Research

# Secondary Outcomes from a Randomized Controlled Trial of Yoga for Veterans with Chronic Low-Back Pain

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## Abstract

Chronic low-back pain (cLBP) is a prevalent condition, and rates are higher among military veterans. cLBP is a persistent condition, and treatment options have either modest effects or a significant risk of side-effects, which has led to recent efforts to explore mind-body intervention options and reduce opioid medication use. Prior studies of yoga for cLBP in community samples, and the main results of a recent trial with military veterans, indicate that yoga can reduce back-related disability and pain intensity. Secondary outcomes from the trial of yoga with military veterans are presented here. In the study, 150 military veterans (Veterans Administration patients) with cLBP were randomized to either yoga or a delayed-treatment group receiving usual care between 2013 and 2015. Assessments occurred at baseline, 6 weeks, 12 weeks, and 6 months. Intent-to-treat analyses were conducted. Yoga classes lasting 60 minutes each were offered twice weekly for 12 weeks. Yoga sessions consisted of physical postures, movement, focused attention, and breathing techniques. Home practice guided by a manual was strongly recommended. The primary outcome measure was Roland-Morris Disability Questionnaire scores after 12 weeks. Secondary outcomes included pain intensity, pain interference, depression, fatigue, quality of life, self-efficacy, and medication usage. Yoga participants improved more than delayed-treatment participants on pain interference, fatigue, quality of life, and self-efficacy at 12 weeks and/or 6 months. Yoga participants had greater improvements across a number of important secondary health outcomes compared to controls. Benefits emerged despite some veterans facing challenges with attending yoga sessions in person. The findings support wider implementation of yoga programs for veterans, with attention to increasing accessibility of yoga programs in this population. *Groessl et al. Int J Yoga Therapy 2020(30). doi: 10.17761/2020-D-19-00036.*

**Keywords:** chronic low-back pain, yoga, veterans, complementary and integrative health

## Background

Chronic low-back pain (cLBP), defined as low-back pain with a duration of 12 weeks or longer,[1] afflicts 70% of all people during their lifetimes.[2] Military veterans[3,4] have higher rates of chronic pain than the general population, and the lower back was the most frequently reported location of chronic pain in a 2009 study.[5] Pain is only one aspect of the symptoms and impairment experienced by those with cLBP. People with cLBP also commonly report increases in disability[6] and psychological symptoms[7,8] as well as overall reductions in health-related quality of life (HRQOL).[9,10] cLBP is also a costly condition, exemplified by U.S. statistics showing that cLBP is the second most frequently cited

reason for physician visits.[11] Billions of dollars are spent annually to treat cLBP, and cLBP is the leading cause of lost productivity in the workforce.[12]

In the past, guidelines for treating cLBP recommended initially providing self-care information[13] followed by medications as needed.[13,14] However, the widespread use of opioid medications to treat cLBP has resulted in addiction, overdose deaths, and other consequences,[15,16] leading to strong interest in nonpharmacological treatments for cLBP.[17,18] A 2017 review[19] concluded that integrative health approaches such as yoga produce benefits similar to other conventional nonpharmacological treatments. That study also included clinical guidelines and recommended the use of both integrative and conventional nonpharmacological treatments, along with self-care, as the first course of treatment for cLBP.[19]

In two large randomized controlled trials (RCT) of yoga for cLBP published in 2011, yoga was found to reduce disability, pain, and/or medication use. However, these RCT samples[20,21] were 65%–70% female, recruited in community settings, and did not report military veteran status or data on rates of psychological disorders and substance use. These factors are important because almost 90% of U.S. veterans are male, and Veterans Administration (VA) patients are more likely than the general population to be disabled, have lower incomes,[22] and have elevated rates of mental health conditions.[23] Given the characteristics of prior study participants,[20,21] the generalizability of those results to VA patients or U.S. military veterans as a whole was unclear. Only small nonrandomized preliminary studies had been conducted with veterans.[24,25] Therefore, the effectiveness of a yoga intervention for treating cLBP in VA patients was assessed in a single-site RCT. The study methods[26] and main results[27] have been published previously and indicated that yoga participants had significantly greater decreases in back-related disability and pain severity than comparison group participants at follow-up assessments. The objective of the current study was to present the results of additional secondary outcomes.

## Methods

### Study Design

A previous publication details the study design and methods.[26] From 2013–2014, 150 VA patients consented and were enrolled and randomized to either the yoga intervention or to a delayed-treatment (DT) comparison group. Yoga intervention participants were asked to begin the 12-week yoga program immediately after randomization. The DT comparison participants received ongoing usual care for 6 months and were then offered the same 12-week yoga intervention. Outcomes were assessed at baseline, 6 weeks, 12 weeks, and 6 months. The study and interventions were conducted at a large VA medical center.

