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Patient-defined outcomes for pain, fatigue, emotional distress, and interference with activities did not differ by age for individuals with musculoskeletal pain

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Abstract

Introduction: Age impacts the prevalence and experience of musculoskeletal pain; however, it is unknown whether this factor impacts patient's anticipated outcomes after treatment.

Objective: Using the Patient-Centered Outcomes Questionnaire (PCOQ), the primary purpose was to determine whether there are age-related differences in desired, successful, expected levels, and importance of improvement in pain, fatigue, emotional distress, and interference with daily activities. As a secondary purpose, anatomical location and sex were then included in the model to examine for interaction effects.

Methods: A secondary analysis of the Optimal Screening for Prediction of Referral and Outcome cross-sectional and longitudinal cohorts was conducted. Included in this analysis were 572 individuals seeking physical therapy for nonsurgical neck, low back, shoulder, and knee pain who completed the PCOQ at the initial evaluation. A three-way analysis of variance examined PCOQ domains by age categories, sex, and anatomical location.

Results: Interaction effects were not observed for any of the domains of interest ($P > 0.01$). Significant main effects were also not observed for age, sex, and anatomical location ($P > 0.01$).

Conclusion: Musculoskeletal pain prevalence may differ across age categories but, in this cohort, neither age, nor sex, nor anatomical location impacted patient-defined outcomes for intensity, fatigue, emotional distress, and interference with daily activities.

Keywords: Age, Sex, Pain location, Treatment expectations, Success criteria

1. Introduction

11.2% of Americans experience daily pain[33] with high-impact chronic pain affecting 4.8% of the population of the United States.[41] Musculoskeletal disorders, such as low back pain, are among the leading causes of disability worldwide[21] and their prevalence continues to increase.[12] Although musculoskeletal pain typically improves rapidly,[3,4,23] up to 65% of people who see a primary care physician for back pain still experience pain 1 year after the initial onset.[24] For individuals who transition to chronic pain, focusing on pain reduction as a primary goal of treatment can be frustrating for the patient and challenging for the provider.[5,47]

Patient-centered approaches to managing medical conditions are mandated by the Affordable Care Act[39] and valued by funding agencies[40] necessitating inclusion of the patient's perspective in choosing treatment approaches, determining the goals of treatment, and interpreting the effectiveness of treatment.[2] Treatment effects for patients with musculoskeletal pain conditions are often judged by comparisons to effect sizes and minimally clinically important differences; however, such approaches may lack meaningfulness to individual patients.[18] Values derived from group means fail to account for interindividual differences in pain along with the patient's perspective in establishing the success of a given treatment. In fact, treatment success criteria for patients with chronic pain[43] as well as those seeking physical therapy with musculoskeletal pain complaints[53] often exceed established criteria for a successful clinical

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outcome, such as the minimally clinically important difference.[52] Patients seeking care for pain conditions also define treatment success by changes in domains beyond pain intensity reduction, including fatigue, emotional distress, and interference.[48,52,53] Subsequently, patient-defined approaches to interpreting treatment effects may better represent individual beliefs.

Age is a consideration in patient-centered approaches to managing individuals with painful conditions due to differences in the pain experience across the lifespan. For example, persistent pain prevalence peaks between 60 and 69 years of age.[27,33] Aging also contributes to differences in pain-related coping and attitudes.[32] For example, older adults attending a tertiary pain clinic report diminished pain-related suffering[42] and pain catastrophizing compared with younger adults.[45] Age-related differences are also observed in pain beliefs. Although younger adults are concerned about the impact of pain on employment, older adults are more concerned about mobility.[31] This body of literature suggests a difference in pain experience between age cohorts. Given the differences across age categories, a patient-centered approach that assesses the condition from a multidimensional perspective could be beneficial.

