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Can Yoga or Physical Therapy for Chronic Low Back Pain Improve Depression and Anxiety Among Adults from a Racially Diverse, Low-Income Community? A Secondary Analysis of a Randomized Controlled Trial.

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Abstract

Objective: To determine and compare the effect of yoga, physical therapy (PT), and education on depressive and anxious symptoms in patients with chronic low back pain (cLBP)

Design: Secondary analysis of a randomized controlled trial

Setting: Academic safety-net hospital and 7 community health centers

Participants: 320 adults with cLBP

Intervention: Yoga classes, PT sessions, or an educational book

Outcome Measure: Depression and anxiety were measured using the Patient Health Questionnaire (PHQ-8) and Generalized Anxiety Disorder (GAD-7) scale, respectively, at baseline, 12, and 52 weeks. We identified baseline and mid-treatment (6-week) factors associated with clinically meaningful improvements in depressive (≥3 points) or anxious (≥2 points) symptoms at 12 weeks.

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Results: Participants (female=64%, mean age=46.0 [SD=10.7]) were predominantly non-white (82%), low-income (<$30,000/year, 59%) and had not received a college degree (71%). Most participants had mild or worse depressive (60%) and anxious (50%) symptoms. At 12 weeks, yoga and PT participants experienced modest within-group improvements in depressive symptoms [mean difference [MD]=−1.23, 95%CI: −2.18, −0.28; and −1.01, 95%CI: −2.05, −0.03, respectively]. Compared to the education group, 12-week differences were not statistically significant, although trends favored yoga [MD=−0.71, 95%CI: −2.22, 0.81] and PT [MD=−0.32, 95%CI: −1.82, 1.18]. At 12 weeks, improvements in anxious symptoms were only found in participants who had mild or moderate anxiety at baseline. Independent of treatment arm, participants who had 30% or greater improvement in pain or function mid-treatment were more likely to have a clinically-meaningful improvement in depressive symptoms [OR: 1.82, 95%CI: 1.03, 3.22; and OR: 1.79, 95%CI: 1.06, 3.04, respectively].

Conclusion: In our secondary analysis we found that depression and anxiety, common in this sample of underserved adults with cLBP, may improve modestly with PT and yoga. However, effects were not superior to education. Improvements in pain and function are associated with a decrease in depressive symptoms. More research is needed to optimize the integration of physical and psychological well-being in PT and yoga.

Keywords

Depression; anxiety; yoga; physical therapy; biopsychosocial; chronic low back pain

Introduction

Low back pain, anxiety, and depression are leading causes of disability worldwide.[1–3] Socio-economic factors are associated with more intense or disabling chronic low back pain (cLBP)[4,5] as well as anxiety and depression.[6–8] Moreover, adults with cLBP are twice as likely to have depression or anxiety. [9], [10] Change in depression predicts change in pain, and vice versa.[11] Few have studied the effects of common cLBP treatments on anxiety and depression outcomes, especially among racially diverse, low-income populations.

Yoga and physical therapy (PT) are effective treatments for cLBP.[12–15] However, there is a paucity of studies evaluating the effects of yoga and PT on anxiety and depression outcomes for adults with cLBP. A meta-analysis of 17 small yoga studies (n=6–118) observed a moderate benefit of yoga on anxiety in adults, although no study focused on participants with cLBP or low-income populations.[16] A moderate benefit on depression when comparing yoga to usual care or aerobic exercise has also been observed.[17–19] Nevertheless, the small and socio-economically homogenous samples in these studies may limit generalizability of their findings to the underserved populations with cLBP that are most susceptible.

Evidence supporting PT for depression or anxiety is sparse. A single-group prospective observational study of 106 adults with work-related orthopedic injuries and depressive symptoms showed a 27% reduction of depressive symptoms with 40% having resolution after 7 weeks of PT.[20] Another small study (n=48) found that traditional PT approaches augmented with psychosocial interventions (e.g., graded activity, goal setting, problem solving, motivational enhancement) was more effective for decreasing depression in patients

with disabling low back pain than PT alone.[21] Neither study assessed anxiety outcomes nor had a predominantly low-income minority sample.

This article addresses a gap in the literature pertaining to the effects of yoga and PT on depressive and anxious symptoms for adults with cLBP from ethnically diverse, low-income populations. We use data from the Back to Health Study, a large randomized controlled trial (RCT) which found that yoga and PT were similarly effective for pain and function outcomes among predominantly low-income non-white adults with cLBP.[22] The current study assesses changes in depressive and anxious symptoms post-intervention (12 weeks) and after one year. Our primary hypothesis is that depressive and anxiety symptoms will improve in those who receive 12 weeks of yoga or PT intervention compared to an education control. Our secondary aim was to identify patient-level factors associated with clinically-meaningful changes in depression or anxiety during the 12-week treatment period.