The primary recruitment method was referral by VA clinicians from clinics, including primary care, physical medicine and rehabilitation, psychology, and pain medicine. Additionally, fliers were posted and distributed at the medical center.

Inclusion and exclusion criteria were verbally reviewed with veterans inquiring about study participation. Those still interested were scheduled to attend a screening examination with study clinicians who applied inclusion and exclusion criteria. The criteria have been published previously[26] and are included in Supplementary Table 1 (online only; access through iayt.org).

Participants were recruited and randomized in six cohorts. Participants attended a group baseline assessment; after completing the assessment, the study coordinator randomly assigned them to an intervention group at a 1:1 ratio via a computer program that used 10-participant blocks to facilitate balanced assignment.

### Interventions

Before, during, and after the intervention period, all participants continued to receive usual care. However, participants were asked to avoid changing treatments for their cLBP during the 6-month study period unless deemed medically necessary by their medical providers. Usual care for cLBP in study participants was individualized and thus varied, but typically comprised nonprescription and prescription pain medications, physical therapy, spinal manipulation, exercise, and other self-help treatments. Participants assigned to the DT group were asked to not practice yoga until their 6-month assessment was completed.

The yoga intervention consisted of two 60-minute yoga sessions per week for 12 consecutive weeks. Yoga sessions were led by a yoga instructor with more than 7 years of teaching experience and experience teaching yoga to people with cLBP. The intervention can be described as Hatha Yoga of mild to moderate intensity, consisting primarily of yoga postures, movement sequences, and breathing techniques. Focused attention and brief periods of meditation were also included. The interventions and postures were designed by physicians and yoga experts to be safe for persons with cLBP and to accommodate beginners. The intervention was also designed to be adaptable for a variety of functional abilities and rates of progression over the 24 sessions. An instructor manual was created to guide sessions and improve standardization. Yoga participants received a home practice manual, and 15–20 minutes of home practice was recommended on days without formal yoga sessions. The home manual included a selection of basic postures from the class sessions and emphasized safety.

Participants could consult with the instructor about any home practice issues. More detail on the intervention has been published elsewhere.[26]

The importance of attendance at the yoga sessions and regular home practice of yoga were emphasized at the baseline assessment and reinforced by the yoga instructor during sessions. Consistent with resources provided to many VA patients for travel to clinical care appointments, participants received $5 per yoga session attended to offset travel costs and encourage attendance. Study staff contacted participants if they missed more than one yoga session without explanation. All participants were contacted by study staff monthly to remind them of their next assessment window. Reminder letters and phone calls were provided directly preceding assessments. Participants were compensated $30 for completing each assessment.

### Measures

Data were collected via self-report questionnaires and VA medical records. Participants spent 30–45 minutes completing self-report questionnaires at each of the four assessments (baseline, 6 weeks, 12 weeks, 6 months). Sociodemographic characteristics were assessed with a brief self-report questionnaire. Medical record data were accessed to apply enrollment criteria. The primary outcome was change over time on the Roland-Morris Disability Questionnaire (RMDQ) score.[28] The main results for the primary outcome (RMDQ), pain severity (measured by the Brief Pain Inventory [BPI]), intervention attendance, adverse events, and pain medication use have been reported previously.[27]

For the secondary outcomes reported here, the short version of the BPI was used to assess pain interference.[29] This 13-item measure has been validated with low-back pain patients.[30] The Fatigue Severity Scale (FSS) was used to assess the impact and severity of fatigue.[31,32] Depressed mood was assessed using the 10-item Center for Epidemiologic Studies Short Depression Scale (CES-D 10).[33,34] Physical and mental aspects of HRQOL were assessed with the Short-Form 12 (SF-12),[35] and global HRQOL was assessed with the EuroQol (EQ-5D),[36,37] which has 5 questions and provides a single QOL summary score that can be used to calculate quality-adjusted life years. Anxiety was measured with the Brief Anxiety Inventory (BAI),[38] which has well-established reliability and validity.[39] Self-efficacy for controlling cLBP was measured using items developed by Lorig[40] in mixed chronic diseases and adapted to be specific to cLBP. Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI).[41] This 9-item measure provides an overall sleep quality score, with lower scores indicating better sleep.

A number of other secondary outcomes were collected for the purpose of exploring the mechanisms by which yoga improves back pain and reduces disability. These physiological variables, such as grip strength, flexibility, and core strength, will be reported in a separate manuscript.

