Original article

Validation of the parent global assessment as a health-related quality of life measure in juvenile idiopathic arthritis: results from ReACCh-Out

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Abstract

Objectives. To (i) validate the JIA parent global assessment (parent global) as a health-related quality of life (HRQoL) instrument; (ii) evaluate measurement properties of accepted HRQoL measures relative to those of the parent global; and (iii) assess causal pathways determining parent global scores.

Methods. Data from the Research in Arthritis in Canadian Children emphasizing outcomes (ReACCh-Out) cohort were used. Measurement properties were assessed in 344 patients at enrolment and 6 months later. Causal pathways were tested by structural equation modelling to understand root causes and mediators leading to parent global scores.

Results. Construct validity was supported by Spearman correlations of 0.53–0.70 for the parent global with the Juvenile Arthritis Quality of Life Questionnaire, Quality of My Life health scale (HRQoML), Pediatric Quality of Life Inventory (PedsQL)-Parent, and Child Health Questionnaire (CHQ)-Physical. Exceptions were PedsQL-Child (0.44) and CHQ-Psychosocial (0.31). Correlations were lower (0.14–0.49) with disease activity measures (physician global assessment of disease activity, active joint count, ESR). Responsiveness of the parent global to improvement according to parent ratings (0.51) was acceptable and within the range (0.32–0.71) of that of other measures. Reliability estimates and measurement errors for all measures were unsatisfactory, likely due to the prolonged time between assessments. Causal pathways for the parent global matched those previously reported for HRQoML.

Conclusions. Our results offer support for the parent global as a valid measure of HRQoL for JIA. If confirmed, existing studies using the parent global may be re-interpreted, enhancing our knowledge of HRQoL in children with JIA.

Key words: Parent global assessment, JIA, health-related quality of life

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CLINICAL SCIENCE

Introduction

The JIA parent global assessment (parent global) was introduced with the Childhood HAQ (CHAQ) in 1994 [1]. This is a visual analogue scale (VAS) anchored by the words 0 very well and 10 very poor, and headed by the instruction: 'Considering all the ways that arthritis affects your child, rate how your child is doing by placing a mark on the line'. The parent global has been included in numerous cohort studies [2–5] and owing to its inclusion in the ACR core set of measures, it has been utilized extensively in clinical trials [6–9]. The parent global is also a component of the Juvenile Arthritis Disease Activity Score (JADAS) and the Juvenile Arthritis Multidimensional Assessment Report (JAMAR) [10, 11]. The formulation of the parent global can be traced in most instances to that provided in the CHAQ or Filocamo's similarly worded 21-circle numerical rating scale [1, 12].

Despite its extensive use, there has been no formal conceptualization or validation of the parent global, resulting in uncertainty as to what it measures. The term 'well-being' was first introduced in the publication of the JIA ACR core set of measures and has been used most often to describe the parent global [2, 6, 9, 10, 12–14]. In turn, well-being may be linked to health, as health is defined by the World Health Organization (WHO) as a 'state of complete physical, mental and social well-being' [15]. Abiding by this definition, health-related quality of life (HRQoL) instruments such as the Juvenile Arthritis Quality of life Questionnaire (JAQQ), the Child Health Questionnaire (CHQ), and the Paediatric Quality of Life inventory (PedsQL) assess physical, mental and social domains of health [16–18]. We propose that the parent global [1, 12] is also an assessment of a child's health as affected by arthritis and should be considered a disease-specific HRQoL measure.

The objectives of the present analyses were: (i) to validate the parent global as a measure of HRQoL in a JIA inception cohort; (ii) to investigate the measurement properties of recognized HRQoL measures in the same cohort to provide context for the performance of the parent global; and (iii) to investigate causal pathways leading to parent global scores.

Methods

Patients and data

Data from the Research in Arthritis in Canadian Children emphasizing Outcomes (ReACCh-Out) cohort were used. Children fulfilling International League of Associations for Rheumatology JIA criteria [19] were enrolled within one year of diagnosis from 2005 to 2010 at 16 Canadian centres. Physician assessments, patient/parent-completed questionnaires, and clinical information were collected at study visits at enrolment, then 6-monthly to 2 years, and yearly thereafter up to 5 years [20]. The ReACCh-Out study was approved by research ethics boards at all participating institutions and was carried out according to the Declaration of Helsinki. Written informed consent and assent as applicable were obtained from parents and patients. The present analyses were approved by the University of British Columbia and Children's and Women's Health Centre of British Columbia Research Ethics Board (H21-03353).