Methods

Design

This is a secondary analysis of a large RCT that compared the effects of yoga, PT, and education on pain and disability in people with cLBP. Detailed methods of the parent study and primary findings are described elsewhere.[22,23] Briefly, the study was conducted in a large safety-net hospital and seven affiliated community health centers in low-income, racially diverse neighborhoods of Boston, MA. From June 2012 to November 2013, 320 English-speaking adults (ages 18–64) with chronic (>12 weeks) low back pain rated 4 or greater on an 11-point back pain numerical rating scale (NRS) were recruited. Persons with specific causes of cLBP such as malignancy or spinal stenosis were excluded. The participants were randomly allocated using permuted blocks in a 2:2:1 ratio to receive PT, yoga, or education interventions, respectively. A 12-week treatment phase was followed by a 40-week maintenance phase. The Boston University Medical Center Institutional Review Board approved the study before data collection, and all participants provided informed consent.

Interventions

The manualized hatha yoga intervention consisted of 12 weekly 75-minute classes that included poses, meditation, breathing, and relaxation was refined from previous studies.[24] Instructor-participant ratios were kept low (<5:1) to allow individualized modifications that accommodated participant needs. The PT intervention utilized a treatment-based classification system[25] to guide selection of a program of graded exercise during 15 visits. Each PT session included a 30-minute one-on-one treatment with the physical therapist who gradually progressed the participant through their individualized program. Additionally, PT participants who scored high on intake on the Fear Avoidance Belief Questionnaire (≥29 on the work subscale) were given a copy of *The Back Book*,[26] a brief resource which addresses the psychological influences on cLBP. Physical therapists reinforced main points of the book. The education intervention was a copy of *The Back Pain Helpbook*,[27] a comprehensive resource that teaches stretching, strengthening, and emotional management techniques for people with cLBP. Education participants also received a newsletter every 3

weeks summarizing main points from the assigned chapters and a 5 to 10-minute check-in phone call from the research staff. Each of our interventions include overlapping as well as distinct features that may reduce depressive or anxious symptoms. For example, all three interventions included some form of exercise, which is a potent treatment for various mental health disorders.[28,29] Additionally, our PT intervention had a 30-minute aerobic exercise component,[30] and our yoga and educational book both included different mindfulness and cognitive reframing strategies.[31,32]

After 12 weeks, participants who attended at least one PT or yoga session were included in the 40-week maintenance phase. In the yoga group, participants were re-randomized to either a weekly drop-in yoga class or home practice only, and in the PT group to either five "booster sessions" or home practice only. All participants in the education group were called every 6 weeks to encourage continued review of the book.

Measurement

Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-8)[33,34] which asks patients to recall the frequency of depressive symptoms during the past two weeks. Each of the eight items is scored 0–3 with higher scores indicating more frequent symptoms of depression. A ninth question that asks about suicidal ideation was not included.[35] The PHQ-8 is widely used as a clinical tool to help identify severity of depressive symptoms in patients attending primary care clinics,[36] including clinics with racially and ethnically diverse populations.[37] Scores of 10 or higher are associated with major depressive disorder[38] and cut points of 5, 10, 15 and 20 distinguish mild, moderate, moderately severe, and severe depression, respectively. The PHQ-8 is responsive to change.[39] A one standard error of measurement (SEM) change has been used to estimate the minimal clinically important difference (MCID) of 3 points.[40]

Anxious symptoms were measured using the Generalized Anxiety Disorder 7-item (GAD-7) scale which asks patients to recall the frequency of anxious symptoms during the past two weeks.[41–44] Each of seven questions are scored 0–3, with total scores ranging from 0–21. Higher scores indicate more frequent symptoms of anxiety. Scores of 5, 10, and 15 are cut-points used to distinguish mild, moderate and severe anxiety, respectively. The GAD-7 is responsive to change.[45] Using a one SEM change criterion, the MCID is estimated to be 2 points.[40]

The following characteristics were measured at baseline and considered as covariates in our analyses: age, sex, body mass index (BMI, kg/m^2), back pain intensity (NRS, 0–11),[46] back-related disability (modified Roland Morris Disability Questionnaire, RMDQ),[47] fear avoidance beliefs (Fear Avoidance Beliefs Questionnaire, FABQ),[48] self-efficacy (Patient Self-Efficacy Questionnaire, PSEQ),[49] annual household income (less than $30,000 vs. greater), education (less than college vs. some college or greater), and employment (currently employed, not employed).

