influence central inflammatory signaling (Ronchetti, Migliorati, & Delfino, 2017).

Thus, while this study did not include a measure of inflammatory markers in patients, a potential mechanism to be investigated in future is the effect of yoga on peripheral and CNS inflammation in chronic pain patients.

### **Limitations and Future Directions**

In a study investigating the effects of catastrophizing and fear of movement on attitudes about yoga, Combs and Thorn (2015) found that higher levels of catastrophizing and fear of movement were related to more negative attitudes about yoga. Interestingly, they found that fear of movement completely mediated the relationship between catastrophizing and yoga beliefs,

indicating that higher levels of fear of movement might change how people feel about engaging in certain types of movement (Combs & Thorn, 2015). This study points to a potential limitation of this study: all participants volunteered to participate, thus likely had somewhat positive beliefs about yoga. Thus, the nature of the recruitment of this study might have selected for a specific type of pain population with relatively low levels of fear avoidance and positive attitudes about yoga.

The population that was recruited was generally healthy and reported low levels of psychological difficulty and functional impairment. The only criterion to be eligible was to report pain interference that was one standard deviation above the mean. It is possible that this level of interference is not significant enough to impact psychological functioning. Thus, in future studies, the pain interference threshold should be increased or additional criteria should be used to ensure participants exhibit elevated experiential avoidance, cognitive rigidity, catastrophizing, fear of movement, or internalizing symptoms to observe the effects of this intervention on those outcomes.

Despite the majority of participants reporting that they currently exercised at baseline, the lack of an exercise-based control group, as well as the inability to blind participants to their treatment condition were weaknesses of the study. By the nature of the intervention, yoga participants received significantly more attention than usual care participants by the PI and other members of the research team. Thus, improvements in the yoga group could have been due to an increase in movement, the knowledge that they got the active intervention, the amount of attention they received, or all of these factors.

There was no clinical evaluation of pain condition and the outcome measures did not include an objective measure of pain chronicity, thus we relied on participants' report that their

experience of pain met criteria for the study. Finally, no objective measures of flexibility or functional ability were included. The lack of objective measures has a variety of implications, such as the possibility that prospective participants could have over-reported symptoms at baseline to increase the likelihood that they would be included in the study or that yoga participants overestimated their improvements because they exerted so much effort to attend classes and they wanted their effort to be worthwhile.

Finally, this study has a high potential for bias because the PI designed the intervention and was the instructor for the yoga intervention. As there was only one instructor, any effect that was seen might be attributable to the effect of the person, not the intervention per se and there is no way to extricate these effects in this study.

Despite its limitations, the results of this study provide preliminary support that Forrest Yoga might be an effective intervention to help reduce pain interference and activity avoidance and opens the door for future studies. At a minimum, future studies should include active control groups, have multiple Forrest teachers instruct classes, and include objective measures of flexibility or functional ability.

To investigate the aspect of the intervention that improves activity avoidance via improving fear of movement, control groups might include a mindfulness of sensation group or a strength training group to assess whether fear of movement decreased due to increased acceptance of painful sensations and fear thoughts, or if the corrective experience of increasing movement without catastrophic consequences was the main instigator or change. Measures of mindfulness and self-efficacy could be included as well.

The biochemical effects of yoga on pain should not be ignored. Future studies should include peripheral measures of inflammatory markers at a minimum to better understand the

relationship between peripheral inflammation and pain severity in the context of yoga interventions.

### **Conclusions**

The current study supports the hypothesis that Forrest Yoga is an effective intervention for chronic pain patients in reducing pain interference and fear of movement while regularly attending yoga classes. It also reduces pain severity, number of painful body parts, and the affective experience of pain more quickly than usual care alone. Between group differences tended not to be sustained following the termination of participation in a class series. The findings from the current study expand the literature in several ways.

Forrest Yoga, despite being physically and emotionally challenging, is safe, acceptable, and feasible for people with heterogeneous pain conditions. This intervention decreased, both clinically and statistically significantly, the degree to which pain interfered with the lives of the yoga participants, and decreased it within eight weeks. For chronic pain patients, the goal often is not to reduce the pain per se but to live with it in such a way as to re-engage with that which is most meaningful in their lives. Reducing pain interference is an important step in that process.

Despite many yoga participants experiencing muscle soreness early in the intervention, the yoga group showed a steeper decline in pain severity ratings compared to usual care, indicating that their pain severity levels decreased quickly, which might increase motivation to continue.

Finally, this study highlighted several future areas of research that span biochemical to behavioral. The more we understand how behavioral interventions exert their effects, the more effectively we can target their use and improve patient outcomes. These findings would have broad implications, such as expanding the recommendation to use yoga, other complementary

and alternative treatments, and behavioral approaches to treat pain-related problems in primary care and specialty medicine settings.

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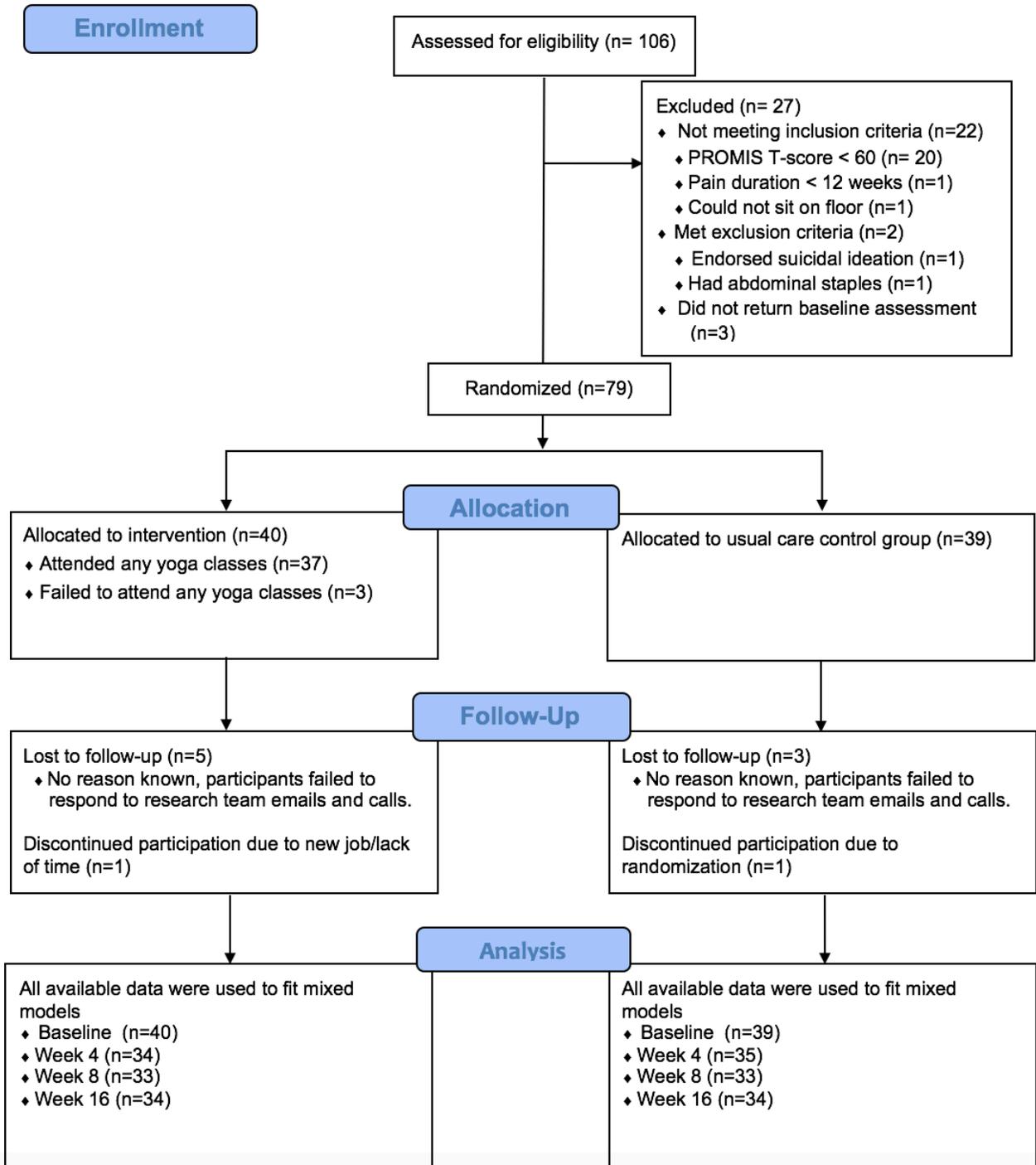
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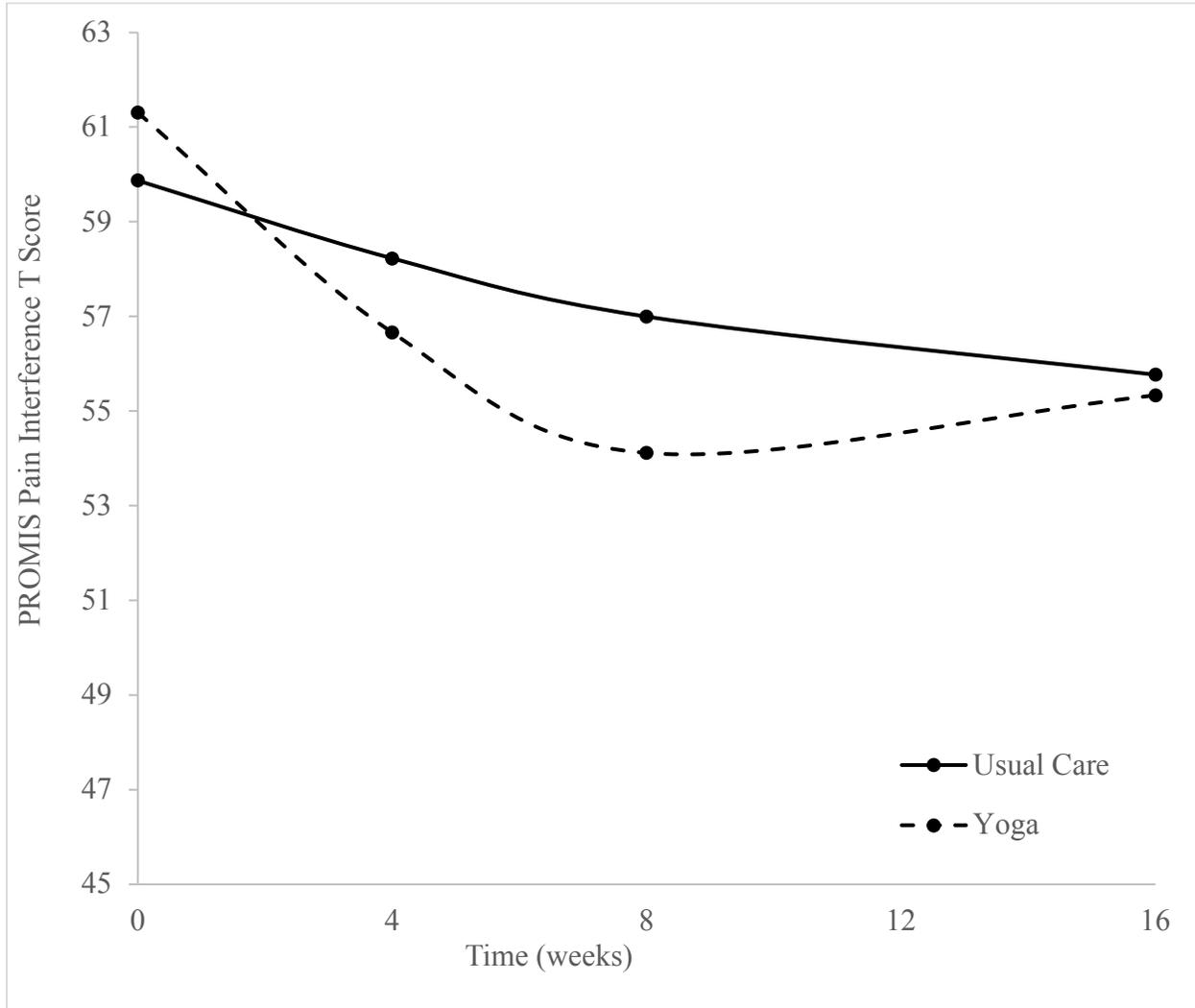
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## Appendix A. Figures