Parents and patients completed the following questionnaires: parent global measured on a 10 cm horizontal VAS, CHAQ-disability index (CHAQ-DI), and a 10-cm VAS for pain severity [1]; the JAQQ [16]; the CHQ (PF50 version) [14, 17, 21]; PedsQL parent and child generic core scales (used with permission from J Varni) [18]; and the preference-based Quality of My Life questionnaire health VAS (HRQoML) [22]. Parents completed the questionnaires for patients <9 years and patients ≥9 years completed their own with or without their parents' help. The complete set of questionnaires was scheduled for the first five study visits for patients enrolled during the first two years of the ReACCh-Out study. The PedsQL and CHQ were omitted thereafter. Physicians completed an active joint count and a 10-cm VAS for physician's global assessment of disease activity (PGADA) at each study visit.

Patients with completed parent global and PedsQL-Parent measures at enrolment were selected for the present analyses. Data from enrolment and 6-month visits were used for estimating measurement properties. Additional analyses compared available data for the 18 and 24-month visits. Causal pathway analyses included all patients who completed a parent global within 28 days after diagnosis, and those who completed it 3–9 months after diagnosis (details provided in Supplementary Data S1, available at *Rheumatology* online).

Evaluation of measurement properties

The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist for evaluation of measurement properties of patient reported outcome measures was followed where applicable, omitting steps related to measure development, multi-item measures, and comparison to a gold standard [23]. Measurement properties were assessed in the same manner for the JAQQ, HRQoML, CHQ-physical, CHQ-psychosocial, PedsQL-Parent and PedsQL-Child.

Reliability

Because conditions for test-retest reliability were not set up within REACCh-Out, reliability was tested comparing enrolment to 6-month, and 18- to 24-month visits. Intraclass correlation coefficients (ICCs) were calculated when at the later visit the patient's rating was 'the same' according to the question 'Since the last time I was here my life is (much worse, a little worse, the same, a little better, much better)', found in the QoML questionnaire [22] or the parent rating was 'same' according to the question 'Relative to the last assessment do you feel your child is (much better, better, same, worse, much worse)', found in the JAQQ, respectively [16]. ICCs were calculated using individual estimates from random

effects models in STATA15 (StataCorp, College Station, TX, USA) as:

$$ICC = \frac{between-subject\ variance}{between-subject\ variance + within-subject\ variance}$$

An ICC ≥ 0.7 was considered good reliability [23–25].

Measurement error
The same change questions were used as external anchors to calculate measurement error and minimal clinical important difference (MCID) over the enrolment to 6-month interval. Change was classified as much worse: –2; worse/a little worse: –1; same/the same: 0; better/a little better: +1; much better:+2. MCID was calculated as the mean change in absolute values of the parent global corresponding to +1 in the external anchor [25, 26]. Smallest detectable change (SDC) was calculated as:

$$SDC = 1.96 \times (\surd 2) \times SEM$$

Where SEM = standard error of measurement $=\surd$ (within subject variance) $=\surd$ (total variance – (1-ICC)) [24]. SDC < MCID was the accepted criterion of good measurement error [23].

Convergent construct validity
Cross-sectional data from enrolment and 6-month visits, respectively, were used to calculate Spearman correlation coefficients (Rs) of the parent global with HRQoL and other JIA measures. The following *a priori* hypotheses were based on a review of the literature followed by a survey and consensus of the authors (K.O., K.T-A., R.A.B., B.F.M., L.B.T., J.G.) [10, 12, 27–29].

- If the parent global is an HRQoL measure, it will correlate with other HRQoL measures with Rs of ≥ 0.5 [23]. Specific hypothesized correlations were: 0.6–0.8, 0.5–0.7, 0.5–0.7, 0.6–0.8 and 0.7–0.8 for the JAQQ, CHQ-Physical, CHQ-Psychosocial, PedsQL and HRQoML, respectively.
- If the parent global is an HRQoL measure it will have Rs of 0.3 to 0.5 with related JIA non-HRQoL measures, except for pain [23]. Specific hypothesized Rs were: 0.5–0.7, 0.4–0.5, 0.4–0.5, 0.3–0.5, 0.2–0.4 for pain VAS, active joint count, PGADA, CHAQ-DI and ESR, respectively.
- Estimated correlations of the parent global with HRQoL measures will be higher than those with non-HRQoL measures but 95% confidence intervals (CIs) may overlap, as included non-HRQoL measures assess constructs also conceptualized as components of health (such as pain, function, symptoms) [15, 30].

CIs were calculated with bootstrapping in 1000 repetitions. For each correlation, overlap of the range of expected values and the 95% CI of observed values was accepted as fulfilling the hypothesis.

Discriminative construct validity
The *a priori* hypothesis was that values of the parent global at 6 months will differ significantly between patients with active and inactive disease. Inactive disease was an active

joint count of 0, absence of systemic manifestations of systemic arthritis, absence of enthesitis in those with enthesitis-related arthritis or psoriatic arthritis, absence of uveitis and a PGADA <10 mm [20]. Differences in scores between patients with active and inactive disease were tested with a Mann–Whitney U test and significance was set at $P < 0.05$.