Additionally, we identified those who had a significant improvement in pain or disability mid-intervention (6 weeks), operationalized as a 30% decrease in NRS or RMDQ from baseline.[50,51]

Data Analysis

Changes in Depressive and Anxious Symptoms

Baseline differences across the intervention groups were examined using an analysis of variance (ANOVA) or chi-square test. Covariates were adjusted for in our analyses if baseline differences between groups were statistically significant ($p<.05$). Within-group changes were computed by calculating change scores from baseline to 12- or 52-week time points. Paired t-tests were used to determine significant within-group changes. To examine between-group differences, we regressed 0–12 week depression and anxiety change scores on treatment group using education change score as the reference. We controlled for age, sex, and baseline RMDQ as well as baseline PHQ-8 or GAD-7 for their respective analyses. We performed the same analysis with 0–52 week change scores. In the original study, the two re-randomized subgroups within each treatment arm (PT and yoga) did not differ in primary outcomes at the end of the maintenance phase.[22] Therefore, for the 52-week analysis we collapsed subgroups and considered each treatment arm collectively as a whole.

We repeated the above analyses using a subgroup of participants who had at least mild depression or anxiety, i.e., a score ≥5 on the PHQ-8 or GAD-7, and then moderate depression or anxiety i.e., a score ≥10 on the PHQ-8 or GAD-7, respectively. Due to decreased sample size and disruption of randomization we limited these exploratory analyses to within-group changes. Between-group analyses of these two subgroups are presented in Appendix 1.

Responder Analyses

In separate logistic regression models for each predictor, we determined the association of baseline and mid-intervention predictive factors with the odds of a clinically meaningful improvement in depressive or anxious symptoms at 12 weeks (improvement of at least 3 and 2 points in PHQ-8 and GAD-7 scores, respectively, corresponding to the MCID for these measures). Factors associated with a meaningful response to intervention were determined separately for the PT and yoga treatment arms.

Missing Data

In a sensitivity analyses, we addressed missing data at the construct-level through a 20-fold regression based multiple imputation using all covariates.[52] We ran the regression without the imputed data (complete case analysis) and with it to determine if there was a meaningful difference between results. All analyses were performed using SPSS Version 25 for Windows (IBM Corporation, Armonk, NY).

Results

Baseline Characteristics

Table 1 displays baseline and demographic characteristics. Our sample was predominantly female (64%), middle aged (mean age 46.0 years [SD=10.7]), and non-white (82%). Additionally, most participants were earning less than $30,000/year (59%) and had not received a college education (71%). The majority of participants had mild or worse

depressive (60%) and anxiety (50%) symptoms. Treatment groups only differed by baseline RMDQ scores ($p<.05$). Estimates from our sensitivity analysis were similar in magnitude and direction to our complete case analysis, thus we report complete case findings below.

Change in Depressive Symptoms

Table 2 reports differences in the full sample and in each subgroup. Within the yoga and PT groups, participants who had moderate or worse baseline depressive symptoms experienced clinically meaningful changes at 12 weeks [MD=−3.56, 95%CI: −5.58, −1.53, and MD=−3.09, 95%CI: −5.10, −1.08, respectively] and greater improvements at 52 weeks [MD=−5.05, 95%CI: −7.14, −2.97, and MD=−5.03, 95%CI: −7.84, −2.23, respectively]. Regardless of severity of symptoms, there were no clinically meaningful improvements in the education group at 12 weeks. However at 52 weeks, education participants with moderate or worse depressive symptoms reported a meaningful improvement [MD=−4.50, 95%CI: −8.03, −0.97].

In the full sample, at 12 or 52 weeks, differences between yoga and education [MD=−0.71, 95%CI: −2.22, 0.81, and MD=−0.95, 95%CI: −2.69, 0.78, respectively] or PT and education [MD=−0.32, 95%CI: −1.82, 1.18 and −0.14, 95%CI: −1.85, 1.58, respectively] were small and not statistically significant. In the full sample, only the yoga and PT participants experienced statistically significant within-group improvements at 12 weeks [MD=−1.23, 95%CI: −2.18, −0.28, and −1.01, 95%CI: −2.05, −0.03, respectively]. All three groups demonstrated statistically significant improvements at 52 weeks.

Comparative subgroup analyses were generally similar in direction (favoring yoga and PT over education) and higher in magnitude than our full sample analyses (Appendix 1) though statistically non-significant. Those who had moderate or worse depressive symptoms experienced the largest improvement compared to education.

