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PROMIS Physical and Emotional Health scores are worse in musculoskeletal patients presenting to physiatrists than to other orthopedic specialists

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Abstract

Background: Physiatrists' unique training in person-centered biopsychosocial management of complex problems may influence musculoskeletal patients' expectations and self- and/or physician-referral patterns to physiatrists. Consequently, average patient complexity and need for multi-disciplinary services may be increased in physiatric patients.

Objective: To compare musculoskeletal patients' self-reported physical and emotional health according to provider specialty. We tested the null hypothesis that there is no significant difference in Patient-Reported Outcomes Measurement Information System (PROMIS) scores between patients who present to physiatrists in comparison to other musculoskeletal specialists.

Design: Cross-sectional study.

Setting: Orthopedic department of a tertiary academic medical center.

Patients: Subjects included 31,791 new adult patients (mean age 52.6±16.2 years) who presented for initial elective evaluation of a musculoskeletal problem by an orthopedic surgeon or sports medicine trained emergency medicine, family medicine, pediatric, or physiatric physician.

Methods: Patients completed the PROMIS computer adaptive test (CAT) Physical Function, Pain Interference, Anxiety, and Depression domains at department check-in prior to the physician encounter. Score differences by provider type were assessed using Wilcoxon rank-sum tests.

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Main Outcome Measurements: Mean PROMIS score in each domain subdivided by psychiatric, surgical, and other non-surgical provider type.

Results: In total, 2,081 patients presented to psychiatrists, 28,267 presented to surgeons, and 1,443 presented to other non-surgical providers. For each respective provider type, average PROMIS scores were: Physical Function 38.9 ± 8.2 , 41.5 ± 9.5 , and 43.5 ± 8.2 ; Pain Interference 62.6 ± 7.2 , 60.9 ± 7.7 , and 59.2 ± 6.8 ; Anxiety 54.5 ± 10.4 , 51.9 ± 10.6 , and 49.8 ± 9.8 ; and Depression 49.3 ± 10.4 , 47.0 ± 10.0 , and 44.2 ± 8.7 . Psychiatric patients had significantly worse average scores for all domains compared to surgical ($p < .001$) and other non-surgical patients ($p < .001$).

Conclusions: Average PROMIS Physical Function, Pain Interference, Anxiety, and Depression scores were worse in musculoskeletal patients who presented to psychiatrists in comparison to surgical or other non-surgical providers. This suggests that some patients who choose to see or are referred to see psychiatrists may have more or be more willing to endorse having biopsychosocial impairments.

Level of Evidence: Level III

INTRODUCTION

When patients choose a physician, the provider's specialty is usually dictated by the medical problem. Musculoskeletal care is unique because patients can choose from physicians with various subspecialty backgrounds. The overwhelming majority of surgical specialists complete an orthopedic surgery residency, but non-surgical musculoskeletal specialists can receive subspecialty training and board certification in sports medicine after completing core training in either emergency medicine, family medicine, internal medicine, pediatrics, or physical medicine and rehabilitation (physiatry).¹ A significant focus of early psychiatrists was to address an unmet need for person-centered biopsychosocial management of complex medical problems in impaired and wounded veterans,² and although the field's patient population has broadened, psychiatrists' unique core training and comprehensive patient approach has endured.³ Consequently, musculoskeletal patients with substantial biopsychosocial impairments may preferentially self-refer or be referred by healthcare providers to psychiatrists, and patients' awareness of psychiatrists' expertise may also affect their interest in *discussing* the interplay between their musculoskeletal problem, functional limitations, and general well-being.

Prior studies have identified trends in patient characteristics based on specific musculoskeletal diagnoses,⁴⁻⁸ but to our knowledge trends based on provider specialty have never been examined. The Patient-Reported Outcomes Measurement Information System (PROMIS) is a new set of measures developed by the NIH starting in the early 2000's, and because the assessments are not disease-specific, it is an ideal tool to compare patients across various musculoskeletal conditions. It was designed to characterize patients' self-reported physical, mental, and social health, regardless of their underlying medical problem. A unique feature is its incorporation of computer adaptive testing (CAT) capabilities, which enables efficient electronic collection of precise scores while maintaining a low survey burden for patients.⁹ The individual PROMIS domains have been extensively studied and are

well-validated in the general population,^{10–12} but understanding proper interpretation of scores in specific patient populations is still ongoing.¹³