### Statistical Analysis

Analyses were conducted using an intent-to-treat approach and R Statistical Software. For secondary outcomes including pain interference, fatigue, HRQOL, depression, anxiety, sleep quality, and self-efficacy, the hypotheses tested were that participants randomized to yoga would have significantly greater improvements than DT comparison participants after 12 weeks and 6 months. Linear mixed-effects modeling was used to assess changes in secondary outcomes longitudinally. The main effect of group and time (coded as a categorical variable for baseline, 6 weeks, 12 weeks, and 6 months) and a group-by-time interaction were included in the model. Linear modeling allowed for the inclusion of all data points collected from all 150 subjects. Missing data were not replaced otherwise.

Baseline characteristics were included as a covariate in the multivariable mixed-effects model if a variable was significantly associated with the outcome or significantly different between the two study groups. Insignificant covariates were removed from the multivariable model using backward selection, and only covariates with $p < 0.100$ were included in the final model. The significance of both random intercept and random slope were assessed using the likelihood ratio test.

## Results

Participant flow is depicted in Supplementary Figure 1 (online only; access through iayt.org). Of the 152 assessed and randomized at baseline, 2 participants later requested withdrawal of participation and all data. Thus, 75 participants were randomized to each arm of the study. Attrition at follow-up assessments was about 20%, 20%, and 27.3% at the 6-week, 12-week, and 6-month assessments, respectively. However, intent-to-treat analyses using linear mixed models allowed for data from all 150 subjects to be included even if only a baseline score was provided.

Participant demographic and clinical characteristics are presented in Supplementary Table 2 (online only; access through iayt.org). All participants were U.S. military veterans eligible for care in the VA Healthcare System. Participants had a mean age of 53 years and were 74% male and 49% non-Hispanic White. Most had attended college; 66% were single, divorced, separated, or widowed; 21% were unemployed; 18% had been homeless in the last 5 years; and 20% were being treated with opioid pain medication at baseline.

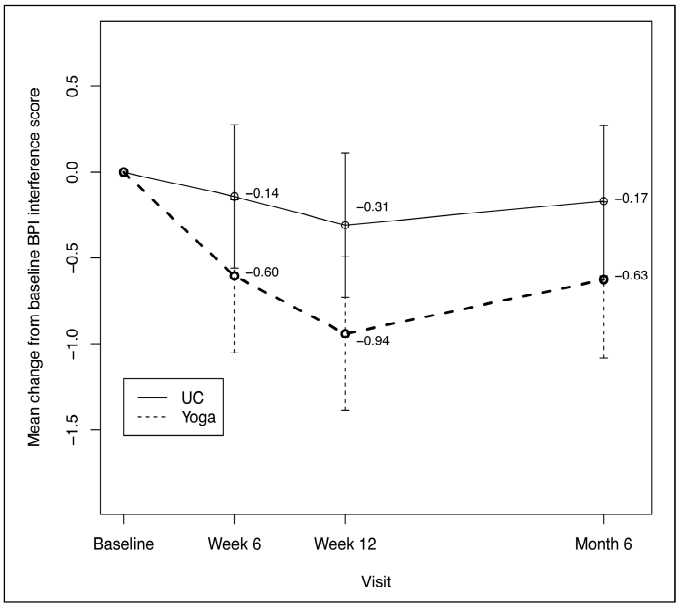
As previously reported in the main results manuscript,

