Full Title: Anxiety and Depressive Symptoms in Juvenile Idiopathic Arthritis Correlate with Pain and Stress Using PROMIS Measures

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Key Indexing Terms: Juvenile Arthritis, Anxiety, Depression, Patient Reported Outcome Measures

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The source(s) of support in the form of grants or industrial support: This study did not receive any financial support or other benefits from grants or commercial sources.

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Conflict of interest: There are no financial interests of any of the authors that could create potential conflicts of interest in regards to this study.

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Short running head (maximum of 4 words): Depression, Anxiety in Juvenile Arthritis

ABSTRACT

Objective: Describe anxiety and depressive symptoms in children with juvenile idiopathic arthritis (JIA) using Patient-Reported Outcome Measurement Information System (PROMIS) measures and evaluate potential correlations with disease manifestations.

Methods: We performed a cross-sectional study of children with JIA and a parent-proxy who completed PROMIS measures on depression, anxiety, stress, and pain. The Childhood Health Assessment Questionnaire (CHAQ) measured mobility, and the clinical juvenile arthritis disease activity score (cJADAS10) measured disease activity.

Results: 84 patients completed the study. Demographic median values included: age 14 years, disease duration 4.73 years, CHAQ score 0, total active joint count 0, and cJADAS10 score 2. Using cJADAS10, 57 patients (68%) had inactive or low disease activity. Mean PROMIS T-scores for depressive and anxiety symptoms were lower in children with JIA compared to the reference population ($p<0.0001$). Nineteen patients (23%) had moderate to severe symptoms of anxiety and/or depression. Age and CHAQ score (mobility) correlated with depressive symptoms ($r=0.36$, $p=0.0008$; $r=0.32$, $p=0.0029$, respectively) but not anxiety. Depressive and anxiety symptoms correlated with pain ($r=0.64$ and $r=0.47$ respectively; $p<0.0001$) and stress ($r=0.79$ and $r=0.75$ respectively; $p<0.0001$) but not with gender, JIA subtype, disease duration, or disease activity.

Conclusions: Approximately one-quarter of children with JIA reported moderate to severe symptoms of anxiety and depression. These symptoms are associated with pain and stress, but they are not associated with other disease manifestations. Understanding how mental health symptoms and JIA impact one another is necessary in order to improve patient outcomes and provide well-rounded care.

INTRODUCTION

There has been a recent increase in depressive symptoms in adolescents (1, 2). Children with chronic diseases have higher rates of depression and anxiety than healthy children and experience less favorable mental health outcomes (3-8). Juvenile idiopathic arthritis (JIA) is the most common chronic pediatric rheumatic disease. Children with JIA experience joint pain and swelling, morning stiffness, and limited mobility. Long term consequences of JIA include joint damage, muscle weakness and atrophy, growth disturbances, uveitis, and medication side effects (9). JIA also likely impacts patients psychologically. However, studies of depression and anxiety in children with JIA and the potential association of these symptoms with disease manifestations have been limited (10-16).

A recent systematic review on depression and anxiety in JIA reported that 7-36% of patients had depressive symptoms while 7-64% had anxiety symptoms, and both correlated with a worse quality of life (17). Some studies report an increased risk for depression or anxiety in children with JIA compared to healthy children while others do not (11, 16-21). Additionally, children with JIA have similar rates of mental health disease compared to most other chronic childhood diseases (21, 22). The correlation between depression, anxiety, and JIA disease manifestations has not been well-explored, and the results are mixed (11-13, 16). Understanding this relationship would provide insight into how mental health and JIA impact one another which can aide physicians in providing well-rounded care. Furthermore, half of pediatric rheumatologists believe there is an unmet need in the identification and treatment of mental health disease within their practices and only 8% use a standardized assessment (23).

The Patient Reported Outcomes Measurement Information System (PROMIS®) was developed to standardize and validate measures for assessing patient-reported outcomes across

all medical conditions and phases of life. Measures are available for children and adults across several domains including social, physical, and mental health. The pediatric PROMIS measures are available for ages 8-17 years and parent-proxy assessments are available for ages 5-17 years (24-27). Some measures have been validated in JIA (26, 28).