The primary purpose of this study was to determine whether there are age-related differences in (1) desired, successful, and expected levels of selected outcome domains and (2) the importance of improvement in each outcome domain. We hypothesized that older adults would expect to experience higher levels of the outcome domains after treatment and define smaller improvements in each domain as successful compared with younger adults. In addition to age, sex and anatomical location were also included as an additional analysis to determine whether these factors alone or in combination with age interact in shaping expectations, treatment success criteria, or the importance attached to improvements in different domains of pain. This additional analysis was conducted because differences among sexes are present in pain[6,14,16] and we wished to determine whether differences by anatomical location were present as well.[51] Understanding age-related differences in patient-defined outcome domains allows for greater individualization of care by focusing on levels of improvement that are meaningful to the individual patient.

2. Methods

2.1. Overview

This study is a secondary analysis pooling baseline data from the Optimal Screening for Prediction of Referral and Outcome (OSPRO) cross-sectional[19,30] and longitudinal cohorts.[20] Data were collected for the cross-sectional cohort from March 2013 to May 2014 at participating physical therapy clinical sites in Florida (n = 11). Data were collected for the longitudinal cohort from December 2014 to December 2015 at participating physical therapy clinical sites (n = 9) located in the Mideast, Southeast, Great Lakes, Rocky Mountain States, and Far West. The data sets were combined because the same eligibility criteria and measures were used for the cross-sectional and longitudinal cohorts.

2.2. Participants

Participants were recruited through a convenience sample of patients seeking physical therapy at participating clinical sites. Patients were eligible for inclusion in the study if (1) aged between 18 and 75 years; (2) seeking outpatient physical therapy treatment for musculoskeletal pain with primary complaints involving the cervical spine, lumbar spine, shoulder, or knee; and (3) able to read and comprehend the English language. Patients were excluded from the study for any diagnosis indicative of (1) widespread chronic pain syndrome (eg, fibromyalgia or irritable bowel syndrome), (2) neuropathic pain syndrome (eg, complex regional pain syndrome or diabetic neuropathy), (3) psychiatric history (currently under the care of a mental health care provider or taking multiple psychiatric medications), (4) cancer (currently receiving treatment for active cancer), or (5) neurological disorder (eg, stroke, spinal cord injury, or traumatic brain injury). Participating physical therapists screened their patients for eligibility during the initial visit and directed those qualifying for the study and expressing interest to a web-based electronic records database (REDCap; Vanderbilt University, Nashville, TN) for online consent and participation. The University of Florida Human Subjects Institutional Review Board (IRB-01) approved the cross-sectional and longitudinal cohort studies, and all participants provided informed consent to participate in the study.

2.3. Measures

2.3.1. Demographic and clinical factors

Age, sex, race, ethnicity, and employment status were collected using a self-reported standard intake form. Clinical factors collected through self-report included: anatomical location (low back, neck, shoulder, or knee), onset of symptoms (gradual, sudden, or traumatic), pain duration (days), and whether the participant had surgery for the current complaint (yes or no).

2.3.2. Patient-centered outcome questionnaire

Individuals who agreed to participate in this study completed the Patient-Centered Outcomes Questionnaire (PCOQ) at the time of the physical therapy evaluation. The PCOQ is a 5 item self-report measure in which patient's quantify their usual, desired, successful, and expected levels across the domains of: pain, fatigue, emotional distress, and interference with daily activities.[43] Each domain within the usual, desired, successful, and expected levels is scored on separate 101-point numerical rating scales from 0 (none) to 100 (worst imaginable). The fifth question asks individuals to rate his or her importance of achieving improvement in each domain. This is assessed with a separate 101-point numeric rating scale from 0 (not important) to 100 (most important). For example, patients may indicate their usual pain as 60/100; desired pain as 0/100; consider 20/100 as successful; expect their pain to be 30/100 after treatment; and rate the importance of seeing improvement in pain as 80/100. The PCOQ has been previously applied to individuals seeking outpatient physical therapy for musculoskeletal pain[52] and individuals seeking treatment at a pain clinic for chronic spine pain.[9] The PCOQ demonstrates good[28,46] test–retest reliability over 48 hours for usual levels of pain, fatigue, emotional distress, and interference with daily activities (correlation coefficient = 0.84–0.90, $P < 0.01$) and moderate-to-good reliability[28,46] for the importance of seeing change in pain, emotional distress, and interference (0.62–0.82, $P < 0.05$).[8,37] The PCOQ also demonstrates concurrent validity with the visual analogue scale ($r = 0.52$–0.78), pain unpleasantness ($r = 0.64$–0.73), Pain Disability Index ($r = 0.75$), and Roland Disability Questionnaire ($r = -0.69$).[8,37]