The purpose of this study was to compare musculoskeletal patients' PROMIS Physical Function, Pain Interference, Anxiety, and Depression scores at their initial clinic visits based on whether they presented to a physiatric, surgical, or other non-surgical provider. We tested the null hypothesis that there is no significant difference in patient-reported physical or emotional health symptomatology between patients who present to physiatrists versus those who present to other musculoskeletal specialists. This question is clinically relevant because if differences are present, the data would provide timely supportive evidence to third-party payers that some musculoskeletal patients, irrespective of their structural diagnosis, present with greater baseline impairment and may require more multi-disciplinary services. Furthermore, an equitable reimbursement system should account for this variation in patient complexity.

METHODS

In this cross-sectional study, electronic medical records were reviewed from the orthopedic department of one tertiary academic medical center between 6/22/15 and 11/1/17. University institutional review board approval was obtained with a waiver of written consent.

Subjects

Subjects included new adult patients who presented for elective outpatient evaluation of a musculoskeletal problem and completed at least one PROMIS domain at their initial clinic visit prior to their clinical evaluation. A “musculoskeletal problem” was defined as pain or impairment that the patient believed to be due to dysfunction of muscles, bones, joints, and/or other related soft tissue structures. Patient age, sex, race, and ethnicity were recorded. Patients younger than 18 years old were excluded because they completed the Pediatric PROMIS measures rather than the adult measures, and they are traditionally less involved in choosing their physician provider than their parents or legal guardians. Patients who presented to the walk-in injury clinic, a trauma surgeon, or an orthopedic oncology surgeon were also excluded because the urgent and/or non-elective nature of their visits precluded their ability to choose their provider based on his/her specialty training.

All patients were evaluated by one of 34 orthopedic surgeons or one of 12 board-certified sports medicine specialists with various core training backgrounds including 8 physiatrists, 2 emergency medicine physicians, 1 family medicine physician, and 1 pediatrician. (The pediatric-trained sports medicine specialist also routinely evaluated adult patients.)

Procedures

As part of standard of care, after patients checked in for their appointment they were asked by the front desk staff to complete four PROMIS CAT domains prior to their physician encounter. The domains included PROMIS Physical Function v1.2, Pain Interference v1.1, Anxiety v1.0, and Depression v1.0, and they were administered on preloaded tablet computers (iPad mini, Apple, Cupertino, CA). The tablet software did not allow patients to skip questions or domains, and only fully completed domains generated scores. All scores

were directly transferred to the patients' electronic medical records. June 22, 2015 was the first day PROMIS measures were collected in the department, which is why it was chosen as the starting date for this study. However, the exact timing of PROMIS implementation varied by each domain and provider. Specifically, the Anxiety domain was implemented ten months after the other domains, and the Physical Function v1.2 domain was replaced by the Physical Function v2.0 domain six months prior to the end-date of this study.

Outcome measures

The primary study outcome was the mean score for each PROMIS domain subdivided by psychiatric, surgical, and other non-surgical provider type. PROMIS scores are normalized to the general population with a mean of 50 and standard deviation of 10, and higher scores represent more of the specific domain. For example, a score of 60 represents better physical function on the Physical Function domain, but a score of 60 on the Depression domain indicates more depressive symptoms than the average person. PROMIS instructs patients to answer all questions while reflecting on symptomatology during the previous seven days. Patients' PROMIS Physical Function and Pain Interference scores were used as markers of their self-reported physical health. The Physical Function domain is designed to characterize patients' self-reported mobility, dexterity, and ability to perform instrumental activities of daily living, while the Pain Interference domain explores "the extent to which pain hinders engagement with social, cognitive, emotional, physical, and recreational activities."¹⁴ PROMIS Anxiety and Depression scores were used as markers of self-reported emotional health. The Anxiety domain inquires about patients' fears, worries, and hyperarousal/somatic symptoms such as tension, restlessness, heart-racing, and dizziness. The Depression domain identifies negative moods such as sadness and guilt, feelings of worthlessness and loneliness, and decreased interest or sense of purpose.¹⁰