The primary aim of our study was to utilize PROMIS measures to evaluate the prevalence of symptoms of depression and anxiety in a cohort of children with JIA. A secondary aim was to assess the potential correlation between anxiety and depressive symptoms and JIA disease manifestations such as subtype, age, disease duration, disease activity, mobility, pain, stress, and treatment.

MATERIALS and METHODS

Patients

Patients were recruited from two pediatric rheumatology clinics, Children's Wisconsin (CW) and Indiana University (IU), from March to November 2019. Inclusion criteria were: 1) onset of JIA before 16 years of age based on International League of Associations for Rheumatology (ILAR) criteria (29); 2) ages 8-17 years; and 3) guardian and patient were fluent in English. The sole exclusion criteria was patients and/or legal guardians who did not have decision making capacity. Written informed consent was obtained from the legal guardian, and assent of the patient was obtained when required. Approval was obtained by Children's Wisconsin IRB (#1291621) and Indiana University IRB (#1907054243).

Control Group

The PROMIS mental health measures' reference general pediatric population served as a historical control cohort. They were recruited from public schools, pediatric subspecialty clinics, and hospital-based outpatient pediatric clinics in North Carolina and Texas. This cohort consists

of children ages 8-17 years old (53% female, 59% white, 21% African American, 17% Hispanic, and 23% with an unspecified chronic condition) (30).

Data Collection:

Study data were collected using REDCap (Research Electronic Data Capture) (31). Data included: age, gender, race/ethnicity, age of initial JIA diagnosis, JIA subtype, number of joints involved throughout disease course, disease duration, current medications, history of other chronic illnesses, and any psychiatric concerns and/or diagnoses.

Mental Health Assessments:

Mental health symptoms were evaluated using the PROMIS Pediatric Short Form v2.0 - Anxiety 8a and PROMIS Pediatric Short Form v2.0 – Depressive Symptoms 8a measures and the PROMIS Parent Proxy Short Form v2.0 – Anxiety 8a and PROMIS Parent Proxy Short Form v2.0 – Depressive Symptoms 6a (30, 32, 33). Each measure requests answers based on the prior week. The depressive symptoms measure focuses on sadness, guilt, criticism, worthlessness, loneliness, interpersonal alienation, loss of interest, loss of meaning, and loss of purpose while the anxiety symptom measure focuses on fear, panic, worry, dread, hyperarousal, and somatic symptoms related to arousal (34). These measures are non-diagnostic, but they provide information about description and quantification of a patient's symptoms. The PROMIS pediatric depressive symptoms and anxiety measures have been clinically validated in JIA (28). Stress was measured separately from mental health symptoms using the PROMIS Pediatric Short Form v1.0 – Psychological Stress Experiences 8a and PROMIS Parent Proxy Short Form v1.0 – Psychological Stress Experiences 8a measures (35, 36).

PROMIS measures elicit a raw score which is converted into a standardized T-score with a mean of 50 and standard deviation of 10 (37). Interpretation of PROMIS T-scores depends on

the reference population used to center and calibrate each measure. The PROMIS pediatric depressive symptom and anxiety measures were determined using a sample from the general pediatric population (30, 38). This suggests that a T-score of 50 on either measure reflects the average anxiety or depressive symptom score for the general pediatric population. Higher T-scores indicate a stronger degree of a specific concept measured, and for the anxiety and depressive symptom measures, a higher T-score correlates with worse symptoms.

PROMIS anxiety and depressive symptom measures are interpreted as follows: normal: T-score < 50, mild symptoms: T-score 50 to ≤ 54, moderate symptoms: T-score 55 to ≤ 64, and severe symptoms: T-score ≥ 65 (37). We chose a T-score ≥ 65 to indicate a clinically significant result based on previous historical childhood behavior and depression assessments (39-41).

Mobility Assessment:

The Childhood Health Assessment Questionnaire (CHAQ) has eight categories: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities and asks about use of aids/devices such as jar openers or shower seats. It is scored from 0 (best) to 3 (worst) (42).