Change in Anxious Symptoms

Participants in the yoga or education group who were moderately anxious or worse at baseline experienced clinically meaningful improvements in their symptoms at 12 weeks [MD=−2.41, 95%CI: −4.38, −0.45, and MD=−4.23, 95%CI: −6.62, −1.85, respectively]. In the PT group, those who had at least mild or moderate anxious symptoms at baseline had clinically meaningful improvements [MD=−2.69, 95%CI: −4.49, −0.88, and MD=−5.68, 95%CI: −7.68, −3.67, respectively]. At 52 weeks, participants in all three groups who had at least mild or moderate anxious symptoms at baseline reported meaningful improvements.

In the full sample, at 12 weeks, there were no statistically significant differences between yoga and education [MD=−1.05, 95%CI: −2.62, 0.52] or PT and education [MD=−1.28, 95%CI: −2.83, 0.26] at 12 weeks. Similar findings were observed at 52 weeks for yoga and PT compared to the education group [MD=−1.14, 95%CI: −2.73, 0.44 and −0.35, 95%CI: −1.91, 1.22, respectively]. In the full sample, modest statistically significant improvements were only found in the yoga and PT group at 52 weeks [MD=−2.06, 95%CI: −3.05, −1.08, and MD=−1.27, 95%CI: −2.50, −0.05].

Comparing yoga and PT to education in participants who had at least mild or moderate anxious symptoms yielded similar results to the full sample analysis, with general trends supporting yoga and PT over education but not reaching statistical significance.

Predictors of Response to Treatment

Irrespective of treatment arm, a minimal clinically significant improvement in pain or function (30%) after 6 weeks was associated with a clinically meaningful improvement in depressive symptoms at 12 weeks [OR: 1.82, 95%CI: 1.03, 3.22 and OR: 1.79, 95%CI: 1.06, 3.04, respectively] (Table 3).

Our analyses did not reveal statistically significant associations of improvement in anxious symptoms, however the direction of effect was similar to what was observed in the depression analyses, with 6-week improvement in function having a non-significant association with meaningful improvement in anxiety at 12 weeks [OR: 1.58, 95%CI: 0.94, 2.66] (Table 4).

Discussion

In our sample of 320 predominantly low-income and minority adults with cLBP, over half reported symptoms of at least mild depression or anxiety. When compared to education, improvements in depression and anxiety in the yoga and PT group were non-significant. However, in participants who were at least mildly or moderately depressed, 12 weeks of yoga or PT modestly improved their symptoms. Participants who had clinically important changes in 6-week function or pain were more likely to experience a meaningful decrease in depression at 12 weeks.

Consistent with other studies of disadvantaged populations and chronic pain,[53–56] most people in our sample had at least mild levels of depression and anxiety at baseline. We attribute this high prevalence to the association of mental health disorders and chronic pain with lower socioeconomic status and lower educational attainment, two characteristics that describe the source population of this study. We observed modest improvements in depressive and anxious symptoms among yoga participants, which is consistent with previous studies.[18,19] Our study is the first to report clinically important changes in depression and anxiety after completing PT for cLBP. Our subgroup analyses suggest that yoga and PT interventions can have modest beneficial effects on depressive and anxious symptoms in patients who have sufficient baseline exposure to these frequent mental health conditions. Because within-group changes are susceptible to placebo effects, Hawthorne effects, or regression to the mean, we do posit this cautiously. However, this finding is in congruence with the empirical effects of social support, exercise, and cognitive reframing on mental health, which were all elements of our yoga and PT and interventions. Thus, in considering safe, non-pharmacological, holistic treatments for patients with cLBP and mental health disorders, yoga and PT are potentially viable options.

Findings from our secondary aim suggest that improvements in physical function or pain 6 weeks were associated with end of intervention improvements in depression or anxiety at 12 weeks. Though we cannot infer a causal effect, this finding does align with clinical and

neurobiological literature that suggest that: 1) pain and mental health have overlapping physiological mechanisms,[53,57] 2) pain can modify the effect of treatment of depression,[58] and 3) treatments that affect functional, somatic, or psychological health may concurrently affect all three.[59,60] Future research could evaluate the effects of holistic or interdisciplinary treatments while examining the mediation relationships between pain, function, and mental health

The high prevalence of depressive symptoms in our sample supports screening for anxious and depressive symptoms in routine clinical care of patients with cLBP.[61] Patients with cLBP and comorbid depression have worse prognosis for recovery, disability, and work return, compared to those without depression.[62,63] Early detection of comorbid depression may improve cLBP outcomes. However, physical therapists report a difficulty detecting depression or anxiety,[64–66] and working with cLBP patients with mental health conditions.[67] Optimizing clinical approaches by identifying patients with co-occurring cLBP and anxiety/depression and combining aspects of PT and yoga that have been shown to improve mental health (e.g., exercise,[28] relaxation training,[68] and different forms of meditation, mindfulness and movement[18]) is an important area for future research.

