Measurement Properties of Functional Activity and Quality of Life Questionnaires in Children with Fibromyalgia

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TABLE OF CONTENTS

Abstract

Objectives: The study evaluated the measurement properties of functional activity and quality of life questionnaires in children with fibromyalgia(FM) using the population of children with FM involved in a randomized controlled pilot trial of an aerobic exercise program (Fibromyalgia Impact Trial).

Methods: Children with FM (8-18 years old, n=30) participated in three sessions of testing (two preintervention and one postintervention) 2-6 weeks apart for the Fibromyalgia Impact Trial. The participants completed the Childhood Health Assessment Questionnaire (C-HAQ), the Quality of My Life (QOML) scale, the Pediatric Quality of Life Inventory (PedsQL) fatigue and pain score, the Functional Status and Symptom Questionnaire (FSSQ), the Childhood Depression Inventory (CDI), and the Habitual Activity Estimation Scale (HAES) at testing times. We evaluated the validity, reliability, and responsiveness of these questionnaires. For construct validity, we estimated the Spearman correlation coefficient between the scales. The test-retest reliability was evaluated by calculating the intrarater intraclass correlation coefficient, the limits of agreement and the standard error of measurement with the 95% confidence intervals between test 1 and test 2. Responsiveness of each scale was assessed using the effect size and the standardized response mean.

Results: The PedsQL fatigue score demonstrated high test-retest reliability and responsiveness. Negative strong significant correlation was seen between the scores of fatigue measured by PedsQL and depression measured by CDI. CDI showed the highest test-retest reliability and moderate responsiveness. C-HAQ total score with 8 domains demonstrated excellent agreement and poor responsiveness. Correlation between fatigue measured by PedsQL and overall rating of illness by C-HAQ was moderate to strong in magnitude and negative in direction.

Conclusion: Functional activity and quality of life scales can be used effectively for patient reported outcomes among children with FM. However, investigators should be aware of the limitations of instruments used for evaluation of patient reported outcomes in this population. Further research is needed with larger sample size to support the results of the current study.

INTRODUCTION

Fibromyalgia (FM) is a common chronic condition characterized by a chronic defining feature of widespread pain and presence of tender points. Yunus and Masi first described the juvenile primary fibromyalgia syndrome (1). Over the past two decades, FM has emerged as a leading cause of visits to rheumatologists. The reported prevalence of FM is between 2 and 7% in most nations, with a female to male ratio of approximately 9:1 (2-5). Although there are limited epidemiological data about the prevalence of FM in children, FM accounts for approximately 7–8% of new patient diagnoses in pediatric rheumatology clinical practice (1, 3-17). FM in pediatric patients is more common in girls than in boys which is consistent with the literature regarding adult patients (3, 4, 9, 13, 14, 18).

FM is often accompanied by a range of non-specific symptoms such as fatigue, sleep disturbances, mood disorders, irritable bowel syndrome, and headache (8, 11-14). Studies support the assumption that patients with FM are deconditioned due to both inactivity and disease process (11, 19-22). The establishment of a diagnosis of FM is based on disease history, exclusion of other causes of symptoms, verbal self-report of symptoms, and physical examination (4, 8, 9, 18). The lack of physiological markers of disease activity for FM complicates the clinical decision-making process, since the treating physician cannot monitor the course of the illness with objective disease indicators that are available for other rheumatologic diseases such as juvenile idiopathic arthritis (1, 6-8, 12, 23). Given the lack of objective outcome measures, the treatment of FM is also complicated; there are no objective findings on the physical examination or laboratory tests that confirm the treatment effect and the extent of disease severity (5, 9, 11, 13, 14, 23).

Taking into consideration the lack of objective outcome measures and the existence of emerging new therapies for FM, the importance of having reliable and valid patient reported outcome instruments for FM is paramount. The aim of this study was to evaluate the measurement properties of functional activity and quality of life questionnaires in children with fibromyalgia. The specific objectives were to investigate the validity, reliability, and responsiveness of the functional activity and quality of life questionnaires using the population of children with FM involved in a randomized controlled trial of aerobic exercise program (Fibromyalgia Impact Trial). The results of the clinical trial have been published previously (26).

Fibromyalgia Impact Trial

The following is the short description of the study population, intervention, outcomes, and instruments used in the study.