Supplemental Assessments:

Patients and guardians completed the PROMIS Pediatric Short Form v2.0 – Pain Interference 8a and PROMIS Parent Proxy Short Form v2.0 – Pain Interference 8a measures which are validated in JIA (28, 32, 33, 43, 44). They are scored similar to the PROMIS pediatric mental health symptom measures (37).

Patients and guardians also completed the PROMIS Pediatric Short Form v1.0 – Psychological Stress Experiences 8a and PROMIS Parent Proxy Short Form v1.0 – Psychological Stress Experiences 8a measures (35, 36). They are scored from very low to very high with an average T-score range of 40-60. T-scores that are one to two standard deviations (1

SD = 10) from the mean are low/high. T-scores more than two standard deviations from the mean are very low/very high (37).

Disease Activity Assessment:

JIA disease activity was measured using the clinical Juvenile Arthritis Disease Activity Score (cJADAS10). The cJADAS10 consists of three components: physician global assessment of disease activity, parent/patient global assessment of well-being, and number of active joints up to 10. This is scored from 0 to 30 with higher numbers indicating greater disease activity (45). The cutoff values for disease activity using the cJADAS10 were established using only two classifications: oligoarticular and polyarticular. Patients were assigned to either classification based on the number of affected joints during their disease course. Disease activity cut-offs for inactive, low, moderate, and high disease activity were based on prior publications (46, 47).

STATISTICAL ANALYSES

Frequency tables were generated for categorical variables. Descriptive statistics were used to summarize continuous variables. To assess the relationship between two continuous variables, Spearman's correlation was utilized. To compare continuous variables between groups, the Kruskal-Wallis test was used. Due to small patient numbers in some of the JIA subtypes, the groupings for the correlation analysis between JIA subtype and the PROMIS pediatric mental health T-scores included: oligoarticular, polyarticular, undifferentiated, and other (psoriatic, systemic, and enthesitis-related arthritis (ERA)). The Wilcoxon Signed-Rank test compared continuous variables between patient and parent surveys.

Regression tree analysis was used to screen for the most important predictors for the outcome variables, PROMIS pediatric depressive symptoms and anxiety T-scores. This is a nonparametric recursive classification method that can identify interactions and possible

thresholds without limiting input variables. The tree was optimized with the least absolute deviation method and 10-fold cross validation. The split criteria minimum was 10 for the parent nodes and 5 for the terminal nodes. Predictor variables included in the tree analysis were: demographics, JIA disease subtype, disease duration, disease activity, functional ability, PROMIS pediatric pain interference T-scores, PROMIS pediatric psychological stress experience T-scores, history of mental health disease, other chronic medical illnesses, and medication use. The most important predictor variables identified by the tree analysis were used in the multivariable analysis. The multivariable analysis was performed using generalized linear models with gamma distribution and log link function. Data is complete in our primary analysis. Missing data is very minimal and was excluded in some secondary analyses. Software SPM 8.2 was used for the regression tree screening, while the software SAS 9.4 was used for the other analyses. $P<0.05$ was considered statistically significant.

RESULTS

Patient Demographics

Eighty-seven patients were recruited (78 at CW and 9 at IU). Two patients were subsequently excluded due to age. One subject was unable to complete the PROMIS surveys. Therefore, the final analysis included data from 84 patients.

Patient demographics are summarized in Table 1. The majority of children with JIA had either oligoarticular JIA (36%; 50% extended) or polyarticular (32%; 81% rheumatoid factor (RF) negative) with 52% receiving biological disease modifying anti-rheumatic drugs (DMARDs) and 39% receiving a conventional synthetic DMARD. Approximately 42% had a second chronic disease in addition to JIA.

The median total active joint count was 0 (range 0-11). Fifty-seven percent of patients had 0 total active joints and 26% had 1-2 total active joints. Seven percent had 10 or more total active joints, and the remaining 10% had between 3 and 9 total active joints. The median cJADAS10 score was 2 (range 0-23), and the median CHAQ score was 0 (range 0-1.75; 57% scored 0). JIA disease activity based on cJADAS10 scores and the total number of joints a patient experienced during their disease course (oligoarticular ≤ 4 joints and polyarticular > 4 joints) is provided in Table 2.