**Table 1.** Linear Mixed-Effects Model of Change at Post-Baseline Visit in Secondary Outcomes

| Variable | Mean Baseline Score (SD) | 6 wk (95% CI) | *p* Value | 12 wk (95% CI) | *p* Value | 6 mo (95% CI) | *p* Value |
|---|---|---|---|---|---|---|---|
| Pain interference | | | | | | | |
| Yoga | 4.73 (2.18) | –0.60 (–1.05, –0.16) | | –0.94 (–1.39, –0.49) | | –0.63 (–1.08, –0.17) | |
| Delayed treatment | 4.77 (2.54) | –0.14 (–0.56, 0.28) | | –0.31 (–0.73, 0.11) | | –0.17 (–0.60, 0.27) | |
| Between-group difference | | –0.46 (–1.07, 0.15) | 0.137 | –0.63 (–1.25, –0.02) | 0.044* | –0.46 (–1.09, –0.17) | 0.155 |
| Fatigue | | | | | | | |
| Yoga | 39.3 (12.5) | –2.34 (–4.78, 0.10) | | –5.77 (–8.21, –3.32) | | –4.97 (–7.56, –2.38) | |
| Delayed treatment | 38.9 (13.3) | 1.47 (–0.84, 3.77) | | 0.61 (–1.70, 2.92) | | 0.80 (–1.62, 3.22) | |
| Between-group difference | | –3.81 (–7.16, –0.45) | 0.027* | –6.38 (–9.74, –3.02) | < 0.001† | –5.37 (–8.83, –1.91) | 0.003** |
| SF-12 Physical | | | | | | | |
| Yoga | 36.3 (9.29) | 2.18 (0.05, 4.32) | | 4.20 (2.20, 6.19) | | 2.77 (–0.10, 5.64) | |
| Delayed treatment | 36.2 (10.5) | –1.62 (–3.60, 0.38) | | 0.65 (–1.22, 2.53) | | –0.74 (–3.53, 2.04) | |
| Between-group difference | | 3.80 (0.88, 6.72) | 0.011* | 3.54 (0.81, 6.28) | 0.012* | 3.51 (–0.48, 7.51) | 0.086 |
| SF-12 Mental | | | | | | | |
| Yoga | 37.7 (6.95) | 0.23 (–1.52, 1.99) | | –0.10 (–1.90, 1.71) | | –1.62 (–4.15, 0.92) | |
| Delayed treatment | 37.8 (6.50) | 0.47 (–1.22, 2.16) | | –0.48 (–2.21, 1.26) | | –0.50 (–3.01, 2.02) | |
| Between-group difference | | –0.24 (–2.68, 2.20) | 0.848 | 0.38 (–2.12, 2.88) | 0.767 | –1.12 (–4.69, 2.45) | 0.539 |
| EQ-5D global QOL | | | | | | | |
| Yoga | 0.66 (0.19) | 0.01 (–0.03, 0.06) | | 0.08 (0.03, 0.12) | | 0.06 (0.01, 0.10) | |
| Delayed treatment | 0.66 (0.21) | –0.001 (–0.04, 0.04) | | 0.02 (–0.02, 0.06) | | –0.01 (–0.05, 0.04) | |
| Between-group difference | | 0.014 (–0.05, 0.07) | 0.656 | 0.06 (–0.003, 0.12) | 0.065 | 0.06 (0.001, 0.13) | 0.047* |
| Depression | | | | | | | |
| Yoga | 13.7 (4.97) | –1.12 (–2.18, –0.06) | | –1.80 (–2.85, –0.75) | | –1.75 (–2.81, –0.60) | |
| Delayed treatment | 13.3 (4.87) | –0.12 (–1.11, 0.87) | | –0.73 (–1.72, 0.26) | | –0.81 (–1.86, 0.24) | |
| Between-group difference | | –1.00 (–2.45, 0.45) | 0.179 | –1.07 (–2.51, 0.37) | 0.147 | –0.94 (–2.43, 0.56) | 0.220 |
| Anxiety | | | | | | | |
| Yoga | 16.2 (11.4) | –1.79 (–3.69, 0.10) | | –1.51 (–4.01, 0.99) | | –2.81 (–5.34, –0.29) | |
| Delayed treatment | 15.3 (12.7) | 0.26 (–1.62, 2.14) | | –0.39 (–2.80, 2.02) | | –0.82 (–3.30, 1.66) | |
| Between-group difference | | –2.05 (–4.72, 0.61) | 0.132 | –1.12 (–4.59, 2.35) | 0.527 | –2.00 (–5.53, 1.54) | 0.269 |
| Sleep quality | | | | | | | |
| Yoga | 11.4 (3.66) | –1.18 (–2.02, –0.34) | | –1.49 (–2.33, –0.65) | | –1.73 (–2.60, –0.86) | |
| Delayed treatment | 10.5 (3.86) | –0.28 (–1.08, 0.52) | | –0.98 (–1.79, –0.18) | | –0.88 (–1.71, –0.04) | |
| Between-group difference | | –0.90 (–2.06, 0.26) | 0.127 | –0.51 (–1.67, 0.66) | 0.392 | –0.85 (–2.06, 0.35) | 0.166 |
| Self-efficacy | | | | | | | |
| Yoga | 5.73 (2.02) | –0.06 (–0.52, 0.40) | | 0.26 (–0.20, 0.72) | | 0.04 (–0.43, 0.51) | |
| Delayed treatment | 6.04 (2.32) | –0.28 (–0.71, 0.15) | | –0.44 (–0.88, –0.01) | | –0.37 (–0.82, 0.08) | |
| Between-group difference | | 0.22 (–0.41, 0.85) | 0.492 | 0.70 (0.07, 1.33) | 0.031* | 0.41 (–0.24, 1.06) | 0.214 |