The secondary outcome was the proportion of patients evaluated by each provider type who reached PROMIS threshold scores consistent with heightened anxiety and depression symptomatology. Similar to previous orthopedic PROMIS research,⁵ the minimum score cutoffs were chosen based on established linkage tables created by Schalet et al. A PROMIS Anxiety score of 62.3 corresponds to a score of 10 on the Generalized Anxiety Disorder (GAD)-7 instrument and is the cutoff with the highest sensitivity and specificity to identify likely cases of clinical GAD.^{15, 16} Similarly, a PROMIS Depression score of 59.9 corresponds to a score of 10 on the Patient Health Questionnaire (PHQ)-9 scale, which is the cutoff with the highest sensitivity and specificity to detect a diagnosis of moderately severe major depression.^{17, 18}

Statistical analysis

Descriptive statistics are reported as means and standard deviations for continuous data and frequency and percents for categorical data. Group differences of continuous variables were assessed using Wilcoxon rank-sum tests. Floor and ceiling effects are reported as the proportion of patients scoring the highest and lowest possible numerical values for each domain. Finally, multivariable logistic regression was used to assess for confounding effects of patient age, sex, and race on choice of provider type. A *p*-value of .05 was considered statistically significant for all analyses. All missing data were excluded with no imputation

of data. The overwhelming majority of missing data were due to intervals at the beginning and end of the study period during which the PROMIS Anxiety v1.0 and PROMIS Physical Function v1.2 domains were not collected, respectively. Due to the confidential nature of patient information, the raw data used in this study cannot be shared.

RESULTS

Of 31,791 total patients (mean age 52.6 ± 16.2 years), 2,081 patients presented to psychiatrists, 28,267 presented to surgeons, and 1,443 presented to other non-surgical musculoskeletal specialists. As shown in Table 1, psychiatric patients were more likely to be female (61% versus 56% versus 55%, $p < .001$) and, on average, were older (55.5 ± 16.2 versus 53.0 ± 16.1 versus 44.3 ± 16.1 years, $p < .001$). There was no difference in race/ethnicity breakdown between psychiatric and surgical patients, but compared to other non-surgical patients, psychiatric patients were more likely to self-report as non-white ($p < .001$).

All PROMIS results according to provider type are presented in Table 2. Compared to surgical and other non-surgical patients, psychiatric patients had significantly worse average scores for all PROMIS domains (Figure 1, all $p < .001$), and a higher proportion met GAD-7 and PHQ-9 equivalent criteria for heightened anxiety and depression symptomatology (Figure 2, all $p < .001$). Furthermore, proportionately fewer psychiatric patients scored the floor score (indicating minimal symptomatology) on PROMIS Anxiety (5% versus 8% versus 11%) and Depression domains (19% versus 24% versus 31%) (Figure 3, all $p < .001$). Even after adjustment for patient age, sex, and race, there was still a significant difference in PROMIS scores between provider type groups ($p = .003$ for comparison of psychiatric to other non-surgical patients on the Pain Interference domain, all other $p < .001$).

DISCUSSION

Patients who elected to present to psychiatrists for evaluation and treatment of a musculoskeletal problem self-reported worse physical and emotional health symptomatology than those who presented to surgical or other non-surgical musculoskeletal specialists. This phenomenon was consistently demonstrated when comparing patients' average PROMIS scores, the proportion of patients meeting heightened emotional health symptom thresholds, and the proportion of patients scoring the floor score on the emotional health domains.

Our study is novel in examining psychiatric versus other musculoskeletal patients, but our data are consistent with results generated during prior analyses of other patient subsets from our institution. Beleckas et al found that 19.5% of all orthopedic department patients (including trauma and oncology patients) reached the PROMIS score threshold for heightened anxiety, and an analysis of just upper extremity orthopedic surgery patients revealed 17% reached the threshold for heightened anxiety and 10% reached the threshold for heightened depression. Across the entire orthopedic surgery population, floor scores were reported by 5.5% of patients on PROMIS Anxiety and 22.4% of patients on PROMIS Depression.^{4, 5} To our knowledge, similar assessments at other institutions and in other practice settings have yet to be performed.