Prevalence of Mental Health Symptoms

Table 3 summarizes the PROMIS pediatric depressive symptoms and anxiety T-scores. Fifty-six patients (67%) had T-scores less than 50 on the PROMIS pediatric depressive symptoms measure while 28 patients (33%) had T-scores greater than 50. Specifically, 13 (15%) had T-scores of 50 to ≤ 54, indicating mild depressive symptoms; 14 (17%) had T-scores of 55 to ≤ 64, indicating moderate depressive symptoms; and 1 patient had a T-score ≥ 65, indicating severe depressive symptoms.

Fifty-nine patients (70%) had T-scores less than 50 on the PROMIS pediatric anxiety measure while 25 patients (30%) had T-scores greater than 50. Specifically, 11 (13%) had T-scores of 50 to ≤ 54, indicating mild anxiety symptoms; 13 (16%) had T-scores of 55 to ≤ 64, indicating moderate anxiety symptoms; and 1 patient had a T-score ≥ 65, indicating severe anxiety symptoms.

Nine patients (11%) had T-scores in the moderate symptom range on both PROMIS pediatric mental health measures. Another 9 patients had a combination of mild to severe symptoms on both PROMIS pediatric mental health measures. The anxiety and depression T-scores were highly correlated ($r=0.73$, $p<0.0001$). In comparison to the historical control cohort,

who had a mean T-score of 50 ± 10 on both mental health measures, the patients in this study had significantly lower depressive symptoms and anxiety mean T-scores ($p<0.0001$). The patient mean PROMIS pediatric depressive symptoms T-score was 45.2 ± 9.3, whereas the mean PROMIS pediatric anxiety T-score was 44.4 ± 9.1 (Table 3).

Twelve patients (14%) had a prior history of diagnosed mental health disease. All had a history of anxiety and 6 (7%) had a history of depression. Some patients reported other mental health disease including post traumatic stress disorder (PTSD), obsessive compulsive disorder (OCD), selective mutism, and anger. Ten patients had received medications for anxiety while 5 had received medications for depression.

Twelve parents (17%) reported concerns for an undiagnosed mental health disease in their child. Ten had concerns for anxiety while 5 had concerns for depression. A few parents reported concerns for PTSD or other unspecified mental health disease.

Parent vs Patient PROMIS Mental Health Assessment Results

Seventy-six patient and parent pairs from CW were included in this analysis. There was no significant difference found between either the parent-proxy and patient pediatric PROMIS depressive symptoms T-scores (45.6 ± 9.3 vs 45.0 ± 9.0, respectively; $p=0.41$) or parent-proxy and patient pediatric PROMIS anxiety T-scores (45.8 ± 8.9 vs 44.5 ± 9.1, respectively; $p=0.14$).

Correlation of Mental Health Symptoms with Disease Manifestations

Age

There was a significant positive correlation between patient age and the PROMIS pediatric depressive symptoms T-scores ($r=0.36$; $p=0.0008$). Older patients had higher depressive symptoms T-scores. There was no significant correlation between patient age and the PROMIS pediatric anxiety T-scores ($r=0.21$; $p=0.054$) (Table 4).

Mobility

There was a significant positive correlation between patient mobility, as measured by the CHAQ, and the PROMIS pediatric depressive symptoms T-scores (r=0.32; p=0.0029). Patients with worse mobility (higher CHAQ scores) had higher depressive symptom T-scores. There was no significant correlation between mobility and the PROMIS pediatric anxiety T-scores (r= -0.04. p=0.69) (Table 4).

Pain

PROMIS pediatric pain interference T-scores had a significant positive correlatation with both PROMIS pediatric depressive symptoms T-scores (r=0.64; p<0.0001) and PROMIS pediatric anxiety T-scores (r=0.47; p<0.0001) (Table 4). Patients with higher pain interference scores have higher depressive and anxiety symptom scores.

Stress

PROMIS pediatric psychological stress experience T-scores had a significant positive correlation with both the PROMIS pediatric depressive symptoms T-scores (r=0.79; p<0.0001) and the PROMIS pediatric anxiety T-scores (r=0.75; p<0.0001) (Table 4). Patients with higher psychological stress experience T-scores have higher depressive and anxiety symptom T-scores.

