

Reliability and Validity of the Self-report Quality of Life Questionnaire for Japanese School-aged Children with Asthma (JSCA-QOL v.3)

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ABSTRACT

Background: Asthma is a chronic disease prevalent in children which threatens their quality of life (QOL) through unexpected asthma attacks and/or the burden of daily self-management. As some conditions of chronic illness make it difficult for a child to accomplish normal developmental tasks, there may be fewer opportunities for the child to obtain a sense of achievement. This study investigated the reliability and validity of the Quality of Life Questionnaire for Japanese School-aged Children with Asthma Version 3 (JSCA-QOL v.3). This questionnaire includes 25 items with a 5-point Likert Scale format over five domains: "asthma attack triggers", "change in daily life", "family support", "satisfaction with daily life" and "restriction in participating in daily activities", and one summary scale.

Methods: In the present study, 2,425 children with asthma aged from 10 to 18 years were investigated in Japan. The internal consistency reliability of each domain was investigated with Cronbach's α reliability coefficient, and test-retest reliability with Spearman's correlations coefficient. Factorial validity by factor analysis using maximum-likelihood extraction with promax rotation was performed. Data analysis was performed using SPSS 12.0J.

Results: The final number of effective replies was 2,097 (the rate of effective data was 86.5%). "Asthma attack triggers", "change in daily life", "family support", "satisfaction with daily life" and "restriction in participating in daily activities" showed a high internal consistency (Cronbach's $\alpha = 0.66-0.86$) as well as good test-retest reliability (Spearman's $\rho = 0.60$, $p < 0.01$).

The factorial validity was appropriate (KMO value = 0.90), because it was conceivable that the five factors extracted from factor analysis would be the same as in our hypothesis and support constructive validity. In addition, there was good correlation between the summary scale and the total QOL score (Spearman's $\rho = 0.58$, $p < 0.01$).

Conclusions: The present study showed that the JSCA-QOL v.3 is a reliable and valid measurement tool that can be used to appropriately assess QOL in school-aged children with asthma. As the JSCA-QOL v.3 can be easily completed in about 10 minutes, it can contribute as an efficient evaluation tool of the outcome of medical treatment through continual utilization in the outpatient clinic. The JSCA-QOL v.3 allows a health provider to help school-aged children with asthma to achieve their developmental tasks.

KEY WORDS

asthma, quality of life, questionnaire, reliability and validity, school-aged children

INTRODUCTION

The progress of medical treatment for children with

bronchial asthma has drastically decreased the number of children requiring long time hospitalization for medical management. Now, most school-aged chil-

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dren with asthma live with their families and are able to attend schools in their community while receiving medical treatment at an outpatient clinic.^{1,2} Children of school age or adolescents are at the development stage of "industry *vs.* initiative"; learning to develop a sense of adequacy regarding abilities and competencies as opportunities for social interactions and learning increase, especially by making efforts towards subject achievement in school life and peer group society. There is a danger that the child may develop an inferiority complex, if he or she does not feel competent in the achievement of tasks.^{3,4}

Since school-aged children with chronic illnesses are faced with not only the usual developmental tasks, but also the crises of various situations induced as a result of their disease, their quality of life (QOL) tends to be poor. Because school-aged children and adolescents spend much time outside the home, it is difficult for parents to grasp how their child self-manages the care of their chronic ill condition. Their children's beliefs may be influenced by peer groups in terms of acceptance and rejection. For school-aged children and adolescents with asthma, it is conceivable that there is a difference between the child's recognition of QOL and that of their parents. Therefore, a self-report questionnaire for children with asthma is required for children to measure their own QOL appropriately.^{5,6}

This study investigated the reliability and validity of the Quality of Life Questionnaire for Japanese School-aged Children with Asthma Version 3 (JSCA-QOL v.3) which consists of 25 items with a 5-point Likert Scale format over five domains; "asthma attack triggers", "change in daily life", "family support", "satisfaction with daily life" and "restriction in participating in daily activities", and one summary scale.

METHODS

DEVELOPMENT PROCESS OF THE JSCA-QOL QUESTIONNAIRE

In 1998, we initiated the project to develop a tool for measuring the QOL of Japanese school-aged children with asthma, based on the QOL questionnaire form designed for data entry by parents or caregivers of children with asthma.⁷ We developed the first version of the self-report questionnaire for the QOL of Japanese school aged-children, which consisted of 40 items with a 5-point Likert Scale format over four domains in 1999. We then modified the QOL questionnaire to contain five domains: "asthma attack triggers", "change in daily life", "family support", "satisfaction with daily life" and "restriction in participating in daily activities", based on the examination results of factor analysis, although in the beginning, we hypothesized the existence of only the following four domains: "physicality", "society", "family" and "emotion".⁸⁻¹² Furthermore we selected adequate items by decreasing the original 40 items step by step to 25

items on the basis of statistical analysis (principal factor analysis, test-retest reliability, Cronbach's alpha etc.), and we added a summary scale in the 2nd version.^{13,14} The development process of the JSCA-QOL v.3 is shown in detail in Table 1.