Although this study was not designed to determine the etiology of our findings, there are several possible explanations. First, some patients may choose to see a psychiatrist specifically because of psychiatrists' expertise in comprehensive person-centered management. These patients may have *more* biopsychosocial impairments than others, or they may be more interested in *discussing* them. This possibility is supported by the proportionately fewer psychiatric patients who scored the floor score on PROMIS emotional health measures. In order to achieve a floor score on the Anxiety or Depression domain, a patient must report absolutely no anxious or depressive symptoms in the previous seven days. While it is theoretically possible that a substantial proportion of musculoskeletal patients achieve the floor score because they are truly more than two standard deviations better than the general population in these domains, there is evidence to suggest that some patients who achieve these floor scores are not answering thoughtfully. Guattery et al demonstrated that, on average, orthopedic patients who contributed to the floor effect on the PROMIS Depression CAT spent substantially less time per question on the Depression domain than the rest of the patient population whose scores fell into an otherwise normally distributed curve (floor group 4 ± 3 sec versus standard group 7 ± 7 sec, $p < .001$). In contrast, the same patients who hastily completed the Depression questions were not substantially quicker when completing the Physical Function questions (floor group 11 ± 9 sec versus standard group 12 ± 10 sec, $p < .001$). Guattery proposed that the hasty completion associated with the PROMIS Depression floor effect may indicate poor validity that a floor score truly indicates minimal depression symptomatology.¹³ Instead, it may suggest that a patient prefers to not discuss or disclose mood-related symptoms to his/her musculoskeletal provider.

Patients' level of interest in discussing biopsychosocial impairments may also vary by their demographic characteristics. In our study, psychiatric patients were more likely to self-report as older, female, and non-white, whereas in Guattery's study the Depression floor group was more likely to self-report the opposite demographics. That is, they were more likely to be younger, male, and self-report as white when compared to the patients who did not report a floor Depression score. Of note, we intentionally did not adjust PROMIS scores for demographic differences because the purpose of the study was to characterize differences between patients who chose psychiatrists instead of other provider types, and the demographic trends are a component of these differences. Furthermore, the association between patients' provider type choice and PROMIS scores was still present even after controlling for demographic variables.

A second possible explanation for the difference in PROMIS scores by provider type is that the location and nature of patients' problems may vary by provider type. At this and many other institutions, psychiatrists manage patients with spine conditions in addition to other musculoskeletal problems, and Beleckas et al previously demonstrated that patients presenting to orthopedic spine surgeons have higher average PROMIS Anxiety scores compared to patients presenting to other orthopedic surgery subspecialists.⁵ Psychiatrists also receive second opinion referrals for patients who have pain despite normal imaging, already failed a course of conservative management, and/or were determined to not be a surgical candidate. When these patients did not receive a clear diagnosis or effective treatment, their overall well-being may have deteriorated in the interim. They could have developed

maladaptive compensatory movement patterns from persistent pain, deconditioning from kinesiophobia,^{19, 20} and/or pain-related impaired sleep quality and subsequent worsening of mood and catastrophic thinking.²¹

Finally, it is also possible that some patients may adjust their PROMIS answers based on the provider type they are scheduled to see. For instance, depression has been linked to poor post-operative outcomes after multiple orthopedic and other medical procedures,^{6, 22–24} and some patients who desire surgery may under-report depression symptoms to surgeons out of fear that a high Depression score will reduce their likelihood of being offered surgery. This hypothesis alone, though, would not explain why PROMIS emotional health scores were worse in psychiatry patients than in other non-surgical patients.

Clinical Relevance

To understand the clinical relevance of our findings, the differences in mean PROMIS scores by provider type can be compared to minimal clinically important differences (MCIDs) for PROMIS measures. Previously published PROMIS MCIDs for musculoskeletal patients with various diagnoses have ranged from 1.9 to 4.2 for Physical Function,^{25–28} 2.4 to 5.5 for Pain Interference,^{25, 28–30} 2.3 to 3.4 for Anxiety,^{25, 31} and 2.0 to 5.3 for Depression.^{25, 28, 31} Our results are within range of these values, which suggests the variation in PROMIS scores by provider type is likely clinically meaningful. Of note, this comparison is included to provide a general conceptual understanding of our study results. It is not intended to claim that our findings meet predetermined clinical relevance cutoffs because MCIDs are designed to assess longitudinal intra-individual change rather than cross-sectional inter-individual differences, and MCIDs for a given outcome measure can vary depending on the specific musculoskeletal diagnosis, MCID calculation method, and format of the outcome measure (i.e., PROMIS CAT versus a paper short form).