Other Disease Manifestations

We found no significant correlations between mental health symptoms and gender, disease subtype, disease activity, or disease duration (Table 4). We also found no correlation between mental health symptoms and the type of medication patients were taking (Supplementary Table 1).

Multivariable Analysis

Two predictors, the PROMIS pediatric pain interference T-scores and PROMIS pediatric psychological stress experiences T-scores, were found to be the strongest predictor variables in the tree analysis and were included in the multivariable analysis. Multivariable analyses were used to test the effect of pain and stress and the interactions between the two on mental health symptoms. Both pain and stress had significant correlations with the PROMIS pediatric depressive symptoms T-scores ($p=0.0076$ and $p<0.0001$, respectively). Only stress had a significant correlation with the PROMIS pediatric anxiety T-scores ($p<0.0001$). The correlation between pain and anxiety was not significant after controlling for stress. There was no significant interaction effect between pain and stress.

DISCUSSION

To our knowledge this is the first study published that has used PROMIS measures to evaluate mental health symptoms in JIA. Using the PROMIS measures, 23% of our patients reported moderate to severe symptoms of anxiety or depression, while 12% reported moderate to severe symptoms of both. Additionally, 19% of patients reported mild symptoms of anxiety or depression, while 5% had mild symptoms of both. While these numbers are relatively high, children with JIA reported less depressive and anxiety symptoms than the historical general pediatric control cohort. Since nearly one-third of our patients had a prior history of mental health disease or concerns of a potential undiagnosed mental health disease, it is possible that previous or current therapy for these conditions resulted in fewer reported symptoms. We also found that patients with more pain or stress reported more symptoms of depression and anxiety, and that older patients and patients with worse mobility reported more symptoms of depression. There was no correlation between gender, JIA subtype, disease duration, disease activity, or

treatment and reported symptoms of anxiety and depression, nor between age or mobility and symptoms of anxiety.

Previous studies have reported that between 7-36% of children with JIA have depression and between 7-64% have anxiety (17). The variability in prevalence is likely attributable to differences in patient population, disease manifestations, and the screening methods used to assess mental health symptoms. Four prior studies reported that children with JIA have lower or similar levels of anxiety and/or depression compared to healthy children, similar to our results (11, 16, 20, 48). In most of these studies, the mean JIA disease duration was approximately 5-6 years, similar to our population, suggesting that a longer disease duration might allow children to adapt and improve, resulting in a decrease in symptoms of depression and anxiety (11, 16, 49). Although we found no correlation between mental health symptoms and disease duration, our population is likely biased as it consists of patients with a very narrow range of long disease durations. Previous studies that reported an increased risk of depression or anxiety in JIA compared to healthy children, studied children with shorter disease durations (1-3 years) (18, 19).

Our study is one of the few studies to evaluate the correlation between JIA subtype and mental health symptoms. Due to small sample sizes for some subtypes, we combined patients with psoriatic, ERA, and systemic JIA for the analysis, potentially biasing the results in favor of no correlation and eliminating the potential of detecting a correlation with any of these individual subtypes. One previous study did not find a correlation between depression and JIA subtypes; however, all the patients in this study scored above the cut off for significant depression, which may have biased the results in favor of no correlation (12). A second previous study reported that polyarticular patients had higher depressive scores than both oligoarticular and ERA patients

(13). While it is reasonable to spectulate that polyarticular patients may have had more severe or extensive arthritis, the published data did not include disease severity, therefore, this cannot be confirmed.

We did not find any correlation between mental health symptoms and disease activity, but nearly three-fourths of our patients had either inactive or low disease activity. Three previous studies also reported no correlation between mental health symptoms and disease activity while other studies found a positive correlation (11, 16, 20). The studies reporting a positive correlation included a population with likely greater severity of disease (12, 13). Future prospective longitudinal studies are needed to better understand the relationship between mental health symptoms and disease activity.

