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What does the patient global health assessment in RA really tell us? Contribution of specific dimensions of health-related quality of life

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Abstract

Objective: To estimate the contributions of health-related quality of life domains to the patient global assessment of health (PGA) in RA.

Methods: Data are drawn from baseline visits of two observational RA cohorts. Participants completed patient-reported outcome measures (PROMs) including PGA and Patient-Reported Outcomes Measurement Information System (PROMIS®) measures and clinical data were collected. Factor analysis was used to identify latent variables, and multivariable linear regression was used to estimate determinants of PGA.

Results: Patients were mostly female (81%), white (78%), and had established disease (mean 12.3 years (SD 10.7), with 62% in remission or LDA. In Cohort 1 (n=196), two factors emerged: 1) **daily function** (moderate-strong (i.e., >|0.65| loadings of physical function, pain interference, social participation, and fatigue, and weak (>0.35) loadings of sleep disturbance; and 2) **emotional distress** (strong loadings of depression and anxiety). In crude analysis, daily function explained up to 53% and emotional distress up to 20% of the variance in PGA. In both cohorts, in adjusted analyses, daily function and to a much lesser extent swollen joint count independently predicted PGA; age was inversely related to PGA in Cohort 1 only.

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Conclusion: These findings suggest that in patients with RA, PGA ratings largely reflect the extent to which patients feel they can function in everyday roles and are not impacted by mood. This suggests that higher than expected PGA scores may offer an opportunity to discuss patient expectations regarding roles and activities, and the impact of their RA symptoms on daily function.

Keywords

Rheumatoid arthritis; Patient-reported outcomes; Quality of life; Disease activity

Introduction

Modern treatment of rheumatoid arthritis (RA) is driven by a treat-to-target approach. Using disease activity indices, treatment is tailored to achieve a remission state, with guidance of patients through shared decision-making. The most commonly used composite measures, including the DAS28, CDAI, SDAI, and ACR Boolean remission, all include a patient-reported domain, the patient global assessment (PGA). The PGA is the single component of these composite measures most likely to impact attainment of remission in the CDAI, DAS28, and ACR/EULAR Boolean remission criteria; in a recent cohort, 10% of patients failed to meet ACR/EULAR Boolean Remission Criteria based on PGA >1 alone (1,2). Despite this central role in assessment of disease activity, the specific aspects of the patient experience of RA which contribute to the PGA are not well-understood.

Many studies have investigated the relative contribution of various health-related quality of life (HRQL) domains to the PGA. Although results have varied, most concluded that major contributors to the global health PGA include pain, physical function, function, fatigue, and others (3). However, previous studies often relied on single item pain and fatigue rating scales (NRS) and the Health Assessment Questionnaire (HAQ) to assess physical function. The HAQ is unable to discriminate among those with high levels of function, hindering interpretation in those with relatively well-controlled disease (4). In addition, many factors identified as predictors of PGA are highly correlated which often has not been considered when interpreting results.

In the present study, we utilized the Patient Reported Outcome Measurement Information System (PROMIS®) domains assessing HRQL to assess their independent contribution to PGA. PROMIS was developed using item response theory (IRT) and offers item banks that can be utilized for computer adaptive testing (CAT) to assess physical, emotional and social health and static short forms for each item bank. PROMIS measures have been shown to be precise, reliable, and relevant in people with RA (5,6), and the physical function CATs and short forms have more robust psychometric properties than HAQ or SF36 PF scale (7,8). We used factor analysis to identify underlying dimensions of HRQL in explaining the PGA (global health). We hypothesized that aspects of HRQL that impacted day to day function would more strongly associate with the PGA than those associated with emotional distress. The protocol was approved by the Johns Hopkins Institutional Review Board (NA_00071923 for Cohort 1, IRB00059930 for Cohort 2) and all participants gave written consent.

Materials and Methods

Data were drawn from the baseline visit of two observational cohorts of RA patients receiving guidelines-based treatment at academic arthritis centers.

Cohort 1

This cohort (derivation cohort) was used to derive a smaller set of initial factors which could then be applied to Cohort 2 (replication cohort). Participants were RA patients receiving treatment at the Johns Hopkins Arthritis Center from 2012 to 2015 (described here (6)). In brief, all patients were fluent in English and met the 2010 ACR/EULAR Classification Criteria for RA (9). Exclusion criteria included significant medical or psychiatric comorbidities including other inflammatory diseases. Study visits occurred during routine care visits.