Strengths and Limitations

Our study's strengths include a large sample size and randomization of an understudied population, i.e., low-income ethnically-diverse adults with cLBP. Additional strengths include the use of reliable and valid outcome measurements, 1-year of follow-up, and a wide variety of clinical, social, and demographic variables available to characterize those who may be more likely to experience improvements in depression or anxiety.

There are several limitations to our work. Predominantly, because our study is a secondary analysis, a minimum amount of depressive or anxious symptoms was not an inclusion criterion and thus within- and between-group changes are susceptible to flooring effects. Subgrouping our sample does address this, however, also reduces sample size and disrupts randomization. Had the emphasis of the original trial been on improving depression or anxiety, other influential variables would have been important to collect, such as chronicity of symptoms, longitudinal use of psychotropic medications, and social isolation. Additionally, our measures do not encapsulate the complexity of depression and anxiety; a clinical evaluation by a psychologist would be a more robust measure of severity and change. Loss to follow up at 12 and 52 weeks was moderate (10% and 20%, respectively), with disproportionately greater loss to follow up in the PT group. Fortunately, our multiple imputation analysis yielded similar results as our complete case analysis, which is consistent with other studies that analyzed imputed data in this sample.[69,70]

Conclusion

Depression, anxiety, and cLBP are common disabling comorbidities that disproportionally afflict groups of people vulnerable to health disparities. In our secondary analysis of a large randomized controlled trial we found that treatments for cLBP, such as PT and yoga, may decrease depressive or anxious symptoms. This work highlights the need to optimize these approaches for patients with co-occurring cLBP, depression and/or anxiety. Mid-treatment

improvements in pain and function are associated with improvement of depressive and anxious symptoms at completion of treatment. Future research should integrate these treatments and explore the mechanism by which they affect pain and mental health.

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Appendix

Appendix 1.

Between-Group Differences in Subgroups of Mild or Moderate Depressive and Anxious Symptoms

	Yoga vs. Education	PT vs. Education
PHQ ≥ 5[†]		
0–12 Weeks	−0.98 [p=.37; −3.14, 1.18]	−0.83 [p=.43; −2.92, 1.25]
0–52 Weeks	−1.35 [p=.28; −3.81, 1.10]	−0.48 [p=.69; −2.85, 1.89]
PHQ ≥ 10[†]		
0–12 Weeks	−1.65 [p=.33; −4.98, 1.68]	−0.93 [p=.57; −4.18, 2.32]
0–52 Weeks	−0.66 [p=.75; −4.69, 3.37]	−0.49 [p=.81; −4.42, 3.44]
GAD ≥ 5[‡]		
0–12 Weeks	−0.33 [p=.79; −2.74, 2.09]	−1.51 [p=.22; −3.90, 0.88]
0–52 Weeks	−1.64 [p=.19; −4.13, 0.84]	−0.49 [p=.69; −2.95, 1.97]
GAD ≥ 10[‡]		
0–12 Weeks	1.81 [p=.28; −1.05, 5.13]	−1.32 [p=.43; −4.56, 1.96]
0–52 Weeks	−0.94 [p=.61; −4.66, 2.78]	−0.50 [p=.79; −4.17, 3.18]

All values are mean [n; 95% CI]

Negative numbers favor the first named group

[†]Between group differences are adjusted for baseline RMDQ score, sex, age, and baseline PHQ

[‡]Between groups differences are adjusted for baseline RMDQ score, sex, age, and baseline GAD GAD, Generalized Anxiety Disorder; PHQ, Patient Health Questionnaire; PT, Physical Therapy

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Highlights:

- Depression and anxiety are common in low-income and minority groups with chronic low back pain
- Physical therapy and yoga for chronic pain may improve symptoms of comorbid depression and anxiety
- Improvement in back-related function is associated with an improvement in depressive symptoms

Table 1.