2.4. Statistical analyses

All analyses were performed with IBM SPSS Software, version 24.0 (IBM Corporation, Armonk, NY). In the larger OSPRO study, nonsurgical and surgical cases were included. However, we were

interested in individuals presenting for nonsurgical management of musculoskeletal pain for the purpose of this secondary analysis; so, we excluded patients referred to physical therapy for postoperative management. Patient's desired, successful, expected, and importance of seeing change in all domains were assessed for general linear model assumptions. Normality was examined visually with histogram, box, and Q-Q plots and quantitatively using the Kolmogorov–Smirnov test. As expected, a positive skew was displayed for all domains in expected and successful levels. For importance of seeing change, a bimodal distribution was displayed for fatigue and emotional distress with peaks at 0 and 100 while pain and interference with daily activities displayed a negative skew. The Kolmogorov–Smirnov test indicated a significant departure from normality ($P < 0.01$). The PCOQ domains could not be normalized with power or Blom transformations.

The primary purpose of the analysis was to determine whether age-related differences exist in beliefs of patients presenting to physical therapy for conservative management. Age was transformed into a categorical variable to determine whether differences exist between age cohorts. Age was categorized by the following decades: 20 to 29, 30 to 39, 40 to 49, 50 to 59, and 60 to 69 years old.[36] For the primary purpose of the study, an analysis of variance examining usual, desired, successful, expected, and importance of improvement across age categories was conducted. Next, the impact of sex and anatomical location was explored for patient-centered outcomes. A three-way analysis of variance was conducted investigating differences in usual, desired, successful, expected levels, and the importance of improvement in each outcome domain by age, sex, anatomical location, and their interactions. These analyses were conducted with 5000 bootstrapped samples with bias-corrected 95% confidence intervals. Bootstrapping is an empirical resampling procedure that computes population standard errors based on our sample. Homogeneity of variance was examined with Levene's test, and bootstrapping was used to correct as needed. Type I error rate was set at 0.01, as opposed to a more conventional 0.05, to partially account for the number of comparisons. A more conservative Type I error correction was considered (eg, Bonferroni) but discounted because such approaches also increase the chance of Type II error.

An accompanying complimentary multiple linear regression analysis was conducted to model age as a continuous variable and to account for other covariates. Due to variations in the proportion of ethnic minorities across age categories (as demonstrated in **Table 1**), ethnicity was included in this additional analysis. Therefore, age, sex, anatomical location, and ethnicity were included in the model. Because anatomical location was a multilevel nominal variable, they were dummy-coded for the regression with the reference category being the low back.

3. Results

3.1. Descriptive statistics

777 participants completed the PCOQ as part of the OSPRO cross-sectional (n = 337) and longitudinal (n = 440) cohorts. Surgical cases (n = 168), participants who do not provide their age (n = 7), and participants aged between 70 and 75 years (n = 30) were removed for data analysis resulting in 572 participants included in this secondary analysis. Demographic and clinical factors by age categories are listed in **Table 1**. The mean age of participants was 43.49 ± 15.17 years and 63.6% were women. The most frequent anatomical location of pain was low back (38.8%) and half (50.3%) reported a gradual onset of symptoms. The range for the duration of symptoms was from 1 to 10,000 days (mean [SD] = 469.89 [62.68])].

3.2. Age, sex, and anatomical location differences in usual levels

Three-way interaction effects were not observed ($P > 0.01$). Significant age by anatomical location effects were not observed ($P > 0.01$) (**Fig. 1**). The main effects of age and anatomical location were not significantly different across each domain ($P > 0.01$). A main effect was observed for sex ($P < 0.01$) with women reporting significantly higher usual levels of fatigue (mean difference [SD] = 11.37 [2.87]) and emotional distress (mean difference [SD] = 8.81 [2.84]).