Demographics, medications, fibromyalgia diagnosis, RA characteristics, and serologic data (RF, anti-CCP antibody) were recorded from the patient chart. Disease activity measures including evaluator global assessment (EGA) and 28-joint swollen and tender joint counts (SJC28 and TJC28) were assessed by trained professionals. ESR and CRP were collected at or adjacent to the visit.

PGA was phrased as: “Considering all the ways arthritis affects you, put a single line (|) on the scale to show how well you are doing” (0 – Very well to 100 – Very Poorly). PROMIS CATs (v 1.0 with exception of *Ability to Participate in Social Roles*) were used to assess *Physical function, Anxiety, Depression, Fatigue, Sleep disturbance, Ability to Participate in Social Roles (v2.0), and Pain Interference*. PROMIS uses a T-score metric (mean 50, SD 10) where higher scores reflect more of the symptom being measured. Specific items, anchors, and sample tests are available at <http://www.healthmeasures.net>. Other PROMs included pain visual analog scale (pain VAS (0-100)), self-reported flare (“Today, are you having a flare of your arthritis?” (yes/no)).

Cohort 2

Baseline data from a multicenter cohort of RA patients followed at three academic rheumatology clinics were used as a replication cohort. Similar sociodemographic and RA characteristics were collected as in Cohort 1; BMI and fibromyalgia diagnoses were not available. The Charlson Comorbidity Index was calculated (insufficient comorbidity data was available for Cohort 1).

In this cohort, PGA was collected as a numerical rating scale (NRS), phrased as “Today, considering all the ways arthritis affects you, how well are you doing?” (0 – Very well, 10 – Very poorly).

PROMIS short forms which have similar measurement properties to PROMIS CATs were used in this study (10): *Anxiety 4a, Depression 8a, Fatigue 7a, Physical Function 20a, Pain Interference 8a, Sleep Disturbance 4a (all v1.0), and Ability to Participate in Social Roles SF 8a (v2.0)*. Other PROMs were the same as those used in the derivation cohort.

Some patients (n=92) participated in both cohorts. These patients were included only in analysis of Cohort 1.

Statistical Analysis

Factor analysis was performed to identify underlying dimensions among the PROMIS domains. Factor analysis identifies correlated structures of variables, groups variables onto a discrete number of factors, and indicates the strength of association of each variable with the factor. Factor analysis was conducted using a maximum likelihood approach and the oblimin method of rotation to allow correlation between the factors (11). Principal component analysis (PCA) was performed (12), and the number of factors to be retained was determined using the location of the “shoulder” of a scree plot (13). Eigenvalue approach and parallel analysis were also applied for comparison. A standardized score was obtained for each individual (mean 0, SD 1) and used in regression analyses.

Univariable linear regression was first conducted for each factor on PGA. A multivariable regression was then performed that included the identified factors, age, sex, BMI, RA duration, and swollen joint count on PGA. Swollen joint count was used as an indicator of disease activity. SJC was chosen over inflammatory markers as many comorbid conditions may drive elevation of ESR or CRP (ie obesity, renal failure), and some medications (ie tocilizumab) may directly interfere with interpretation of these values. Variables were chosen due to empirical and theoretical associations with PGA.

All statistical procedures were repeated in Cohort 2. Covariates in the multivariable linear regression included age, sex, comorbidities (CCI), RA duration, and swollen joint count. Sensitivity analyses were performed to assess robustness of the above findings. In each cohort, factor analysis and regressions were repeated stratified by sex, race (Caucasian vs other), education (some college or more vs high school or less) and RA disease duration (3 years vs. >3 years). Statistical analysis was performed using STATA/IC 14.1 software (14).

RESULTS

Sample Characteristics

The characteristics of the 196 participants in Cohort 1 and 262 participants in Cohort 2 are shown in Table 1. As is typical of many RA studies, patients were mainly female, Caucasian, seropositive, with established disease and two thirds were in remission or low disease activity (68% in Cohort 1, 60% in Cohort 2). Medications were also similar in both cohorts with most patients on either csDMARD monotherapy or csDMARD + biologic therapy.