Responsiveness
The standardized response mean (SRM) was used to estimate responsiveness. Internal responsiveness estimating change over time was the mean change in scores from enrolment to 6 months divided by the standard deviation of changes [31]. External responsiveness relating change to an external standard [31] was calculated separately for patients who improved or worsened according to answers to the above change questions (better/a little better/much better and worse/a little worse/much worse, respectively). SRM for improvement was the mean change in those who improved divided by the standard deviation of change in those who improved, and SRM for worsening was the mean change in those who worsened divided by the standard deviation of change in those who worsened [31, 32]. Sensitivity analyses were performed using a change score of ≥ 10 mm in PGADA as alternative physician-based external standard to define improvement or worsening [33]. Responsiveness statistics were calculated as the mean change in those who improved or worsened, respectively, divided by the standard deviation of change in patients deemed to be the same [31]. We adopted generally used cut-off values for SRM and responsiveness statistic: 0.20: small; 0.50: moderate; 0.80: large [34]. Values of ≥ 0.5 were considered acceptable responsiveness.

Path analysis

The *a priori* hypothesis was that causal pathways determining parent global scores will be similar to those previously identified for HRQoML [35]. Methods are detailed in Supplementary Data S1, available at *Rheumatology* online. Structural equation modelling was performed using previously published models for 'at diagnosis' and at 3–9 months after diagnosis, substituting parent global for HRQoML [35]. Models were tested in the same subjects included in our previous analysis and final models were selected based on clinical plausibility and fit statistics [35]. Path analyses were conducted with the lavaan package in R software [36], and all other analyses were conducted using STATA15 (StataCorp).

Results

Patients

A total of 344 ReACCh-Out patients met criteria for inclusion to assess measurement properties (Supplementary Fig. S1, available at *Rheumatology* online). Patients were enrolled at a median of 1.25 (25, 75th centile, 0, 4.7) months after diagnosis with median parent global of 1.3

(0.2, 3.4) cm and median active joint count of 2 (1, 5) (Table 1). For the causal pathway analysis, 561 patients were included 'at diagnosis' and 887 at 3–9 months after diagnosis.

The distribution of observed scores for the parent global and the reference HRQoL instruments are shown in Fig. 1. As often seen in modern JIA cohorts, the distributions are skewed with scores concentrating at the optimal end of the scales. Exceptions are the CHQ scores, which are normalized to a reference population, meaning 50 points is the mean and 10 points is the standard deviation in healthy children.

TABLE 1 Baseline characteristics of patients included in the study

Characteristic	Participants with data	Value
Age at onset, years	341	7.9 (3.3, 11.8)
Female sex, n (%)	344	220 (63.9)
JIA category, n (%)	344	
Oligoarthritis		129 (37.5)
Polyarthritis RF-negative		67 (19.5)
Enthesitis related Arthritis		46 (13.4)
Systemic arthritis		29 (8.4)
PsA		27 (7.8)
Polyarthritis RF-positive		12 (3.5)
Undifferentiated		34 (9.9)
Diagnosis to enrolment, months	344	1.25 (0, 4.7)
Onset to enrolment, months	341	6.9 (3.8, 12.3)
cJADAS10	343	7.1 (3, 14)
Active joints, number	344	2 (1, 5)
PGADA, cm	343	2.6 (1, 5.2)
ESR, mm/h	309	19 (8, 38)
CRP, mg/L	260	2 (0.01, 12.7)
CHAQ-DI score	332	0.37 (0.05, 0.875)
Pain intensity in last week, cm	344	1.9 (0.5, 5)
Parent global assessment, cm	344	1.3 (0.2, 3.4)
JAQQ total score	335	2.5 (1, 3.5)
HRQoML, cm	329	8.2 (5.4, 9.5)
CHQ-Physical score	311	42.9 (31.4, 51.3)
CHQ-Psychosocial score	311	51.3 (42.9, 56.8)
PedsQL-Parent total score	344	78.1 (61.2, 89)
PedsQL-Parent Physical	344	71.9 (51.6, 90.6)
PedsQL-Parent Psychosocial	344	80.5 (65, 90.4)
PedsQL-Child total score	239	77.2 (60.9, 88)

Values are median (25th, 75th centiles) unless otherwise specified. Pain was measured on a 10 cm visual analogue scale. cJADAS10: clinical juvenile arthritis disease activity score with up to 10 joints (0 best to 30 worst) [37]; PGADA: physician's global assessment of disease activity (0–10); CHAQ-DI: childhood health assessment questionnaire disability index (0–3); JAQQ: juvenile arthritis quality of life questionnaire (1–7); HRQoML: health scale of the quality of my life questionnaire (10–0); CHQ: child health questionnaire (100–0, 50 is the mean of healthy children); PedsQL: paediatric quality of life inventory (100–0).