SAMPLE

Physicians all over Japan requested 5,370 children with asthma aged from 10 to 18 years who were attending outpatient clinics or hospitals to participate in the present study. The eligible subjects who met the requirements for inclusion in the present study were 2,425 school-aged children with asthma. The requirements for inclusion were: (1) signed confirmation of agreement; (2) completion of all items of the JSCA-QOL v.3; (3) aged between 10 and 18 years; (4) history of bronchial asthma of at least 6 months; and (5) no history of hospitalization within one month before the investigation period. Test-retest analysis of 93 subjects was done in intervals of 2-4 weeks.

DESIGN AND PROCEDURES

Convenience sampling was used in this study. Physicians all over Japan requested 5,370 children with asthma aged from 10 to 18 years who were attending outpatient clinics or hospitals to participate in the current study. After obtaining consent from both the child and family, physicians handed out the questionnaire and a stamped envelope, and asked the participants to mail the envelope to the researchers after completing the questionnaire. The survey period was from January to March 2003. As an ethical consideration, prior to participation in the present study, participants were informed of their rights concerning the study, and written consent was obtained.

MEASUREMENT

JSCA-QOL v.3; The JSCA-QOL v.3 is composed of 26 items including one summary scale (Table 2). The 25 items are contained in five domains: "asthma attack triggers" (3 items), "change in daily life" (6 items), "family support" (4 items), "satisfaction with daily life" (8 items) and "restriction in participating in daily activities" (4 items).¹⁵ The JSCA-QOL v.3 has two types of question; one asks about frequency and the other asks about the degree of the condition over the past one month. Each item was evaluated on a 5-point scale; for example 5 for "none" and 1 for "more than a lot". Although the JSCA-QOL v.3 includes some reverse items, the total score shows a high QOL condition as a high number. In addition, the summary scale, which asked about the overall condition of the participant's life in the recent past few days, was evaluated on a 5-point scale from 5 for "fantastic" to 1 for "not so good". The summary scale was used to confirm correlation with the QOL total score. Furthermore, the participants were requested to state the age at which they first contracted bronchial

Table 1 Development Process of the JSCA-QOL v.3

| |
|--|
| Phase 1 (1998); Selection of domains and 51 items for the questionnaire Referring to the questionnaire for mothers of asthmatic infants (Torii S <i>et. al.</i>) ⁷ Based on our research on the experience of asthmatic children using the KJ Method ⁹ |
| Phase 2 (1999); Selection of 40 items for pre-test ⁹ Brain storming among 6 youths with past asthma and research members Focus group interview; Asking some school age children about their understanding of expressions for several items and answer style |
| Phase 3 (1999-2000); Survey using the JSCA-QOL v.1 (40 items) ⁸⁻¹¹ Subjects -159 children with bronchial asthma (10-18 y) in Aichi Pref. Test-retest (after 2 weeks) Comparative study with healthy children |
| Phase 4 (2001); Survey using the JSCA-QOL v.2 (30 items + summary scale) ^{2,12,13} Modification of domains from four to five on the basis of the results of factor analysis Addition of a summary scale Elimination of some items with small factor loading Subjects- 316 children with bronchial asthma (10-18 y) in Aichi, Gifu, Shizuoka, Mie and Ehime Pref. Focus group interview ¹⁴ |
| Phase 5 (2002); Revision to the JSCA-QOL v.3 ¹⁵ Selection of 25 items in 5 domains and 1 item for summary |

asthma, while on the other hand, physicians were requested to state the severity of their patient's disease according to the Japanese pediatric guideline for the treatment and management of asthma in 2000.¹⁶

STATISTICAL ANALYSIS

The complete data, excluding the data deficit to even 1 item of the 26 QOL items including the summary scale and/or age, were analyzed using SPSS 12.0J (SPSS Japan Inc., Tokyo, Japan) in the present study. Cronbach's reliability coefficient α was used for the internal consistency of the five domains of the JSCA-QOL v.3. Cronbach's $\alpha > 0.7$ was taken as reliable.^{17, 18} The test-retest reliability of the total score was investigated using Spearman's rho correlations coefficient, taking Spearman's rho >0.6 as reliable.

The factorial validity was investigated by factor analysis using maximum-likelihood extraction with promax rotation. In addition, the correlation between the summary scale and the QOL total score and the correlation among the five domains were confirmed.