In the Cohort 1, three participants had missing data for one PROMs. Missing data was similar in Cohort 2, with 6 participants with missing data. These participants were not included in factor analysis. Table 2 shows the means and ranges of PROMIS scores for the cohorts. Across all domains, the cohorts were similar, with mean values within the normal range for each domain.

Cohort 1

In Cohort 1, the scree plot suggested two components. PCA also revealed two components with eigenvalues >1 , and similar results were seen with parallel analysis, which fell just above a threshold of two components.

Rotated values for factors are shown in Table 3. F1, which we termed daily function, had strong (>0.7 or <-0.7) negative loadings with physical function and social participation, moderate-strong positive (>0.67) loadings with pain interference and fatigue and weak (>0.3) loadings on sleep disturbance. F2, which we termed emotional distress loaded strongly with depression and anxiety.

Table 4 shows results of regression in Cohorts 1 and 2. In univariate regression, daily function accounted for 53% of the variance in PGA; the PGA increased by 21.5 points ($p<0.001$) for each 1 SD increase (i.e., with worsening daily function). Emotional distress accounted for 15% of the PGA variance. Fibromyalgia diagnosis, higher SJC (a surrogate for disease activity), and BMI were also correlated with higher PGA. In multivariable regression, daily function, SJC and age were independent predictors explaining 57% of the variance in PGA. Notably, emotional distress was not associated with PGA in either crude or adjusted analyses.

Among those reporting current flare, mean F1 was 0.55 SD above the mean, while those not in flare had mean F1 -0.15 SD below the mean ($p<0.0001$). In contrast, there was no significant difference ($p=0.07$) in emotional distress factor scores by flare status. In sensitivity analyses, when stratified for sex, race, level of education, and disease duration, factor structures and regression results remained unchanged (data not shown).

Cohort 2

Results of PCA in Cohort 2 also supported two factors. Rotated factor loadings are shown in Table 3. Again, the daily function factor loadings were strongest for physical function, pain interference, social participation (all $>|0.9|$) and fatigue. Sleep disturbance loaded weakly on this factor. Depression and anxiety loaded strongly on F2 (emotional distress). In univariable analysis daily function, emotional distress, SJC and female sex were associated with PGA. In adjusted analyses, only daily function and SJC were independently associated with PGA. Results were similar when stratified by sex, race, level of education, and disease duration (data not shown).

DISCUSSION

Despite inclusion of the PGA in most indices of RA disease activity, the primary contributors to global health PGA scores are unclear. Our data suggest that two underlying dimensions of HRQL in RA are factors we termed daily function and emotional distress. Daily function encompasses physical function, pain interference, social participation, fatigue, and to a lesser extent sleep disturbance, while emotional distress reflects depression and anxiety. In models that were developed then replicated in two diverse observational RA patient cohorts, we found that more than half the variance of the PGA was explained by

daily function. Conversely, in adjusted models, emotional distress was not an independent predictor of PGA.

Others have reported that pain and physical function are strongly associated with the PGA (3,15–26). Along with pain and function, fatigue and social participation also loaded strongly on this HRQL dimension factor, and sleep disturbance to a lesser extent. In an international survey of 274 RA patients, improved pain, fatigue, and physical function were described as essential characteristics of remission (27) or the absence of disease activity. The validated RA Flare Questionnaire (RA-FQ), a measure developed using domains identified by consensus among several hundred RA patients, rheumatologists and other stakeholders, also includes the domains of pain, physical function, participation, and fatigue, and adds stiffness (28,29). The finding that patients who rated themselves as flaring had significantly worse daily function factor scores (though similar scores on emotional distress) also supports the importance of these domains to how patients perceive their overall health.

In both cohorts, emotional distress was not independently associated with the PGA after controlling for daily function and sociodemographic and RA characteristics. Further, though average mood scores were in the normal range, about 1 in 5 in our samples had high depression or anxiety scores (i.e., ≥ 60). Our findings suggest that generally, mood does not significantly influence patient ratings of their overall health. Ferreira et al (2017) reported similar findings when assessing predictors of the PGA among 1588 patients with RA (24). However, others have reported anxiety and depression were significantly associated with the PGA (15,17,18,21,22,25,30,31). Several explanations may account for differing findings regarding the effect of emotional distress in the PGA. Others have used a variety of measures to assess emotional distress including the Hospital Anxiety and Depression Scale (HADS) (15,25,31,32), Arthritis Impact Scale (AIMS) (18), PHQ-9 (22), CES-D (26,30), Psychological HAQ (33), emotional well-being VAS (17), or RA Impact of Disease (RAID) emotional well-being scores (24). The present study utilized PROMIS Depression and Anxiety scales, which were developed using IRT and in consultation with investigators of several of the legacy instruments previously used. PROMIS scales incorporated items and constructs from legacy scales such as the HADS, CES-D and Beck Depression Inventory, and correlate strongly with these measures (34,35). PROMIS has, however, improved on precision relative to many legacy instruments, and has a broader base of data to suggest validity in wider patient populations (34).