Patients. The study involved 30 children ages 8–18 years diagnosed with FM from rheumatology and pain clinics of the Hospital for Sick Children and Bloorview Kids Rehab in Toronto, Ontario, Canada. The patient's attending rheumatologist confirmed the diagnosis of FM using the criteria of the American College of Rheumatology (ACR) (24, 25). Patients with minimum tender point count of five were eligible for the study (1, 25). Patients were excluded if they had cardiopulmonary disease, unstable disease (defined as receiving an unstable dose of medication), engaged in three or more hours of physical activity per week, or unable to cooperate with testing procedures. The Research Ethics Boards at the Hospital for Sick Children and Bloorview Kids Rehab approved the study. Fully informed written consent was obtained from all children and their parents.

Intervention. Patients completed a once-weekly supervised session and twice-weekly unsupervised sessions of an aerobic or qigong program with 12 week overall duration. Trained instructors led the exercise programs.

Outcomes. The main objective of the study was to determine the feasibility of an aerobic exercise program in children with FM by evaluating the adherence and recruitment (26). The secondary objectives of the study were to identify the effect of the interventions on measures in physical fitness, FM symptoms, and physical function in children with FM. Physical fitness was defined by peak aerobic capacity, muscular power, and metabolic efficiency.

Data were collected during 3 exercise testing sessions: familiarization (Test 1) at the time of enrollment, baseline (Test 2) 2 to 6 weeks later, and posttest (Test 3) within 2 weeks of completion of the intervention program. The intervention was implemented after the second test. Between first and second testing no intervention was present. Cardiorespiratory fitness and physiological, functional and activity outcomes of each participant were assessed at each testing(26).

Study instruments. During each testing session, to assess the effect of the exercise intervention on FM symptoms and physical activity outcomes, patients completed the Childhood Health Assessment Questionnaire (C-HAQ) (27-30), the Quality of My Life (QOML) scale, the Pediatric Quality of Life Inventory (PedsQL) fatigue and pain score (31-35), the Functional Status and Symptom Questionnaire (FSSQ) (36-40), the Fibromyalgia Impact Questionnaire (FIQ)(41-44), the Childhood Depression Inventory (CDI) (45-47), and the Habitual Activity Estimation Scale (HAES) (17, 48). Table 1 presents the short description of main domains and measurement methods of the instruments used in the current study.

The C-HAQ has 8 functional domains evaluating eating, dressing and grooming, walking, arising, hygiene, reach, activities, and grip. A summary score is given for 8 functional activity domains and is rated on a 3-point scale (where 0 indicates no limitations and 3 indicates severe limitations) (27-30). The overall well-being of the patient over the past week, the severity of illness and pain severity is also measured by 10-cm Visual Analog Scale (VAS).

Overall quality of life (QOL) and health-related quality of life (HRQOL) were measured by the QOML scale on separate 10-cm VAS (where lower scores indicating worse QOL/HRQOL and higher scores indicating better QOL/HRQOL) (49-51) .

The PedsQL fatigue module is validated for use in children and teenagers with FM. A summary score is given based on 3 fatigue domains and is rated on a 5-point ordinal scale (where 0 indicates never and 4 indicate almost always). Higher scores indicate better outcomes. The PedsQL pain scale has been validated to quantify pain levels in children with rheumatic diseases. The questionnaire consists of two 10-cm VAS measuring present pain and the worst pain experienced in the past week (where higher scores indicate worse pain) (31-35).

The modified FIQ is a health status questionnaire adapted from the adult version FIQ for children with FM. The modified FIQ includes 9 scales measuring function, depression, anxiety, pain, stiffness, fatigue, and sleep quality (41-44).

The CDI is a depression symptom scale validated for use in children aged 7–17 years. The index consists of 27 items with regard to different aspects of depressive symptoms. The items are scored on a 3-point scale (0 –2), where higher scores indicate worse depression (45-47).

The HAES questionnaire is a physical activity questionnaire in which children are asked to recall physical activity on a typical weekday and weekend day during the past 2 weeks. Activity is categorized into 1 of 4 intensity categories: inactive, somewhat inactive, somewhat active, and

very active. Respondents report about time spent in each of the 4 categories to calculate summary scores of total activity (TA) hours ("somewhat active" plus "active") and total very active hours scores (VAS) separately for weekends and weekdays (17, 48).

The FSSQ evaluates change in FM symptoms and determines the impact of FM symptoms on activities of daily living using a 4-point ordinal scale (where 0 indicates unable to do and 3 indicates no difficulty) to rate degree of difficulty for each task by marking a 10-cm VAS.

Aim of the Current Study

The purpose of the current study was to evaluate the validity, reliability, and responsiveness of functional activity and quality of life instruments of FM patients using the data from the Fibromyalgia Impact Trial using different statistical approaches for the assessment of each measurement property.