Baseline Characteristics among 320 Participants Randomized to Yoga, Physical Therapy and Back Pain Education

	Yoga (n=127)	Physical Therapy (n=129)	Education (n=64)
Age, years, mean (SD)	46.7 (10.2)	46.0 (11.4)	44.3 (10.3)
Female, n (%)	72 (56.7)	90 (69.8)	42 (65.6)
Hispanic, n (%)			
Yes	20 (15.7)	17 (13.2)	6 (9.4)
No	107 (84.3)	112 (86.8)	58 (90.6)
Race, n (%)			
American Indian	0 (0)	1 (.8)	1 (1.5)
Asian/Pacific Islander	2 (1.6)	4 (3.1)	3 (4.7)
Black	70 (55.1)	62 (48.1)	40 (62.5)
White	30 (23.6)	17 (13.2)	11 (17.2)
Other/Multiple	23 (18.1)	30 (23.2)	9 (14.1)
Missing	2 (1.6)	15 (11.6)	0
BMI, mean (SD)	30.8 (6.7)	32.7 (7.4)	32.0 (8.1)
Annual Income ≤ $30,000, n (%)	76 (59.8)	71 (55.0)	41 (64.1)
Earned College Degree or Higher	38 (29.9)	30 (23.3)	25 (39.1)
RMDQ score, mean (SD)	13.9 (5.6)	15.6 (5.1)	15.0 (5.0)
Back pain intensity, mean (SD)	7.1 (1.5)	7.2 (1.5)	7.0 (1.4)
PHQ-8, mean (SD)*	7.7 (6.0)	8.5 (6.0)	8.23(5.7)
PHQ 0–4	49 (38.6)	39 (30.2)	20 (31.2)
PHQ 5–9	36 (28.4)	41 (31.8)	22 (34.4)
PHQ 10–14	21 (16.5)	25 (19.4)	12 (18.8)
PHQ 15–19	14 (11.0)	17 (13.2)	6 (9.4)
PHQ ≥20	7 (5.5)	7 (5.4)	4 (6.2)
GAD-7, mean (SD)*	6.9 (6.0)	7.2 (5.9)	7.3 (5.7)
GAD 0–4	61 (48.1)	59 (45.7)	23 (35.9)
GAD 5–9	29 (22.8)	30 (23.3)	21 (32.8)
GAD 10–14	15 (11.8)	19 (14.7)	11 (17.2)
GAD ≥15	22 (17.3)	21 (16.3)	9 (14.1)

BMI, body mass index; RMDQ, Roland-Morris Disability Questionnaire; PHQ-8, Patient Health Questionnaire Depression Scale; GAD-7, Generalized Anxiety Disorder 7-item Scale; SD, standard deviation

*Subgroups are n (%)

Table 2.

Changes in Depressive (PHQ-8) and Anxious (GAD-7) Symptoms at 12 and 52 Weeks

	Yoga	PT	Education	Yoga vs. Education	PT vs. Education
PHQ Full Sample[†]					
0–12 Weeks	−1.23 [n=125; −2.18, −0.28]	−1.01 [n=103; −2.05, −0.03]	−0.58 [n=60; −1.66, 0.49]	−0.71 [p=.36; −2.22, .81]	−0.32 [p=.67; −1.82, 1.18]
0–52 Weeks	−2.36 [n=108; −3.37, −1.34]	−1.81 [n=90; −3.19, −0.43]	−1.60 [n=56; −3.03, −0.17]	−0.95 [p=.28; −2.69, .78]	−0.14 [p=.88; −1.85, 1.58]
PHQ ≥ 5					
0–12 Weeks	−2.50 [n=76; −3.85, −1.14]	−2.29 [n=66; −3.64, −0.93]	−1.36 [n=41; −2.77, 0.03]		
0–52 Weeks	−4.42 [n=66; −5.56, −2.92]	−3.26 [n=60; −5.08, −1.42]	−2.72 [n=39; −4.65, −0.79]		
PHQ ≥ 10					
0–12 Weeks	−3.56 [n=41; −5.58, −1.53]	−3.09 [n=33; −5.10, −1.08]	−2.10 [n=19; −4.36, −0.17]		
0–52 Weeks	−5.05 [n=37; −7.14, −2.97]	−5.03 [n=30; −7.84, −2.23]	−4.50 [n=18; −8.03, −0.97]		
GAD Full Sample[‡]					
0–12 Weeks	−0.55 [n=125; −1.36, 0.25]	−0.77 [n=103; −1.90, 0.37]	0.47 [n=60; −1.08, 2.02]	−1.05 [p=.19; −2.62, 0.52]	−1.28 [p=.11; −2.83, 0.26]
0–52 Weeks	−2.06 [n=108; −3.05, −1.08]	−1.27 [n= 91; −2.50, −0.05]	−1.09 [n=56; −2.46, 0.28]	−1.14 [p=.16; −2.73, 0.44]	−0.35 [p=.66; −1.91, 1.22]
GAD ≥ 5					
0–12 Weeks	−1.47 [n=64; −2.90, −0.04]	−2.69 [n=51, −4.49, −0.88]	−0.89 [n=38; −2.93, 1.19]		
0–52 Weeks	−4.34 [n=55; −5.87, −2.82]	−3.13 [n=47; −5.08, −1.18]	−2.40 [n=35; −4.44, −0.36]		
GAD ≥ 10					
0–12 Weeks	−2.41 [n=36; −4.38, −0.45]	−5.68 [n=28; −7.68, −3.67]	−4.23 [n=17; −6.62, −1.85]		
0–52 Weeks	−6.03 [n=32; −8.12, −3.95]	−5.85 [n=26; −8.43, −3.26]	−5.38 [n=16; −8.03, −2.72]		