Similar to our results, most previous studies have reported a positive correlation between worse mobility and mental health symptoms (11-13, 16). Active arthritis often limits movement, frequently resulting in deconditioning which has been associated with a lower quality of life. Depression with ahendonia may exacerbate these problems. Promotion of physical activity, for example through physical therapy, may therefore be crucial for those with mental health disease.

We found a positive correlation between both pain and stress and mental health symptoms, similar to most previous studies (10, 12, 13, 15). It is well recognized that pain and stress are risk factors for developing mental health disease, particularly in other painful conditions like fibromyalgia (50). Future interventional prospective studies focusing on coping strategies for both pain and stress management may also help improve mental health symptoms.

Our study has limitations. As a cross-sectional study, mental health symptoms were only assessed at one time point. Therefore, acute or intermittent symptoms may not have been reported and causation cannot be assessed. Patients were self-selected, this was not a random

sample, and selection bias may have affected our results. Most patients were enrolled at one site, were predominantly caucasian, and the small sample size limits generalizability. Most patients had inactive or low disease activity and long disease durations further limiting the generalizability of the results. Small sample sizes led to the combining of some JIA subtypes which may have biased some of the analysis. Finally, the historical control cohort utilized in this study was composed of healthy and chronically ill children who may have had higher levels of depression and anxiety.

This study is the first to report use of PROMIS measures to evaluate depression and anxiety in children with JIA. We found that anxiety and depressive symptoms are prevalent in patients with JIA, and older patients and patients with worse mobility reported more depressive symptoms. Additionally, we found that patients with greater reported pain and stress have worse anxiety and depression. In our relatively small sample, there was no association between other JIA disease manifestations and mental health symptoms. The use of PROMIS measures provides a unique opportunity for researchers to better evaluate and compare findings on the relationship between JIA and mental health. Future studies, particularly prospective, multi-center, and longitudinal with larger and more diverse populations, are needed to help further understand the incidence, prevalence, and potential risk factors for depression and anxiety in JIA.

ACKNOWLEDGMENTS

We would like to acknowledge and thank Jan Lemke, registered nurse, and Stella Protopapas, clinical research coordinator, for all their hardwork in helping recruit and consent patients to be a part of the study. We would also like to acknowledge and thank Dr. Alan Silverman PhD, a psychologist, who provided guidance on the study design.

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Table 1. Patient Demographics

Variables	Number (%) or Median (Range) N = 84[#]
Gender	
Female	63 (75%)
Race	
Caucasian or White	72 (86%)
Black or African American	5 (6%)
Asian	5 (6%)
Other	2 (2%)
Current age (years)	14 (8.04-17.87)
Length of Disease (years)[#]	4.73 (0.28-16.86)
JIA Subtype	
Oligoarticular	30 (36%)
Extended Oligoarticular	15 (18%)
Persistent Oligoarticular	15 (18%)
Polyarticular	27 (32%)
RF - Polyarticular	22 (26%)
RF + Polyarticular	5 (6%)
CCP +	4 (5%)
CCP -	1 (1%)

Systemic	6 (7%)
Psoriatic	3 (3.5%)
Enthesitis-Related	3 (3.5%)
Undifferentiated	15 (18%)
Medications	
NSAIDS	48 (57%)
Biological DMARDs	44 (52%)
Conventional Synthetic DMARDs	33 (39%)
Oral Steroids	3 (4%)
Intra-articular steroids+	10 (12%)
Active Joint Count#	0 (0-11)
cJADAS10 score (range 0-30)#	2 (0-23)
CHAQ score (range 0-3)	0 (0-1.75)
Any Other Chronic Disease	35 (42%)
Asthma	5 (6%)
Chronic Pain	6 (7%)
Uveitis	9 (11%)
Other*	20 (24%)

+ Received within three months of visit

All variables used a total N of 84 except for a few variables as noted: 1 patient had missing information for length of disease and 2 subjects had missing information for active joint count and cJADAS10 score

* Other includes: celiac, thyroid disease, cardiovascular disease, macrophage activation syndrome (MAS), diabetes, hypermobility, attention deficit hyperactivity disorder, autoimmune hepatitis, chronic headaches, allergies, asperger's, avascular necrosis, scoliosis, linear scleroderma, spherocytosis, pharyngo-esophageal dysphagia, and pituitary hypoplasia with secondary adrenal insufficiency