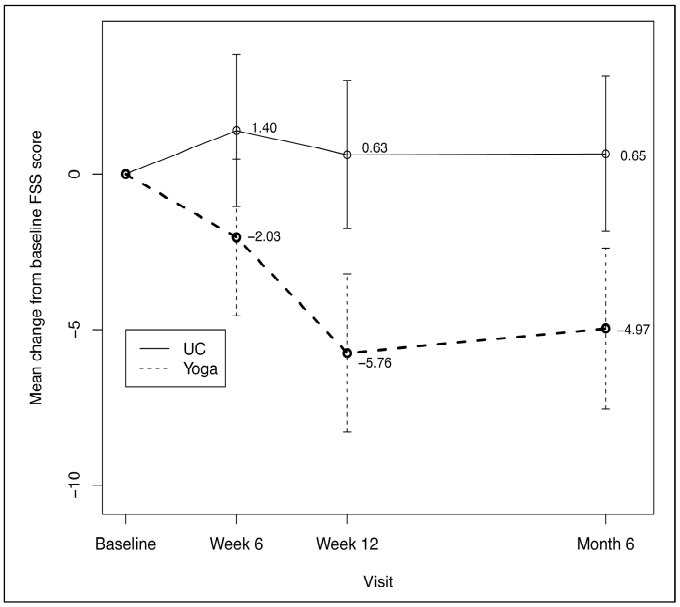
*$p < 0.05$; **$p < 0.01$; †$p < 0.001$.
SD = standard deviation; CI = confidence interval; SF = Short-Form; EQ-5D = EuroQol 5D; QOL = quality of life.

**Figure 1.** Mean Change in Pain Interference Scores



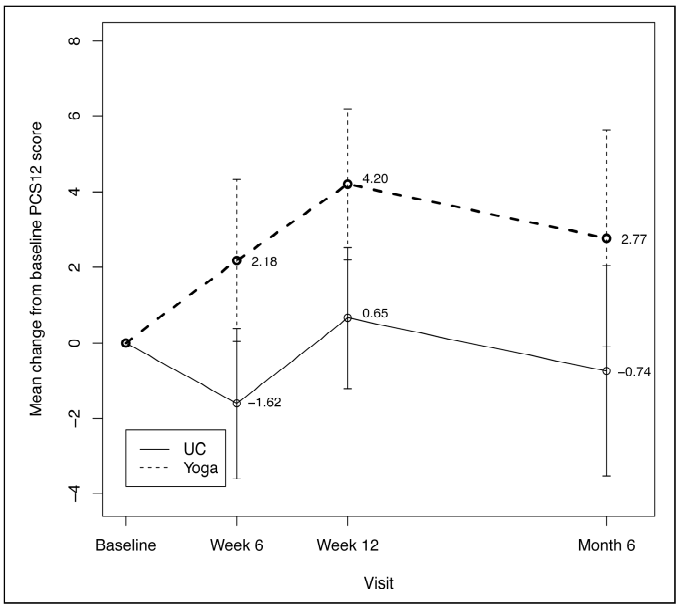

BPI = Brief Pain Inventory; UC = usual care.

**Figure 2.** Mean Change in Fatigue Scores




FSS = Fatigue Severity Scale; UC = usual care.

**Figure 3.** Mean Change in Physical Quality-of-Life Scores




PCS12 = physical component of Short-Form 12 (SF-12) QOL measure; UC = usual care.

yoga participants had significantly greater decreases in the primary outcome, back-related disability, at 6 months but not at 12 weeks. Pain severity decreased significantly more among yoga participants at all three assessments.[27] Opioid pain medication use decreased significantly for the study sample as whole but did not significantly differ by intervention group.

Results on other secondary outcomes (Table 1) indicate that yoga participants reported significantly greater decreases in pain interference at 12 weeks ($p = 0.044$; Fig. 1); significantly greater decreases in fatigue at 6 weeks ($p = 0.027$), 12 weeks ($p < 0.001$), and 6 months ($p = 0.003$; Fig. 2); significantly greater increases in SF-12 physical QOL at 6 weeks ($p = 0.011$) and 12 weeks ($p = 0.012$; Fig. 3); significantly greater increases in global QOL (EQ-5D) at 6 months ($p = 0.002$); and significantly greater increases in self-efficacy at 12 weeks ($p = 0.031$). No significant differences over time were found between the intervention groups on depression, anxiety, or sleep quality.

## Discussion

Secondary outcomes from an RCT of yoga for military veterans with cLBP are presented. The main results of the study, showing that disability and back pain intensity improved more among yoga participants, were published earlier.[27] Yoga participants had significantly greater improvements on secondary outcomes, including pain interference, fatigue, various aspects of QOL, and self-efficacy, than the comparison group. These findings add valuable data on health outcomes that are not always reported or measured in similar studies.[20,21]

Coinciding with our finding on self-efficacy for managing pain, Tilbrook et al.[21] reported that yoga participants had larger increases in pain self-efficacy compared with a usual-care group, but no differences were found for QOL (SF-12). Our finding that pain interference was reduced after yoga participation is similar to a result from a study that compared yoga for cLBP to stretching or self-care and found that yoga participants had less pain "bothersomeness" at 12 weeks.[20] Pain bothersomeness and pain interference are slightly different constructs, but both attempt to quantify the self-reported consequences of pain on one's

life. That study did not, however, report other comparable secondary outcomes.