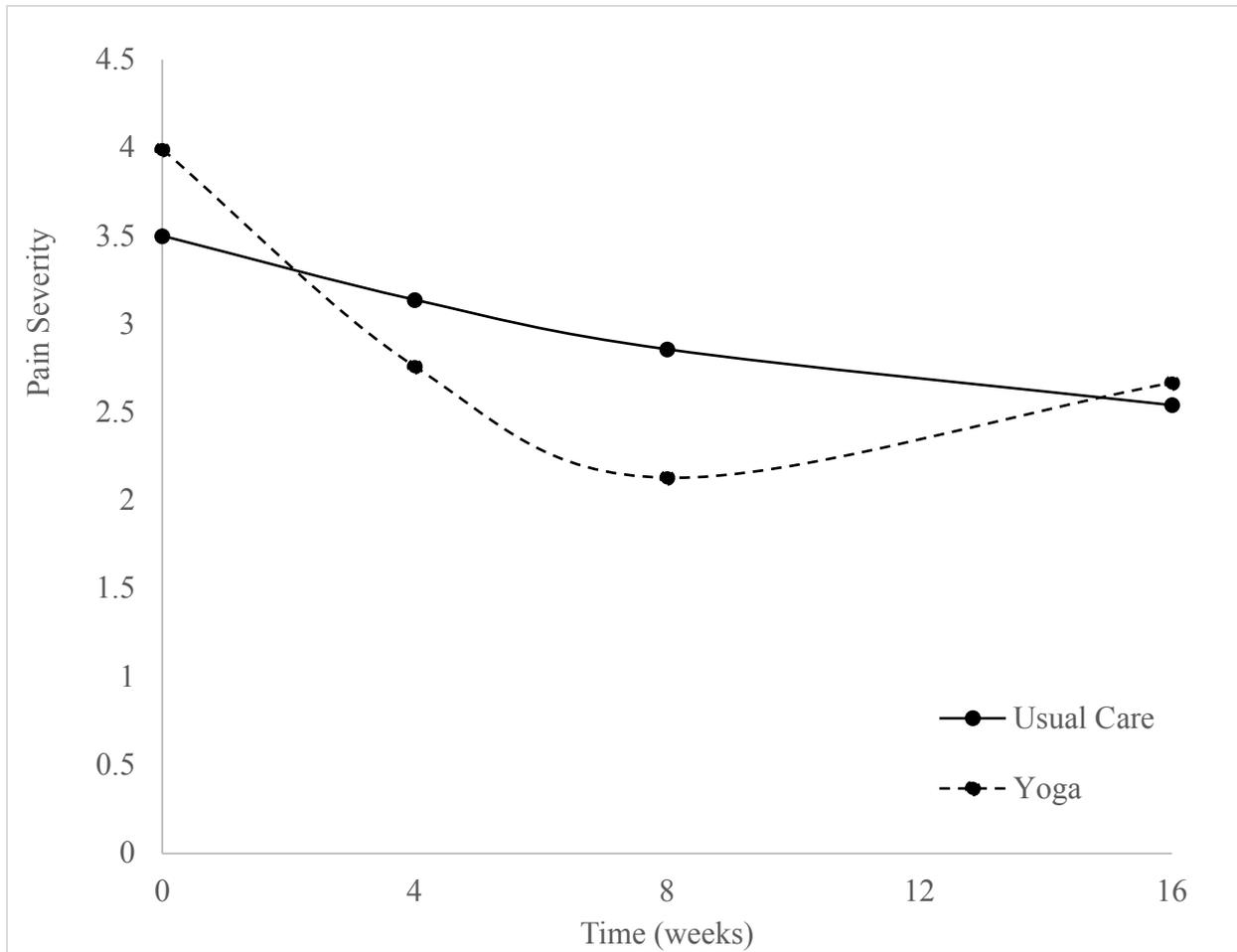


**Figure A1. Participant flow diagram**



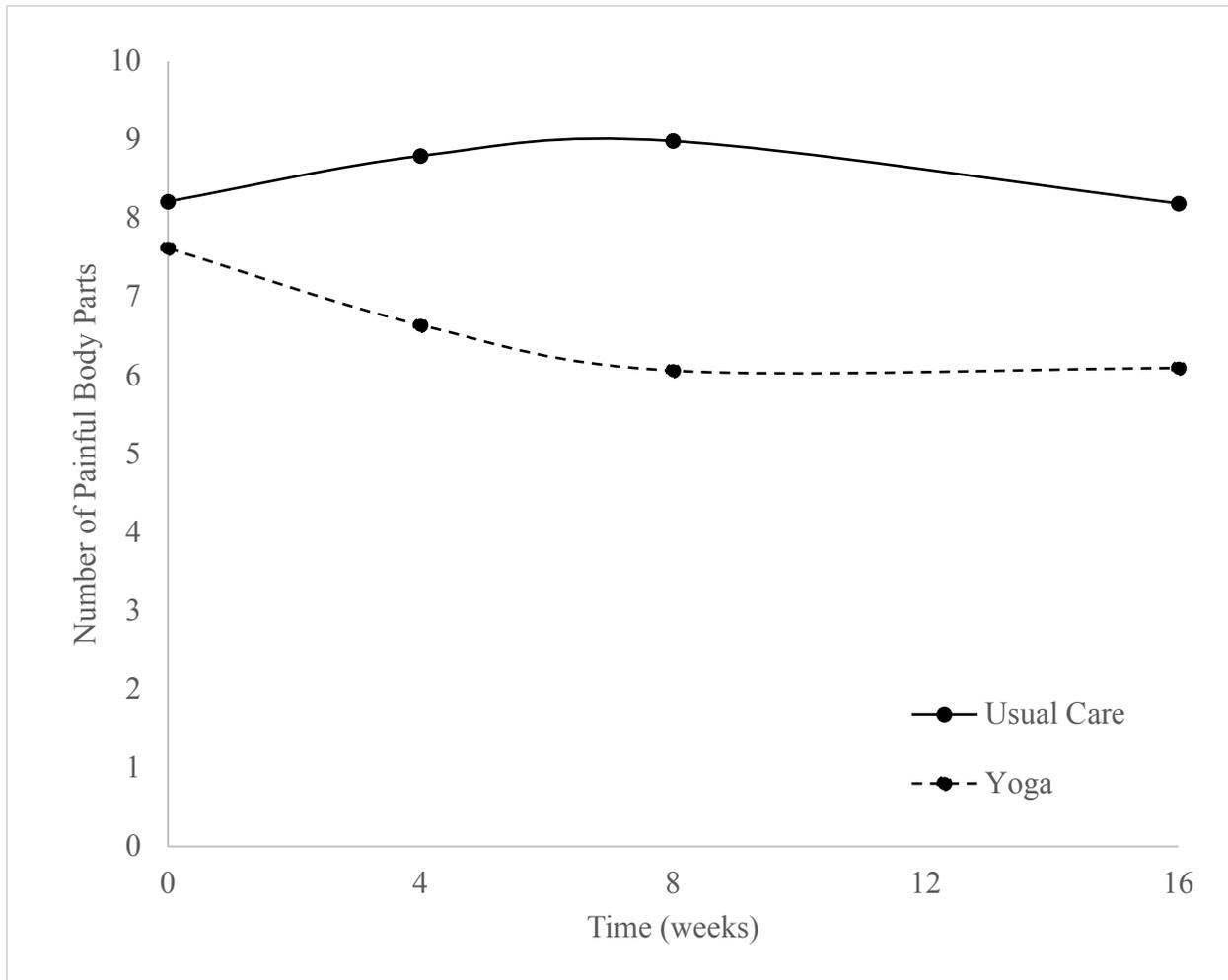
**Figure A2. Model predicted pain interference rating by group**

Pain interference significantly decreased over time in both groups ( $p < 0.001$ ). The difference between groups at week 8 (post-intervention) reached both clinical and statistical significance ( $p = 0.015$ ). The difference between groups did not persist at 16-week follow-up ( $p = 0.76$ ).



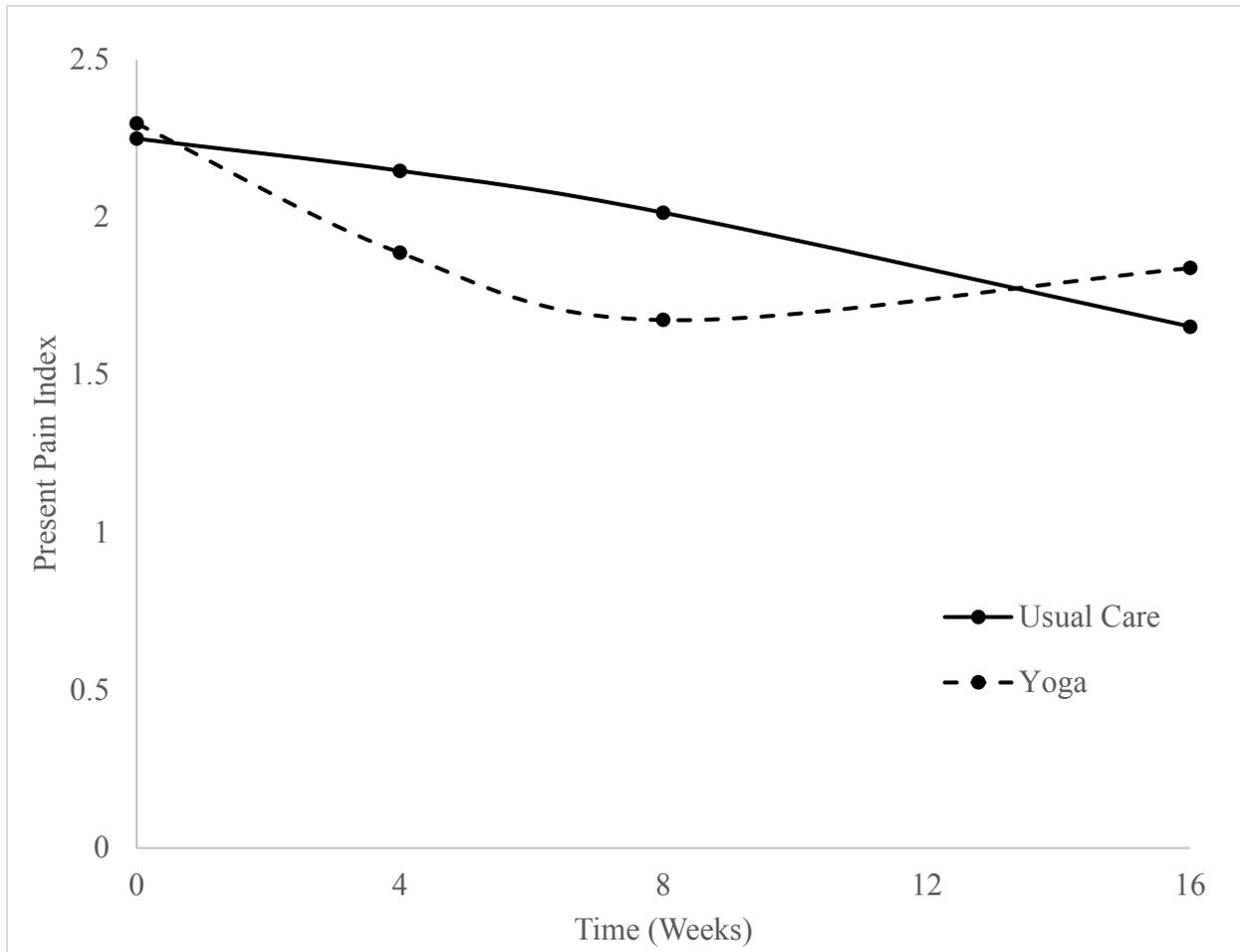
**Figure A3. Model predicted pain severity scores by group**

The usual care group showed a non-significant reduction in Visual Analogue Scale scores between baseline and week 8 ( $p = 0.26$ ), whereas the yoga group's scores decreased more quickly ( $p = 0.005$ ) and started to increase after the intervention ended ( $p = 0.0059$ ). There was a trend towards a difference between groups in pain severity scores ( $p = 0.085$ ) at 8 weeks. No differences between groups were observed at 16 weeks ( $p = 0.78$ ).



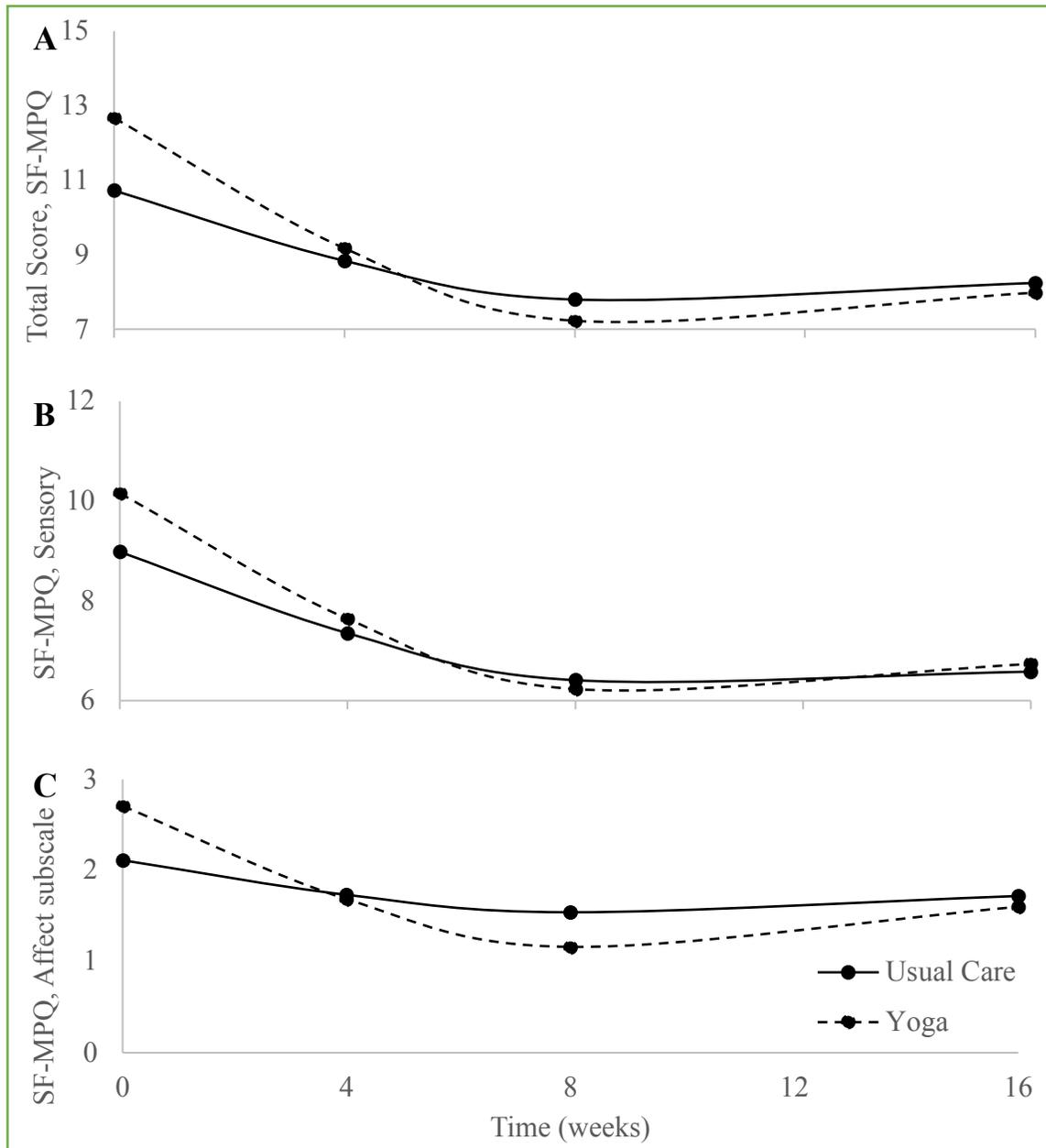
**Figure A4. Model predicted Michigan Body Map scores by group**

Number of painful body parts decreased at a significantly faster rate ( $p = 0.022$ ) in the yoga group compared to usual care and was non-linear in trajectory because this quick decline leveled off at the end of the intervention ( $p = 0.044$ ). At 8 weeks, the yoga group reported a trend toward having fewer painful body parts compared to baseline ( $p = 0.063$ ). No differences between groups existed at 16 weeks ( $p = 0.26$ ).