METHODS

Construct validity

Data from baseline assessment (Test 2) was used to assess the construct validity. The study used the nonparametric Spearman correlation coefficient to assess the correlation between the scales because of a small sample size and potentially skewed distribution of values. Correlation coefficients were interpreted based on guidelines by Cohen (52) suggesting a correlation less than 0.10 as small, 0.30 as moderate, and 0.50 as large.

The following hypotheses were tested for construct validity:

1. There will be moderate correlation between the child's pain measured by PedsQL and pain assessed by the parent using C-HAQ.

2. There will be a negative strong correlation between total physical activity hours measured by HAES and depression measured by CDI.

3. There will be a moderate correlation between depression measured by CDI and overall quality of life measured by QOML.

4. There will be a strong correlation between the overall quality of life and health related quality of life measured by QOML.

5. There will be strong correlation between fatigue measured by PedsQL and total C-HAQ.

Reliability

Results of Test 1 and 2 were used to estimate the test-retest reliability using type 3 intrarater intraclass correlation coefficient ($ICC_{3,1}$). An ICC of 0.61-0.80 was considered to indicate a substantial agreement while an ICC >0.80 indicated an excellent agreement (53, 54). Paired differences between Test 1 and Test 2 were plotted against the average of the two tests in accordance with Bland and Altman method (55-57). Limits of agreement (LOA) were calculated as twice the standard deviation of the mean paired difference (55, 57). The standard error of measurement (SME) was $SD\sqrt{1-ICC}$, with the 95% confident intervals (95% CI) (58).

Responsiveness

The responsiveness of the instruments was evaluated using the results from the baseline (Test 2) and follow-up tests (Test 3) by estimating the standardize response mean (59) and the effect size (52). The standardized response mean (SRM) was the mean change in scores divided by the standard deviation of change in scores. The effect size (ES) was the mean change in

scores divided by the standard deviation of the baseline scores (52). The values of SRM and ES around 0.2 are generally considered to be small, around 0.5 moderate, and 0.8 large (59).

The data were analyzed using SPSS 12.0 (SPSS, Chicago, IL) statistical software.

The Research Ethics Boards at The Hospital for Sick Children and Bloorview Kids Rehab approved the study protocol.

RESULTS

The clinical trial recruited thirty children diagnosed with FM from The Hospital for Sick Children and Bloorview Kids Rehab in Toronto, Ontario, Canada between October 2005 and April 2007. Table 2 summarizes demographic data of patients from two intervention groups (qigong and aerobics) (26).

Construct validity. Table 3 presents the nonparametric Spearman correlation coefficients (r_s) describing relationships between the measured outcomes by all instruments and their domains.

The worst pain scores by PedsQL were significantly strongly associated with pain scores of the C-HAQ(r=.58; p=.001). Correlations between the fatigue measured by PedsQL and overall rating of illness by C-HAQ (r=.31; p=.09) and scores from 8 domains by C-HAQ (r=.31; p=.098) were moderate in magnitude and negative in direction. The present pain scores by PedsQL were significantly strongly associated with pain scores of the C-HAQ(r=.58; p=.001). Correlation between present pain scores by PedsQL and pain scores by C-HAQ VAS scale was low and not significant (r=.252; p=.18).

Correlation between depression measured by CDI and overall quality of life measured by QOML was negative in direction and moderate to high in magnitude (r=.3; p=.1). Negative

strong significant correlation was seen between the scores of fatigue measured by PedsQL and depression measured by CDI (r=.58; p=.001). Moderate to strong correlation was observed between QOL and HRQL scales (r=.452; p=.012).

Correlation analysis demonstrated a negative strong significant correlation between total physical activity hours measured by HAES and C-HAQ VAS scores (r=.578; p=.001). The correlation was strong between total physical activity hours measured by HAES and overall rating of illness by C-HAQ scales (r=.522; p=.003).

The study detected moderate to strong negative significant association between worst pain measured by PedsQL and mean scores for all items and symptom by FSSQ (r=.362; p=.049) and total physical activity hours measured by HAES (r=.365; p=.047).

Reliability. Table 4 presents the results for reliability testing. Children Depression Inventory showed the highest test-retest reliability and little change from Test 1 to Test 2 ($ICC_{3,1}$ =0.86). The PedsQL fatigue scale and the C-HAQ total score from 8 domains demonstrated high test-retest reliability (excellent agreement: $ICC_{3,1}$ was 0.83 and 0.82, accordingly) and little change from Test 1 to Test 2 (Table 4).

The HAES physical activity questionnaire showed high reliability for weekends ($ICC_{3,1}$ =0.8102) and low reliability for week days ($ICC_{3,1}$ =0.45). In a separate analysis of the HAES (results not presented), less variability was seen for weekdays very active hours ($ICC_{3,1}$ =0.68-substantial agreement) but more for weekends ($ICC_{3,1}$ =0.26).