Reliability

The ICC estimate for the parent global at enrolment to 6 months as well as all HRQoL measures fell below the 0.7 threshold for good reliability (Table 2). Because test-retest reliability depends on the stability of respondents, ICC was also calculated for 18–24 months, a more stable time than the period immediately following diagnosis. At 18–24 months, point estimates of ICCs for parent global, HRQoML and the JAQQ were indeed higher than at the earlier time period, but only the ICC for the JAQQ using the parent change question reached the critical threshold of 0.7 (Table 2).

Measurement error

The requirement of SDC<MCID for good measurement error was not met by the parent global or any HRQoL measure (Supplementary Table S1, available at *Rheumatology* online). Because of their dependence on the respondents' assessments over the first 6 months and the broad scales used (only two gradations for improvement), these results should also be viewed with caution.

Convergent construct validity

Correlations of the parent global with measures of HRQoL at enrolment and 6 months are shown in Fig. 2 and Supplementary Table S2, available at *Rheumatology* online. Spearman correlations of the parent global were 0.63 and 0.70 with the JAQQ, 0.58 and 0.59 with PedsQL-Parent, and 0.64 and 0.66 with CHQ-Physical, at enrolment and 6 months, respectively, and 0.63 with PedsQL-Child at 6 months. These correlations fulfilled the test hypotheses. Lower than predicted correlations were found with HRQoML, 0.53 and 0.55, and with CHQ-Psychosocial, 0.31 and 0.31, respectively, and PedsQL-Child at enrolment, 0.44. Correlations with PedsQL-Psychosocial were 0.52 and 0.58, respectively.

Among non-HRQoL measures, observed correlations of the parent global with traditional measures of disease activity including PGADA (0.41 and 0.49 at enrolment and 6 months, respectively), active joint count (0.34 and 0.47) and ESR (0.23 and 0.14) were all <0.5, and all fulfilled the test hypotheses (Fig. 2 and Supplementary Table S3, available at *Rheumatology* online). The correlations of parent global with CHAQ-DI (0.65 and 0.63) and with pain (0.79 at 6 months) were higher than predicted. Other HRQoL measures had similar patterns of low correlations with disease activity measures and high correlations with pain and CHAQ-DI (Fig. 2 and Supplementary Table S3, available at *Rheumatology* online). Exceptions were correlations of JAQQ with active joint count (0.51) and PGADA (0.50) at 6 months.

Discriminative construct validity

The parent global and all other HRQoL measures, except CHQ-Psychosocial, met criteria for discriminative validity as their values were significantly better during inactive than during active disease (Supplementary Table S4,

Fig. 1 Violin box plots for parent global and HRQoL measures at enrolment (**A**), 6 months (**B**)
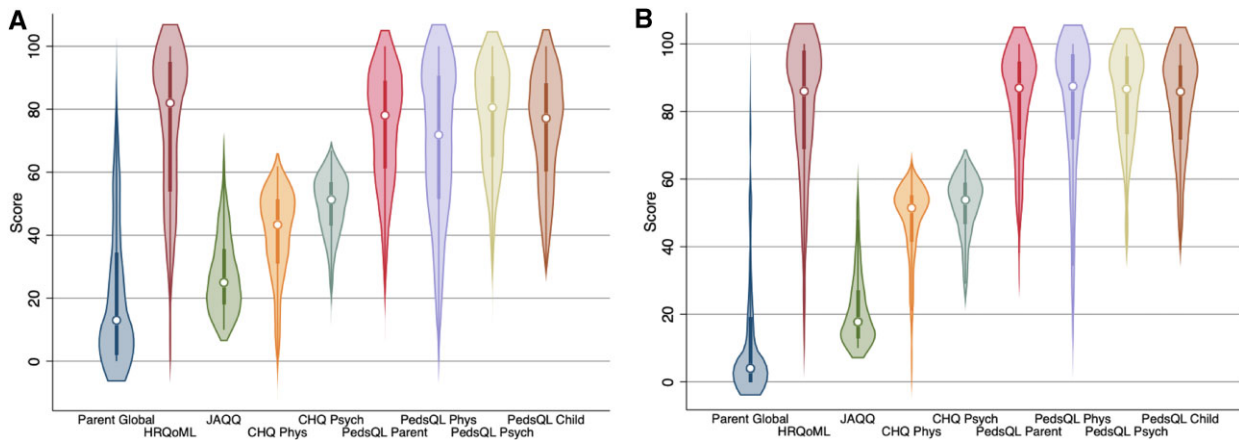
Parent global, quality of my life health scale (HRQoML), and juvenile arthritis quality of my life questionnaire (JAQQ) scores were multiplied by 10. Range of scores are 0 (best) to 100 (worst) for parent global, 0 (worst) to 100 (best) for HRQoML, 10 (best) to 70 (worst) for JAQQ, 0 (worst) to 100 (best) for child health questionnaire (CHQ) and 50 is the mean of healthy children, 0 (worst) to 100 (best) for paediatric quality of life inventory (PedsQL). Phys: Physical; Psych: Psychosocial.