3.3. Age, sex, and anatomical location differences in desired levels

Three-way interaction effects were not observed ($P > 0.01$) (**Fig. 1**). Significant age by anatomical location effects were not observed ($P > 0.01$). The main effects of age, sex, and anatomical location were not significantly different across each domain ($P > 0.01$).

3.4. Age, sex, and anatomical location differences in success criteria

Three-way interaction effects were not observed ($P > 0.01$) (**Fig. 1**). Significant age by anatomical location effects were not observed ($P > 0.01$). The main effects of age and anatomical location were not significantly different across each domain ($P > 0.01$). Significant main effects of sex for fatigue and emotional distress were observed ($P < 0.01$) with women considering higher levels as successful (fatigue mean difference [SD] = 5.97 [1.99] and emotional distress mean difference [SD] = 6.17 [1.93]). However, these differences were mitigated when covaried with the usual level for fatigue and emotional distress ($P > 0.01$). For the total sample, mean percentage improvement from baseline for treatment to be considered successful was 64.60% for pain, 55.95% for fatigue, 52.43% for emotional distress, and 64.71% for interference with daily activities. When stratified by age, these percentages did not significantly differ ($P > 0.01$).

3.5. Age, sex, and anatomical location differences in expected outcomes

Three-way interaction effects were not observed ($P > 0.01$) (**Fig. 1**). Significant age by anatomical location effects were not observed ($P > 0.01$). Significant main effects of sex for fatigue and emotional distress were observed ($P < 0.01$) with women expecting higher levels of fatigue (mean difference [SD] = 5.66 [2.12]) along with emotional distress (mean difference [SD] = 6.48 [2.02]) However, these differences were mitigated when covaried with the usual level for fatigue and emotional distress ($P > 0.01$). For the total sample, mean expected improvement from baseline was 66.54% for pain, 58.66% for fatigue, 54.17% for emotional distress, and 64.71% for interference with daily activities. When stratified by age, these percentages did not significantly differ ($P > 0.01$).

3.6. Age, sex, and anatomical location differences in importance attached to outcome domains

Three-way interaction effects were not observed ($P > 0.01$) (**Fig. 2**). Significant age by anatomical location effects were not

Table 1

Demographic and clinical factors by age categories

	20–29 years old (n = 125)	30–39 years old (n = 109)	40–49 years old (n = 109)	50–59 years old (n = 118)	60–69 years old (n = 111)	Total sample (n = 572)	*P*
Mean (SD) age	24.28 (2.77)	34.16 (2.72)	44.47 (2.94)	54.86 (2.85)	64.26 (2.84)	43.49 (15.70)	
% Female	49.2	64.2	67.0	71.2	67.6	63.6	<0.01
Race							0.03
% American Indian/Native Alaskan	1.6	0.0	1.9	0.0	0.9	0.9	
% Asian	10.7	2.8	4.6	3.5	3.6	5.2	
% Black/African American	14.8	22.4	24.1	20.9	10.9	18.5	
% White	73.0	74.8	69.4	75.7	84.5	75.4	
Ethnicity							0.08
% Hispanic	11.8	6.9	7.8	4.5	2.9	6.9	
Employment							<0.01
% full time	48.7	70.6	76.6	56.9	31.2	56.6	
% part time	29.9	14.7	10.3	6.9	13.8	15.2	
% unemployed	21.4	14.7	11.2	26.7	5.5	16.1	
% retired	0.0	0.0	1.9	9.5	49.5	12.0	
Anatomical location							0.19
% neck	18.4	14.7	18.3	17.8	14.4	16.8	
% low back	39.2	46.8	32.1	39.0	46.9	38.8	
% shoulder	15.2	20.2	26.6	27.1	26.8	23.4	
% knee	27.2	18.3	22.9	16.1	19.8	21.0	
Pain duration							0.33
Mean days (SD)	243.99 (527.06)	626.44 (2951.82)	330.83 (939.05)	298.34 (778.01)	304.08 (864.33)	469.89 (62.68)	

Data are presented as percentage or mean (SD).

observed ($P > 0.01$). The main effects of age, sex, and anatomical location were not significantly different across each domain ($P > 0.01$).

