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ORIGINAL ARTICLE

Cross-cultural adaptation and validation of the Japanese version of the Childhood Health Assessment Questionnaire (CHAQ)

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Abstract To assess cross-cultural adaptation, and to validate the parent's version of a health-related quality-of-life instrument, the Childhood Health Assessment Questionnaire (CHAQ) was investigated after its translation into Japanese. A total of 132 subjects were enrolled: 63 patients with juvenile idiopathic arthritis (JIA) (34 systemic and 29 polyarticular) and 69 healthy children. The CHAQ distinguished clinically between healthy subjects and the two JIA subtypes of patients. The average disability index (DI) scores for systemic JIA (sJIA) and polyarticular JIA (pJIA) patients and healthy subjects were 1.5, 1.2, and 0.0, respectively. All variables in the questionnaire were shown to be significant ($P < 0.001$). Patients with pJIA showed better correlation than those with sJIA. Significant correlation was seen in the polyarticular group with CRP, ESR, parents' VAS, the number of joints with pain, and the number of active joints. However, there was even a negative correlation between DI and parent's assessment of overall well-being for the sJIA group. The Japanese version of the CHAQ was a reliable and valid tool for the functional assessment of children with pJIA. Functional ability, as assessed by the CHAQ, may not be the main consideration of sJIA patients' parents when assessing their child's status.

Keywords Japanese · Childhood Health Assessment Questionnaire (CHAQ) · Cross-cultural adaptation · Health-related quality of life · Juvenile idiopathic arthritis (JIA)

Introduction

Juvenile idiopathic arthritis (JIA) is one of the most common rheumatic diseases of childhood and is defined as "a chronic inflammatory disease characterized predominantly by idiopathic arthritis with onset before the 16th birthday" by the International League Against Rheumatism (ILAR) [1]. The etiology of the disease is still obscure, but it is well known as one of the most frequent childhood causes of short stature and long-term disability. There has been an increasing need to assess the quality of life in pediatric rheumatic diseases as part of the evaluation of new drug treatments. Functional status is one of the aspects of patients' overall well-being. A recent World Health Organization-International League Against Rheumatism (WHO-ILAR) taskforce defined the health-related quality of life (HRQOL) as "the physical, emotional, and social aspects of quality of life influenced by an individual's disease and its treatment".

To assess the quality of life, several instruments have been developed, initially for adults and then in corresponding versions for children. The Childhood Health

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Fig. 1 The Childhood Health Assessment Questionnaire (CHAQ)

The Childhood Health Assessment Questionnaire adapted for Japanese culture Questionnaire on Your Child's Health

Date completed: _____

This questionnaire is intended to throw light on how your child's illness affects his/her ability to function in daily life. For each of the following questions, please check the one response that best describes your child's usual activities OVER THE PAST WEEK.
ONLY NOTE THOSE DIFFICULTIES OR LIMITATIONS WHICH ARE DUE TO ILLNESS. If most children at your child's age are not expected to do a certain activity, please mark it as "Not Applicable." For example, if your child has difficulty in doing a certain activity or is unable to do it because he/she is too young, but NOT because he/she is RESTRICTED BY ILLNESS, please mark "Not Applicable."
If your child uses aids or devices (e.g., self-help devices, splints) or needs help to perform a certain activity, please mark it as "Much difficulty" or "Unable to do."

Dressing & grooming					
Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
1. Put on and remove underwear and jackets, including doing	☐	☐	☐	☐	☐
2. Shampoo his/her hair?	☐	☐	☐	☐	☐
3. Remove socks?	☐	☐	☐	☐	☐
4. Cut fingernails?	☐	☐	☐	☐	☐
5. Put on socks?	☐	☐	☐	☐	☐
6. Put on slip-on shoes?	☐	☐	☐	☐	☐
7. Pull on a sweater, T-shirt, etc.over his/her head?	☐	☐	☐	☐	☐
Arising					
Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
8. Stand up from a low chair?	☐	☐	☐	☐	☐
9. Stand up from the floor?	☐	☐	☐	☐	☐
10. Get in and out of bed or stand up in a crib?	☐	☐	☐	☐	☐
Eating					
Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
11. Eat with a fork or spoon?	☐	☐	☐	☐	☐
12. Eat with chopsticks?	☐	☐	☐	☐	☐
13. Lift a bowl or cup to his/her mouth?	☐	☐	☐	☐	☐
14. Open a new box of sweets?	☐	☐	☐	☐	☐
Walking					
Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
15. Walk on flat ground?	☐	☐	☐	☐	☐
16. Climb up five steps?	☐	☐	☐	☐	☐
Hygiene					
Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
17. Wash and towel-dry his/her entire body?	☐	☐	☐	☐	☐
18. Get in and out of a bath tub?	☐	☐	☐	☐	☐
19. Get on and off the toilet or potty chair?	☐	☐	☐	☐	☐
20. Brush teeth?	☐	☐	☐	☐	☐
21. Comb/brush hair?	☐	☐	☐	☐	☐