TABLE 2 Intraclass correlation coefficients comparing scores in patients reporting no change

| External standard measure	Parent assessment of my child: 'same'		Child assessment of my life: 'the same'	
	n	ICC (95% CI)	*n*	ICC (95% CI)
Enrolment and 6 months				
Parent Global	67	0.32 (0.09, 0.52)	78	0.37 (0.16, 0.55)
JAQQ	65	0.57 (0.38, 0.71)	71	0.52 (0.30, 0.69)
HRQoML	62	0.48 (0.27, 0.65)	74	0.51 (0.32, 0.66)
CHQ-Physical	51	0.57 (0.35, 0.73)	51	0.63 (0.43, 0.77)
CHQ-Psychosocial	51	0.51 (0.27, 0.68)	51	0.59 (0.37, 0.74)
PedsQL-Parent	56	0.49 (0.26, 0.66)	62	0.45 (0.23, 0.63)
PedsQL-Parent Physical	56	0.52 (0.30, 0.69)	62	0.43 (0.20, 0.61)
PedsQL-Parent Psychosocial	56	0.55 (0.33, 0.71)	62	0.55 (0.35, 0.70)
PedsQL-Child	36	0.64 (0.41, 0.80)	39	0.64 (0.41, 0.80)
18 and 24 months[a]				
Parent Global	238	0.53 (0.43, 0.61)	253	0.43 (0.32, 0.53)
JAQQ	249	0.72 (0.66, 0.78)	241	0.66 (0.58, 0.72)
HRQoML	223	0.51 (0.41, 0.60)	245	0.55 (0.45, 0.63)

[a]Scores between 18 and 24 months are for all patients in the ReACCh-Out cohort who had available scores for parent global, JAQQ or HRQoML at those visits. There were few patients with scores for other measures at those visits. CHQ: child health questionnaire; HRQoML: health scale of the quality of my life questionnaire; ICC: intraclass correlation coefficient; JAQQ: juvenile arthritis quality of life questionnaire; PedsQL: paediatric quality of life inventory.

available at *Rheumatology* online). For the parent global, median values were 0.1 (25th, 75th centiles 0, 0.4) during inactive and 1.1 (0.2, 3.4) during active disease ($P < 0.0001$).

Responsiveness

Internal responsiveness for overall change from enrolment to 6 months regardless of individual direction of change was low for all measures with the exception of the JAQQ, which just reached a moderate SRM of 0.50, the cut-off for acceptability (Table 3). External responsiveness to improvement defined by parent change ratings was moderate (SRM 0.50–0.79) for the parent global, JAQQ, CHQ-Physical and PedsQL-Child, and small (SRM 0.20–0.49) for HRQoML, PedsQL-Parent and CHQ-Psychosocial. Based on child ratings, responsiveness to improvement was small for the parent global, HRQoML, CHQ-Psychosocial and PedsQL-Parent and moderate for the JAQQ, CHQ-Physical and PedsQL-Child.