3.7. Results of the multiple linear regression

Table 2 displays the *P*-values and R^2 results of the multiple linear regression. Overall, the regression models indicated minimal influence of age, sex, anatomical location, or ethnicity and the R^2 values were low (<7% total variance explained). When modeled as a continuous variable, age was not associated with patient-defined outcomes ($P > 0.01$). In addition, the regression model indicated only one sex difference, that considered higher levels of emotional distress ($b = 4.62$, $\beta = 0.12$) as successful (**Table 2**). Anatomical location and ethnicity were not associated with patient-defined outcomes in the regression models ($P > 0.01$). Significant differences by ethnicity were not observed ($P > 0.01$).

4. Discussion

The primary purpose of this analysis was to examine the influence of age on patient-defined outcomes, while also accounting for the influence of sex and anatomical location. The pain experience is different across age categories necessitating consideration of age-related differences in pain for optimal patient centered management. In this cohort of individuals with musculoskeletal pain between 20 and 69 years, we observed usual levels, desired levels, expected levels, and the importance attached to different domains of pain to not differ by age, sex, anatomical location, and their interactions.

4.1. Age-related differences in usual levels

Differences were not observed in usual levels of pain-related domains by age categories. Pain sensitivity and pain modulatory capacity are impacted by aging[29,34,35]; however, results are inconsistent. Despite these differences, the results of this study indicate that age does not affect clinical pain intensity of individuals seeking care for musculoskeletal pain. Anatomical location also does not impact usual clinical pain intensity or pain-related psychosocial factors. However, usual emotional distress and fatigue levels are impacted by sex. Women display higher prevalence of pain and clinical pain intensity[6,15] but we add to this body of literature by demonstrating differences in usual emotional distress and fatigue are present as well.

4.2. Age-related differences in desired levels

In the placebo literature, desire is defined as the need or want for symptom relief and equated to emotional distress.[49,50] By contrast, the PCOQ measures desire in the context of the desired level of individual domains or "ideal outcomes" rather than the desire for complete relief. Participants in our study did not uniformly express 0 as the desired or ideal level of each domain. Instead, our findings were similar to other studies using the PCOQ that also found variability.[52,53] Furthermore, we add to this body of knowledge by demonstrating these findings hold across age, body regions, and sex.

4.3. Age-related differences in success criteria and expectations

Patients also present for health care with high expectations for improvement[22,25] and expect successful outcomes.[43,53] Similarly, the participants in this study generally expected successful outcomes in each domain. Older adults consider pain as a normal part of aging[42] and could reasonably be anticipated to expect higher levels of the domains of pain on completing a course of care as well as defining higher levels of the domains as successful. In contrast to our hypothesis, we did not observe age-related differences in expectations or success criteria for each domain. Expectations are associated with treatment