Additional differences may be found in statistical methodology. Several prior studies suggesting association between depression/anxiety and PGA utilized only univariate regression, (17,25,31). The present analysis suggests that while emotional distress may be associated with the PGA, this association does not persist after adjusting for daily function. Other differences may relate to sample characteristics; for example, Smedstad et al (1997) found association between PGA and depression (AIMS) in patients with disease duration < 4 years (18). It is not surprising that patients early in their disease course may perceive the impact of their disease differently than those who have adjusted to living with RA over time. On average, disease duration in our sample was 12 years. Notably, however, sensitivity analysis among those with disease duration 3 years or less to those with more than 3 year duration yielded similar factors and relationships with the PGA.

In the QUEST-RA cohort of 7023 patients with established RA (mean duration 11 years), psychological status (i.e., Psych-HAQ) influenced both PGA (global health) and PGA (disease activity), when adjusted for pain VAS, fatigue VAS, HAQ, and other demographic characteristics and comorbid conditions, including fibromyalgia diagnosis (33). Absent from this analysis, however, was social participation, which was included here as a major component of daily function. The differences from our results imply that when additionally controlled for participation, emotional distress no longer plays a determining role in the PGA. Additionally, the only measure of physical function used in the QUEST-RA cohort was the HAQ, which is unable to discriminate among those with high levels of function (4). The PROMIS instrument used in the present study, in contrast, performs better in populations with high levels of function, and thus is likely to capture differences that may not have been seen in QUEST-RA.

The approach used in this study, using factor analysis as a data reduction tool, has been previously applied to this question. In the present study, we began by identifying a discrete set of HRQL domains *a priori* that RA patients have reported are highly relevant to them (36). In a cohort of 70 patients, Challa et al (2017) utilized a broader range of variables including binary diagnoses (osteoarthritis, fibromyalgia, etc) and a mixed set of PROMs, and found 8 distinct constructs related to the PGA (22). The 8 factors grouped primarily similar instruments onto each factor (pain VAS, PROMIS Pain Interference, and Short Form McGill Pain Questionnaire-2 on F1; PROMIS Fatigue and Bristol Rheumatoid Arthritis Fatigue scale on F2; 3 separate measures of anxiety and depression on F3, etc). While this large number of constructs stands in contrast to the two seen here, the first two factors seen in their study closely resemble daily function identified by our study, grouping pain, social participation, and fatigue within the top two factors. In addition, they similarly found no significant association of any emotional distress factors to the PGA, though they did not adjust for covariates outside the latent factors.

Within our cohort, other unmeasured factors contributed to the remaining variance in PGA unexplained by our analysis (~45%). For example, patient characteristics such as structural damage, osteoarthritis and back pain, self-efficacy, health beliefs, health literacy and socio-cultural determinants also contribute to overall health and wellbeing. Similarly, subtle differences in RA disease activity not reflected swollen joint counts and inflammatory markers may attribute for some of the variance not explained in this model.

It is important to note some considerable strengths of the present study. The inclusion of Cohort 2, designed to improve upon a lack of diversity in Cohort 1, allowed for a more diverse sample of participants than often seen in studies of RA, and included arthritis care centers in varied geographic locales. In addition, a wide array of clinical indicators, including both PROMs and detailed disease activity measures were available for analysis. Finally, the statistical approach employed allowed the distillation of multiple interrelated variables to a discrete number of constructs. This in turn allowed for regression analysis of these closely correlated measures.