Fig. 2 Construct validity of the parent global as a measure of health-related quality of life
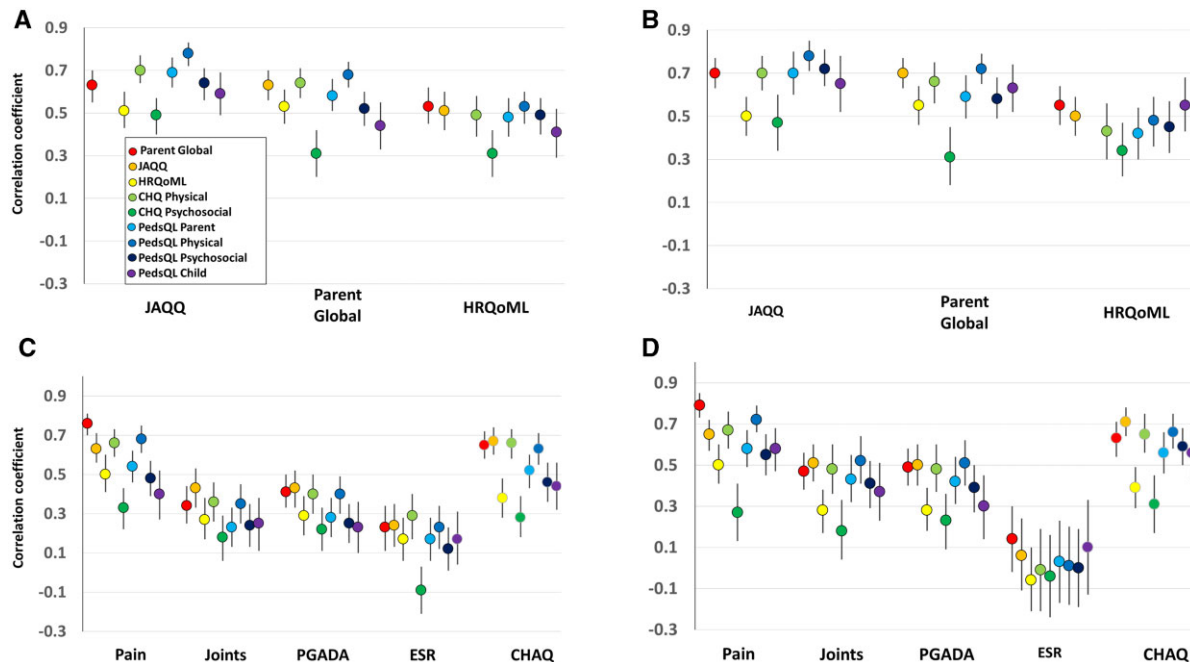
Spearman correlations (95% confidence intervals) of parent global with measures of heath related quality of life at diagnosis (A), at 6 months (B); correlations with other related JIA measures at diagnosis (C), at 6 months (D). Pain was measured on 10-cm visual analogue scale. CHAQ: childhood HAQ disability index; CHQ: child health questionnaire; HRQoML: quality of my life health scale; JAQQ: juvenile arthritis quality of life questionnaire; Joints: active joint count; PedsQL: paediatric quality of life inventory; PGADA: physician's global assessment of disease activity.

SRMs for worsening were based on fewer patients (12–26) and tended to be lower than those for improvement, except for the parent global when using parent ratings (0.80 for worsening, 0.51 for improvement) (Table 3). When improvement was defined as a ≥10 mm decrease in PGADA, SRMs were in the moderate range for the parent global, JAQQ and CHQ-Physical, and small for HRQoML, CHQ-Psychosocial, PedsQL-Parent and PedsQL-Child (Supplementary Table S5, available at *Rheumatology* online). Responsiveness statistics for parent rating of much better were just below moderate for the parent global and HRQoML (both 0.49), large for the JAQQ, small for CHQ-Psychosocial and moderate for the remaining HRQoL measures (Supplementary Table S6, available at *Rheumatology* online). Values for child rating of much better were moderate for all measures except CHQ-Physical (large) and HRQoML and PedsQL-Parent (both small) (Supplementary Table S7, available at *Rheumatology* online).

Considering all responsiveness indicators, the parent global SRMs for improvement were at the median relative to other HRQoL measures, but its responsiveness statistic for much better improvement was relatively lower.

Path analysis

The *a posteriori* models for causal pathways leading to parent global scores had good fit statistics when using the same pathways previously published for HRQoML

(Fig. 3 and Supplementary Table S8, available at *Rheumatology* online) [35]. However, the effect of pain was greater on parent global (path coefficient 0.50 and 0.58 at diagnosis and 3–9 months, respectively) than on HRQoML (0.24 and 0.27 as previously reported [35]).

Discussion

Our study presents the following preliminary findings supporting the validity of the parent global as a measure of HRQoL in children with JIA: (i) construct validity was supported by moderate-to-high correlations with accepted HRQoL measures and correlations with non-HRQoL measures largely as predicted; (ii) discriminant validity was supported by significant differences in scores during active and inactive disease; (iii) responsiveness to change was acceptable; (iv) the performance of other HRQoL measures was similar to that of the parent global; and (v) causal pathways leading to parent global scores mirrored those for HRQoL. On the other hand, reliability and measurement error were unsatisfactory for parent global and most other measures. The lack of good reliability in our study is likely due to the prolonged time interval of six months. Good reliability has been reported previously for the CHQ, and a recent study showed good test-retest reliability for the parent global when administered over a 1-to-2-week interval [38–40].