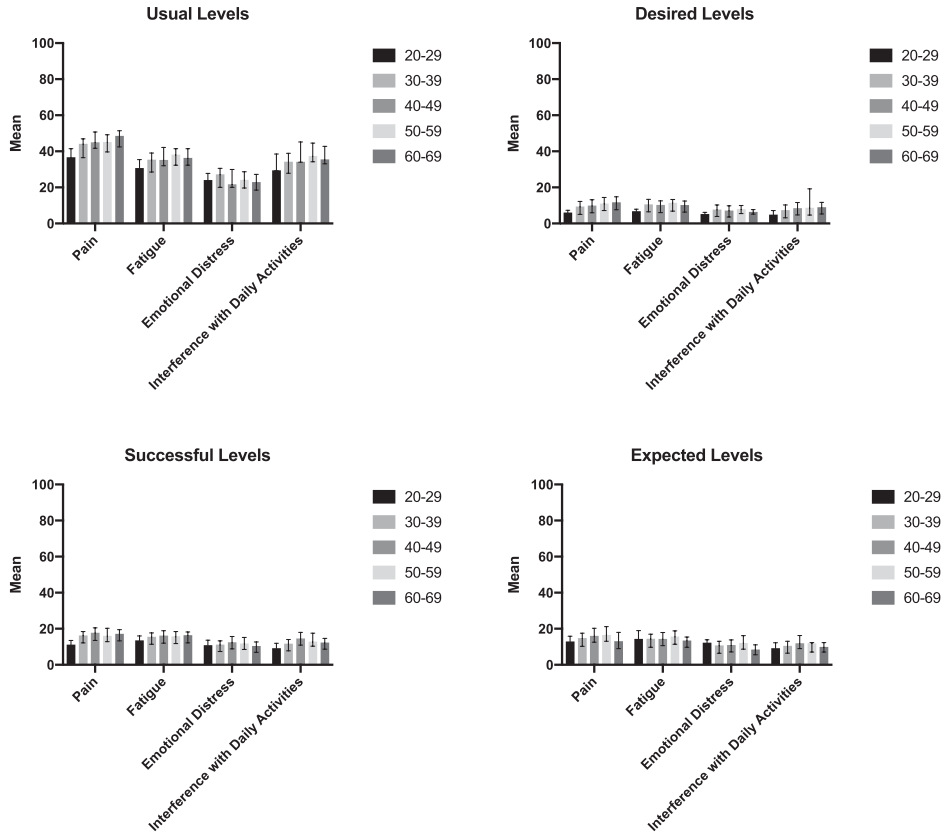

Figure 1. Mean values for PCOQ domains by age category. Error bars represent 95% confidence intervals.

outcomes in patients with pain.[7] Furthermore, patient-defined success criteria require larger changes than commonly cited minimally clinically important differences.[43,53] Subsequently, awareness of patient expectations as well as success criteria are important considerations in patient-centered care. Our findings add to the prior findings of studies using the PCOQ by suggesting that expectations and success criteria as measured by the PCOQ are not related to patient age, body region of pain, or sex. This indicates that the PCOQ can be clinically applied across a range of ages, body regions, and sex.

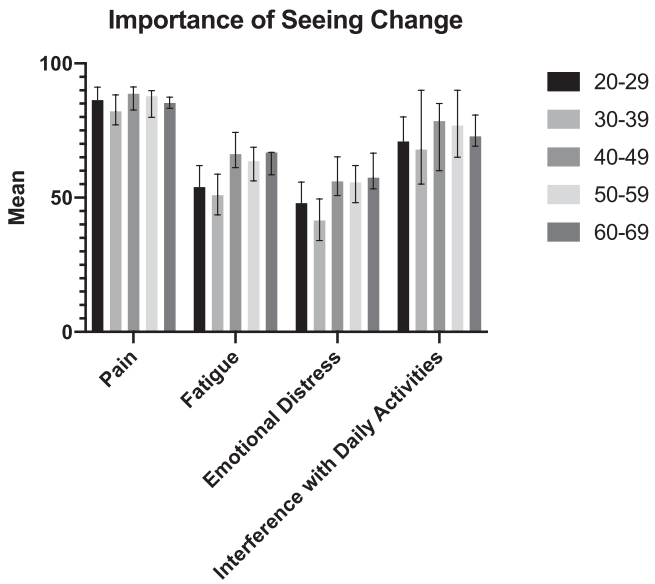

Figure 2. Mean values for the importance of seeing change in pain, fatigue, emotional distress, and interference with daily activities by age category. Error bars represent 95% confidence intervals.

4.4. Age-related differences in importance attributed to different domains

Patient-centered care traditionally has focused on involvement in the treatment choice; however, more recent models include consideration of the patient's goals for treatment.[13] The importance attached to improvement in different outcome domains represents an important consideration in identifying patient specific goals for interventions for pain. Furthermore, discrepancies may arise if a standardized approach is not taken to identify outcomes of importance to patients. Our findings are consistent with other studies of the PCOQ indicating patients presenting to physical therapy with musculoskeletal pain complaints endorse improvements in multiple domains of pain as important including domains not traditionally assessed by physical therapist such as emotional distress and fatigue.[52,53] Our study adds to these by suggesting that the importance attributed to improvements in multiple domains does not differ across age categories. The findings of similar importance attached to domains of emotional distress across age categories are particularly relevant to rehabilitation providers practicing patient-centered care because (1) assessment of these domains requires a systematic approach using standardized questionnaires,[10,11] (2) providers do not commonly assess these domains in their patients

Table 2

R^2 and *P*-value results of multiple linear regression.