All values are mean [n; 95% CI]

For all analyses, negative numbers mean improvement. For between group analyses, negative numbers favor the first named group

[†]Between group differences are adjusted for baseline RMDQ score, sex, age, and baseline PHQ

[‡]Between groups differences are adjusted for baseline RMDQ score, sex, age, and baseline GAD GAD, Generalized Anxiety Disorder; PHQ, Patient Health Questionnaire; PT, Physical Therapy

Table 3.

Predictors of Improvement in Depressive Symptoms at 12 Weeks

	Full Sample		Yoga		Physical Therapy	
Predictor	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**
Treatment						
Education	16/60 (27)	Ref				
Yoga	44/125 (35)	1.49 [0.76, 2.95]				
PT	36/102 (35)	1.50 [0.74, 3.03]				
Treatment						
Education	16/60 (27)	Ref				
Yoga or PT	80/227 (35)	1.50 [0.79, 2.82]				
Age						
<34	18/50 (36)	Ref	7/18 (39)	Ref	9/19 (47)	Ref
35 – 44	19/59 (32)	0.84 [0.38, 1.87]	12/32 (38)	0.94 [0.29, 3.09]	2/15 (13)	0.17 [0.03, 0.97]
45 – 54	33/110 (30)	0.76 [0.38, 1.55]	11/42 (26)	0.56 [0.17, 1.80]	16/39 (41)	0.77 [0.26, 2.33]
>55	26/68 (38)	1.10 [0.52, 2.35]	14/33 (42)	1.16 [0.26, 3.74]	9/29 (31)	0.50 [0.15, 1.65]
Sex						
Female	62/189 (33)	Ref	27/72 (38)	Ref	25/75 (33)	Ref
Male	34/98 (35)	1.08 [0.65, 1.82]	17/53 (32)	0.79 [0.37, 1.66]	11/27 (41)	1.38 [0.56, 3.40]
Income						
≤ $30,000	61/169 (36)	Ref	30/75 (40)	Ref	19/57 (33)	Ref
>$30,000	35/118 (30)	0.74 [0.45, 1.23]	14/50 (28)	0.58 [0.27, 1.26]	17/45 (38)	1.24 [0.54, 2.75]
Education						
Less than College Degree	70/198 (35)	Ref	31/85 (37)	Ref	27/77 (35)	Ref
College Degree or Higher	26/89 (29)	0.75 [0.44, 1.3]	13/40 (33)	0.84 [0.38, 1.86]	9/25 (36)	1.04 [0.41, 2.67]
Employment						
Not Currently Working	41/128 (32)	Ref	25/66 (38)	Ref	20/61 (33)	Ref
Currently Working	55/158 (35)	0.86 [0.53, 1.40]	19/59 (32)	0.78 [0.37, 1.63]	16/41 (39)	1.31 [0.58, 2.99]
Baseline LBP Score						
Moderate (≤7)	48/162 (30)	Ref	22/70 (31)	Ref	20/54 (37)	Ref

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	Full Sample		Yoga		Physical Therapy	
Predictor	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**
Severe (8–10)	48/122 (39)	1.54 [0.94, 2.53]	22/54 (41)	1.50 [0.72, 3.15]	16/46 (35)	0.91 [0.40, 2.06]
Baseline RMDQ Score						
<13	22/92 (24)	Ref	14/49 (29)	Ref	7/30 (23)	Ref
13–17	33/96 (34)	1.67 [0.88, 3.15]	16/40 (40)	1.67 [0.69, 4.05]	12/29 (41)	2.31 [0.75, 7.13]
≥18	41/99 (41)	2.25 [1.21, 4.20]	14/36 (39)	1.59 [0.64, 3.96]	17/43 (40)	2.15 [0.76, 6.10]
6 Week LBP Change Score						
<30% Improvement	64/204 (31)	Ref	28/86 (33)	Ref	24/68 (35)	Ref
≥30% Improvement	30/67 (45)	1.82 [1.03, 3.22]	15/32 (47)	1.83 [0.80, 4.18]	11/26 (42)	1.34 [0.53, 3.39]
6 Week RMDQ Change Score						
<30% Improvement	57/186 (31)	Ref	23/73 (32)	Ref	23/69 (33)	Ref
≥30% Improvement	38/86 (44)	1.79 [1.06, 3.04]	21/46 (46)	1.83 [0.85, 3.91]	12/26 (46)	1.71 [0.68, 4.30]

LBP low back pain; OR, odds ratio; RMDQ, Roland Morris Disability Questionnaire

Table 4.