TABLE 3 Responsiveness of parent global and health-related quality of life measures

External standard	Measure	Direction of change	Participants with data	Mean change	s.d. of change	SRM: Mean/s.d. of change
None	Parent Global	Not applicable, all subjects with scores at enrolment and 6 months are included in calculation	297	0.67	2.54	0.26
	JAQQ		274	0.60	1.20	0.50
	HRQoML		283	−0.73	2.48	−0.29
	CHQ-Physical		173	−5.08	13.3	−0.38
	CHQ-Psychosocial		173	−2.52	9.70	−0.26
	PedsQL-Parent		209	−6.18	18.53	−0.33
	PedsQL-Parent Physical		209	−8.85	24.65	−0.36
	PedsQL-Parent Psychosocial		209	−5.01	16.14	−0.31
	PedsQL-Child		133	−7.23	16.74	−0.43
Parent rating	Parent Global	Better	185	1.13	2.23	0.51
		Worse	22	−2.13	2.67	−0.80
	JAQQ	Better	183	0.81	1.14	0.71
		Worse	22	−0.38	1.04	−0.37
	HRQoML	Better	178	−0.92	2.30	−0.40
		Worse	20	0.92	3.23	0.28
	CHQ-Physical	Better	101	−7.46	12.22	−0.61
		Worse	13	6.22	14.4	0.43
	CHQ-Psychosocial	Better	101	−2.92	9.23	−0.32
		Worse[a]	13	−3.41	8.63	−0.39
	PedsQL-Parent	Better	128	−7.75	18.14	−0.43
		Worse[a]	16	−8.27	17.24	−0.48
	PedsQL-Parent Physical	Better	128	−11.93	22.2	−0.54
		Worse	16	0.08	36.79	0.00
	PedsQL-Parent Psychosocial	Better	126	−6.67	15.44	−0.43
		Worse[a]	16	−8.4	14.6	−0.58
	PedsQL-Child	Better	77	−11.07	16.46	−0.67
		Worse	12	7.02	16.30	0.43
Child rating	Parent Global	Better	190	1.04	2.46	0.42
		Worse	26	−0.54	2.85	−0.19
	JAQQ	Better	178	0.69	1.22	0.57
		Worse[a]	22	0.20	1.1	0.18
	HRQoML	Better	184	−0.80	2.4	−0.33
		Worse[a]	24	−0.57	3.09	−0.18
	CHQ-Physical	Better	108	−6.87	13.8	−0.50
		Worse	13	2.01	17.9	0.11
	CHQ-Psychosocial	Better	108	−3.69	9.10	−0.40
		Worse[a]	13	−2.86	15.44	−0.19
	PedsQL-Parent	Better	128	−6.94	17.95	−0.39
		Worse[a]	16	−3.62	19.95	−0.18
	PedsQL-Parent Physical	Better	128	−9.78	22.75	−0.43
		Worse[a]	16	−1.06	33.13	−0.03
	PedsQL-Parent Psychosocial	Better	126	−6.68	15.34	−0.44
		Worse[a]	16	−2.66	17.81	−0.15
	PedsQL-Child	Better	84	−9.30	16.61	−0.56
		Worse	10	3.13	19.94	0.16

External standards were parent's or child's ratings of better (better/a little better, much better) or worse (worse/a little worse, much worse) at 6 months relative to enrolment. For the quality of my life questionnaire health scale (HRQoML), child health questionnaire (CHQ) and paediatric quality of life inventory (PedsQL) negative values for change reflect improvement. [a]change in score suggests improvement, not worsening. Change: score at enrolment minus score at 6 months; mean change: average of individual changes in score; JAQQ: juvenile arthritis quality of life questionnaire; SRM: standardized response mean.

Fig. 3 Path analysis for parent global at diagnosis (**A**), 3–9 months after diagnosis (**B**)
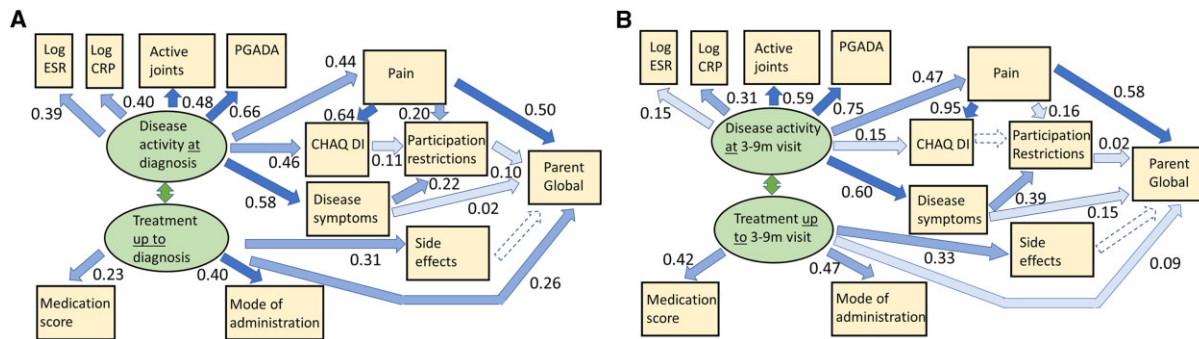
Structural equation modelling results after substituting parent global in models previously reported for HRQoML [35]. See Supplementary Data S1, available at *Rheumatology* online for details. At diagnosis: ≤28 days after actual diagnosis date; 3–9 months: 3–9 months after actual diagnosis date; dashed lines: paths not supported; numbers: path coefficients; colour shades: light, path coefficients <0.2; medium, 0.2–0.49; dark, ≥0.5; medication score: weighted sum of potency of treatments; mode of administration: 1, oral to 4, repeated intravenous injection; joints: active joint count; PGADA: physician's global assessment of disease activity; CHAQ DI: childhood HAQ disability index.