**Figure A5. Model predicted Present Pain Intensity Index scores by group**

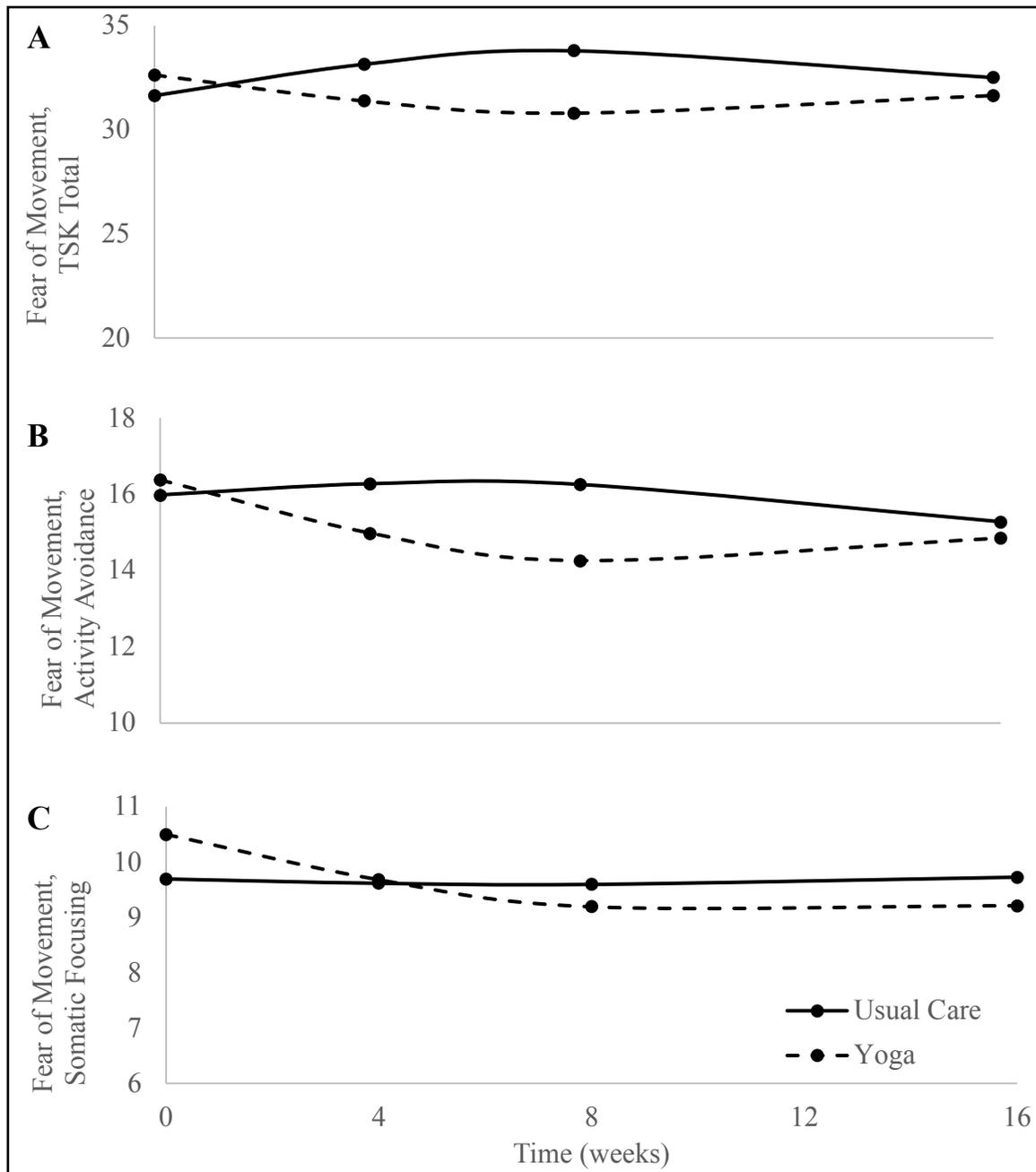
The Short Form McGill Pain Questionnaire (SF-MPQ) Present Pain Intensity Index (PPI) rates pain experience on a scale of No pain (0) to Excruciating (5). On average, the usual care group's scores did not change significantly ( $p = 0.53$ ), and the trajectory of change was linear. The yoga group's trajectory showed a quicker decrease in scores compared to usual care ( $p = 0.034$ ), which was non-linear in nature ( $p = 0.013$ ). Differences between groups at 8-weeks and 16-weeks did not reach statistical significance ( $p = 0.11$  and  $0.46$ , respectively) .



**Figure A6. Model predicted Total, Sensory, and Affective experience of pain subscales**

Overall, the Total Short Form-McGill Pain Questionnaire (SF-MPQ) score (A) and Sensory subscale (B) score decreased over time for both groups ( $p$  values  $< 0.01$ ). The yoga group improved more quickly than usual care on the Affective subscale (C,  $p = 0.05$ ). At 8-weeks and

16-weeks, there were no significant differences between groups for any of the word list scales (all p values > 0.40).



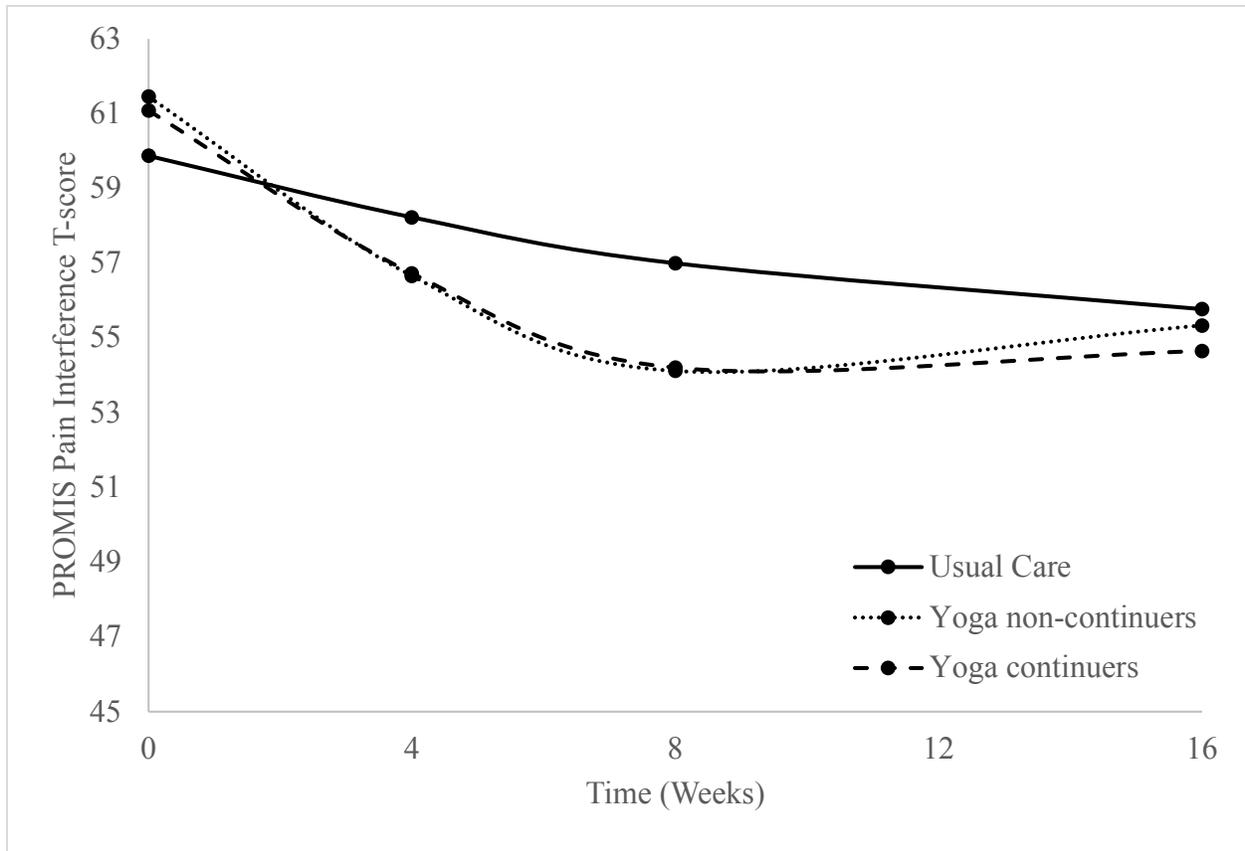
**Figure A7. Model predicted TSK Total, Somatic Focusing and Activity Avoidance subscales**

A. There was a significant overall change in Total fear of movement ratings over time ( $p = 0.030$ ) and the change for both groups was quadratic in nature ( $p = 0.037$ ), with the model-predicted scores for the usual care group increasing over time and the model-predicted scores for the yoga group decreasing over time. Compared to usual care, the yoga group decreased

significantly more quickly early in the measurement period ( $p = 0.006$ ). Post-treatment, the between group difference did not meet statistical significance ( $p = 0.06$ ), nor did it at 16-week follow-up ( $p = 0.66$ ).

B. The yoga group showed steep early decreases in Activity Avoidance that differed significantly from the trajectory of the usual care group ( $p = 0.002$ ), and that this change was quadratic in nature ( $p = 0.002$ ). The yoga group showed significant improvement at week 8 compared to usual care ( $p = 0.023$ ) but this difference was not maintained at 16 weeks ( $p = 0.68$ ).

C. There were no significant differences between groups post-treatment or at follow-up on the Somatic Focusing subscale ( $p$  values  $> 0.47$ ), though the yoga group trended toward decreasing at a faster rate compared to usual care early in the intervention ( $p = 0.052$ ).



**Figure A8. Model predicted pain interference scores comparing Yoga continuers, Yoga-noncontinuers, and Usual care groups**

During the intervention, there were no differences in the trajectory of pain interference change between the participants who continued to practice yoga and those that did not after the intervention was over. When the intervention concluded, those that did not continue to practice yoga reported a 1.2 point increase in PROMIS Pain Interference T-scores, but this increase did not reach statistical significance compared to those that continued to practice yoga ( $p = 0.52$ ).

While both groups reported significantly lower Pain Interference scores compared to usual care at 8-weeks ( $p = 0.015$ ), the usual care group scored decreased during the follow-up period such that at 16-week follow-up, it was no longer different than either yoga group ( $p$  values  $> 0.53$ ).

**Appendix B.**  
Tables

**Table B1. Summary of yoga studies for chronic low back pain**

<b>Citation</b>	<b>Population</b>	<b>Total N</b>	<b>Intervention</b>	<b>Control Group</b>	<b>Measures</b>	<b>Follow-up</b>	<b>Results</b>
Cox et al., 2010	Patients who presented to their PCP with low back pain	20	12 weeks Iyengar yoga (75 minutes, once per week)	Usual Care	RMDQ, ABPS	None	There were no significant changes in disability or pain severity compared to baseline after the intervention was complete.

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Galantino et al., 2004	Community members reporting more than six months of back pain, not aided by two prior medical interventions.	22	6 weeks Hatha yoga (60 minutes, twice per week, plus recommended daily home practice)	No treatment	ODI, BDI, and sit-and-reach	3-month (qualitative)	There were no significant differences between groups (p values > 0.170), though the N was very low (11 in the yoga group, 5 in the control group). While the ODI, BDI and flexibility measures don't seem to significantly differ due to high variability in the data, the mean disability in the control group was 12 points higher than the yoga group, BDI was 8 points higher in the control group, and the yoga participants already were slightly more flexible than the control group. At follow-up, 54% of participants reported improved low back pain, 63% stated they continued to benefit from yoga, 72% would recommend yoga to others, but none continued to practice yoga.

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Groessler et al., 2012	Veterans with CLBP	53	10 weeks Anusara yoga (Unspecified duration, once per week, home practice was encouraged)	No control group	PSS, CESD-10, and SF-12	None	Average pain decreased ( $p = 0.05$ ), but worst pain and total pain reductions did not reach significance ( $p$ values $> 0.164$ ). Participants had decreases in depression ( $p = 0.046$ ), increases in energy ( $p = 0.011$ ), and increases in quality of life ( $p = 0.044$ ).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Groessler et al., 2017	Veterans with CLBP	150	12 weeks Hatha yoga (60 minutes, twice per week, plus 15-20 minutes recommended self-led home practice 5 days/week)	Delayed treatment	RMDQ, BPI, medication use	6-month	Both groups had significant reductions in RMDQ at 12-weeks, but the groups did not differ from each other (Yoga: 95% CI = -3.18 - -0.92; Control 95% CI = -2.36 - -0.22). The yoga group continued to improve at 6-months, while the control group returned to baseline levels; this between group difference met statistical significance ( $p = 0.003$ ). RMDQ reductions met clinical significance for more yoga participants than control participants at 6 months ( $p < 0.01$ ). Pain intensity decreased for all participants, the yoga participants decreased significantly more than controls. Overall, the reductions did not meet clinical significance. More yoga participants had clinically significant reductions compared to controls ( $p = 0.037$ at 12 weeks and $p = 0.020$ at 6 months). Pain medication use did not differ between groups, but all medication use, including narcotics, decreased among all participants during the study period ( $p$ values $< 0.01$ ).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Highland et al., 2017	Patients at a Department of Defense Medical Center	68	8 weeks RESTORE yoga (60 minutes, twice per week for four weeks then once per week for four weeks, plus optional home practice with CD)	Treatment as usual	Defense and Veterans Pain Rating Scale, RMDQ, PROMIS Physical Functioning subscale, PROMIS sleep disturbance, Pain Interference, Anxiety, Depression, and Fatigue combined measure	3- and 6-month	The yoga group reported significantly lower pain severity at mid- and post-treatment (p values < 0.02) but not at either follow-up time point (p values > 0.17). There was no effect for yoga on pain disability or functioning (all p values > 0.3).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Nambi et al., 2014	Patients with non-specific low back pain that persisted at least 3 months.	54	4 weeks Iyengar (60 minutes once per week, plus 30 minute home practice 5 days/week)	Exercise (core strengthening and stretching )	VAS, HRQoL-4	6-month	There were significant between and within group reductions in pain severity for the yoga group by the end of the intervention, and these changes persisted at six month follow-up (p values = 0.001). The yoga group also reported higher levels of physical and mental health quality of life compared to baseline and compared to controls and these changes persisted at six month follow-up (p values = 0.001)
Saper et al., 2009	Patients at community health centers reporting chronic low back pain	30	12 weeks Hatha yoga (75 minutes once per week, plus recommended daily 30 minute home practice)	Waitlist	NRS, RMDQ	26-week	Pain scores significantly decreased in the yoga group (p = 0.02) and the proportion of patients that met the minimum clinical difference for the Roland was higher in the yoga group compared to the control group (p = 0.008), but the overall difference between groups did not reach significance (p = 0.28). Statistical analyses were not presented for the follow-up data, though the yoga group appeared to maintain their improvements. The usual care also reported improvements at follow-up.

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Saper et al., 2017	Community dwelling adults with nonspecific cLBP	320	12 weeks Hatha yoga (75 minutes, once per week, plus recommended daily 30-minute home practice with DVD)	Physical Therapy (15 60-minute sessions over 12 weeks) and Education (self-care book)	RMDQ, NRS, SF-36, pain medication, and self-reported improvement	1-year, with 1/2 of PT and Yoga participants in a structured maintenance program	Yoga was noninferior to PT at 12-weeks for RMDQ (Mean between group difference = -0.26, 95% CI = -∞ to 0.83). Neither intervention was superior to education (Yoga mean between group difference = -1.3, 95% CI = -2.8 to 0.25; PT mean between group difference = -1.0, 95% CI = -2.6 to 0.79). Both Yoga and PT were more likely to result in clinically meaningful changes in RMDQ scores than education (OR = 2.3, 95% CI = 1.1 to 4.5). Yoga was noninferior to PT in decreasing NRS scores (Mean between group difference = 0.51, CI = -∞ to 0.83), but it was not superior to education (Mean between group difference = -0.33, 95% CI = -0.97 to 0.32). PT outperformed education for NRS (Mean between group difference = -0.84, 95% CI = -1.5 to -0.18). PT, but not Yoga, had superior global improvement compared to education (stats not reported). There were no significant differences in medication use or SF-36 scores.