Regardless of the underlying etiology, these findings have direct implications for third-party payers because patients with more severe symptomatology often require a more comprehensive level of care and additional services. For example, O'Connor et al found that musculoskeletal patients who use or plan to use alternative therapies report greater average PROMIS Pain Interference scores and trend toward greater average PROMIS Depression scores, possibly because their pain was not sufficiently managed with treatment options that are traditionally covered by insurance.³² For these patients, we believe the next level of care should be a multi-disciplinary approach including services such as a re-focused course of physical therapy with a subspecialist, acupuncture, myofascial massage, nutrition optimization, smoking cessation counseling, and/or cognitive behavioral therapy. All these services have a growing body of evidence to support their efficacy in addressing contributors of musculoskeletal pain.^{33–45} Our study results also support that patient complexity is influenced, not only by clinical diagnosis, but also by symptom burden and response to treatment, and equitable reimbursement based on patient complexity is essential so that providers can dedicate the time-intensive expertise these patients require and deserve. As the United States struggles with the opioid crisis even as millions of Americans continue to report chronic pain,⁴⁶ it is clear our current model of healthcare delivery to complex musculoskeletal patients is not adequate. Improved, timely access to these multi-disciplinary

services may be an effective solution to prevent the development of chronic pain, disability, and their associated effects on morbidity and healthcare costs.

Strengths and Limitations

This study's strengths include the robust patient and provider sample size, the high PROMIS completion rate for the timeframe under study, the wide variety of provider types included in the analysis, and the use of a validated outcome measure. Also, our use of PROMIS adds to the growing body of literature regarding how to interpret PROMIS scores in various subsets of the musculoskeletal patient population. Lastly, this study examined a clinical question that has not been previously asked.

The primary study limitation is all patients were evaluated at a single tertiary care institution, so unique referral patterns, triage protocols, and physician reputations could have affected the study results. At this institution musculoskeletal providers of all types receive community referrals from surrounding rural areas, and patients are also referred from one provider type to another within the department, depending on each patient's needs. The majority of patients referred to physiatrists in this department are referred from primary care providers (63%), non-musculoskeletal specialists (20%), and other musculoskeletal/pain specialists (12%). Patients who request an appointment in the orthopedic department but do not have a provider preference and are not interested in surgery are triaged to see a conservative provider (which could be a physiatrist or other non-surgical musculoskeletal specialist). Other patients request to see a certain provider because of his/her unique expertise, irrespective of board-certified specialty training. Prospective physiatric patients are educated that the physiatrists in the department do not routinely take over chronic opioid management, although it is conceivable that some patients may still have requested to see a physiatrist because they were seeking a pain management provider. In summary, the generalizability of the study's findings to other institutions and practice environments is limited, but the results still highlight that patient-reported physical and emotional health may vary based on provider characteristics, and the physiatric patient population may be uniquely complex.

Future directions

The next logical step is to investigate whether other provider characteristics influence patient-reported health and how these various factors interact with one another and with patients' clinical characteristics. Provider characteristics to evaluate include sex and age, and potential patient characteristics of interest include pain location, pain duration, structural diagnosis, and medical and behavioral comorbidities.

CONCLUSIONS

In summary, patients who presented to physiatrists in comparison to surgical or other non-surgical musculoskeletal specialists self-reported worse average physical and emotional health symptomatology on PROMIS measures. This suggests that some patients who choose to see or are referred to see physiatrists may have more or be more willing to endorse having biopsychosocial impairments. These impairments are important to identify because they can

affect the manifestation of patients' musculoskeletal problems, and they influence patients' need for additional services to improve their pain and function.

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Figure 1:
Mean PROMIS scores for patients evaluated by each provider type. Compared to surgical and other non-surgical patients, physiatric patients had significantly worse average scores for all PROMIS domains (all $p < .001$). Error bars depict 95% confidence intervals.

Figure 2:

Proportion of patients evaluated by each provider type who met predetermined thresholds consistent with heightened emotional health symptomatology.