The health outcome on which the intervention groups differed the most over time was fatigue. Fatigue has not been measured in most large trials of yoga for cLBP or in cLBP trials more generally. However, scientific literature does conclude that chronic pain leads to or causes increased fatigue.[42,43] Although the mechanisms of this process are complex, people who are coping with chronic pain report less energy available for activities. Greater reductions in fatigue among yoga participants have been reported before in a nonrandomized pre-post trial of yoga for veterans with cLBP.[24,25]

Improved HRQOL among participants assigned to yoga was evidenced on two different measures, the SF-12 PCS (physical component score) and the EQ-5D. The SF-12 and its parent measure, the SF-36, have been used in a number of previous trials of yoga for cLBP. As noted above, Tilbrook et al.[21] did not find any difference between yoga participants and usual-care participants on the SF-12, despite yoga participants having greater improvement in back function over time. Saper et al.[44] found that participant groups attending either once- or twice-weekly yoga both had significant improvements on the SF-36 physical score, but only the one-weekly yoga group had significant increases in SF-36 mental scores. A separate study comparing yoga to physical therapy and health education also found significant increases over time on the SF-36 using a noninferiority design, but no group differences were found.[45] However, comparisons are difficult to make because these studies used the broader SF-36 and did not have usual-care comparison groups.

The EQ-5D is a preference-based measure that provides a single summary score ranging from 0.0 to 1.0; it is useful for calculating quality-adjusted life years for cost-effectiveness analysis.[37] No studies of yoga specifically for cLBP were located that measured HRQOL with the EQ-5D measure. However, a cost-effectiveness study of yoga for managing musculoskeletal conditions in the workplace did find significantly greater improvements in yoga participants over time.[46] In comparison to those findings, the size of the mean difference over time in the study presented here was about twice as large. With the minimum clinically important difference for the EQ-5D ranging from 0.3–0.5 in chronic pain studies,[47,48] the yoga intervention in the current trial had a clinically important effect across all randomized participants.

A number of unique aspects of the study may limit generalizability or conclusions and should be considered. This was the first RCT of yoga for cLBP among military veterans and in VA patients more specifically. Overall, VA patients face more health challenges, with about 45% having a military service–connected disability. When compared to samples studied in previous RCTs of yoga for cLBP, the current sample had a higher mean age, higher unemployment and history of homelessness, less education, a 50% longer duration of cLBP, and higher rates of opioid medication use at baseline. Coinciding with these greater challenges, our sample had lower attendance rates, more attrition from assessments, and slightly smaller effect sizes across some outcomes.[27] However, attrition rates remained within guidelines indicating no major concern of bias.[52] Analyses to examine systematic attrition have been reported previously, finding no differences between completers and attriters and thus no evidence of bias.[27]

## Conclusions

In addition to significantly larger reductions in back-related disability and pain severity, U.S. veterans with cLBP who were assigned to a yoga intervention had greater improvements in pain interference, fatigue, QOL, and self-efficacy compared to a DT comparison group. These results provide additional support for concluding that yoga is a beneficial treatment for many people with cLBP and can improve multiple aspects of health and function. The results also indicate that yoga can be effective in diverse populations, including those facing greater challenges with attendance and a wider profile of comorbid conditions. Additionally, the study demonstrated that a 12-week intervention in this population can have durable effects observable 3 months later. The results support ongoing efforts to expand the availability of mind-body interventions in the VA Healthcare System, especially for veterans with chronic pain.

### Conflict-of-Interest Statement

The authors have no conflicts of interest or financial relationships to disclose.

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Author contributions: EJG, LL, DGC, and JEB were involved in the conceptualization and design of the study. EJG, LS, DGC, WIC, and CS were involved in the collection of data for the study. EJG, LL, LS, and AM were involved in the analysis of the data and the initial draft of

the manuscript. All authors (EJG, LL, LS, DGC, AM, WIC, CS, and JEB) were involved in interpretation of data and revision of the manuscript, and all approved the final version.