The PedsQL worst pain scale and C-HAQ VAS scores demonstrated very low, negative test-retest reliability ($ICC_{3,1}$ =-0.0773 and $ICC_{3,1}$ =-0.2610, accordingly). The Functional Status and Symptom Questionnaire results showed high variability in FM symptoms severity VAS and

mean scores ($ICC_{3,1}$ =-0.23 and $ICC_{3,1}$ =-0.053, accordingly). Low test-retest reliability was observed for overall QOL and health-related QOL ($ICC_{3,1}$ =0.16 and $ICC_{3,1}$ =0.2, accordingly).

Figures 1 and 2 present Bland and Altman plots of PedsQL fatigue and worst pain last week scores. Small improvement in PedsQL fatigue scores were noted from Test 1 to Test 2 (Figure 1). This study detected small improvement in PedsQL worst pain last week scores from Test 1 to Test 2 (Figure 2).

Responsiveness. Table 5 shows the responsiveness of each scale measured by standardized response mean (SRM) and effect size (ES). Table 6 presents the rank ordering of responsiveness based on these statistics.

C-HAQ demonstrated relatively high responsiveness indices in both scales with the highest scores in overall rating of illness by proxies (SRM=0.58, ES=0.75), and health-related quality of life by patients (SRM=-0.57, ES=-0.83). Among the PedsQL scales, fatigue scores had moderate to high responsiveness (SRM=-0.41, ES=-0.41), while worst pain score demonstrated high indices in all calculated responsiveness' indices (SRM=-0.43, ES=-0.85).

The lowest responsiveness indices were seen in HAES scales for both scores. The FSSQ showed high responsiveness with SRM=0.7, ES=0.94 for symptom scores, and SRM=0.6, ES=1.1 for mean scores.

DISCUSSION

Fibromyalgia, as a chronic musculoskeletal pain syndrome with no identifiable cause and no physiological markers of disease activity, represents a significant challenge in the clinical

decision-making process. The treating physician cannot monitor the course of the illness with objective disease indicators; it mainly dependents on patient self-report (33, 60).

There is an abundance of instruments to measure "quality of life" or "health status". When selecting an instrument for the use in medical research, one should evaluate its appropriateness for the target population and the type of intervention, the reliability, validity and measurement efficiency for detecting differences of the size expected to occur between groups. The findings of the current study indicated that the functional activity and quality of life scales show weaknesses to varying extents in children with FM.

As expected, patient-reported "worst pain" scores by PedsQL were significantly strongly associated with pain VAS scores of the C-HAQ rated by parents. However, correlation between 'present pain scores' by PedsQL and pain scores by C-HAQ VAS scale was lower than expected. One potential reason is that our patients with FM may not be truly "stable" because 'present pain' in FM is quite a variable symptom, and the differing responses may reflect true fluctuations in disease manifestation. Low to moderate associations were observed between FSSQ scores rated degree of difficulty for each task of children and C-HAQ results scored by parent in correlation analysis.

Health professionals usually use parents as a child's proxy. They may have a better understanding of the health issues being investigated and the content of the questionnaire than the child, but it is the patient's experience that must be the main focus (61). It is known that, for rheumatology, parents' ratings of disease activity are only moderately correlated with actual disease activity. For function, parent-completed measures achieve only a modest correlation with responses by the child (33, 62). Pediatric patient-reported outcomes should be considered as the standard for HRQOL measurement in pediatric clinical trials in which patient health-

related quality of life is investigated in FM (63-65). This way, the voices of the children will be heard in matters pertaining to their health and well-being given the perspective that some symptoms are known only to the patient (66, 67).

Correlations between fatigue measured by PedsQL and overall rating of illness by C-HAQ scores were moderate to strong in magnitude and negative in direction. As predicted, correlation between depression measured by CDI and overall quality of life measured by QOML was negative in direction and moderate in magnitude. More importantly, as hypothesized, the study observed negative strong significant correlation between the scores of fatigue measured by PedsQL and depression measured by CDI.

Correlation analysis demonstrated a negative strong significant association between total physical activity hours measured by HAES and pain scales of C-HAQ. Furthermore, this study detected strong correlation between total physical activity hours measured by HAES and overall rating scores of severity of illness by C-HAQ scales. Moderate to strong negative significant association was seen between worst pain measured by PedsQL and mean scores for all items and symptom by FSSQ and total physical activity hours measured by HAES. The findings of this study are consistent with previous research suggesting the marked impact recurrent pain has on multiple domains of functioning in children (68-70).