The PROMIS Anxiety score cutoff depicted is 62.3 or greater, and the PROMIS Depression score cutoff depicted is 59.9 or greater. Compared to surgical and other non-surgical patients, a higher proportion of physiatric patients met criteria for heightened anxiety and depression symptomatology (all $p < .001$). Error bars depict 95% confidence intervals.

Figure 3:

Percentage of patients reporting PROMIS floor scores (indicating minimal symptomatology).

Compared to surgical and other non-surgical patients, proportionately fewer physiatric patients reported the floor score on PROMIS Anxiety and Depression domains (all $p < .001$). Error bars depict 95% confidence intervals.

Table 1:

Patient demographics by provider type

Variable	Physiatrist	Surgeon	P-value*	Other Non-surgeon	P-value†
Providers	8 (17%)	34 (74%)		4 (9%)	
Total patients	2,081 (7%)	28,267 (89%)		1,443 (5%)	
Patient age (years)	55.5 ± 16.2	53.0 ± 16.1	<.001	44.3 ± 16.1	<.001
Patient sex			<.001		<.001
Female	1,267 (61%)	15,810 (56%)		794 (55%)	
Male	814 (39%)	12,457 (44%)		649 (45%)	
Race			.09		<.001
White	1,749 (84%)	23,954 (85%)		1,257 (87%)	
African American	239 (11%)	3,313 (12%)		102 (7%)	
Other	93 (5%)	1,000 (2%)		84 (6%)	
Ethnicity			.43		.07
Hispanic	25 (1%)	406 (1%)		29 (2%)	
Not Hispanic	2,047 (98%)	27,698 (98%)		1,403 (97%)	
Unknown	9 (0%)	163 (1%)		11 (1%)	

Continuous data presented as 'mean ± standard deviation,' categorical data presented as 'n (%)'.

* Comparison of physiatric patients to surgical patients.

† Comparison of physiatric patients to other non-surgical patients.

Table 2:

Patient PROMIS scores by provider type

Variable	Physiatrist	Surgeon	P-value*	Other Non-surgeon	P-value†
Physical Function v1.2					
Mean score	38.9 ± 8.2	41.5 ± 9.5	<.001	43.5 ± 8.2	<.001
Ceiling score (73.3)	1 (0%)	80 (0%)	.04	8 (1%)	.003
Floor score (15.4)	2 (0%)	42 (0%)	.54	1 (0%)	.81
Missing‡	507 (24%)	6,956 (25%)	.80	386 (27%)	.11
Pain Interference v1.1					
Mean score	62.6 ± 7.2	60.9 ± 7.7	<.001	59.2 ± 6.8	<.001
Ceiling score (83.8)	6 (0%)	61 (0%)	.50	0 (0%)	.04
Floor score (38.7)	24 (1%)	769 (3%)	<.001	24 (2%)	.20
Missing	2 (0%)	8 (0%)	.10	24 (2%)	.24
Anxiety v1.0					
Mean score	54.5 ± 10.4	51.9 ± 10.6	<.001	49.8 ± 9.8	<.001
62.3 (GAD-7 criteria)	345 (23%)	3,483 (17%)	<.001	105 (10%)	<.001
Ceiling score (84.9)	1 (0%)	58 (0%)	.13	0 (0%)	.39
Floor score (32.9)	74 (5%)	1,686 (8%)	<.001	115 (11%)	<.001
Missing‡	584 (28%)	7,260 (26%)	.02	360 (25%)	.04
Depression v1.0					
Mean score	49.3 ± 10.4	47.0 ± 10.0	<.001	44.2 ± 8.7	<.001
59.9 (PHQ-9 criteria)	318 (15%)	3,014 (11%)	<.001	61 (4%)	<.001
Ceiling score (84.4)	0 (0%)	11 (0%)	0.37	0 (0%)	-
Floor score (34.2)	387 (19%)	6,677 (24%)	<.001	444 (31%)	<.001
Missing	16 (1%)	204 (1%)	.81	13 (1%)	.67

Continuous data presented as 'mean ± standard deviation,' categorical data presented as 'n (%)'.

* Comparison of physiatric patients to surgical patients.

† Comparison of physiatric patients to other non-surgical patients.

‡ The relatively increased proportion of missing scores for PROMIS Physical Function v1.2 and Anxiety v1.0 domains are due to intervals at the beginning and end of the study period during which these domains were not collected.