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005	Patients who presented to their PCP with low back pain	101	12-weeks Viniyoga yoga (75 minutes, once per week, plus recommended daily home practice with CD)	Conventional therapeutic exercise or self-care book	RMDQ, Bothersomeness of pain, medication use	26-week	All RMDQ scores decreased over the intervention. Yoga scores decreased the most and were statistically lower than the self-care group both post-intervention and at 26-week follow-up (p values = 0.002). Bothersomeness of pain was not statistically different between groups post-intervention (p = 0.135). At 26-week follow-up, medication use decreased most sharply in the yoga group: 21% reported using medication in the yoga group compared to 50% in the exercise group (RR = 0.41 [CI, 0.20 to 0.87]) and 59% in the book group (RR= 0.35 [CI, 0.17 to 0.73]).
Sherman et al., 2011	Community members and patients who had presented to their PCP with low back pain	228	12-weeks Viniyoga yoga (75 minutes, once per week, plus recommended 20 minute daily home practice with CD)	Conventional therapeutic exercise or self-care book	RMDQ and Bothersomeness of pain	26-week	The yoga group had significantly lower disability compared to self-care post-intervention and at 26-week follow-up (p values < 0.05 ). The yoga group had significantly lower bothersomeness of pain scores (p = 0.01) after the intervention, but not at follow-up (p = 0.51).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Tekur et al., 2008	Residential health center patients	80	1-week intensive residential yoga program (education, breathing exercises, and postures for 7.5 hours per day)	Time-matched Therapeutic exercise (walking, strengthening, and stretching)	ODI, spinal flexibility	None	There were significant reductions in the ODI in the yoga group ( $p = 0.001$ , $ES = 1.144$ ) and no significant changes in the control group. Between group analyses were not reported. Spinal flexion increased in both groups, but was significantly higher in the yoga group post-intervention ( $p = 0.008$ ).
Tekur et al., 2012	Residential health center patients (same study as Tekur et al, 2008, different data presented)	80	1-week intensive residential yoga program (education, breathing exercises, and postures for 7.5 hours per day)	Time-matched Therapeutic exercise (walking, strengthening, and stretching)	NRS, BDI, STAI, sit-and-reach	None	State and trait anxiety, depression, and pain severity all decreased in the yoga group compared to controls ( $p$ values $< 0.001$ , Effect Sizes = 0.72, 1.09, 0.96, 1.62 respectively). Flexibility measured significantly increased in the yoga group ( $p < 0.001$ , $ES = 2.99$ )

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Telles et al., 2016	Community members responding to advertisements	40	12 weeks Hatha yoga (60 minutes three times per week for two weeks, then daily home practice for remaining 10 weeks)	Wait-list	VAS, STAI, sit and reach, MRI	None	There were no significant group by time interactions, indicating that there was no significant effect for yoga for any outcome measures.
Teut et al., 2016	Older adults (65 years and older) with cLBP	176	12 weeks Viniyoga (45 minutes, twice per week)	Qi-Gong (90 minutes, once per week) and Wait-list	VAS, back function, fall frequency and risk, SF-36, handgrip strength, GDS, body self-efficacy, and medication use	6-month	At 3 months, there were no differences between the yoga group and the control group on any outcome. At 6 months, the yoga group had experienced fewer falls than controls (Mean between group difference = -0.25, 95% CI = -0.50 to 0.0).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Tilbrook et al., 2011	Patients seen by a PCP in the previous 18 months for low back pain, as well as community members.	313	12 weeks (75 minutes, once per week, plus recommended daily home practice with CD), no style listed but the treatment was manualized	Usual Care	RMDQ, ABPS, SF-12, PSEQ	6- and 12-month	The yoga group had significantly lower disability compared to controls post-intervention, and at 6- and 12-month follow-up (p values < 0.012). Additionally, the yoga group also showed higher self-efficacy compared to controls post-intervention and at 6-months but not at 12-months (p values = 0.027, 0.014, and 0.190 respectively). Differences in pain severity and health related quality of life did not reach significance (p values > 0.06).
Williams et al., 2005	Community members responding to advertisements and referrals from physician	60	16 weeks Iyengar yoga (90 minutes, once per week, plus 30 minute home practice 5 days/week)	Education control	VAS, PPI, PDI, SF-MPQ, TSK, SOPA, CSQ-R, BPSES, ROM, medication use	3-month	The yoga group increased functional ability (p = 0.004) and decreased medication use (p = 0.002) compared to controls. No other comparisons reached significance (p values > 0.15). At three-month follow-up, pain related disability, pain severity, and medication use were all significantly lower in the yoga group compared to controls (p values < 0.05).

Table B1 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Williams et al., 2009	Community members responding to advertisements	90	24 weeks Iyengar yoga (90 minutes, twice per week, plus daily 30-minute home practice with DVD)	Wait-list	ODI, VAS, BDI-II	None	ODI, VAS, and BDI-II scores all significantly decreased in the yoga group compared to controls post-intervention (p values < 0.01).

Abbreviations: ABPS = Aberdeen Back Pain Scale for pain severity, BDI = Beck Depression Inventory, BPI = Brief Pain Inventory, BPSES = Back Pain Self-Efficacy Scale, CES-D = Center for Epidemiologic Studies Depression Scale, GDS = Geriatric Depression Scale, HRQoL = Health Related Quality of Life, NRS = Numeric Rating Scale, ODI = Oswestry Disability Index, PDI = Pain Disability Index, PPI = Present Pain Index, PROMIS = Patient-Reported Outcomes Measurement Information System, PSEQ = Pain Self Efficacy Questionnaire, PSS = Pain severity scale, RMDQ = Roland-Morris Disability Questionnaire, ROM = Range of Motion, SF-12 = Short Form Health Survey (12 item), SF-36 = Short Form Health Survey (36 item), SF-MPQ = Short Form - McGill Pain Questionnaire, SOPA = Survey of Pain Attitudes, STAI = State-Trait Anxiety Inventory, TSK = Tampa Scale of Kinesiophobia, VAS = Visual Analogue Scale

**Table B2. Summary of yoga studies for chronic neck pain**

<b>Citation</b>	<b>Population</b>	<b>Total N</b>	<b>Intervention</b>	<b>Control Group</b>	<b>Measures</b>	<b>Follow-up</b>	<b>Results</b>
Bramberg et al., 2017	Community members with chronic back and neck pain responding to advertisements	119	6 weeks Kundalini yoga (60 minutes, twice per week, recommended 60 minute home practice 2-5 days/week with CD and written instructions)	Strength training (5 supervised 60 minute sessions, recommended home workouts twice per week) and education controls	Sickness absence, sickness presenteeism, CPGS	6- and 12-month	At 6-month follow-up, both the yoga and strength training groups reported lower levels of neck disability (p values <0.05). Yoga did not have an effect on neck or back pain intensity, nor on back pain disability. At 12-month follow-up, there were no significant changes to sick absences or presenteeism based on study group. However, when number of workouts or yoga classes attended was included in the analyses, those who adhered to the recommended frequency decreased work absences by 50% in the yoga group and 40% in the strength training group (p values < 0.035).

Table B2 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Cramer, Lauche, Hohmann, Ludtke, et al., 2013	Healthy adults with chronic neck pain	51	9 weeks Iyengar yoga (90 minutes, once per week, plus daily recommended home practice)	Waitlist	VAS, NDI, SF-36	None	The yoga group reported significantly lower pain intensity ( $p = 0.03$ ), neck disability ( $p = 0.006$ ), and overall body pain ( $p = 0.001$ ) compared to controls post-treatment. They also reported improved social and emotional functioning ( $p$ values $< 0.03$ ) and overall mental health ( $p = 0.027$ ) compared to controls.

Table B2 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Cramer, Lauche, Hohmann, Langhorst, et al., 2013	Healthy adults with chronic neck pain	51	9 weeks Iyengar yoga (90 minutes, once per week, plus daily recommended home practice)	Waitlist	VAS, NDI, SF-36	12-months	12-month follow-up data were presented in this article. Waitlist control data were added to the yoga group, thus there was no comparison group at 12-months. Compared to baseline, participants reported significantly lower pain intensity ( $p < 0.001$ ), neck related disability ( $p = 0.001$ ), and bodily pain. Mental health improvements seen post-treatment did not persist at 12 months (all $p$ values $> 0.1$ )
Dunleavy et al., 2016	Healthy adults with chronic neck pain	56	12 weeks Hatha yoga (60 minutes, once per week)	Pilates (60 minutes, once per week), no-treatment control	NDI, NRS, CROM, Posture	6-weeks	The yoga group's NDI scores significantly decreased from baseline to mid-intervention and this difference was maintained post-intervention. There was no group by time interaction for pain rating, range of movement, or posture for the yoga group.

Table B2 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Michalsen et al., 2012	Community members with chronic neck pain responding to a press release	77	9 weeks Iyengar yoga (90 minutes, once per week, plus 10-15 minute home practice 2-3 days/week)	Self-care/Exercise education	VAS, NDI, NPAD, SF-36, and POMS	None	The yoga group reported significantly less neck pain post-intervention than controls ( $p < 0.001$ ) as well as lower levels of disability ( $p < 0.001$ ). The yoga group also reported significantly less pain-related apprehension ( $p = 0.001$ ). They also reported lower levels of pain bothersomeness, depression, and anger/hostility (all $p$ values $< 0.02$ ) as well as increases in physical quality of life ( $p = 0.003$ ).

Abbreviations: CROM = Cervical Range of Movement, CPGS = Chronic Pain Grading Scale, NDI = Neck Disability Index, NPAD = Neck Pain and Disability Questionnaire, NRS = Numeric Rating Scale, POMS = Profile of Mood States, SF-36 = Short Form Health Survey (36 item), VAS = Visual Analogue Scale

**Table B3. Summary of yoga studies for osteoarthritis**

<b>Citation</b>	<b>Population</b>	<b>Total N</b>	<b>Intervention</b>	<b>Control Group</b>	<b>Measures</b>	<b>Follow-up</b>	<b>Results</b>
Brennem an et al., 2015	Community dwelling older women with knee osteoarthritis	45	12 weeks yoga-inspired strengthening program (60 minutes, three times per week)	None	KOOS	None	Self-report measures of pain levels, symptom burden, quality of life, ability to perform activities of daily living and engage in recreation all significantly improved (p values < 0.001). In addition, objective measures of function also improved: participants walked further in the 6 minute walk test (p <0.001) and stood from seated more quickly (p = 0.006).

Table B3 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Cheung et al., 2017	Adults over the age of 60 with knee osteoarthritis	83	8 weeks Hatha yoga (45 minutes, once per week, plus four 30-minute home practices were encouraged per week)	Aerobic and Strength Exercise; Education	WOMAC, VAS, SPPB, HADS, FESI, SF-12, pain medication use	None	Compared to the Aerobic and Strength Exercise (ASE), at 4 weeks, the Hatha Yoga (HY) participants had overall symptom improvement ( $p = 0.001$ ), significantly less overall pain severity ( $p = 0.03$ ), knee pain ( $p = 0.04$ ) and higher perceived function ( $p = 0.001$ ). Similar results were seen comparing HY to Education, and in both cases, these results were maintained at 8-weeks. Post-intervention, the HY group took less time to complete repeated chair stands and 8 foot walk than the Education group ( $p$ values = 0.03 and 0.04, respectively), and had lower anxiety ( $p = 0.04$ ) and lower fear of falling ( $p = 0.02$ ) compared to the ASE group.

Table B3 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Cheung et al., 2014	Older (65-90 years) women with knee osteoarthritis	36	8 weeks Hatha yoga (60 minutes, once per week, plus four 30-minute home practices were encouraged per week)	Wait-list	WOMAC, SPPB, SF-12, PSQI, Cantrill's Self-Anchoring Ladder, pain medication use	3-month	At 8 weeks, the yoga group had significant improvements in WOMAC pain and stiffness scores, and they also significantly increased the number of repeated chair stands they could complete. There were no significant improvements on any other measure. At 3-month follow-up, the WOMAC pain improvements were maintained.
Ghasemi et al., 2013	Female referrals from orthopedic physicians	30	8 weeks Hatha yoga (60 minutes, three times per week)	No treatment	VAS, KOOS	None	There were no significant group by time interactions. The yoga group reported significant within-group improvements in pain severity, ability to perform activities of daily living, sports and hobbies, and quality of life (all p values < 0.05),
Kolasinski et al., 2005	Community dwelling older, obese adults with knee osteoarthritis	11	8 weeks Iyengar yoga (90 minutes, once per week)	None	WOMAC, VAS, AIMS2	None	There were statistically significant reductions in WOMAC pain, improved physical function, and improved affect (all p values < 0.04) after the yoga intervention.

Table B3 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Moonaz et al., 2015	Sedentary adults with rheumatoid arthritis (RA) or knee osteoarthritis (OA)	75	8 weeks of yoga (60 minutes, twice per week, plus one home practice per week)	Wait-list	SF-36, CES-D, PANAS, PSS, ASES, VAS	9-month	Compared to the control group at the post-intervention time point, the yoga group's SF-36 Physical Component Scale had significantly improved, as had their overall ratings of body pain, flexibility, depression, positive affect, vitality. At 9-months, the control group had been given the yoga intervention, thus there was no longer a comparison group. Compared to baseline, participants reported significantly improved physical function, pain, vitality, positive affect, depression, and perceived stress.

Table B3 – continued.

Citation	Population	Total N	Intervention	Control Group	Measures	Follow-up	Results
Park et al., 2017	Older (>65 years) community-dwelling adults with verified osteoarthritis	131	8 weeks Iyengar-based Hatha Chair Yoga (45 minutes, twice per week)	Health Education Program (45 minutes, twice per week)	PROMIS Pain Interference 8-item Short Form, PROMIS Fatigue 8-item Short Form, Berg Balance Scale, Gait Speed Test, WOMAC	1- and 3-month	There were overall effects of time for both groups for Pain Interference ( $p = 0.003$ ), fatigue ( $p = 0.043$ ), WOMAC pain ( $p < 0.001$ ), and WOMAC physical function ( $p < 0.001$ ). The Chair Yoga (CY) participants had greater decreases in Pain Interference than the Health Education Program (HEP) post-intervention ( $p = 0.01$ ) and 3 months ( $p = 0.012$ ). WOMAC pain, Gait Speed, and Fatigue all significantly improved compared to controls ( $p$ values = 0.048, 0.024, and 0.037, respectively). None of these differences sustained at 3 months.

Abbreviations: AIMS2 = Arthritis Impact Measurement Scale 2, ASES = Arthritis Self Efficacy Scale, CES-D = Center for

Epidemiologic Studies Depression Scale, KOOS = Knee Injury and Osteoarthritis Outcome Score, PANAS = Positive and Negative

Affect Scale, PROMIS = , PSQI = , PSS = Perceived Stress Scale, SF-12 = Short Form Health Survey (12 item), SF-36 = Short Form

Health Survey (36 item), SPPB = Short Physical Performance Battery, WOMAC = Western Ontario and McMaster Universities OA Index Scale

**Table B4. Demographic variables by group**

<b>Demographic variable</b>	<b>Usual Care (N)</b>	<b>Yoga (N)</b>
Gender (% female)	74.4	80
Male	10	8
Female	29	32
Ethnicity		
White	36	39
American Indian or Alaska Native	1	0
Asian	1	0
Multiple	1	0
Other	0	1
Marital Status		
Single	1	5
In a relationship/Living with partner	2	2
Married	30	22
Widowed	0	5
Divorced	4	6
Education		
High school graduate	4	2
Some college	4	9
2-year degree	7	5
4-year degree	11	10
Professional degree	6	8
Doctorate	6	6
Other	1	0
Annual Household Income		
<10,000	1	1
10,000-29,999	3	8
30,000-49,999	5	6
50,000-69,999	5	4
70,000-89,999	4	8
90,000+	10	9
Prefer not to answer	11	4
Employment status		
Employed full-time	12	25
Employed part-time	8	5
Unemployed looking for work	1	2
Unemployed not looking for work	2	0
Retired	16	6
Disabled	0	2
Pain Duration (years)	11.1 ± 1.9	10.6 ± 1.4

**Table B5. Model predicted scores by group and time point**

<b>Outcome Measure</b>	<b>Time point</b>	<b>Yoga Model-predicted score</b>	<b>Usual Care Model-predicted score</b>
PROMIS Pain Interference t-score	Week 0: Baseline	61.31	59.87
	Week 8: Post-Intervention	54.12	57.00
	Week 16: Follow-up	55.33	55.77
	$\Delta$ Baseline to Week 8	-7.19	-2.87
	$\Delta$ Week 8 to Week 16	1.21	-1.23
Visual Analogue Scale	Week 0: Baseline	3.99	3.50
	Week 8: Post-Intervention	2.13	2.85
	Week 16: Follow-up	2.67	2.54
	$\Delta$ Baseline to Week 8	-1.86	-0.65
	$\Delta$ Week 8 to Week 16	0.54	-0.31
Michigan Body Map	Week 0: Baseline	7.62	8.22
	Week 8: Post-Intervention	6.06	8.99
	Week 16: Follow-up	6.09	8.19
	$\Delta$ Baseline to Week 8	-1.56	0.77
	$\Delta$ Week 8 to Week 16	0.03	-0.8
SF-MPQ Present Pain Index	Week 0: Baseline	2.30	2.25
	Week 8: Post-Intervention	1.67	2.02
	Week 16: Follow-up	1.84	1.65
	$\Delta$ Baseline to Week 8	-0.63	-0.23
	$\Delta$ Week 8 to Week 16	0.17	-0.37
SF-MPQ Total word score	Week 0: Baseline	12.67	10.72
	Week 8: Post-Intervention	7.22	7.79
	Week 16: Follow-up	7.98	8.24
	$\Delta$ Baseline to Week 8	-5.45	-2.93
	$\Delta$ Week 8 to Week 16	0.76	0.45
SF-MPQ Sensory subscale	Week 0: Baseline	10.16	8.98
	Week 8: Post-Intervention	6.23	6.41
	Week 16: Follow-up	6.74	6.58
	$\Delta$ Baseline to Week 8	-3.93	-2.57
	$\Delta$ Week 8 to Week 16	0.51	0.17
SF-MPQ Affect subscale	Week 0: Baseline	2.71	2.11
	Week 8: Post-Intervention	1.16	1.54
	Week 16: Follow-up	1.6	1.72
	$\Delta$ Baseline to Week 8	-1.55	-0.57
	$\Delta$ Week 8 to Week 16	0.44	0.18

Table B5 – continued.