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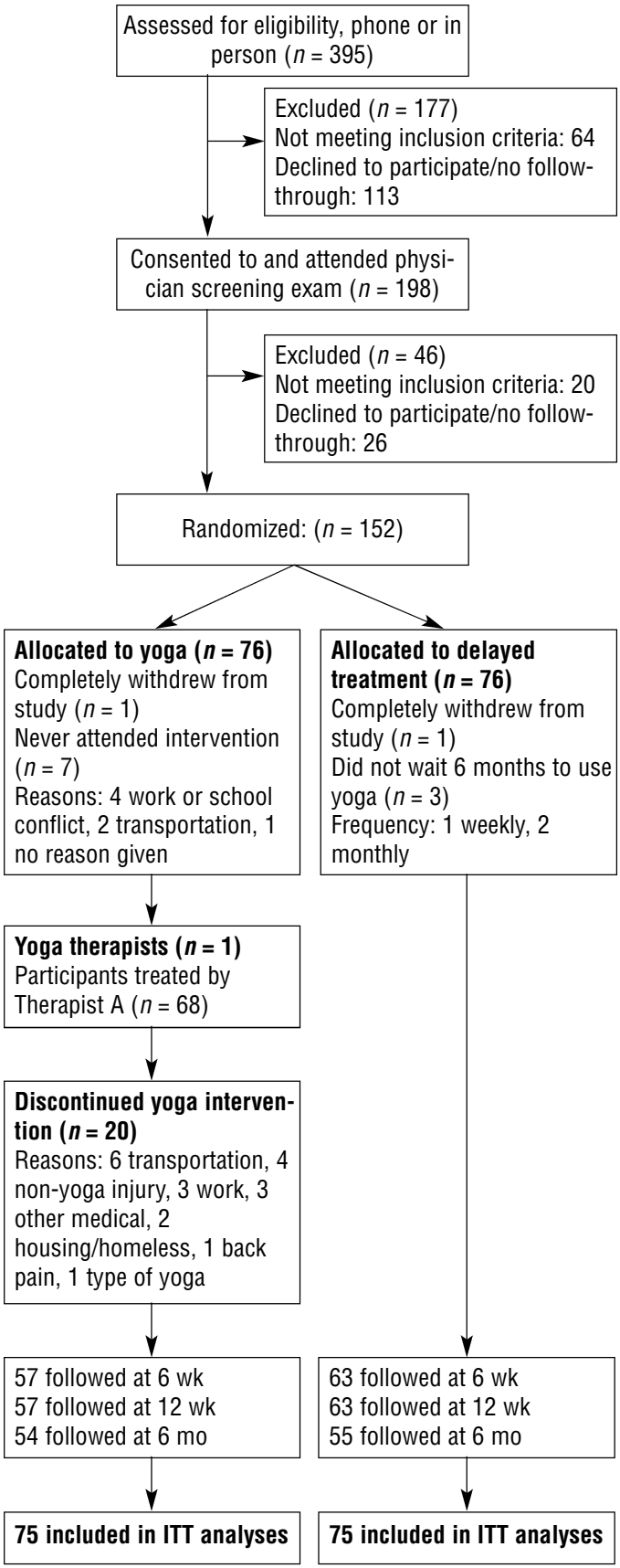
**Supplementary Figure 1.** Study Participants




ITT = intention-to-treat.

**Supplementary Table 1.** Inclusion/Exclusion Criteria and Corresponding Screening Measures Used to Determine Eligibility for Study Participation

| Inclusion Criteria | Determined by | Exclusion Criteria | Determined by |
|---|---|---|---|
| VA patients > 18 y | VA EMR | Back surgery within the last 12 mo | VA EMR; screening interview/exam |
| Has a VA primary care provider | VA EMR | Back pain due to specific systemic problem (e.g., lupus, scleroderma, fibromyalgia) | VA EMR; screening interview/exam |
| Diagnosis of chronic low back pain > 6 mo | VA EMR; screening interview | Morbid obesity (BMI > 40) | VA EMR screening interview/exam |
| Willing to attend a yoga program or be assigned to delayed treatment with yoga | Signed informed consent | Significant sciatica or nerve compression < 3 mo or chronic lumbar radicular pain > 3 mo* | VA EMR; screening interview/exam |
| Willing to complete 4 assessments | Signed informed consent | Unstable, serious coexisting medical illness (e.g., CHF, cancer, COPD, morbid obesity, dementia) | VA EMR; screening interview/exam |
| English literacy | Self-report; informed consent process | Unstable, serious psychiatric illness (e.g., unmanaged psychosis, active substance dependence) | VA EMR; screening interview/exam |
| Has not begun new pain treatments or medications in the past month | VA EMR; screening interview/exam | Insufficient data to rule out acute, metastatic disease (unless primary care physician approves) | VA EMR; primary care signoff |
| Willing to not start or stop pain treatments during the intervention period unless medically necessary | Informed consent; screening interview/exam | Attended or practiced yoga > 1x in the last 12 mo | VA EMR; screening interview/exam |
| | | Positive Romberg test | Screening interview/exam |

*The following definition of chronic lumbar radicular pain was applied.[1] Evidence of lumbar radiculopathy, including pain in one or both buttocks or legs, for 3 months or greater for at least 5 days a week, as well as at least one of the following features on the side corresponding to leg pain:

- Sharp and shooting pain below the knee
- Pain evoked by straight-leg raising to 60 degrees or less
- Decreased or absent ankle reflex
- Weakness of muscles below the knee
- Sensory loss in L5/S1 distribution
- Electromyographic evidence for L4, L5, or S1 root denervation
- Imaging (MRI, CT/myelogram) evidence of nerve root compression in the lower lumbar region

VA = Veterans Administration; EMR = electronic medical record; BMI = body mass index; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease.