Limitations of this study, however, also are acknowledged. Despite efforts to improve upon diversity, we do acknowledge that samples were mostly white and female, with established

RA. Determinants of PGA may differ in other groups of individuals including those with earlier disease. However, we note that Cohort 2 specifically oversampled minorities to achieve a diverse sample, and our sensitivity analyses found results were unchanged when samples stratified by sex, race, level of education, or disease duration. Nonetheless, future work in this area would benefit from further study of more diverse populations and those with early RA. Future studies would benefit from routine assessment of fibromyalgia in participants (22).

In conclusion, using optimal measures of HRQL in a large, diverse sample of people with RA, we identified two underlying dimensions of HRQL in RA that we termed daily function and emotional distress. We found that daily function alone explained more than half of the variance in PGA (global health) of RA patients, underscoring the central role that being able to function independently, fulfill social roles and participate in meaningful activities play when judging health. Perhaps this is what patients are describing when they say they wish to feel “normal” again. After controlling for daily function, our second factor, emotional distress, did not offer additional information about PGA. Our results are also limited to the global health version of the PGA and may not be generalizable to the version that asks patients to rate their overall disease activity.

These findings have important implications for patient-centered arthritis care. Our results suggest that when rating their global health, RA patients are strongly influenced by their ability to function in everyday roles. In contrast, the lack of association between the PGA and emotional distress suggests when PGA scores are higher than expected given the patient’s clinical profile, this offers a good opportunity to discuss with patients their expectations regarding roles and activities, and the extent to which RA symptoms may limit their ability to function and fulfill important roles. While we found no consistent evidence that emotions play a substantive role in PGA scores, but acknowledge this may be an important determinant for specific individuals.

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Significance and Innovation

- We identified two dimensions of health-related quality of life in patients with RA: “Daily function” (including physical function, pain interference social participation, fatigue, and weakly sleep disturbance) and “Emotional distress” (including anxiety and depression).
- “Daily function” explained 53% of the variance score, and “Emotional Distress” explained 15% of patient global assessment of health (PGA) scores
- Daily function, emotional distress, SJC, sex, and comorbidities were each associated with PGA; in adjusted analyses, daily function and to a smaller extent swollen joint count accounted for 52% of the variance of PGA
- These findings suggest that generally when RA patients rate their global health, they are primarily describing the impact of RA impact upon their daily function

Table 1:

Baseline characteristics of participants in derivation and replication cohorts.

	Cohort 1	n	Cohort 2	n
Age (mean (SD); years)	54.8 (13.4)	196	56.6 (13.9)	262
Female sex, n(%)	158 (81)	196	213 (82)	260
RA duration (mean (SD); years)	11.0 (9.6)	196	13.2 (11.4)	252
Seropositive [RF or anti-CCP antibody], n(%)	152 (78)	196	196 (80)	245
Race, n (%)		196		260
Caucasian	162 (83)		193 (74)	
Black	25 (13)		34 (13)	
Other	9 (4)		33 (13)	
Charlson Comorbidity Index (median (IQR))	n/a	n/a	3 (1, 4)	262
Fibromyalgia diagnosis, n(%)	11 (6)	194	n/a	n/a
Clinical Disease Activity Index (median (IQR))	6.4 (1.8, 11.8)	195	7.8 (3.0, 15.0)	253
Remission, n(%)	62 (32)		54 (21)	
Low, n(%)	70 (36)		98 (39)	
Mod to High, n(%)	64 (32)		101 (40)	
Tender Joints [0-28] (median (IQR))	0 (0, 2)	196	1 (0, 3.5)	260
Swollen Joints [0-28] (median (IQR))	1 (0, 4)	196	1 (0, 4)	261
Evaluator Global (health) (0-100; median (IQR))	10 (3, 20)	195	18 (5, 32)	258
Patient Global (health) (Cohort 1- 100 mm VAS; Cohort 2 - 0-100 NRS; median (IQR))	20 (5, 50)	196	30 (10, 50)	259
ESR (median (IQR); mm/h)	14 (5, 29)	180	13.5 (5, 29.5)	148
CRP (median (IQR); mg/dL)	0.3 (0.1, 0.7)	184	0.3 (0, 0.9)	187
Baseline DMARD regimen		196		262
csDMARD only, n (%)	94 (48)		100 (38)	
Biologic only, n (%)	12 (6)		40 (15)	
csDMARD + Biologic, n (%)	77 (39)		99 (38)	
No DMARDs, n (%)	13 (7)		23 (9)	

EGA – Evaluator Global Assessment; PGA – Patient Global Assessment; DMARD – disease modifying antirheumatic drugs; csDMARD - conventional synthetic disease modifying antirheumatic drugs.