Assessment Questionnaire (CHAQ) (Fig. 1; Japanese version available as supplementary Fig. S1) [2] is a pediatric modification of the Stanford Health Assessment Questionnaire (HAQ) [3] in which several questions were added so that there is at least one question in each functional area that is relevant to children of all ages up to 18 years old. The CHAQ is a self-report questionnaire and one the best examples of the "disease-specific" instruments, which measures disability and discomfort. It has been shown to be a valid and sensitive tool in the evaluation of functional outcomes in children with chronic arthritis and is a component of the validated JIA core set criteria used to measure functional improvement and flare in clinical trials.

The CHAQ is usually completed by the parents, but a child's version is also available for children >8 years old. The questionnaire comprises 30 items and measures eight

Fig. 1 continued

Reach

Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
22. Reach and get down a heavy object such as a large book or game box from just above his/her	☐	☐	☐	☐	☐
23. Bend down to pick up clothing or a piece of paper from	☐	☐	☐	☐	☐
24. Turn his/her neck to look over both shoulders?	☐	☐	☐	☐	☐
25. Reach his/her back with his/her hands?	☐	☐	☐	☐	☐

Grip

Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
26. Write, draw, or scribble?	☐	☐	☐	☐	☐
27. Open jars (e.g., jam jars) that have been previously opened?	☐	☐	☐	☐	☐
28. Open plastic bottles that have been previously opened?	☐	☐	☐	☐	☐
29. Turn taps on and off?	☐	☐	☐	☐	☐
30. Cut paper with scissors?	☐	☐	☐	☐	☐
31. Open a door by turning a round doorknob?	☐	☐	☐	☐	☐

Errands, Chores, and Play

Is your child able to:	Without ANY Difficulty	With SOME Difficulty	With MUCH Difficulty	UNABLE to DO	Not Applicable
32. Run errands or shop?	☐	☐	☐	☐	☐
33. Get in and out of a car, toy car,or school bus?	☐	☐	☐	☐	☐
34. Ride a bicycle or tricycle?	☐	☐	☐	☐	☐
35. Do household chores (e.g., wash dishes, take out trash, vacuum, work in the garden, make beds,	☐	☐	☐	☐	☐
36. Run and play?	☐	☐	☐	☐	☐

How much physical pain do you think your child has experienced in the past week because of his/her illness? Place a mark (/) on the line below to indicate the severity of the pain.

No pain at all — Very severe pain

How would you rate your child's current condition after taking into account all the effects of the arthritis? Place a mark (/) on the line below to indicate the current condition.

Excellent — Very poor

functional areas: dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities. In addition, there are visual analogue scales to assess the amount of pain and overall well-being. This questionnaire takes less than 10 min to complete and scoring is easily done by manual calculation.

However, the original questionnaire is difficult to adapt to Japanese children because it was prepared in American English and was designed for use by North Americans. Translating an existing instrument into the language of another country may not be sufficient to assure its validity in that country. Some items in the questionnaire may not be suitable for the population of the other country because of cultural differences [4] so the questionnaire may need to be modified to take into account differences in lifestyle.

This paper describes how the American English version of the CHAQ was translated into Japanese, cross-culturally adapted and validated in a cohort of healthy Japanese children and Japanese patients with JIA.

Materials and methods

Patients and questionnaires

Patients

A total of 132 Japanese children were enrolled in this study. Sixty-three patients had juvenile idiopathic arthritis (JIA) (34 systemic and 29 polyarticular) while 69 were

healthy children used as controls. The protocol was approved by the ethics committees of participating institutions and consent was obtained from each child's parents.