Responsiveness depends on the way change is assessed [41]. Our findings showed acceptable moderate SRMs of the parent global for external responsiveness to improvement assessed by parents and to clinical improvement assessed by physicians. While internal responsiveness of the parent global was similar to that previously reported after intraarticular injection, it was lower than that reported following methotrexate initiation or a disease flare [42–44].

Although most of the hypotheses for construct validity of the parent global as an HRQoL measure were fulfilled, correlations with pain and CHAQ were higher, and those with HRQoML and CHQ-Psychosocial were lower than predicted. The first may be explained on a conceptual basis as both pain and physical function may be conceived as components of health [15, 30]. An additional explanation for the high correlation with pain may be the proximity of the parent global to the pain VAS on the CHAQ questionnaire [45]. The low correlation with HRQoML may relate to the parent global being a disease-specific measure and the HRQoML a generic measure, or to a difference in the respondents implied by the wording of the questions (parent for parent global, child for HRQoML).

The relatively low correlation of the parent global with CHQ-Psychosocial has been noted previously [12], and may suggest that the parent global does not capture the mental and social components of health satisfactorily, or alternatively that the CHQ-Psychosocial does not detect the early psychosocial impacts of JIA well. We favour the second explanation because scores of the CHQ-Psychosocial at enrolment were close to the range of scores for healthy children [14, 46], scores were similar in patients with inactive or active disease, correlations were also low with the JAQQ and the HRQoML, and the PedsQL-Psychosocial had correlations >0.5 with the parent global.

Van Dijkhuizen *et al.* have recently proposed that the parent global measures constructs beyond disease activity 'including all aspects of the disease burden affecting' HRQoL [40]. Disease activity in JIA has been defined as those aspects that are potentially reversible measuring 'signs and symptoms related to inflammation' [47]. Disease activity measures such as ESR, active joint count and PGADA can be thought of as indicators of the inflammatory pathogenic process, while the consequences of this biologic activity on the individual include effects on function and ultimately HRQoL as illustrated in our path analysis. The results of our study are more in keeping with the view of the parent global as a measure of HRQoL rather than a measure of disease activity by showing higher correlations with HRQoL measures in contrast to lower correlations with measures of disease activity, and causal pathways very similar to those for other HRQoL measures [35].

The ReACCh-Out study did not collect data for formal assessment of face and cross-cultural validity. Face validity of the parent global as a measure of health may be surmised from multiple studies in which it is referred to as a measure of well-being; while its cross-cultural validity as a component of the JAMAR was found to be satisfactory [2, 9–11, 13, 48, 49]. However, future studies are necessary to confirm face validity, including qualitative studies with parents and patients to ascertain what they consider when completing the parent global.

The main strengths of the present study are the large representative sample of children with JIA, the availability of established HRQoL measures collected simultaneously with the parent global, and the assessment of their measurement properties in the same manner. The present analyses have several limitations. First, conditions for testing reliability and measurement error were suboptimal. In particular, it is likely patients and parents assessed change relative to their preceding *clinic visit* rather than the

preceding *study visit* 6 months earlier when the first set of measures were collected. Some patients considered 'the same' since their previous clinic appointment could have changed significantly since the earlier study visit, increasing within-subject variance. Second, respondents could not be confidently separated into child and parent because the questionnaires were often completed by both together. Lastly, although our results are derived from a representative Canadian JIA cohort, their generalizability to other settings needs confirmation.

This study has explored the validity of the parent global as a measure of HRQoL in children with JIA. Although our findings support this concept, further studies in other settings are needed, especially to reassess its test-retest reliability, confirm its construct validity as a measure of HRQoL, and assess its face validity both for researchers and parents/patients. Measurement properties of accepted HRQoL measures for JIA should be assessed simultaneously in a comprehensive manner to ensure appropriate validation. Confirmation of the parent global as an HRQoL measure would allow a re-interpretation of the many existing studies using this measure and increase our understanding of HRQoL in JIA.

Acknowledgements

Data availability statement

The data underlying this article are available in the article and in its online supplementary material.

Supplementary data

Supplementary data are available at *Rheumatology* online.

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