<b>Outcome Measure</b>	<b>Time point</b>	<b>Yoga Model-predicted score</b>	<b>Usual Care Model-predicted score</b>
Hospital Anxiety and Depression Scale, Total	Week 0: Baseline	11.76	10.27
	Week 8: Post-Intervention	9.25	10.28
	Week 16: Follow-up	8.69	9.85
	$\Delta$ Baseline to Week 8	-2.51	0.01
	$\Delta$ Week 8 to Week 16	-0.56	-0.43
Hospital Anxiety and Depression Scale, Anxiety subscale	Week 0: Baseline	5.85	5.37
	Week 8: Post-Intervention	5.21	5.45
	Week 16: Follow-up	4.63	5.17
	$\Delta$ Baseline to Week 8	-0.64	0.08
	$\Delta$ Week 8 to Week 16	-0.58	-0.28
Hospital Anxiety and Depression Scale, Depression subscale	Week 0: Baseline	5.91	4.90
	Week 8: Post-Intervention	4.03	4.84
	Week 16: Follow-up	4.04	4.67
	$\Delta$ Baseline to Week 8	-1.88	-0.06
	$\Delta$ Week 8 to Week 16	0.01	-0.17
Acceptance and Action Questionnaire	Week 0: Baseline	17.21	15.56
	Week 8: Post-Intervention	16.32	14.96
	Week 16: Follow-up	15.43	14.72
	$\Delta$ Baseline to Week 8	-0.89	-0.6
	$\Delta$ Week 8 to Week 16	-0.89	-0.24
Psychological Inflexibility in Pain Scale, Total	Week 0: Baseline	42.35	43.52
	Week 8: Post-Intervention	36.76	39.11
	Week 16: Follow-up	35.52	38.43
	$\Delta$ Baseline to Week 8	-5.59	-4.41
	$\Delta$ Week 8 to Week 16	-1.24	-0.68
Psychological Inflexibility in Pain Scale, Fusion subscale	Week 0: Baseline	24.02	23.30
	Week 8: Post-Intervention	19.33	20.98
	Week 16: Follow-up	18.77	20.46
	$\Delta$ Baseline to Week 8	-4.69	-2.32
	$\Delta$ Week 8 to Week 16	-0.56	-0.52
Psychological Inflexibility in Pain Scale, Avoidance subscale	Week 0: Baseline	32.63	31.64
	Week 8: Post-Intervention	30.80	33.79
	Week 16: Follow-up	31.64	32.5
	$\Delta$ Baseline to Week 8	-1.83	2.15
	$\Delta$ Week 8 to Week 16	0.84	-1.29

Table B5 – continued.

<b>Outcome Measure</b>	<b>Time point</b>	<b>Yoga Model-predicted score</b>	<b>Usual Care Model-predicted score</b>
Pain Catastrophizing Scale, Total	Week 0: Baseline	26.42	25.04
	Week 8: Post-Intervention	22.15	23.11
	Week 16: Follow-up	21.19	22.23
	$\Delta$ Baseline to Week 8	-4.27	-1.93
	$\Delta$ Week 8 to Week 16	-0.96	-0.88
Pain Catastrophizing Scale, Rumination subscale	Week 0: Baseline	8.99	9.12
	Week 8: Post-Intervention	7.17	7.74
	Week 16: Follow-up	6.86	7.51
	$\Delta$ Baseline to Week 8	-1.82	-1.38
	$\Delta$ Week 8 to Week 16	-0.31	-0.23
Pain Catastrophizing Scale, Magnification subscale	Week 0: Baseline	5.91	5.52
	Week 8: Post-Intervention	5.29	5.37
	Week 16: Follow-up	4.71	5.31
	$\Delta$ Baseline to Week 8	-0.62	-0.15
	$\Delta$ Week 8 to Week 16	-0.58	-0.06
Pain Catastrophizing Scale, Helplessness subscale	Week 0: Baseline	11.52	10.61
	Week 8: Post-Intervention	9.72	10.06
	Week 16: Follow-up	9.65	9.55
	$\Delta$ Baseline to Week 8	-1.8	-0.55
	$\Delta$ Week 8 to Week 16	-0.07	-0.51
Tampa Scale of Kinesiophobia, Total	Week 0: Baseline	32.63	31.64
	Week 8: Post-Intervention	30.80	33.79
	Week 16: Follow-up	31.64	32.5
	$\Delta$ Baseline to Week 8	-1.83	2.15
	$\Delta$ Week 8 to Week 16	0.84	-1.29
Tampa Scale of Kinesiophobia, Somatic Focusing subscale	Week 0: Baseline	10.5	9.69
	Week 8: Post-Intervention	9.19	9.6
	Week 16: Follow-up	9.21	9.73
	$\Delta$ Baseline to Week 8	-1.31	-0.09
	$\Delta$ Week 8 to Week 16	0.02	0.13
Tampa Scale of Kinesiophobia, Activity Avoidance subscale	Week 0: Baseline	16.38	15.98
	Week 8: Post-Intervention	14.26	16.26
	Week 16: Follow-up	14.85	15.28
	$\Delta$ Baseline to Week 8	-2.12	0.28
	$\Delta$ Week 8 to Week 16	0.59	-0.98

Table B5 – continued.

<b>Outcome Measure</b>	<b>Time point</b>	<b>Yoga Model-predicted score</b>	<b>Usual Care Model-predicted score</b>
Social Provisions Scale, Total	Week 0: Baseline	79.18	81.29
	Week 8: Post-Intervention	80.76	80.64
	Week 16: Follow-up	80.63	80.67
	$\Delta$ Baseline to Week 8	1.58	-0.65
	$\Delta$ Week 8 to Week 16	-0.13	0.03
Social Provisions Scale, Guidance subscale	Week 0: Baseline	13.64	13.90
	Week 8: Post-Intervention	13.96	13.84
	Week 16: Follow-up	14.02	14.03
	$\Delta$ Baseline to Week 8	0.32	-0.06
	$\Delta$ Week 8 to Week 16	0.06	0.19
Social Provisions Scale, Reassurance subscale	Week 0: Baseline	13.75	13.07
	Week 8: Post-Intervention	13.83	13.11
	Week 16: Follow-up	13.67	13.04
	$\Delta$ Baseline to Week 8	0.08	0.04
	$\Delta$ Week 8 to Week 16	-0.16	-0.07
Social Provisions Scale, Social Integration subscale	Week 0: Baseline	13.15	13.66
	Week 8: Post-Intervention	13.38	13.45
	Week 16: Follow-up	13.55	13.54
	$\Delta$ Baseline to Week 8	0.23	-0.21
	$\Delta$ Week 8 to Week 16	0.17	0.09
Social Provisions Scale, Attachment subscale	Week 0: Baseline	12.63	13.40
	Week 8: Post-Intervention	13.14	13.38
	Week 16: Follow-up	13.03	13.27
	$\Delta$ Baseline to Week 8	0.51	-0.02
	$\Delta$ Week 8 to Week 16	-0.11	-0.11
Social Provisions Scale, Nurturance subscale	Week 0: Baseline	12.28	12.58
	Week 8: Post-Intervention	12.08	12.50
	Week 16: Follow-up	12.63	12.66
	$\Delta$ Baseline to Week 8	-0.2	-0.08
	$\Delta$ Week 8 to Week 16	0.55	0.16
Social Provisions Scale, Reliable Alliance subscale	Week 0: Baseline	13.73	14.68
	Week 8: Post-Intervention	14.48	14.48
	Week 16: Follow-up	13.85	14.19
	$\Delta$ Baseline to Week 8	0.75	-0.2
	$\Delta$ Week 8 to Week 16	-0.63	-0.29

Abbreviations: PROMIS = Patient Reported Outcomes Measurement Information System; SF-  
MPQ = Short Form – McGill Pain Questionnaire

**Table B6. Proportion of participants that met MCID by group**

<b>Outcome</b>	<b>Yoga Group</b>	<b>Usual Care Group</b>	<b><math>\chi^2</math> p-value</b>
PROMIS – PI, 5-point reduction	21/33	6/34	< 0.001
VAS, 15 mm reduction	18/33	9/34	0.019
VAS, 20% reduction	25/33	13/34	0.002
MBM 30% reduction	21/32	9/34	0.001
SF-MPQ, Total scale, 5.9-point reduction	11/26	8/30	0.22
SF-MPQ, Sensory subscale, 4.3-point reduction	11/32	10/33	0.73
SF-MPQ, Affective subscale, 1.6-point reduction	9/24	5/25	0.18

Abbreviations: MCID = Minimal Clinically Important Difference; PROMIS-PI = Patient Reported Outcomes Measurement Information System – Pain Interference Scale; VAS = Visual Analogue Scale; MBM = Michigan Body Map; SF-MPQ = Short Form, McGill Pain Questionnaire.

## Appendix C - Treatment Manual

### Class 1 – Deep Breathing – Expand the Ribs (BASICS)

- **Props:** Roll and block
- **Have students set up against the wall and let them know that we will set up this way most of the time.** Before turning on recording, cover the following: Review consent document risks and class logistics (dates/times/what to do if they will miss a class or be late).  
**Set Theme and Intent:** Our focus today is on deep breathing. Deep breathing tells our bodies it's okay to relax and also nourishes our brain and body with oxygen so we can learn new things.
- **Pranayama in easy cross legged** (allow to sit in other leg positions if cross legged is not available. Demo baddha konasana on floor and on a block, virasana on blocks)
  - DEMO UJJAYI STAGE 1
    - **Ujjayi, Stage 1** (3B)
    - DEMO AND HAVE STUDENTS COMPLETE STAGES 2 AND 3
  - DEMO EXPANDING THE RIBS
    - **Expanding the ribs** (5 rounds)
- **Classical spinal twist in easy cross legged** (3B per side)
- DEMO ELBOW TO KNEE, LOW BACK VARIATION WITH BLANKET UNDER SACRUM AND BADDHA ON BACK, PLUS HOW TO SIT UP WITH A RELAXED NECK
  - **Elbow to Knee, low-back variation**, 4 rounds
  - **Baddha on back, with back traction** (3B)
- DEMO ABS WITH A ROLL AND BRIDGE, BLOCK UNDER SACRUM
  - **Abs with a roll, legs bent or on wall** (4 rounds)
  - **Bridge, block under sacrum** (4B)
- DEMO TURBOPUPPY (KNEES ON FLOOR)
  - **Turbopuppy**
- DEMO
  - **Lunge, Hands on Floor > Turbopuppy > Lunge, Hands on Floor > Turbopuppy** (2 rounds)
- IF TIME: DEMO
  - **IF TIME: Lunge, Hands on Knee > Plank > Low Cobra > Turbopuppy > Lunge, Hands on Knee** (2 rounds)
- IF TIME: DEMO, INCLUDE TUCK TAILBONE AND TELESCOPE RIBS
  - **IF TIME: Sun Salutations with Turbopuppy instead of Downward Dog** (2 rounds)
- **Back Release Pose > IF TIME Laying down spinal twist**
- **Savasana**  
Bring your attention back to your breath. Inhale, expand your ribs. Expand your awareness to your body. <pause> Make your way to one side <pause> and keeping your neck relaxed all the way, make your way up to seated. When you are all the way up, use your whole hand to pick your head up. <pause>

At the end of every class, I say “Aho and Namaste.” Aho is from Native American traditions and Namaste is a hindu word. Both are words for respectful greetings and a way to close sacred space. You are welcome to say “Aho and Namaste” after me, or one of the words, or nothing at all, whatever you feel most comfortable with.

May you take deep breaths throughout your day. Aho and Namaste.

**Remember to drink lots of water! If you are sore, an Epsom salts bath can help. But the best way to ease that soreness is to do more yoga! See you all <NEXT CLASS TIME>. Please stay and ask questions if you have them.**

## Class 2 – FEEL your body - Transition from Thinking into Feeling (BASICS)

- **Props:** Roll, Block
- **Set Theme:** We spend most of our time subconsciously and/or consciously engaged with our mental experiences – our thoughts, judgments, memories, plans, and stories. In today’s class, we start to practice moving our attention purposefully to sensations – we bring our attention to what this practice *feels* like.
- **Set Intent:** Take a deep inhale and expand the ribs. *Feel* the stretch of the muscles between the rib bones.
- **Wrist stretches**
- **Pranayama in easy cross-legged**
  - DEMO KAPALABHATTI > CHEST OPENER, HOLDING THE BREATH > FORWARD FOLD
  - **Kapalabhatti (30 pumpings) > Chest opener, Holding the Breath > Forward Fold (2 rounds)**
    - CUE TO GO AS SLOWLY AS NEEDED TO FEEL ACTIVATION BETWEEN THE BELLY BUTTON AND PUBIC BONE. THEN CAN INCREASE SPEED.
- **IF TIME: Seated side bend in baddha konasana**, 2 arm positions (2B per position)
- **Elbow to Knee, low back variation** (4 rounds)
- **Abs with a roll** (4 rounds)
- **Bridge, block under sacrum** (4B)
- **Turbopuppy** (4B)
- DEMO DOWNWARD DOG WITH KNEES BENT
  - **Downward Dog with knees bent**
- DEMO SUN SALUTATIONS
  - **Sun Salutations** (4 rounds: Hands on Floor, Hands on Knee x2, Hands up: CUE ACTIVE HANDS)
- DEMO STANDING BACKBEND WITH A ROLL, CHAIR ON WALL
  - **Standing Backbend with a roll** (4B)
  - **Chair on the Wall with a block** (3B)
  - **IF TIME: Standing Backbend with a roll** (4B)
- **Laying down spinal twist** (4B per side)
- **Savasana**

Bring your attention back to your breath. Inhale, expand your ribs. Make your way to one side. Press yourself up to seated, keeping your neck relaxed the whole way up. When you are settled on your sit bones, pick your head up. May you choose to step out of fascination with your mental stories and fascinate on your sensations. Aho and Namaste.