Children were classified as having systemic JIA (sJIA) or polyarticular JIA (pJIA) based on the Durban criteria [5]. The controls were all healthy children (2–18 years of age) of workers at Yokohama City University Hospital. They were defined as healthy after examination by a physician and/or based on the parent's declaration.

All patients underwent clinical, rheumatologic, and laboratory assessments to evaluate the current status of six variables included in the core set outcome measures for JIA, which are (1) the physician's evaluation of current disease activity on a 10-cm visual analogue scale (VAS); (2) the parental assessment of overall well-being on a 10-cm VAS; (3) a functional assessment tool (exact instrument not specified in the original core set—here the CHAQ); (4) the number of joints with active arthritis; (5) the number of joints with limited range of motion; (6) the erythrocyte sedimentation rate (Westergren method). CRP was also measured.

The questionnaire

Each of the items within the eight domains (dressing and grooming, arising, eating, walking, hygiene, reach, grip, and activities) has four possible categories of answers: "without any difficulty" (score 0); "with some difficulty" (score 1); "with much difficulty" (score 2); "unable to do" (score 3). The category "not applicable" was added for the items that most children of that age are not expected to do (also applicable in the original American English version). Parents were instructed only to assess impairment due to disease in the past week. The item with the highest score in a domain determines the score for that domain. The use of any aids/devices or help from another person is assigned a minimum score of 2 for that domain. The scores from the eight domains are then averaged to obtain a summary score called the disability index (DI), which may range from 0 to 3 with higher scores meaning greater disability. The CHAQ also provides two 10-cm visual analog scales (VASs) for the evaluation of pain and overall well-being by the parent or child.

Methods

This project was divided into two phases: phase I, the cross-cultural adaptation phase, which involved the translation procedures and a preliminary probe test in the target population, and phase II, the validation phase, which consisted of large-scale data collection for psychometric and statistical evaluation. The method of cross-cultural adaptation and validation of the CHAQ followed the guidelines provided by Guillemin et al. [6]. The detailed procedure followed that described by Ruperto et al. [7]. All documents for translation, adaptation, pilot testing, and validation were prepared at the Yokohama City University Hospital, Japan.

Phase I. Cross-cultural adaptation

Translation and back-translation. Forward translation from American English into Japanese was done by three independent translators. They were of different educational levels, backgrounds, and sexes, were fluent in American English, and were instructed to use wording that could be understood by a 10- to 12-year-old child. At least two of them were unaware of the purpose of the project.

Back-translation was performed to improve the quality of the final version of the questionnaire by amplifying any misunderstandings in forward translation [8]. The back-translators had not seen the original American English text of the questionnaire, were also unaware of the purpose of the project, and were of different educational levels, backgrounds, and sexes. A single back-translation was done independently by each of the three translators. A meeting was then convened among all of the forward and back-translators in order to discuss the comments received from the reviewers of the back-translations. The purpose of this meeting was to reach a consensus among the translators for a second version of the translated questionnaire.

Pilot testing in the target population using a probe technique

Before the adapted CHAQ was used on a large scale, it was administered to 15 parents of patients with JIA, of different educational levels and backgrounds, using a probe technique [9] to ensure parent comprehension. The probe method worked as follows: a health professional familiar with the purpose of each question administered the questionnaire to the parents, asking them to consider each item in an open-ended manner. The parents were encouraged to explain their understanding of the meaning of each item. The health professional judged whether the item was perfectly understood by each parent. Questions that were misunderstood in any way by 10% or more of the parents were reviewed and revised appropriately.

Phase II. Validation

Following the process of cross-cultural adaptation, a large-scale data collection phase was set up using the adapted questionnaire. To evaluate the underlying framework and psychometric properties of the questionnaire, SPSS (version 12.0 J) was applied.

Results

Demographic and clinical characteristics of the subjects

A total of 132 subjects were enrolled: 63 patients with JIA (34 sJIA and 29 pJIA) and 69 healthy children. The CHAQ was completed in all cases by either the father or mother.

Table 1 shows that there are differences between the three groups in demographics and between the two JIA groups in background disease characteristics. Both the sJIA and healthy groups were approximately half male and half female, whereas the pJIA group was predominantly female, as would be expected on the basis of disease epidemiology. The overall mean age of the JIA patients was similar to that of the healthy children (approximately 10 years old), but the mean age of the sJIA group was lower than that of the pJIA group (sJIA 8.3 ± 3.9 vs. pJIA 13.3 ± 3.7 years). The pJIA group also had a longer mean disease duration than the sJIA group and less acute inflammation, as indicated by mean CRP and ESR, but considerably more joint involvement and a higher percentage who were ANA- and RF-positive, again as would be expected on the basis of disease characteristics.