RESULTS

RESPONSE RATE AND POPULATION

From a population of 5,308 children, responses were

Table 2 JSCA-QOL v.3

| Subscale | |
|---------------|---|
| A | Asthma attack triggers |
| | 9 having a cough because of cigarette smoke |
| | 20 having a cough in a crowd |
| | 22 having a cough because of a sudden change in temperature |
| B | Change in daily life |
| | 3 being absent from school |
| | 4 unpleasant feeling to be told about asthma |
| | 5 disturbance of sleep |
| | 10 emergency visit |
| | 13 leaving school earlier |
| | 21 giving family trouble |
| C | Family support |
| | 6 family support when having an asthma attack |
| | 11 family's careful consideration to prevent asthma attacks |
| | 12 being praised for making efforts toward asthma treatment |
| | 16 family support in daily life |
| D | Satisfaction with daily life |
| | 1 being as healthy as friends |
| | 2 enjoying daily life |
| | 7 enjoying at play |
| | 14 enjoying school life |
| | 15 enjoying what I want to do |
| | 17 spending daily life with satisfaction |
| | 19 having dreams or hopes for the future |
| | 25 spending daily life as well as friends do |
| E | Restriction in participating in daily activities |
| | 8 restriction in participating in sports |
| | 18 difficulty in playing cheerfully with friends |
| | 23 restriction in participating in physical education class |
| | 25 restriction in participating in school events |
| Summary scale | |
| | 26 How has your life been the last few days? |

Sample of question

| | | | |
|-----|---|--------------------------|-----------------|
| Q14 | Do you think that you enjoyed your school life including studying last month? | <input type="checkbox"/> | none |
| | | <input type="checkbox"/> | a little |
| | | <input type="checkbox"/> | so-so |
| | | <input type="checkbox"/> | a lot |
| | | <input type="checkbox"/> | more than a lot |

received from 2,425 (response rate 45.7%). However, 328 of these were excluded from data analysis, finally leaving 2,097 eligible subjects. The reasons for exclusion were missing data in one or more items of the JSCA-QOL v.3 in 216 and age exceeding the age limit or missing age in 112 subjects.

Table 3 shows the characteristics of the subjects included in the present study. The mean age was 12.48 (SD 2.18) years. Of the children, 1,322 were boys (63.0%), 766 were girls, and 9 were unknown. The se-

Table 3 Subjects Characteristics

| Sex | Male | Female | Unknown | |
|------------------------|------------|-------------|-------------|---------|
| | 1,322 | 766 | 9 | |
| | 63.0% | 36.5% | 0.5% | |
| grade (school) | Elementary | Junior high | Senior high | |
| | 1,168 | 646 | 283 | |
| | 55.7% | 30.8% | 13.5% | |
| | Mean (y) | SD | Range (y) | |
| Age | 12.48 | 2.18 | 10-18 | |
| Age at Onset of asthma | 3.84 | 3.06 | 0-17 | |
| Severity of Asthma | | | | |
| Severe | Moderate | Mild | Remission | Unknown |
| 41 | 440 | 1224 | 285 | 107 |

Table 4 Factor Analysis (Pattern Matrix)

| JSCA-QOL 3rd Version | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|--|----------|----------|----------|----------|----------|
| spending daily life with satisfaction | 0.807 | | | | |
| enjoying daily life | 0.798 | | | | |
| enjoying what I want to do | 0.758 | | | | |
| enjoying school life | 0.696 | | | | |
| spending daily life as well as friends do | 0.613 | | | | 0.250 |
| enjoying at play | 0.579 | | | | 0.201 |
| being as healthy as friends | 0.406 | | | | |
| having dreams or hopes for future | 0.402 | | 0.230 | | |
| emergency visit | | 0.816 | | | |
| being absent from school | | 0.646 | | | |
| disturbance of sleep | | 0.584 | | | |
| leaving school earlier | | 0.400 | | | 0.183 |
| giving family trouble | | 0.343 | - 0.182 | | |
| unpleasant feeling to be told about asthma* | | 0.173 | | | |
| family support in daily life | | | 0.784 | | |
| family's careful consideration to prevent asthma attacks | | | 0.706 | | |
| family support when having an asthma attack | | | 0.668 | | |
| being praised for making efforts toward asthma treatment | | | 0.585 | | |
| having a cough in a crowd | | | | 0.873 | |
| having a cough because of a sudden change of temperature | | | | 0.751 | |
| having a cough because of cigarette smoke | | | | 0.452 | |
| restriction in participating in physical education class | | | | | 0.674 |
| restriction in participating in school events | | | | | 0.595 |
| restriction in participating in sports | | | | | 0.543 |
| difficulty in playing cheerfully with friends | 0.211 | | | | 0.438 |

* Maximum-Likelihood Extraction with Promax rotation
 $n = 2,097$ KMO value = 0.900

The KMO value was 0.9. This showed that the factor analysis was appropriate. The first factor was "satisfaction with daily life". The second factor was "change in daily life", the third factor was "family support", the fourth factor was "asthma attack triggers" and the last factor was "restriction in participating in daily activities". No item indicated a factor loading weight similar to the plural factors. Only one item* was classified as belonging to the second factor "change in daily life" although originally it was hypothesized as being one of the first factor items.

verity of asthma was as follows: mild 1,224 (58.3%), moderate 440 (21.0%), severe 41 (2%), remission 285 (13.6%), and unidentified 107 (5.1%).