Previous studies provided evidence that among patients with FM with moderate to severe pain, greater pain severity before treatment was associated with worse HRQOL (71). However, the correlation analysis in the current study between scores of pain by PedsQL and C-HAQ with QOL and HRQOL showed low association. The correlation between QOML scale and HRQL scale was moderate to strong. Differences in the findings from previous studies and this study

could be related to the fact that people with chronic illness might have different quality of life priorities or concerns (72, 73).

Reliability is one of the important requirements of health measurement scales. Children Depression Index showed the highest test-retest reliability and little change from Test 1 to Test 2. High test-retest reliability and little change from Test1 to Test 2 demonstrated PedsQL fatigue and worst scales, C-HAQ total score from 8 domains, and the HAES physical activity questionnaire for weekend hours.

Reliability analysis detected low test-retest reliability in overall QOL and health-related quality of life (HRQOL) measured by the QOML separate VAS scale. This study found that the FSSQ results showed high variability in FM symptoms severity and mean scores and low test-retest reliability. Furthermore, in this study, the PedsQL worst pain scale and C-HAQ VAS scores demonstrated negative test-retest reliability. Differences in the findings from previous studies and the present study may stem from the potential confounders including diet, circadian variations, and ambient temperature (74).

Responsiveness is an important criterion when choosing a health measurement scale (59). Highly responsive scales are preferred because they allow clinical trials to be performed with smaller sample size (52). Responsive scales may be particularly important when comparing different types of treatment where the differences are expected to be much smaller than the changes of more radical treatments such as surgery.

This study suggested that C-HAQ demonstrated relatively high responsiveness indices in both scales with the highest scores in overall rating of illness by proxies, and health-related quality of life by patients. Among the PedsQL scales fatigue scores have generally moderate to high responsiveness, while worst pain score demonstrated relatively high indices in both

calculated responsiveness' indices. The lowest responsiveness indices were seen in HAES scales for all scores. The ranked ordering of responsiveness indices provided evidence that the FSSQ scale is the highest responsive scale. Nevertheless, a gold standard for change for the functional disability is lacking, and the scale with the greatest responsiveness may not always be measuring change which is important to patients (59).

The results of this study should be interpreted within the limitations of the study. The sample size for this study was relatively small. Although the sample size does not impact validity and reliability coefficients, it reduces the power of statistical tests associated with them (75, 76). The small sample size in this pilot trial may also limit the generalizability of the results. Furthermore, this study used data collected from participants recruited from rheumatology clinics. Therefore, the generalizability of results to other settings (e.g., primary care) and no treatment seeking samples cannot be ascertained based on these data.

In conclusion, the study used a small sample of patients to evaluate the validity, reliability, and responsiveness of functional activity and quality of life questionnaires in children with FM. The findings of the current study indicated that each functional activity and quality of life scales provide a measurement approach that has a great potential as outcome measures in the clinical setting regarding the physical functioning and activity among children with FM. However, investigators should be aware of limitations of the instruments used for evaluation of patient reported outcomes in this population, and instruments should be chosen cautiously in accordance with the needs of the study and peculiarities of the target population to meet the objectives of the study. Further research is needed to support the results of the current study.

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Table 1. Study instruments

Name	Domains & Measurement
Pediatric Quality of Life inventory (PedsQL)	**Fatigue**: summary score of 3 fatigue domains rated on a 5-point ordinal scale **Present pain**: 10 cm VAS **Worst pain last week**: 10 cm VAS
Childhood Health Assessment Questionnaire (C-HAQ)	**Total**: Sum of 8-functional activity domains (0-3 scale of each domain) **Overall well being:** (10 cm VAS) **Pain (parent):** 10 cm VAS **Illness (parent):** 10 cm VAS
Quality of My Life (QOML)	**Overall QOL:** 10 cm VAS **Health related QOL:** 10 cm VAS
Habitual Activity Estimation Scale (HAES)	Total activity hours, weekday Total activity hours, weekend
Childhood Depression Inventory (CDI)	27 items on a 3-point scale (mean score)
Functional Status and Symptom Questionnaire (FSSQ)	**Symptom score:** mean score on 10 cm VAS **Mean score:** mean degree of difficulty for all activities (0-4 difficulty scale)

Table 2. Patient characteristics at enrollment*

Characteristic	Qigong group (n = 16)	Aerobics group (n = 14)
Age, years	12.9 ± 2.7	13.6 ± 1.8
Female, no. (%)	12 (75)	10 (71.4)
Height, cm	153 ± 13.4	159 ± 8.4
Weight, kg	49 ± 17.0	62 ± 10.5
BMI, kg/m^2	21.5 ± 11	19.2 ± 7.1
Number of FM tender points	10.6 ± 3.8	10.5 ± 4.2

* Values are the mean ± SD unless otherwise indicated. BMI-= body mass index; FM = fibromyalgia.