Table 2 reports mean scores (mean ± SD) obtained using the Japanese CHAQ and the physician's Visual Analog Scale (VAS) of overall disease activity. The result for the eight CHAQ domains, the DI, and the two VAS scores for the parent evaluations of pain and overall well-being are included in the questionnaire completed by the parent. In addition, the physician's VAS of overall disease activity as a part of the JIA core set was assessed. The mean DI resulting from CHAQ scoring was slightly higher for the sJIA than for the pJIA group (sJIA 1.5 ± 1.0 vs. pJIA 1.2 ± 1.0) whereas the mean parent VAS scores of overall well-being were slightly higher for the pJIA than the sJIA group (sJIA 5.6 ± 2.1 vs. pJIA 6.2 ± 2.2 cm for the parent VAS of overall well-being and sJIA 5.4 ± 1.4 vs. pJIA 6.0 ± 2.0 cm for the physician VAS of overall disease activity). Interestingly, the mean parent VAS scores of pain were significantly higher for the pJIA than the sJIA group (sJIA 4.5 ± 2.8 vs. pJIA 8.3 ± 1.0 cm, P-value = 0.000005 by Student t-test), though only six out of 29 pJIA patients had assessments made. The standard deviation of the mean for all these measures was considerable, reflecting a homogeneous population.

The adapted CHAQ

The fully translated, adapted questionnaire is shown in Fig. 1. Once translated into Japanese, some questions had to be changed to achieve better cultural adaptation. These included the following: (1) in the eating domain, "Cut his/her own meat?" was changed to "Eat with a fork and spoon?" and "Eat with chopsticks?" because the Japanese do not use a knife for eating. Most meals are eaten using chopsticks unless the food is unsuitable for this, in which case a fork and spoon will be used. Young children who have not yet learned to use chopsticks and those with a disability would also use a fork and spoon.(2) In the eating domain, "Open a new cereal box?" was changed to "Open a new box of sweets?" because cereal is not popular in Japan. The adapted questionnaire consists of 36 items now that some new questions have been added.

Clinical discriminant validity

The CHAQ discriminated between healthy subjects and JIA patients, with the JIA patients having a higher degree

Table 1 Demographic and clinical characteristics of the Japanese sample

	Systemic onset JIA $n = 34$	Polyarticular onset JIA $n = 29$	Healthy controls $n = 69$
Age of children (years)	8.3 ± 3.9	13.3 ± 3.7	10.7 ± 4.3
Number (and percentage age) of females	19 (55.8%)	24 (82.8%)	35 (50.7%)
Disease duration (years)	3.7 ± 2.7	6.8 ± 4.1	NA
CRP (mg/dL)	7.1 ± 6.5	3.1 ± 3.2	NA
ESR (mm/hr)	45.9 ± 29.8	41.5 ± 25.8	NA
Physician's VAS of overall disease activity (0–10 cm)	5.4 ± 1.4	6.0 ± 2.0	0.0 ± 0.0
Number of swollen joints	4.9 ± 5.3[a]	ND	NA
Number of joints with pain	3.3 ± 5.2[a]	17.1 ± 13.4	NA
Number of joints with limited range of motion	3.1 ± 8.7	ND	NA
Number of active joints	4.9 ± 5.4	18.7 ± 14.3	NA
Antinuclear antibody-positive	3 (8.8%)	24 (82.8%)	NA
Rheumatoid factor-positive	6 (17.6%)	16 (55.1%)	NA

Values represent mean ± SD, *NA* not appropriate, *ND* not described

[a] Nine out of 34 patients had assessments made

of disability, pain, and a lower overall well-being when compared to their healthy peers, in that the sample of healthy children had a mean score of 0 for all parameters. All variables showed significance using the Kruskal–Wallis test ($P < 0.001$) (Table 2).

Equal items-scale correlation and item internal consistency (linearity)

This analysis was carried out using Pearson correlation coefficients to test the second Likert assumption (equal item-scale correlations); that is, each item should contribute a roughly equal proportion of information to the total score with regard to the construct being measured. Pearson items-scale correlations were roughly equivalent for items within a scale for all of the CHAQ domains. The correlation coefficients were >0.4 for all of the CHAQ domains (Table 3).