Table 2:

Baseline mean PROMIS T-scores and ranges in derivation and replication cohort.

Domain*	Cohort 1 (n=193)			Cohort 2 (n=260)		
	Mean (SD)	Range		Mean (SD)	Range	
Physical Function	43.7 (8.9)	24.1 - 70.1		40.5 (9.7)	21.0 - 62.5	
Anxiety	50.5 (8.3)	33.6 - 71.1		51.1 (9.7)	40.3 - 75.0	
Depression	48.7 (8.8)	34.9 - 71.6		49.0 (9.4)	38.2 - 81.1	
Fatigue	53.6 (10.1)	26.3 - 76.0		55.0 (10.7)	29.4 - 78.6	
Sleep Disturbance	51.5 (9.7)	27.5 - 73.8		52.0 (10.5)	32.0 - 73.3	
Social participation	50.5 (8.9)	22.4 - 66.4		47.2 (10.2)	25.9 - 65.4	
Pain Interference	53.5 (9.3)	39.1 - 73.7		57.6 (10.1)	40.7 - 77.0	

* All instruments were CAT in cohort 1. Cohort 2 used the following short forms: Physical Function 20a, Anxiety 4a, Depression 8a, Fatigue 7a, Sleep disturbance 4a, Social participation 8a, Pain interference 8a.

Table 3:

Rotated factor loadings for each PROMIS domain in derivation and replication cohorts.

Domain*	Cohort 1 (n=193)		Cohort 2 (n=260)	
	Factor 1	Factor 2	Factor 1	Factor 2
Physical Function	-0.96	-0.15	-0.92	0.01
Anxiety	-0.02	0.98	0.03	0.97
Depression	0.11	0.78	0.07	0.83
Fatigue	0.67	0.18	0.70	0.21
Sleep Disturbance	0.39	0.18	0.46	0.23
Social Participation	-0.70	0.16	-0.99	0.06
Pain Interference	0.78	0.09	0.93	0.01

*. In cohort 1, all instruments CAT v1 except Social Participation (CAT v2). Cohort 2 used the following short forms: Physical Function 20a, Anxiety 4a, Depression 8a, Fatigue 7a, Sleep disturbance 4a, Social participation 8a, Pain interference 8a.

Table 4: Univariate and multivariable predictors of patient global assessment in two cohorts of rheumatoid arthritis patients.

	Cohort 1				Cohort 2			
	Univariable		Multivariable*		Univariable		Multivariable**	
	β (SE)	p-value	R^2	β (SE)	p-value	β (SE)	R^2	p-value
F1 (Daily function)	21.0 (1.4)	<0.001	0.53	21.5 (2.0)	<0.001	19.5 (1.2)	0.50	<0.001
F2 (Emotional Distress)	11.1 (1.9)	<0.001	0.15	-1.34 (1.8)	0.46	12.4 (1.6)	0.20	0.38
RA Duration	0.30 (0.2)	0.15	0.01	0.20 (0.2)	0.17	0.08 (0.1)	0.59	0.00
Swollen Joints	2.69 (0.6)	<0.001	0.11	0.87 (0.4)	0.048	2.56 (0.5)	0.10	0.86
BMI	0.55 (0.3)	0.04	0.02	-0.31 (0.2)	0.11	n/a	n/a	n/a
Charlson Comorbidity Index	n/a	n/a	n/a	n/a	n/a	1.51 (0.9)	0.01	0.94
Female Sex	-0.44 (5.0)	0.93	0.00	-5.87 (3.6)	0.10	11.0 (4.3)	0.01	5.46
Age (decade)	-0.5 (2.0)	0.73	0.00	-2.5 (1.0)	0.02	-0.1 (1.0)	0.92	-1.5
Fibromyalgia Diagnosis	24.0 (8.4)	0.01	0.04	4.16 (6.0)	0.49	n/a	n/a	n/a

F1 (daily function) loads most strongly with physical function, pain interference, social participation, fatigue. F2 (emotional distress) loads strongly only with depression and anxiety. Cohort 1 n=191; Cohort 2 n=244.

* Adj $R^2 = 0.57$

** Adj $R^2 = 0.52$