Cue: Normalize difficulty in connecting to abdominals in kapalabhatti.  
Cue: When we “fascinate” on feeling, we get curious about it. We step out of your stories *about* it and we *observe* it.

Cue: A natural response to sensation is to do something to make it stop, like coming out of a yoga pose. Practice being curious – what happens if you stay present in the pose, even when sensation is there?

### **Class 3 – Home Practice: Deep Breathing – Connect to Breath (BASICS)**

- **Props:** Roll, block
- **Set Theme/Intent:** Come to a comfortable seat. Plug your sit bones down and grow your spine up. Deepen your breath.  
Home practices add a layer of complexity to our practice – it is HARD to stay on your mat with so many distractions around. When you notice yourself distracted, guide your attention back to feeling your breath.
- **Pranayama in baddha konasana:**
  - [Kapalabhatti (30 pumpings) > Chest opener, Holding the Breath > Forward bend] x2
- **Elbow to knee, low back variation** (5 rounds)
- **Abs with a roll** (5 rounds)
- **Bridge, block under sacrum** (5B)
- **Turbopuppy** (5B)
- **Sun Salutations** (4 rounds, hands on floor x1, hands on knee x1, hands up x2)
- **Standing Backbend with Roll** (4B)
- **Elbow to Knee, Low Back Variation** (3 rounds)
- **Laying down spinal twist** (3B)
- **Savasana**

## Class 4 – FEEL your body - Strong legs

- **Props:** Roll, Block
- **Set Theme/Intent:** In addition to strengthening the core, one of the ways we work to alleviate pain is to wake up and strengthen the legs.
- **Set Intent:** Activate your feet. Press out through the balls of the feet and pull the toes back. Spread the toes wide. Take a deep inhale and send your breath through your thighs, knees, calves, and feet. Connect to your strong legs.
- **Wrist Stretches**
- **Pranayama in baddha konasana**
  - **Shivananda breath** (4 rounds)
    - CUE EXPAND THE RIBS
- **Seated side bend, one leg straight, option to stay in baddha** (2 arm positions, 3B each)
  - CUE ACTIVATE FOOT, INSIDE LINE OF STRAIGHT LEG
- **Elbow to knee, low back variation** (5 rounds)
  - Practice curling tailbone up, pulling low belly down before starting full Elbow to Knee.
- **Abs with a roll** (4 rounds)
- **Bridge with a roll** (6B)
- **Turbopuppy** (4B)
- **Sun Salutations** (5 rounds)
- **Standing Pose Series**
  - **Warrior II with Back Traction**
  - **Extended Warrior Variation with Sacral Push**
  - **Triangle**
  - **Pyramid with Back Traction**
- **DEMO PIGEON**
- **Pigeon** (4B each side)
- **Dead Bug**(5B)
- **Savasana**

Cue: Notice when you lose connection to your legs. When they go limp. Use this practice to reconnect to them so you can stand up on your strong legs.

Deepen your breath. Send your breath through your ribs and down into your legs. Feel for reaching out through your feet. <pause> Bend your knees and make your way to one side. <pause> Keep your neck relaxed all the way to the side and press yourself back up to seated. When you're all the way up, use your hand to pick up your head. Activate your feet.

May you notice when you've lost your footing and choose to pause and activate your feet. Aho and Namaste.

## Class 5 – Get Curious – Pick a spot (HIPS, TWISTS, STRENGTH)

- **Props:** Rolled up mat, Block, Rock
- **Cue to set up against the wall, sitting on a block/blanket/pillow. Distribute rocks to students.**
- **Set Theme:** Rock mindfulness exercise (3 minutes): Experience the rock through your sense of sight. See how the light reflects off the rock, creating areas that glitter or are dull. <Pause> Notice that your mind layers judgments on top of what you perceive through your senses, like “It’s pretty” or “I like that part of the rock but not this other part.” Guide your attention back to observing the rock. <Pause> Close your eyes and begin to experience the rock through your sense of touch. Feel the rock between your finger tips and notice where it is rough and smooth, jagged and curved. <Pause> Notice when distracted thoughts show up and guide your awareness back to the rock. <Pause> As you are ready, open your eyes and bring your attention back to the room.

You joined this intervention with the hopes of walking free of pain. Most of us get caught in our thoughts about our pain: we focus on how much we don’t like it, how angry we are that it interferes with our lives, we push against it, pretend it’s not there, get irritable, quiet, and turn away from it. Or, we go to the other side of the spectrum. We ruminate on it. We layer suffering and struggle on to our pain. Today’s we step out of struggle and look at our pain like we looked at our rocks.

- **Set Intent:** Identify a painful, achy, or tender spot and breathe into it. Observe it like you observed the rock. <pause> Notice the thoughts, judgments, and urges that show up and bring your mind back to observing your spot, and sending your breath into it.
- **IF TIME: Wrist stretches**
- **Pranayama in baddha konasana**
  - **Breath of Equal Holds**, 6+ counts/inhale (4 rounds)
- **Spinal twist in easy cross legged** (4B each side)
- **Abs with a roll** (5 rounds)
- **DEMO FROG LIFTING THROUGH WITH FEET ON WALL**
  - **Frog Lifting Through** (feet on wall, 6 rounds)
- **IF TIME: Bridge** (6B)
- **Horse on the wall (3-5B)**
- **Dolphin** (5B)
- **Sun Salutations** (4 rounds)
- **Standing Pose Series** (4B per pose)
  - **Warrior II with Shoulder Shrugs**
  - **Reverse Warrior with Neck Release**
  - **CUE FOOT RESET FOR PYRAMID**
  - **Pyramid with Back Traction**
  - **Easy Twisting Lunge**
- **Neck Release Pose** (2 neck positions, 3B each)
- **Savasana**

Cue: It is so human to get caught in struggle. Struggle against sensation in your legs, and struggle with your spot. Just like you noticed thoughts ABOUT the rock while observing the rock, notice the urge to struggle as separate from the sensations you perceive.

Deepen your breath, ballooning your breath into your spot. Open up your awareness of your spot so you can observe it fully. Notice if you have the urge to push the sensation in your spot away. <Pause> Bend your knees and make your way to one side. <Pause> Keeping your neck relaxed all the way to the side, make your way back to seated. When you're all the way up, use one hand to pick your head back up. May you keep noticing your sensations, thoughts, urges, and feelings as they are, throughout your week. Aho and Namaste.

## **Class 6 – Home Practice: FEEL your body - Strengthen core and legs (HIPS)**

- **Props: Roll**
- **Set Theme:** In our last class, we focused on looking at our pain like we look at a rock – creating a little space between the sensations of pain and our interpretations of it. To walk free of back pain, we identify the source of pain and start to breathe into our painful spots, observing them as they are. Then, we strengthen our legs and core, so our strong legs and core support our backs throughout our days.
- **Set Intent:** Inhale, activate your feet. Exhale, pull low belly in and tone the core. Bring your attention to a painful spot in your back and send the support of your legs and core to that spot.
- **Pranayama in easy cross legged:**
  - Breath of Equal Holds (8-8-8-8, 2 rounds each leg)
- **Abs with a roll (6 rounds)**
  - CUE CONNECTING TO LOWER ABDOMINALS
- **Frog Lifting Through (6 rounds)**
- **Bridge (6B)**
  - CUE BREATHING INTO STRONG LEGS
  - CUE PRESSING DOWN THROUGH FEET TO ACTIVATE INSIDE LINE OF LEGS
- **Horse Stance on the Wall**
- **Standing Pose Series (4B per pose)**
  - **Warrior II with Shoulder Shrugs**
    - CUE TUCKING TAILBONE
  - **Reverse Warrior with Back Traction and Neck Release**
  - **Triangle**
  - **Extended Warrior Variation with Sacral Push**
  - **Lunge**
  - **Easy Twisting Warrior/Lunge**
- **Happy Baby**
- **Savasana**

## Class 7 – Get Curious: Notice Fear and Come Back to FEELING (INVERSIONS)

- **Props: Set up against the wall, Roll, Block**
- **Set Theme:** When we have been in pain, it's natural for our minds to send us fear thoughts about how terrible it is to feel pain. Adding these “Not again!,” “Why me?,” or “Oh no!” thoughts transforms intense sensations to suffering. We can step out of suffering when we notice those thoughts *as thoughts* and choose to get CURIOUS about the sensation instead of jumping on the train of our thoughts.
- **Set Intent:** Bring your attention to what you can sense in this moment. FEEL your breath expanding your ribs. Activate your feet and FEEL where they make contact with the floor.
- **Wrist stretches, seated on block against wall**
- **Pranayama in baddha konasana**
  - **Brahmeri** (2B into front/sides/back of heart)
  - CUE FOR BUZZING UP THE HEART – WHICH CONTAINS BOTH OUR FEAR AND OUR COURAGE
- **Seated Side Bend, 1 Leg Straight, option to sit in baddha** (2 arm positions, 3B each)
- **Abs with a roll** (5 rounds)
- **Straddle Lifting Through, option for Frog Lifting Through** (5 rounds)
- DEMO BRIDGE OVER THE BLOCK, ONE LEG UP
- **Bridge over the block, 1 leg up** (4B per leg), give option to keep both feet on the floor
- **Dolphin, uplevel: 1 leg up** (4B per leg)
- **Sun Salutations** (6 rounds)
- DEMO DOLPHIN ON THE WALL, with options to keep feet on the floor, focusing on sending chest towards wall
- **Dolphin on the Wall, downlevel: dolphin**
- **Standing Pose Series** (4B each pose)
  - **Warrior I**
  - **Warrior I with Eagle Arms**
  - **Easy Twisting Warrior**
  - CUE FOOT RESET FOR PYRAMID
  - **Pyramid with Back Traction**
- **IF TIME: Tree**
- **Neck Release Pose**
- **Savasana**

Deepen your breath. Feel the difference in your body when you acknowledge fear and get CURIOUS instead of getting caught in suffering. <Pause> Bend your knees and make

Cue: When you notice that you feel sensation in your body, pause. Notice the urge to let your legs go limp. Instead of getting caught in your suffering thoughts, take a breath into the sensation. What do you feel?

Cue: Notice the difference between feeling sensation and getting caught up in thoughts ABOUT the sensation. When we get caught in our thoughts, we add suffering to what is simply sensation.

your way to one side. Keep your neck relaxed and come back up to seated. Pick your head up with your hand.  
May you continue to get CURIOUS.  
Aho and Namaste.

## Class 8 – Deep Breathing: Send Deep Breaths to Your Back (BACKBENDS)

- **Props:** Block and roll
- **Set Intent:** Bring your awareness to a painful or achy spot that needs your attention. Take a deep breath in to your spot. In your mind's eye, zoom your focus in, envision the bones, joints, or the muscles surrounding your spot. Zoom in even more and picture the cells of your spot in your mind's eye.
- **Set Theme:** Inhale and see in your mind's eye that your breath carries nutrients to these cells, giving them everything they need to do what cells do. Exhale and picture your cells releasing their waste, and let your exhale carry that waste away. Inhale nutrients to your spot, exhale what is no longer needed.
- **Pranayama in easy cross legged (shoelace if available):**
  - DEMO UDDIYANA
  - **Kapalabhatti** (30 pumpings) > ([ **Chest opener** > **Uddiyana** ] x2) > **Forward Fold** > other side
  - CUE to use breath as a way to warm up the core during kapalabhatti, then fill your breath through back and chest during chest opener. Lengthen back in uddiyana.
- **Elbow to Knee** (5 rounds)
- **Abs with a roll** (5 rounds)
- **Bridge with the Roll** (8B)
- **Turbopuppy** (5B)
- **Sun Salutations** (5 rounds)
- **Chest opener on the wall** (4B each side)
- **B series with 2 pose vignettes**
  - **Warrior II with Back Traction** > **Reverse Warrior** > **Downdog** > other side > ½ **salutation with Cobra**
  - **Warrior I Backbend** > **Warrior I with Brain Cradle** > **Down Dog** > CUE TO SIT
    - DEMO COBRA OVER ROLL WITH BLOCK
    - **Cobra over roll with block** > other side > IF TIME: **Cobra over roll with block**
- DEMO LOUNGE LIZARD
- **Lounge Lizard**
- **IF TIME: Dead bug**
- **Savasana**

Cue: Breathe in to the chest and back in Chest Opener. Feel the chest open and back lengthen with the breath.

Cue: Telescope ribs with the breath.

Bring your awareness back into the room, to your mat, and to your body. Narrow your attention so you are aware of the cells in your spot taking nourishment from your breath and releasing what is no longer needed. Then expand your awareness back out to the trees just outside this door, who take in what we exhale as their nourishment. Knowing that what you don't need, the earth transforms back into nourishment for us. Make your way to one side. Keep your neck relaxed and come up to seated. Sit up. May you continue to intentionally nourish your cells with your breath. Aho and Namaste.

## **Class 9 – Home Practice: Use the Strength of your Legs to Free Your Back (BACKBENDS)**

- **Props: Block and Roll**
- **Set Theme:** Come to a comfortable seat and get your breathing going. Close your eyes and go inside, feeling your legs from the inside out. Our legs are our foundation. The way they support us sets up how the rest of the body will be. We strengthen our legs to give the rest of our body the support it needs to be free.
- **Set Intent:** Activate your legs to free your back. Use the strong foundation they give you to lift your spine away from your hips.
- **Pranayama in Baddha (Active Feet!)**
  - **Breath of Equal Holds (10-10-10-10, 3 rounds)**
- **Twisting Abs with the Roll (4 rounds)**
- **Frog Lifting Through (5 rounds)**
- **Bridge (6B)**
- **Dolphin 1 leg up (4B each leg)**
- **Horse Stance with Back Traction (4B)**
- **Sun Salutations (3 rounds)**
- **B series with 2 pose vignettes**
  - **Warrior II with Back Traction > Reverse Warrior with Back Traction > ½ salutation with Cobra > other side > ½ salutation with Cobra over the roll with the block**
  - **Lunge, Hands on Hips Telescoping Ribs > Easy twisting lunge with back traction > Boat with the block > other side > cobra over the roll with the block**
- **Back Release Pose (5B per side)**
- **Savasana**

Deepen your breath. Send your breath from your ribs down into the pelvis, all the way through the thighs into your feet. Connect with your feet and energize your legs. <pause> Bend your knees, and make your way to one side. Keep your neck relaxed and make your way up to a tall, grounded, seated position. Bring your hands to your heart. May you use your strong legs to help you stand tall and free of pain. Aho and Namaste.