Table 3. Correlation coefficients between measurement scales

Measurement Scales	Tender point	PedsQL fatique	PedsQL pain 1	PedsQL pain 2	QOL	HRQOL	C-HAQ severity of illness	C-HAQ pain VAS	C-HAQ overall	C-HAQ total	HAES TA week da	HAES TA weekend	CDI	FSSQ symptom	FSSQ mean
Tender point	-	-.423*	-.336	-.070	-.276	.087	-.124	-.196	-.050	.142	-.082	.161	.233	.303	.101
PedsQL fatique	-.423	-	.049	.031	.190	.202	-.029	-.001	-.309	-.308	.189	.078	-.59**	-.134	.070
PedsQL pain 1	-.336	.049	-	.457*	.081	.213	.358	.252	.254	.021	.120 .	-.087	-.149	.446*	.411*
PedsQL pain 2	-.070	.031	.457*	-	.048	-.069	.484***	.579**	.249	-.205	-.211	-.365*	-.174	.182	.362*
QOL	-.276	.190	.081	.048	-	.452* .	-.047	-.019	-.147	.041	.070	.216	-.300	.168	.170
HRQOL	.087	.202	.213	-.069	.452*	-	.156	.092	.002	-.160	.052	.222	-.309	.152	-.065
C-HAQ severity of illness	-.124	-.029	.358	.484*	-.047	.156	-	.778***	.435*	.070	-.024	-.457**	-.101	.138	.145
C-HAQ pain VAS	-.196	-.001	.252	.579*	-.019	.092	.778**	-	.520**	.217	-.231	-.578**	-.177	.282	.331
C-HAQ overall	-.050	-.309	.254	.249	-.147	.002	.435*	.520**	-	.307	-.265	-.522**	.296	.313	230
C-HAQ total	-.050	-.308	.021	-.205	.041	-.160	.070	.217	.307	-	-.302	-.286	.035	.343	.102
HAES TA week day	-.082	.189	.120	-.211	.070	.052	-.024	-.231	-.265	-.302	-	.414*	-.102	.136	.163
HAES TA weekend	.161	.078	-.087	-.365*	.216	.222	-.457*	-.578**	-.522**	-.286	.414*	-	-.183	-.201	-.197
CDI	.233	-.588**	-.149	-.174	-.300	-.309	-.101	-.177	.296	.035	-.102	-.183	-	-.145	-.193
FSSQ symptom	.303	-.134	.446*	.182	.168	.152	.138	.282	.313	.343	.136	-.201	-.145	-	.828***
FSSQ mean	.101	.070	.411*	.362*	.170	-.065 .	.145	.331	230	.102	.163	-.197	-.193	.828***	-

***p< 0.001**p<0.01; *p<0.05 C-HAQ = Childhood Health Assessment Questionnaire; VAS = visual analog scale; QOL = quality of life; HRQOL = health-related quality of life; PedsQL = Pediatric Quality of Life Inventory: pain 1 = present pain, Pain 2 = worst pain; HAES = Habitual Activity Estimation Scale; TA = total activity; SA = somewhat active; VA = very active CDI = Children Depression Index; FSSQ = Functional Status and Symptom Questionnaire;