Internal consistency (Cronbach's alpha)

Cronbach's alpha is a test for a model or survey's internal consistency. It measures how well a set of items (or variables) measures a single unidimensional latent construct. Reliability is indicated by a Cronbach's alpha coefficient of at least 0.7 (minimum 0.5). This statistic was 0.959 for all domains of the CHAQ with all JIA patients combined; 0.953 in sJIA and 0.968 in pJIA.

External validity (convergent or construct validity)

This is the correlation of the summary scores with external criterion variables not used to score the scales. This was tested using Spearman rank order correlation coefficients between the DI of the CHAQ and other variables including those in the core set of outcome measures for JIA, i.e., the

Table 2 Mean scores obtained using the Japanese CHAQ and physician's visual analog scale (VAS) of overall disease activity

CHAQ	Systemic JIA $n = 34$	Polyarticular JIA $n = 29$	Healthy controls $n = 69$
1. Dressing	1.5 ± 1.2	1.2 ± 1.2	0.0 ± 0.0
2. Arising	1.1 ± 1.2	1.2 ± 1.1	0.0 ± 0.0
3. Eating	1.1 ± 1.2	0.9 ± 1.1	0.0 ± 0.0
4. Walking	1.4 ± 1.1	1.0 ± 1.2	0.0 ± 0.0
5. Hygiene	1.5 ± 1.4	1.1 ± 1.2	0.0 ± 0.0
6. Reach	1.9 ± 1.1	1.5 ± 1.2	0.0 ± 0.0
7. Grip	1.4 ± 1.2	1.2 ± 1.0	0.0 ± 0.0
8. Activities	1.9 ± 1.2	1.5 ± 1.2	0.0 ± 0.0
Disability index (DI)	1.5 ± 1.0	1.2 ± 1.0	0.0 ± 0.0
Parents' VAS of overall well-being (cm)	5.6 ± 2.1	6.2 ± 2.2	0.0 ± 0.0
Parents' VAS of pain (cm)	4.5 ± 2.8	8.3 ± 1.0*	0.0 ± 0.0
Physician's VAS of overall disease activity (cm)	5.4 ± 1.4	6.0 ± 2.0	0.0 ± 0.0

For the eight CHAQ domains, the possible score range is 0–3, for the disability index (DI) 0–3 and for the two VAS scores, 0–10 cm. Lower scores indicate better functional ability. Values are expressed as mean ± SD. P-value < 0.001 for all variables using the Kruskal–Wallis test

* P-value = 0.000005 compared with sJIA by Student's t-test

[a] Six out of 29 patients had assessments made

Table 3 Equal items-scale correlation and item internal consistency (linearity)

	1. Dressing	2. Arising	3. Eating	4. Walking	5. Hygiene	6. Reach	7. Grip	8. Activities
Disability index	0.960	0.887	0.867	0.931	0.959	0.957	0.895	0.960
1. Dressing	1.000	0.832	0.816	0.870	0.922	0.907	0.859	0.908
2. Arising	–	1.000	0.687	0.858	0.826	0.828	0.743	0.817
3. Eating	–	–	1.000	0.766	0.831	0.807	0.745	0.811
4. Walking	–	–	–	1.000	0.890	0.870	0.761	0.894
5. Hygiene	–	–	–	–	1.000	0.896	0.840	0.908
6. Reach	–	–	–	–	–	1.000	0.850	0.925
7. Grip	–	–	–	–	–	–	1.000	0.843
8. Activities	–	–	–	–	–	–	–	1.000

Pearson items-scale correlations were >0.4 for all of the CHAQ items

Table 4 Spearman correlation between CHAQ DI and other disease variables (external validity)