## Class 10 – Get Curious – Open your Awareness to It All

- **Props:** Roll and Block
- **Set Theme:** Come to a seat. Plug down, open the chest, get your breathing going. When I was in my teacher training, I woke up early one morning to go journal by the river bank before sunrise. As I sat and wrote, I suddenly noticed that it smelled bad. I looked up and was horrified to see a slew of dead fish on the rocky shore right in front of me. I was instantly disgusted and started packing up my things. But then I looked up to the left, and gasped as I saw the first edge of the sun pop up over the horizon. I looked to the right and a great blue heron swooped in front of me and landed not 30 feet away on the other side of the bank. I couldn't help but laugh out loud. The dead fish and the smell were still there, but my awareness had expanded. If I had walked away in disgust, I would have missed those miraculous moments.
- **Set Intent:** As you sit here, you might notice aches and pains, thoughts you wish would go away, and emotions you'd rather not have. Open your awareness to all that this moment offers. Instead of focusing on the dead fish, can you see the sunrise and the heron?
- **Wrist Stretches**
- **Pranayama in Baddha Konasana**
  - **Shivananda breath** (6 rounds)
- **Seated Side Bend in easy cross legged** (2 arm positions, 3B each)
- **Twisting Abs with a roll** (4 rounds)
- **Frog Lifting Through** (5 rounds)
- **IF TIME: Bridge** (8B)
- **Turbopuppy**, give turbodog option (5B)
- DEMO UDDIYANA
- **Horse with uddiyana** (3 rounds)
- **Sun Salutations** (6 rounds)
- **B series with 2 pose vignettes**
  - **Warrior II with Kite Hawk Arms > Warrior II with Eagle Arms > ½ salutation with Cobra > Turbodog > other side > ½ salutation with Boat Shrugs > other side > Down Dog**
  - **IF TIME: Warrior I > Easy Twisting Warrior > ½ salutation with Boat with Shoulder Shrugs > other side > Down Dog**
  - **IF TIME: Warrior I with Unlocking Shoulders > Twisting Warrior > boat with block > other side > Down Dog**
- **IF TIME: DEMO TWISTING SQUAT ON WALL**
  - **IF TIME: Twisting Squat on Wall**
- **Neck Release Pose**
- **Savasana**

Deepen your breath. Connect in to the truth that every moment offers a choice to notice the fish or notice the sunrise. You can choose to treat yourself harshly or you can choose to approach your thoughts, sensations, and feelings with curiosity and compassion. As

Cue: Notice when you start to focus on the fish and open up. Inhale and feel your ribs spread.

Cue: Notice when your habitual ways of thinking and responding show up. Take a deep inhale into your spot and choose a new, healing way to respond.

you transition up to seated, notice the urge to sit up fast and crank your neck. Choose to roll to one side and relax your neck even as you come up to seated. <Pause> Draw the chest away from the belly button, hands come to heart center. May you open your awareness to all that this moment offers. Aho and Namaste.

## Class 11 – Compost: Notice Habitual Patterns (BACKBENDS)

- **Props: Block and a Roll**
- **Set Theme:** Physical pain and suffering are not the same. We sense physical pain in our bodies, and use words like “sharp, achy, hot” to describe our sensations. Suffering comes when we layer on thoughts ABOUT our pain, thoughts like “This is a disaster!” “I can’t handle this!” “No one understands the pain I feel.” Pain in and of itself is plenty to deal with. Notice when you layer on thoughts and get caught up in them.
- **Set Intent:** Choose to bring your attention back to the sensations you feel when you realize you jumped on the train of your thoughts.
- **Pranayama in easy cross legged**
  - **Brahmeri into all 7 chakras** (starting at 7, going down to 1, 3B per area)
- **Seated Side Bend One Leg Straight** (Neck Release > Over ear > Fold over straight leg, 3B per position)
- **Elbow to Knee**, 5 rounds
- **Abs with a Roll**, 5 rounds
- **Bridge**, 8B
- **Dolphin** (5B)
- **Sun Salutations** (8 rounds)
- **B series with 2 pose vignettes**
  - **Warrior II with Shoulder Shrugs > Warrior II with Eagle Arms > ½ salutation with Cobra over the Roll with a Block > other side > ½ salutation with Boat Grabbing Sit Bones**
  - IF TIME: DEMO PRELUDE TO WAVE DANCER, STAGE 2
  - **Lunge with Hands on Hips, Telescoping Ribs > Lunge with the Back Knee Up with Soft Lions > IF TIME: ½ salutation with Prelude to Wave Dancer, Stage 2 > other side**
- **Standing Backbend with a Roll**
- IF TIME: DEMO CAMEL ON THE WALL
  - IF TIME: **Camel on the Wall**
- **Lounge Lizard** (4B each side)
- **IF TIME: Elbow to Knee, 1 leg straight** (3 rounds)
- **Laying down spinal twist**
- **Savasana**

Deepen your breath. Bring your awareness to your body. To the spots you habitually hold tension. Inhale into one of those spots and use your breath to make space there. Exhale, let one layer of tension be composted with your breath. Keep the space that you made and make your way to one side. Keep your neck relaxed and make your way back up to seated. May you continue to get clear about what you can compost. Aho and Namaste.

Cue: Use the intensity and warmth in the legs to unstick your unhelpful, habitual patterns. Use Soft Lions as a way to exhale out them out.

## Class 12 – Home Practice: Learn to Create Space Internally (TWISTS)

- **Props:** Roll and Block
- **Set Theme:** Learning to create space internally. In our last few classes, we've been working on identifying and letting go of habitual patterns that aren't helping us. Our knee jerk reactions that end up taking us away from what's important instead of bringing us closer. Learning to create space internally means taking a step back from that habitual pattern and pausing and choosing how to move forward. On the yoga mat, it might mean noticing when you start to constrict, like clenching the jaw or using your neck to pull you out of a pose. Instead of indulging in that, instead of tightening your jaw even more or clenching your neck, making space internally means noticing that you just did that. Pausing, taking a deep breath and ballooning your breath into that spot so that you can make a choice as to how to proceed.
- **Set Intent:** Notice a stop right now that feels a little constricted. That feels tight, achy, or painful. This can be a physical pain or emotional pain. Balloon your breath into that spot right now. Noticing that even the act of identifying the constriction, the pain, acknowledging its existence might be in and of itself an act of creating space internally. Send your breath to that spot. Fill that spot with your nourishing, oxygenated breath.
- **Pranayama in Baddha Konasana**
  - **Breath of Equal Holds with Uddiyana** (10-10-10-uddiyana, 3 rounds)
- **Forward Fold in Baddha Konasana** (4B)
- **Elbow to Knee** (5 rounds)
- **Bridge over Block, Ankle over Knee** (4B per leg)
- **Dolphin 1 leg up** (4B per leg)
- **Sun Salutations** (4 rounds)
- **B series with 2 pose vignettes**
  - **Lunge > Easy twisting lunge > ½ salutation with Cobra > other side > ½ salutation with Cobra Over the Roll with a Block**
  - **Lunge with the Back Knee Up and Soft Lions > Pigeon Sternum to Foot > Downward Dog > other side**
- **Laying Down Spinal Twist**
- **Savasana**

## Class 13 – Spirit: Connect to Future Wiser Self (BACKBENDS)

- **Props: Block, Strap, and a Roll**
- **Start laying on the back, knees bent.**
- **Set Theme:** Imagine that you are walking along a path, just behind someone who looks strangely familiar. As you catch up to this person, you realize that it is your future wiser self. The you that has survived your current challenges and lives in alignment with your values. Ask your future wiser self what lessons you need to learn to step out of the habitual patterns that aren't serving you and step in to a more meaningful and vitalizing life. Take the time to listen for any answers.
- **Set Intent:** Breathe in the way of your future wiser self.
- **Laying down spinal twist**
- **Abs with a Roll** (6 rounds)
- **Frog or Straddle Lifting Through** (6 rounds)
- **Bridge over block** (6B)
- **Sun Salutations** (6-8 rounds)
- **B series with 2 pose vignettes**
  - **Warrior I with Archer Arms > Warrior I Backbend (Hands on Hips Telescoping Ribs) > ½ salutation with Cobra > other side > ½ salutation with Boat with Shoulder Shrugs**
  - DEMO TRIANGLE > HALF MOON AND SHOW OPTION ON THE WALL
  - **Triangle > Half Moon > ½ salutation with Boat Grabbing Sit Bones > other side > ½ salutation with Cobra over Roll**
  - IF TIME: DEMO LOUNGE LUNGE
  - **IF TIME: Lunge with Brain Cradle > Lounge Lunge > Down Dog > other side > Down Dog > Knees down**
- IF TIME: DEMO DANCER ON THE WALL WITH STRAP
  - **IF TIME: Dancer on the Wall with Strap**
- DEMO COBRA PUSHUPS OVER THE ROLL WITH A BLOCK
- **Cobra pushups over the roll with a block** (4 rounds)
- **Elbow to Knee, 1 leg straight up**
- **Laying down spinal twist**
- **Savasana**

Use your deep breath to bring your awareness back to the room. Wake up your body and transition to one side in the way of your future wiser self. <Pause> Keep your neck relaxed and come up to seated. <Pause> Sit in the way of your future wiser self. <Pause> May you continue to embody your future wiser self today. Aho and Namaste.

Cues throughout class:  
Breathe in the way of your future wiser self.

Come in to this pose in the way of your future wiser self.

Transition from one pose to the next in the way of your future wiser self.

## Class 14 – Spirit: Do Poses as Future Wiser Self (HIPS AND TWISTS)

- **Props: Block**
- **Set Theme/Intent:** Connect to your Future Wiser Self. How does your Future Wiser Self breathe? What is the quality of your Future Wiser Self’s attention in challenging poses? In poses designed to release tension? Begin to breathe in the way of your Future Wiser Self.
- **Pranayama in shoelace**, option for cross-legged
  - **Alternate Nostril Breathing, 4-16-8, 2 rounds per side, 4 rounds total**
- **Spinal twist (Option for bind or ½ lotus if available)**
- **Elbow to Knee** (5 rounds)
- **Frog or Straddle Lifting Through**, option for feet on wall (8 rounds)
- **Bridge over the Block, ankle over knee** (5B, then put block under sacrum > cross ankle over knee, 3B per side)
- **Turbodog** (5B)
- **Twisting Horse** (4B each side)
- **Sun Salutations** (5 rounds)
- **Standing Pose Series**
  - DEMO HEAD TO ANKLE PREP, LOUNGE LUNGE
  - **Warrior II with Shoulder Shrugs**
  - **Reverse Warrior**
  - **Head to Ankle Prep**
  - **Twisting Lunge**
  - **Maine Coon Stretch**
  - **Lounge Lunge**
- **IF TIME: Twisting Squat on the Wall**
- **Dead Bug**
- **Savasana**

Bring your attention back to your breath. Breathe in the way of your Future Wiser Self. Make your way to one side, choosing to stay aware through this whole transition. Smoothly make your way up to seated, keeping your neck relaxed the whole way up. When you are up, pick your head up. Sit in a way that embodies your wisest self. Bring your hands to heart center. May you walk as your Future Wiser Self for the rest of the day and week. Aho and Namaste.

Cue: Do this pose in the way of your Future Wiser Self.

**Class 15 – Home Practice: Choose Life –  
Bring your BEST quality of attention (Chest opener)**

- **Props:** Block and access to wall
- **Set Theme:** Come to a comfortable seat. Plug your sit bones down and grow your spine up. Send your deep breath through your spine, lifting it from the inside out. Mindfulness doesn't mean that we are able to empty our minds or stop our thoughts. Mindfulness means that when we notice that we are distracted, we choose to come back to the moment instead of staying stuck in our story. When we bring our BEST quality of attention to the moment, it doesn't mean that we stop all of our judging thoughts, it means that we notice them AS THEY ARE (thoughts) and choose to bring our attention back to the breath.
- **Set Intent:** Inhale and expand your ribs. Feel your ribs flare. Commit to bringing your best quality of attention to this practice.
- **Pranayama in whatever leg position feels best**
  - **Brahmeri into a spot that needs your attention, or to back/sides/front of heart**  
(2B per spot)
- **Chest Opener (3B) > Forward Fold (3B)**
- **Elbow to Knee (5 rounds)**
- **Bridge (6B)**
- **Dolphin 1 leg up**
- **Sun Salutations (6 rounds)**
- **Down Dog on Wall**
- **B Series (2 rounds)**
- **Chest Opener on the Wall**
- **Chair on the wall with a block**
- **Laying down spinal twist**
- **Savasana**

## Class 16 – Spirit: Habitual Patterns vs Your Future Wiser Self (Backbends)

- **Props:** Roll and Optional Block(s) for Lunges and Wheel
- **Set Theme/Intent:** As you step onto the path of your Future Wiser Self, what habitual patterns show up that don't serve you? Getting distracted, avoiding connection to your body or to others, resorting to an internal “freak out” instead of staying with your breath? When you're no longer frantic and preoccupied with stopping the sensation in your legs in a yoga pose, you have more space to choose how to be. You can notice tension in your shoulders and ease them down, even as your legs work. Notice when habitual patterns surface and bring your intention back to staying on the path of your Future Wiser Self.
- **Pranayama in baddha konasana**
  - **Kapalabhatti** (75 pumpings) > [Chest Opener > forward fold]x2
- **Elbow to Knee** (6 rounds)
- **Abs with a roll** (6 rounds)
- **Bridge** (8B)
- **IF TIME: Dolphin prelude** (5B)
- **Dolphin** (5B)
- **Sun Salutations** (6 rounds)
- **B series with 2 pose vignettes**
  - **Warrior I Hands on Hips, Telescoping Ribs > Warrior I Archer > ½ salutation with Boat grabbing sit bones > other side > ½ salutation with Cobra over the roll**
  - **Lunge Backbend > Lunge with the Back Knee Up > ½ salutation with Cobra over the roll > other side > boat**
- **Backbend Series**
  - DEMO WHEEL
  - **Bridge/Wheel – option for blocks at wall for feet or hands/Bridge (5B, up to 10B, 5B)**
    - Downlevel: Bridge/Bridge with block under sacrum/Bridge
- **Lounge Lizard** (4B per side)
- **Elbow to Knee, 1 leg straight to ceiling** (3 rounds)
- **Laying Down Spinal Twist**
- **Savasana, cue to take up space**

Bring your awareness back to your body. Notice if you have begun to clench the jaw, tighten the forehead, or otherwise resort to habitual holding. Inhale and balloon your breath in to those spots, using your breath and your commitment to living as your Future Wiser Self to unwind this habitual holding. <Pause> Without tensing those areas, make your way to one side. <Pause> Come up to seated and sit in the way of your Future Wiser Self. <Pause> May you continue to discover your habitual patterns and choose to lay them aside in favor of your Future Wiser Self path. Aho and Namaste.

Cue: Notice when habitual patterns come up. Use these poses as an opportunity to discover what yours are. Choose to disobey your habitual patterns and step onto the path of your Future Wiser Self.

## Class 17 – Spirit: Acceptance/Struggle Free (HIPS AND INVERSIONS)

- **Props:** Roll
- **Set Theme:** Acceptance is a goal in many traditions, and it is also often misunderstood. We think that if we accept what is going on, if we let go of the struggle, we become push overs and victims. We equate acceptance with resignation. We think our only choice to not be overwhelmed by our thoughts, sensations, or feelings is to push at them. On our mat, we can learn that struggling in poses actually keeps us from going deeper in our practice. It keeps us from feeling our body and doing the wise and compassionate thing for ourselves. We think that struggling helps, and yet the harder we struggle, the less we get out of our practice.
- **Set Intent:** Pick a spot that needs some extra attention or support. Breathe in to that spot. Notice when you get caught in struggle. Ease back until you can lay the struggle down, and then stay there there. That is your edge today.
- **Pranayama in easy cross legged**
  - **Brahmeri into spot (8B)**
- **Seated Side Bend, one leg straight (2 arm positions) > Forward fold over extended leg**
- **Twisting Abs with a Roll (4 rounds)**
- **Twisted Root Abdominals, foot on wall (3/2)**
- **Bridge with a Roll (6B)**
- **Turbodog (5B)**
- **Sun Salutations (5 rounds)**
- **B Series with 2 pose vignettes**
  - **Warrior II with Shoulder Shrugs > Warrior II with Archer Arms > ½ salutation with Boat > other side**
    - **DEMO DOWN DOG ON THE WALL**
      - **Dolphin OR Down Dog on the Wall**
  - **Extended Warrior Variation with Sacral Push > Pyramid with Back Traction > IF TIME: ½ salutation with Cobra, or downdog > other side**
- **Back Release Pose > Laying Down Spinal Twist**
- **Savasana – Read *A Reply to Rumi* poem**

Cue: Stepping out of struggle doesn't mean being a wet noodle in poses. It means coming in to poses deep enough so that you feel sensation and vitality in your body and still being able to breathe with awareness.