Table 4. Reliability analysis of measurement scales

Measurement Scales	Test 1	Test 2	Paired difference	ICC	LOA	SEM	95% CI of SEM
Tender point	10.59 ± 4.57	10.63 ± 4.171	-.04 ± 2.65	0.82	±5.30	.511	±1.2
PedsQL fatique	801.85 ± 289.4	827.78 ± 290	-25.93 ± 168.63	0.83	±337.26	.69	±1.38
PedsQL pain 1	4.60 ± 2.91	4.48 ± 2.94	.11 ± 3.58	0.26	±7.16	3.08	±6.17
PedsQL pain 2	7.69 ± 2.78	7.19 ± 1.67	.50 ± 3.37	-0.08	±6.74	.65	±1.298
QOL	7.14 ± 2.36	7.08 ± 2.52	.055 ± 3.17	0.16	±6.34	2.90	±5.80
HRQOL	5.22 ± 2.30	4.61 ± 2.26	.60 ± 2.88	0.20	±5.78	2.59	±5.18
C-HAQ illness	5.33 ± 2.69	4.62 ± 2.60	.71 ± 3.53	0.11	±7.06	3.33	±6.66
C-HAQ pain VAS	5.76 ± 2.75	5.51 ± 2.45	.24 ± 4.12	-0.26	±8.24	4.63	±9.25
C-HAQ overall	3.65 ± 2.22	3.92 ± 2.35	-.27 ± 2.93	0.18	±5.86	2.64	±5.29
C-HAQ total	.65 ± .540	.663 ± .525	-.02 ±. 28	0.86	±.56	.10	±.21
HAES TA week day	5.2 ± 3.1	5.6 ± 3.02	-.22 ± 2.17	0.45	±4.34	1.61	±3.21
HAES TA weekend	4.97 ± 3.65	5.13 ± 3.23	-.22 ± 2.17	0.81	±4.34	.65	±1.30
CDI	11.76 ± 9.95	10.82 ± 7.25	1.13 ± 4.69	0.86	±9.38	1.77	±3.55
FSSQ symptom	3.20 ± 1.95	3.64 ± 1.80	-.44 ± 2.33	0.23	±4.66	2.05	±4.09
FSSQ mean	4.94 ± 2.41	5.32 ± 1.73	-.37 ± 2.89	0.05	±5.78	2.81	±5.62

* Values are the mean ± SD unless otherwise indicated. C-HAQ = Childhood Health Assessment Questionnaire; VAS = visual analog scale; QOL = quality of life; HRQOL = health-related quality of life; PedsQL = Pediatric Quality of Life Inventory: pain 1 = present pain, Pain 2 = worst pain; HAES = Habitual Activity Estimation Scale; TA = total activity; CDI = Children Depression Index; FSSQ = Functional Status and Symptom Questionnaire; ICC = intraclass correlation coefficient; LOA = limits of agreement; SEM = standard error of measurement; 95% CI = 95% confidence interval.

Table 5. Responsiveness of measurement scales

Measurement Scales	Standardized response mean	Effect size
Tender point	0.55	0.78
PedsQL fatique	-0.41	-0.41
PedsQL pain 1	0.26	0.31
PedsQL pain 2	0.43	0.85
QOL	-0.26	-0.30
HRQOL	-0.57	-0.83
C-HAQ severity of illness	0.30	0.42
C-HAQ pain VAS	0.48	0.74
C-HAQ overall	0.58	0.75
C-HAQ total	0.41	0.31
HAES TA week day	-0.05	-0.06
HAES TA weekend	-0.02	-0.03
CDI	0.33	0.29
FSSQ symptom	0.70	0.94
FSSQ mean	0.60	1.00

*C-HAQ = Childhood Health Assessment Questionnaire; VAS = visual analog scale; QOL = quality of life; HRQOL = Health-related quality of life; PedsQL = Pediatric Quality of Life Inventory: pain 1 = present pain, Pain 2 = worst pain; HAES = Habitual Activity Estimation Scale; TA = total activity; CDI = Children Depression Index; FSSQ = Functional Status and Symptom Questionnaire

Table 6. Rank ordering of responsiveness

Standardized response mean		Effect size	
FSSQ symptom	0.70	FSSQ mean	1.00
FSSQ mean	0.60	FSSQ symptom	0.94
C-HAQ overall	0.58	PedsQL pain 2	0.85
Tender point	0.55	HRQOL	-0.83
HRQOL	-0.57	Tender point	0.78
C-HAQ pain VAS	0.48	C-HAQ overall	0.75
PedsQL pain 2	0.43	C-HAQ pain VAS	0.74
C-HAQ total	0.41	C-HAQ severity	0.42
PedsQL fatique	-0.41	PedsQL fatique	-0.41
CDI	0.33	C-HAQ total	0.31
C-HAQ severity	0.30	PedsQL pain 1	0.31
PedsQL pain 1	0.26	QOL	-0.30
QOL	0.26	CDI	0.29
HAES TA week day	-0.05	HAES TA week day	- 0.06
HAES TA weekend	-0.02	HAES TA weekend	-0.03

*C-HAQ = Childhood Health Assessment Questionnaire; VAS = visual analog scale; QOL = quality of life; HRQOL = health-related quality of life; PedsQL = Pediatric Quality of Life Inventory: pain 1 = present pain, Pain 2 = worst pain; HAES = Habitual Activity Estimation Scale; TA = total activity; CDI = Children Depression Index; FSSQ = Functional Status and Symptom Questionnaire