Sample		Disease duration	CRP	ESR	Physician's VAS[a]	Parents' VAS[b]	No. of swollen joints	No. of joints with pain	No. of joints with limited ROM	No. of active joints	Rheumatoid factor
Systemic and polyarticular onset JIA combined ($n = 63$)	Correlation coefficient	0.048	0.262	0.306	0.162	0.191	0.465	0.088	0.313	0.256	0.120
	P-value (two-tailed)	0.708	0.038*	0.015*	0.206	0.133	0.011*	0.534	0.049*	0.042*	0.349
Systemic onset JIA ($n = 34$)	Correlation coefficient	0.093	0.024	0.026	0.226	−0.006	0.379	−0.290	0.262	0.427	0.248
	P-value (two-tailed)	0.601	0.892	0.885	0.198	0.975	0.074	0.179	0.135	0.012*	0.157
Polyarticular onset JIA ($n = 29$)	Correlation coefficient	0.030	0.458	0.578	0.202	0.402	0.348	0.390	0.765	0.374	0.178
	P-value (two-tailed)	0.878	0.012*	0.001*	0.293	0.030*	0.499	0.037*	0.077	0.046*	0.355

* *P*-value < 0.05 (Spearman rank order correlation)

[a] Physician's VAS of overall disease activity

[b] Parents VAS of overall disease activity

physician's evaluation of overall disease activity on a 10-cm VAS, the patients' assessment of overall well-being on a-10 cm VAS, the number of joints with active arthritis, the number of joints with a limited range of motion and ESR. In addition, correlation with disease duration, CRP, the number of joints with pain, the number of swollen joints and rheumatoid factor were tested. Convergent validity was tested only for the subgroup of patients with JIA. The median of the Spearman correlation coefficients between the CHAQ DI and the other variables for all JIA patients combined was 0.224, ranged from 0.048 to 0.465 (Table 4), the highest correlation being with number of swollen joints ($r = 0.465$, *P*-value $= 0.011$). The group of pJIA patients showed better correlation between the CHAQ DI and other variables than the group of sJIA patients. Significant correlation was seen between DI and CRP, ESR, parent's VAS of overall well-being, number of joints with pain, and number of active joints for the pJIA group. For the sJIA group, the only significant correlation was between DI and the number of active joints.

Discussion

The first Japanese cross-cultural adaptation and validation of the CHAQ is reported here. The original CHAQ is one of the most widely used questionnaires to assess physical function of JIA patients in the US and is both valid and reliable. It has already been culturally adapted and validated in numerous countries [7, 11, 12].

A version of the CHAQ translated directly from American English to Japanese could not be used without adaptation because of lifestyle differences, especially in the eating domain. However, the results of this study showed that the Japanese-adapted CHAQ still has many very useful features. Further studies are needed to evaluate the usefulness of the adapted CHAQ in distinguishing between patients who are in remission and those with disease activity.

This disease-specific questionnaire proved its ability to discriminate between patients with two different JIA subtypes and their healthy peers. sJIA is characterized by a remittent–spiking fever and an evanescent erythematous macular rash. Arthritis may affect any joint. Other features include hepatosplenomegaly, lymphadenitis, and polyserositis. Sometimes it progresses to macrophage activation syndrome (MAS), whose inflammatory status was recently revealed to be due to cytokine storm [13, 14]. From a viewpoint of disease-related quality of life, it is possible to say that sJIA and pJIA are different diseases since the problems in sJIA are not restricted to arthritis. As shown in Table 1, children in the sJIA group showed higher inflammatory biomarkers than those with pJIA, whereas

the number of active joints was relatively small. In terms of external validity, the pJIA group showed better correlation between DI and other JIA core set variables than the sJIA group. The DI in pJIA patients was statistically significantly correlated with CRP, ESR, parent VAS, the number of joints with pain, and the number of active joints, whereas only the number of active joints showed correlation with the DI in the sJIA group. This indicates that pJIA is a more appropriate disease subtype for this questionnaire than is sJIA. This may be because biomarkers in pJIA reflect only inflammation due to arthritis, whereas in sJIA biomarkers reflect both systemic and articular inflammation. There was even a negative correlation between DI and the parent's assessment of overall well-being for the sJIA group. This indicates that functional ability, as assessed by the CHAQ, is not the main consideration of sJIA patients' parents when assessing their child's status. This should be borne in mind when using the CHAQ in studies of treatment of sJIA. In summary, the CHAQ was designed as the principal rheumatic "disease-specific" instrument to be used for studies involving patients with JIA. The usefulness of this questionnaire has been reported with other pediatric rheumatic diseases such as juvenile dermatomyositis (JDM) [15] and juvenile systemic lupus erythematosus (SLE) [16]. The adapted Japanese CHAQ could also be applicable to Japanese children with these rheumatic diseases.

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