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**Supplementary Table 2.** Baseline Patient Characteristics, *n* (%)

| | | **Total (*n* = 150)** | **Yoga (*n* = 75)** | **Delayed Treatment (*n* = 75)** |
|---|---|---|---|---|
| **Demographics** | | | | |
| Age (y) | Mean (SD) | 53.4 (13.3) | 53.3 (12.7) | 53.6 (13.9) |
| Gender | Male | 111 (74) | 55 (73) | 56 (75) |
| Race/ethnicity | African American or Black | 26 (17.0) | 16 (21.0) | 10 (13.0) |
| | White | 74 (49.0) | 35 (47.0) | 39 (52.0) |
| | Native American | 2 (1.3) | 1 (1.3) | 1 (1.3) |
| | Hispanic | 30 (20.0) | 15 (20.0) | 15 (20.0) |
| | Asian/Pacific Islander | 9 (6.0) | 3 (4.0) | 6 (8.0) |
| | Other | 9 (6.0) | 5 (6.7) | 4 (5.3) |
| Marital status | Single | 38 (26.0) | 17 (23.0) | 21 (28.0) |
| | Married | 50 (34.0) | 24 (32.0) | 26 (35.0) |
| | Separated | 4 (2.7) | 4 (5.3) | 0 (0) |
| | Divorced | 52 (35.0) | 28 (37.0) | 24 (32.0) |
| | Widowed | 5 (3.4) | 2 (2.7) | 3 (4.1) |
| Education | Grade school | 1 (0.7) | 0 (0) | 1 (1.4) |
| | High school diploma/GED | 10 (6.8) | 6 (8.1) | 4 (5.5) |
| | Some college | 56 (38.0) | 30 (41.0) | 26 (36.0) |
| | College graduate | 46 (31.0) | 19 (26.0) | 27 (37.0) |
| | Postgraduate | 34 (23.0) | 19 (26.0) | 15 (21.0) |
| Employment | Full-time | 29 (21.0) | 16 (23.0) | 13 (18.0) |
| | Part-time | 19 (14.0) | 8 (12.0) | 11 (15.0) |
| | Unemployed | 29 (21.0) | 13 (19.0) | 16 (22.0) |
| | Disabled | 19 (14.0) | 10 (15.0) | 9 (13.0) |
| | Retired or volunteer | 32 (23.0) | 14 (20.0) | 18 (25.0) |
| | Other | 13 (9.2) | 8 (12.0) | 5 (6.9) |
| Homeless in last 5 y | Yes | 25 (18) | 12 (17) | 13 (19) |
| Living situation | Homeless | 5 (3.5) | 3 (4.2) | 2 (2.8) |
| | Group living | 16 (11.0) | 9 (13.0) | 7 (9.7) |
| | Own house | 67 (47.0) | 32 (44.0) | 35 (49.0) |
| | Apartment | 56 (39.0) | 28 (39.0) | 28 (39.0) |
| Transportation to VA | Own vehicle | 107 (75.0) | 53 (74.0) | 54 (76.0) |
| | Ride with family/friends | 7 (4.9) | 3 (4.2) | 4 (5.6) |
| | Public transportation | 21 (15.0) | 11 (15.0) | 10 (14.0) |
| | Other | 8 (5.6) | 5 (6.9) | 3 (4.2) |
| Travel time to VA medical center | 30 min or less | 63 (42) | 35 (47) | 28 (37) |
| | 30–60 min | 65 (43) | 27 (36) | 38 (51) |
| | 1 hour+ | 22 (15) | 13 (17) | 9 (12) |
| Ever practiced yoga? | No | 91 (61) | 39 (52) | 52 (69) |
| Clinical characteristics | | | | |
| Narcotic medication, current | No | 120 (80) | 61 (81) | 59 (79) |
| Using other pain treatments | Yes | 77 (51) | 42 (56) | 35 (47) |
| Using self-help pain treatments | Yes | 111 (74) | 57 (76) | 54 (72) |
| RMDQ score | Mean (SD) | 9.85 (5.52) | 9.40 (5.15) | 10.30 (5.87) |
| Pain intensity (BPI) | Mean (SD) | 4.66 (1.96) | 4.64 (1.76) | 4.68 (2.16) |

SD = standard deviation; VA = Veterans Administration; RMDQ = Roland-Morris Disability Questionnaire; BPI = Brief Pain Inventory.