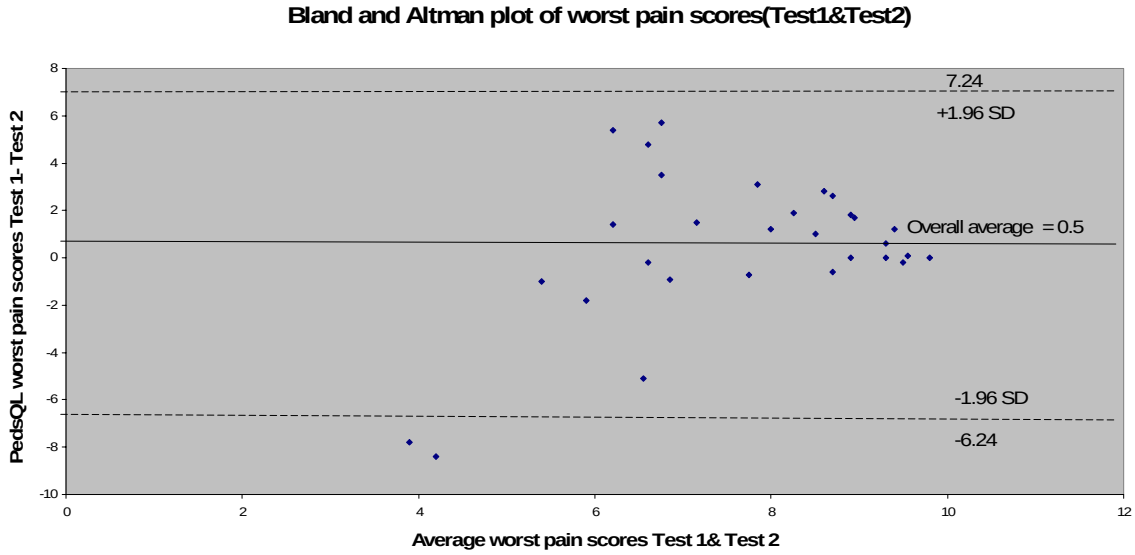

Figure 1. Bland and Altman plot of PedsQL worst pain scores
The paired difference between Test 1 and 2 is represented on the vertical axis, while the paired average is represented on the horizontal axis. The solid line is the overall paired average. The broken lines represent 2 SDs above and below the overall average and are therefore the limits of agreement. Under a normal distribution we would expect ~ 95% of the data to fall between these limits.

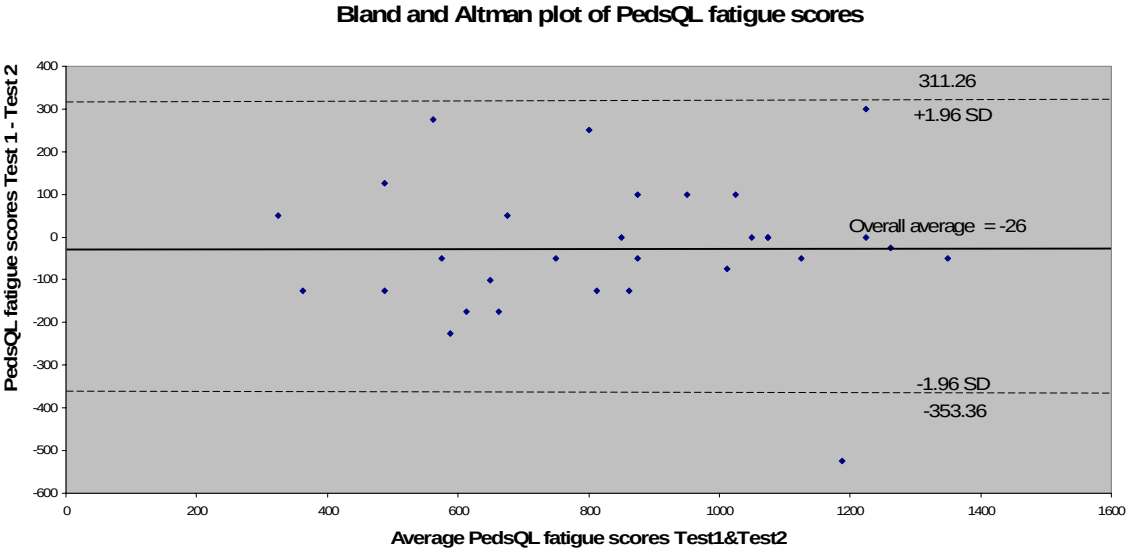

Figure 2. Bland and Altman plot of PedsQL fatigue scores
The paired difference between Test 1 and 2 is represented on the vertical axis, while the paired average is represented on the horizontal axis. The solid line is the overall paired average. The broken lines represent 2 SDs above and below the overall average and are therefore the limits of agreement. Under a normal distribution we would expect ~ 95% of the data to fall between these limits.