Predictors of Improvement in Anxious Symptoms at 12 Weeks

	Full Sample		Yoga		Physical Therapy	
Predictor	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**
Treatment						
Education	22/60 (37)	Ref				
Yoga	41/125 (33)	0.84 [0.44, 1.60]				
PT	46/103 (45)	1.39 [0.73, 2.68]				
Treatment						
Education	22/60 (37)	Ref				
Yoga or PT	87/228 (38)	1.07 [0.59, 1.92]				
Age						
<34	21/51 (41)	Ref	4/18 (22)	Ref	11/20 (42)	Ref
35 – 44	21/59 (36)	0.79 [0.37, 1.71]	13/32 (41)	2.40 [0.64, 8.93]	6/15 (40)	0.55 [0.14, 2.12]
45 – 54	39/110 (35)	0.79 [0.40, 1.55]	13/42 (31)	1.57 [0.43, 5.70]	15/39 (39)	0.51 [0.17, 1.52]
>55	28/68 (41)	1.00 [0.48, 2.09]	11/33 (33)	1.75 [0.47, 6.60]	14/29 (48)	0.76 [0.24, 2.40]
Sex						
Female	72/190 (38)	Ref	22/72 (31)	Ref	36/76 (47)	Ref
Male	37/98 (38)	0.99 [0.60, 1.64]	19/53 (36)	1.27 [0.60, 2.70]	10/27 (37)	0.65 [0.27, 1.61]
Income						
≤ $30,000	62/170 (36)	Ref	23/75 (31)	Ref	26/58 (45)	Ref
>S30,000	47/118 (40)	1.15 [0.71, 1.87]	18/50 (36)	1.27 [0.60, 2.71]	20/25 (44)	0.99 [0.45, 2.16]
Education						
Less than College Degree	75/199 (38)	Ref	27/85 (32)	Ref	34/78 (44)	Ref
College Degree or Higher	34/89 (38)	1.02 [0.61, 1.71]	14/40 (35)	1.16 [0.52, 2.56]	12/25 (48)	1.20 [0.48, 2.95]
Employment						
Not Currently Working	57/158 (36)	Ref	20/66 (30)	Ref	27/61 (44)	Ref
Currently Working	52/130 (40)	1.15 [0.72, 1.84]	21/59 (36)	1.27 [0.60, 2.69]	19/42 (45)	1.04 [0.47, 2.29]
Baseline LBP Score						
Moderate (≤7)	55/162 (34)	Ref	18/70 (26)	Ref	25/54 (46)	Ref

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	Full Sample		Yoga		Physical Therapy	
Predictor	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**	**N (%)**	**OR [95% CI]**
Severe (8–10)	53/123 (43)	1.47 [0.91, 2.39]	22/54 (41)	1.97 [0.93, 4.26]	21/47 (45)	0.94 [0.43, 2.10]
Baseline RMDQ Score						
<13	30/93 (32)	Ref	13/49 (27)	Ref	12/31 (39)	Ref
13–17	34/96 (32)	1.15 [0.63, 2.11]	13/40 (33)	1.33 [0.53, 3.33]	13/29 (45)	1.29 [0.46, 3.60]
≥18	45/99 (4)	1.75 [0.97, 3.15]	15/36 (42)	1.98 [0.79, 4.95]	21/43 (49)	1.51 [0.59, 3.86]
6 Week LBP Change Score						
<30% Improvement	76/204 (37)	Ref	26/86 (30)	Ref	32/68 (47)	Ref
≥30% Improvement	30/66 (45)	1.40 [0.80, 2.46]	14/32 (44)	1.80 [0.78, 4.14]	11/26 (42)	.96 [0.39, 2.39]
6 Week RMDQ Change Score						
<30% Improvement	66/186 (35)	Ref	21/73 (29)	Ref	30/69 (44)	Ref
≥30% Improvement	40/86 (47)	1.58 [0.94, 2.66]	19/46 (41)	1.74 [0.80, 3.78]	14/26 (54)	1.51 [0.61, 3.75]

LBP low back pain; OR, odds ratio; RMDQ, Roland Morris Disability Questionnaire