There is a poem by the poet Rumi in which he advocates for welcoming all thoughts and feelings with gratitude. This poem offers an additional layer to this wise advice.

### *A Reply to Rumi*

Welcome all the visitors you say.  
Do not put bars on the windows  
Or locks on the doors. Do not close up the  
Chimney flue. Duct tape and plastic  
sheeting will not keep the visitors at bay.  
They'll pound on the doors, they'll break  
your windows, they'll create the barricades

they'll storm the beach, swarm in like ants  
through cracks. They'll lead like water through  
the walls, and creep like mice, and curl like smoke  
and crack like ice against the window glass.

Keep them out? It can't be done, don't try.  
Welcome all the visitors.

Fine. There's all kinds  
Of welcoming, however.

I do not have to throw a house party.  
I will not post flyers.  
There will be no open bar.  
No one will get drunk  
and lock themselves in the bathroom.  
No one will break the furniture, grind chips  
into the rug, throw anyone else in the pool,  
or lose an earring in the couch.

I do not have to run a guest house, either  
There will be no crackling fire  
And no easy chairs. I will not serve  
tea to the visitors. I will not dispense  
ginger snaps and ask my guests  
about themselves:  
"Did my mother send you?"  
"Why must you plague me?"  
"Why not stay a while longer?"  
"Who are you really?"

If I must welcome-and I am convinced I must-  
Let me build a great hall to receive my guests.  
Like a Greek temple, let it be open on all sides.  
Let it be wide, and bright, and empty.  
Let it have a marble floor.  
Beautiful and cold and hard.  
Let there be no sofas, no benches, no dark corners  
no ante-rooms and no coat closets  
No walls and not even a ledge to lean against.

I'll welcome anyone who comes  
I'll show them my enormous empty all.  
Come in, come in, I'll say. I'll even smile  
perhaps make conversation for a while.

And if someone settles on the floor, as if to stay,  
or circles round and round, as if they have lost their way,  
I'll be kind, extend my hand,  
and gently show them out again.

**Class 18 – Home Practice: FEEL Your Body –  
Do these poses in the way of your Future Wiser Self**

- **Props:** Block and a Roll
- **Set Theme:** Come to a comfortable seat. Feel for sitting in the way of your Future, Wiser Self. While our hopes and intentions give clues as to who we are, we have to make changes to how we behave to step in to being our Future Wiser Self. We have to treat ourselves the way our Future Wiser Self treats themselves.
- **Set Intent:** Feel around inside for one thing you can do in this practice to start acting like your wiser self? Maybe it's focusing on your breath or modifying if needed. Maybe it's staying present and engaged in poses even if they are challenging. Choose your one step and commit to it now.
- **Pranayama in knee pile**
  - **Shivanada breath** (4 rounds be side)
- **Elbow to Knee** (5 rounds)
- **Abs with a Roll** (6 rounds)
- **Bridge** (8B)
- **Turbodog** (5B)
- **Sun Salutations** (5 rounds)
  - **Low cobra** (3 rounds)
  - **Cobra** (2 rounds)
- **B series with 2 pose vignettes**
  - **Lunge with the Back Knee Up > Lounge Lunge > ½ salutation with Cobra over the roll with a block > other side**
  - **Maine coon stretch > Pigeon > Down Dog > other side**
- **Neck Release Pose**
- **Savasana**

## Class 19 – Turning Garbage into Compost (BACKBENDS AND TWISTS)

- **Props:** Block, Strap, Roll
- **Set Theme:** If you've ever gardened, you know that waste (food scraps and other things) is essential to create rich soil that will nourish the seeds we want to grow. We can turn our past habitual patterns into compost that helps us grow into our future wiser selves. What is a seed that you want to grow? <Pause> What can you distill from your patterns that will help you nourish this seed?
- **Set Intent:** Identify where the seed lives in your body and send your breath there now.
- **Pranayama in easy cross legged or knee pile**
  - **Alternate nostril breathing**, 2 rounds per side
- **Seated side bend, one leg straight** (option for baddha, 2 arm positions)
- **Elbow to Knee** (5 rounds)
- **Twisted Root Abs** (3/2)
- **Bridge over block** (6B)
- **Dolphin** (5B)
- **Horse with Uddiyana** (2 rounds)
- **Sun Salutations** (5 rounds)
- **B series with 2 pose vignettes**
  - **Warrior I Archer > Warrior I Backbend > ½ salutation with Cobra > other side > ½ salutation with Cobra over the roll with a block**
  - **Warrior II with Back traction > Extended Warrior Variation with Sacral Push > ½ salutation with Cobra over the roll with a block > other side >**
  - **Lunge with Brain Cradle > Lunge with a Strap > Down Dog > other side**
- **IF TIME: Dancer on the Wall with a Strap**
- **IF TIME: Lounge Lizard**
- **Baddha on back with Uddiyana**
- **IF TIME: Laying Down Spinal Twist**
- **Savasana**

Begin to deepen your breath. Bring your best, nourishing quality of attention and energy to your spot. Keeping that connection to your spot, transition to one side. When you notice you've lost that connection, pause, reconnect, and then continue the movement. Make your way back to seated. When you're all the way back up, use one hand to pick your head up. May you continue to use your old patterns as compost to nourish your growth. Aho and Namaste.

Cue: Notice when those habitual patterns come up – they will! Then use them to cultivate your seed. If your habitual pattern is disconnecting from the present, turn it to compost! CHOOSE to reconnect when you notice you have disconnected.

## Class 20 – Spirit: Acceptance/Struggle Free Part II

- **Props:** Roll, Little towel for foot, Extra padding and Block as needed
- **Set Theme:** In Forrest Yoga, we say, “never waste a good trigger.” Triggers are those moments when we suddenly fire up or feel instantly deflated. Our triggers on and off the mat give us information about what we need, what is important to us, and where there is a disconnect between what is and what we deeply desire for our lives. When we waste a trigger, we get lost in it. We don’t learn from it. When we use our triggers, we connect to our wisest self to discern what our triggers are telling us we need and we can effectively take steps in a healing direction.
- **Set Intent:** Connect to your wisest self. Commit to coming back to your wisest self even when you notice you’ve been triggered.
- **Pranayama in baddha**
  - **Ujjayi breathing in 3 stages**, 3B per stage
- **Twisting Shoelace towards the foot > Shoelace forward bend** (If accessible, otherwise easy cross-legged)
- **Elbow to Knee** (6 rounds)
- **Frog Lifting Through** (6 rounds)
- **Bridge** (8B)
- **Sun Salutations** (8 rounds)
- **Down Dog on the Wall** (up to 10B)
- **Lunges on the Wall**
- **Standing Pose Series** (5B per pose)
  - **Warrior II with Bird Wing**
  - **Reverse Warrior**
  - **Triangle**
  - **Half Moon**
  - **Vertical Splits**
- **DEMO FROG OVER THE ROLL**
- **Frog over the Roll**
- **Sacrum circles**
- **Savasana**

Cue: Watch for your triggers!  
Notice when you find yourself in automatic pilot, saying “come on!” or tuning out. Instead of wallowing in it, don’t waste it! Learn from it. What do you need to do right now to create some space around that trigger?

Deepen your breath and connect back in to your wisest self. Listen for what your triggers can teach you about what’s important to you. <Pause> When we learn from our triggers, we evolve into our wisest self. <Pause> Bend your knees and make your way to one side. Notice when you resist letting your neck relax and choose the most healing way to move forward. Bring your hands to heart center. May we all learn greatly from our triggers. Aho and Namaste.

## Class 21 – Home Practice: Spirit – Use Your Practice to Heal

- **Props: Block and Roll**
- **Set Theme/Intent:** Pick a spot that needs some healing and breathe into it, using your intuition to identify the issue – what is the physical/emotional/spiritual need and how can you help heal it right now in this moment?
- **Pranayama in seated position**
  - **Brahmeri into your spot (8B)**
- **Do a twist or side bend that would feel good for your spot. Stay in each side for 4B, then switch to the other side**
- **Elbow to Knee (5 rounds)**
- **Abs with a Roll (5 rounds)**
- **Bridge – option to use roll or over block (6B)**
- **Dolphin (6B)**
- **Sun Salutations (6 rounds)**
- **Chest Opener on the Wall (4B each side)**
- **Chair on the Wall (5B)**
- **Dead Bug**
- **Savasana**

## Class 22 – Curious: Cultivate Your Best Quality of Attention

- **Props: Roll, Block**
- **Set Theme:** What is the quality of attention you want to bring to the moments of your life? Distracted? Disconnected? Aloof? Or do you want to be present, open, and connected? We don't change our way of being in the world overnight – it takes time and we stumble along the way. In Forrest Yoga, we use the Formula For Change to help us with this process. Notice when you have defaulted to your old patterns. Take several deep breaths and congratulate yourself for noticing. Then take a healing step.
- **Set Intent:** Connect to the quality of attention you want to cultivate. Notice when you have defaulted to your old habits and use the Formula for Change to move forward in a healing way.
- **Pranayama in baddha konasana**
  - **Brahmeri into back/sides/front of heart** (3-4B per spot)
- **Seated side bend, 1 leg straight** (2 arm positions, 4B each)
- **Abs with a Roll, Knees Bent** (6 rounds)
- **Frog Lifting though** (6 rounds)
- **Bridge** (8B)
- **DEMO GATE OPENER, KNEES BENT AND FROG VARIATION**
- **Gate Opener, Knees Bent and Frog Variation** (3 rounds)
- **Turbodog** (5B)
- **Sun Salutations** (6 rounds)
- **Standing Backbend with a Roll, hands on hips**
- **B Series with 2 pose vignettes**
  - **Arrow Lunge** (Option for Lunge, Back Knee Up) > **Twisting Warrior** (Option for Easy Twisting Warrior or Lunge) > **½ salutation with Cobra** > other side > **½ salutation with Boat**
  - **Warrior I Backbend with Brain Cradle** > **Lance Dodger with Brain Cradle** > **½ salutation with Cobra over Roll** > other side > **½ salutation with Prelude to Wave Dancer, stage 2**
- **Camel on the Wall** (6B)
- **IF TIME: Lounge Lizard**
- **Elbow to Knee 1 leg straight** (3 rounds)
- **Dead Bug** (5B)
- **Savasana**

Begin to deepen your breath. As you transition from savasana back to seated, notice when habitual patterns show up and use the Formula for Change! Make your way to one side. Press yourself up to seated, keeping your neck relaxed the whole way up. Bring your hands to heart center. May you use the Formula for Change instead of beating yourself up for the rest of your days! Aho and Namaste.

Cue: Notice when that self-destructive or critical voice pipes up and use the formula for change! Pause and take several deep breaths. Congratulate yourself! Ask yourself what a healing step would be that you could take right now. Listen for an answer. Take a step!

## Class 23 – Gratitude

- **Props:** Roll, Set up with short end of mat on wall
- **Set Theme:** Reflect back on how far you have come, the strides you made, the insights gathered. Take note of the ways in which you are now more fully walking the path of your wiser self. You are stronger and more mindful than when you began. Feel for actually feeling that truth. Celebrate that truth.
- **Set Intent:** Feel inside for that part of you that houses your wiser self, your spirit, your greatest, wisest life force. Breathe into that spot.
- **Wrist Stretches**
- **Pranayama in shoelace, start on tight side (option for easy cross-legged)**
  - [Kapalabhatti (50 pumpings) > Shivanada breath (2 rounds)], switch cross of legs, 3 rounds
- **Elbow to Knee** (5 rounds)
- **Twisting Abs with a Roll** (4 rounds)
- **Bridge** (8B)
- **Turbodog** (5B)
- **Sun Salutations** (6 rounds)
- **B series with 2 pose vignettes**
  - **Warrior II with Shoulder Shrugs > Warrior II with Kite Hawk > ½ salutation with Cobra > other side**
  - **Dolphin or Down Dog on Wall**
  - **Warrior I with Eagle Arms > Warrior I with Archer Arms > ½ salutation with boat > other side > Down Dog**
  - **IF TIME: Dolphin or Down Dog on Wall**
- **Pigeon**
- **Neck Release Pose**
- **Savasana**

Feel the support of the earth beneath you. Now connect to a time in your life when you felt without a doubt that you were loved. When you felt deep affection and connection coming from another person, a pet, or perhaps from the land. Breathe that in and feed it to your core. Breathe in the truth that you're loved and feed it to your cell tissue. Now, forming a shining cord of energy built on this truth and that you are loved, attach it to the top of the inside of your skull and run it all the way through your core and down to the bottom of the pelvis. Brighten it up with your breath. Take a few deep breaths.

Now connect to a time when you felt love for another, when you felt that exquisite energy of love and affection and care welling up inside of you and pouring out into another person or pet or your deep love and affection for the land. Connect to that feeling right now. Breathe deeply, amp up your breath, and pour the truth that you can love through all your cell tissue. Taking another very deep breath, form that energy that you just made into a second shining cord and attach it to the top of the inside of your skull all the way through your core down to the first chakra. Breathe on it and brighten it up.

Deepen your breath. Now focus on the last time you felt gratitude. It could be gratitude for something you have learned from this intervention, for deep breaths, for the ones you love and who love you, or for discovering your truths and giving them the room to grow into bigger truths. It could be connecting to your heart and spirit, or beginning the journey to do that. Perhaps by now you're even generous of heart enough to have gratitude for the really difficult lessons in your life that have forced you to discover other parts of you. Whatever you have gratitude for, generate that energy right now. Breathe that in and wash it through your core. Offer that gratitude, like a precious gift, to feed to your cell tissue. Create a third shining cord and attach it to the top of the inside of your skull alongside the other two cords, all the way through your core down to the first chakra.

Use your breath to make these three cords brilliant. Picture using your hands to braid them together: the trust that you are loved, the truth that you can generate the exquisite energy of love, and the truth that you have much to be grateful for. Breathe and sparkle up your braid.

When you feel the winds of change blowing through you, reconnect to this braid, recreating it as necessary. You are loved. You can love. Your gratitudes. Stay centered on feeling the truths of your shining braid. It is yours. No one can take the truth of this from you. Find out what nourishes and delights you and your wisest self. Do something to nourish and delight your spirit every day, even if it's for just a moment. Consume what nourishes you, give your spirit the space it needs to grow.

Deepen your breath. Make your way to one side. Keep your neck relaxed and make your way back to seated. When you're all the way up, pick your head up with your hand. Plug your sit bones down. Grow your spine up long. Bring your hands to heart center.

I am so grateful to all of you for trusting me to guide you through these practices. May you grow the strength, wisdom, and courage, to go deeper, find your truth, and take these gifts you have earned beyond your mat into the rest of your life.