JIA: Juvenile Idiopathic Arthritis; RF: Rheumatoid Factor; CCP: Cyclic Citrullinated Peptide; NSAIDS: Non-Steroidal Anti-Inflammatory Drugs; DMARDS: Disease Modifying Anti-Rheumatic Drugs; cJADAS10: Clinical Juvenile Arthritis Disease Activity Score; CHAQ: Childhood Health Assessment Questionnaire

Table 2. JIA Disease Activity based on cJADAS10 Scores

JIA Disease Activity*	Number (%)
Oligoarticular (≤ 4 joints)+	
Inactive Disease	11 (50%)
Low Disease Activity	9 (41%)
Moderate Disease Activity	2 (9%)
High Disease Activity	0 (0%)
Polyarticular (> 4 joints)x	
Inactive Disease	29 (48%)
Low Disease Activity	8 (13%)
Moderate Disease Activity	19 (32%)
High Disease Activity	4 (7%)
All Patients Combined	
Inactive Disease	40 (49%)
Low Disease Activity	17 (21%)
Moderate Disease Activity	21 (25%)
High Disease Activity	4 (5%)

*2 patients were unable to be classified into a disease activity subtype

+ Included persistent oligoarticular JIA and patients with ≤ 4 joints during their disease duration

X Included polyarticular JIA, extended oligoarticular JIA, and patients with > 4 joints during their disease duration

JIA: Juvenile Idiopathic Arthritis; cJADAS10: Clinical Juvenile Arthritis Disease Activity Score

Table 3. JIA Patient Mental Health PROMIS T-Scores based on Symptom Severity

PROMIS Survey/Score	Mean T-score (SD)	Number (%)
Depression	45.15 (± 9.28)	--
T-score < 50 = normal	--	56 (67%)
T-score 50 -- ≤ 54 = mild symptoms	--	13 (15%)
T-score 55 -- ≤ 64 = moderate symptoms	--	14 (17%)
T-score ≥ 65 = severe symptoms	--	1 (1%)
Anxiety	44.41 (± 9.13)	--
T-score < 50 = normal	--	59 (70%)
T-score 50 -- ≤ 54 = mild symptoms	--	11 (13%)
T-score 55 -- ≤ 64 = moderate symptoms	--	13 (16%)
T-score ≥ 65 = severe symptoms	--	1 (1%)

JIA: Juvenile Idiopathic Arthritis; PROMIS: Patient-Reported Outcome Measurement Information System; SD: Standard Deviation

Table 4. Relationship between JIA Disease Manifestations and PROMIS Mental Health T-scores

Disease Manifestation	PROMIS Depression r values	PROMIS Depression P values	PROMIS Anxiety r values	PROMIS Anxiety P values
JIA Sub-type	--	p = 0.88	--	p = 0.26
Age	r = 0.36	p = 0.0008	r = 0.21	p = 0.054
Total active joint count	r = -0.02	p = 0.87	r = -0.03	p = 0.76
cJADAS10 score				
Oligoarticular[+]	--	p = 0.20	--	p = 0.52
Polyarticular[X]	--	p = 0.30	--	p = 0.60
CHAQ	r = 0.32	p = 0.0029	r = -0.04	p = 0.69
Disease Duration	r = 0.06	p = 0.59	r = -0.02	p = 0.87
PROMIS Pain Interference	r = 0.64	p <0.0001	r = 0.47	p <0.0001
PROMIS Stress Experiences	r = 0.79	p <0.0001	r = 0.75	p <0.0001

[+] Included persistent oligoarticular JIA and patients with ≤ 4 joints during their disease course

[X] Included polyarticular JIA, extended oligoarticular JIA, and patients with > 4 joints during their disease course

JIA: Juvenile Idiopathic Arthritis; PROMIS: Patient-Reported Outcome Measurement Information System; cJADAS10: Clinical Juvenile Arthritis Disease Activity Score; CHAQ: Childhood Health Assessment Questionnaire