	R^2 (total model)	*P* (total model)	Age, *P*	Age-standardized coefficient beta	Sex, *P*	Anatomical locations, *P*	Ethnicity, *P*
Desired levels							
Pain	0.02	0.07	0.28	0.05	0.42	>0.01	0.21
Fatigue	0.02	0.16	0.52	0.03	0.11	>0.01	0.43
Emotional distress	0.01	0.49	0.98	0.001	0.22	>0.01	0.37
Interference with daily activities	0.02	0.05	0.19	0.06	0.66	>0.01	0.77
Success criteria							
Pain	0.01	0.38	0.15	0.06	0.22	>0.01	0.55
Fatigue	0.01	0.33	0.82	−0.01	0.01	>0.01	0.54
Emotional distress	0.02	0.19	0.19	−0.06	0.007*	>0.01	0.64
Interference with daily activities	0.01	0.66	0.74	0.015	0.15	>0.01	0.35
Expected levels							
Pain	0.01	0.93	0.85	−0.01	0.36	>0.01	0.94
Fatigue	0.01	0.53	0.21	−0.06	0.06	>0.01	0.89
Emotional distress	0.02	0.05	0.02	−0.10	0.01	>0.01	0.48
Interference with daily activities	0.01	0.76	0.69	−0.02	0.38	>0.01	0.58
Importance of seeing change							
Pain	0.01	0.84	0.85	−0.01	0.35	>0.01	0.77
Fatigue	0.03	0.01	0.02	0.11	0.01	>0.01	0.05
Emotional distress	0.04	0.01	0.06	0.08	0.02	>0.01	0.02
Interference with daily activities	0.02	0.23	0.50	0.03	0.25	>0.01	0.28

* Indicates statistical significance.

with pain,[38,44] and (3) providers express uncertainty in directing treatments towards these domains in their patients with musculoskeletal pain complaints.[1,17] Furthermore, treatment modifications to traditional rehabilitation approaches may be necessary[26] to fully address these domains identified as important independent of the age, sex, and body region of the patient.

4.5. Limitations

There are limitations worth considering when interpreting the results of this study. We categorized age for our analyses in a similar manner as others.[36] Standardized age categories are not in the literature and, as a result, classifying age by decades provided the most logical representation. However, this categorization resulted in exclusion of individuals older than 70 years. Furthermore, there was no direct attempt to recruit any given age group and the original OSPRO studies excluded individuals older than 75 years. As a result, imbalances in the distribution of sex, race, and ethnicity are present among age categories as a convenience sample was conducted for individuals with neck, low back, shoulder, or knee pain. Only these anatomical locations were included; so, these findings may not be generalizable to individuals with other musculoskeletal or chronic pain conditions. The generalizability of this study is further constrained by excluding those with age-associated conditions such as cancer, diabetic neuropathy, and stroke. In addition, this sample included all individuals seeking care at outpatient physical therapy clinics and may not generalize to other health care settings. A larger sample size may have detected statistical differences in some of the domains. However, the effect sizes across each pain domain were small (partial eta^2 < 0.02), making the clinical relevance of these statistical findings questionable. Finally, the measurement invariance for the PCOQ across demographic characteristics, including age, has not been established and is an area ripe for future research.

5. Conclusion

Patient-centered care necessitates accounting for individual pain variability with age as an important consideration due to known age-related differences in the pain experience. Contrary to our hypothesis, we did not observe age-related differences in desired levels of different domains of pain, expected levels of different domains of pain, success criteria, or importance of seeing change in different domains of pain. Additional analyses indicated limited influence from sex and anatomical location of pain for these same domains.

Disclosures

The authors have no conflicts of interest to declare.

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