INTERNAL VALIDITY

Factor analysis using maximum-likelihood extraction with promax rotation identified five factors which were almost the same as those hypothesized (Table 4). The inter-factor correlation is shown in Fig-

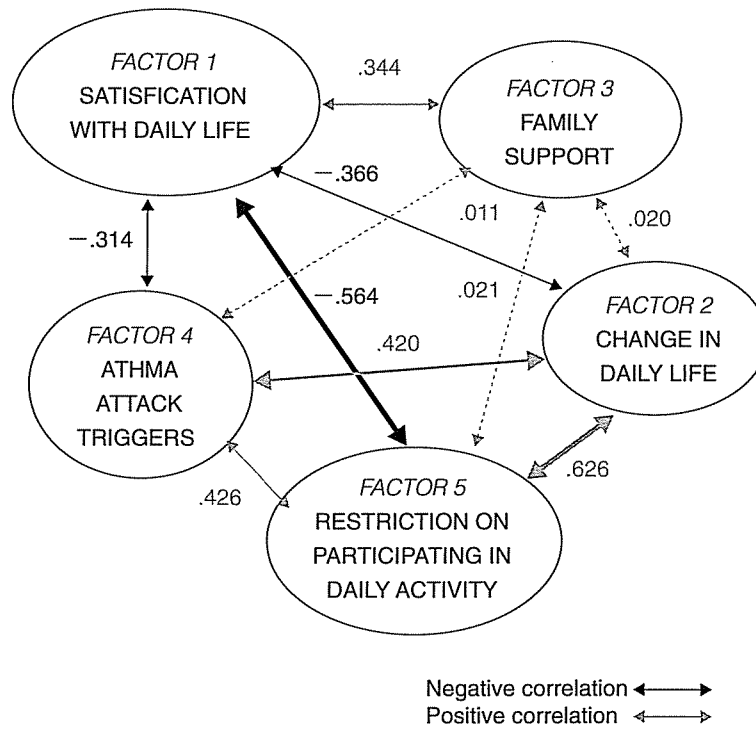


Fig. 1 Inter-factor correlation of JSCA-QOL3 v.3. Number shows the value of Inter-factor correlation matrix. Factor analysis using Maximum-Likelihood Extraction with a Promax rotation. Factor Correlation Matrix means that the relation among the five domains of JSCA-QOL v.3.

Table 5 Internal consistency reliability of five domains of JSCA-QOL

| Domain name | Items | Cronbach's α |
|--|-------|---------------------|
| Satisfaction with Daily Life | 8 | 0.86 |
| Change in Daily Life | 6 | 0.70 |
| Family Support | 4 | 0.78 |
| Asthma Attack Triggers | 3 | 0.72 |
| Restriction on participating in Daily Activity | 4 | 0.71 |
| Total | 25 | 0.86 |

Items = number of items
 Cronbach's $\alpha > 0.7$ was taken as reliable
 The reliability coefficient of all domains was reliable. The reliability coefficient of all items of the JSCA-QOL v.3 was high (Cronbach's $\alpha = 0.86$).

ure 1. The KMO value point was 0.9. This showed that the factor analysis was appropriate. The first factor was "satisfaction with daily life". The second factor was "change in daily life", the third factor was "family support", the fourth factor was "asthma attack triggers" and the last factor was "restriction in participating in daily activities". No item indicated a factor loading weight similar to the plural factors. Only one item "Do you feel unpleasant to be told about your

asthma at school?" was classified as belonging to the second factor "change in daily life" although originally it was hypothesized as being one of the first factor items. Therefore, this question item was moved from the "satisfaction with daily life" to the "change in daily life" domain.

RELIABILITY

The internal consistency reliability coefficient (Cronbach's α) of the JSCA-QOL v.3 was investigated after one item was moved from the second factor to the first according to the result of factor analysis. The reliability coefficient of each domain of the JSCA-QOL v.3 is shown in Table 5. More than 0.7 of all domains with Cronbach's α ranged from 0.86 (satisfaction with daily life) to 0.70 (change in daily life). The reliability coefficient of all items of the JSCA-QOL v.3 was high (Cronbach's $\alpha = 0.86$).

Test-retest reliability, which was investigated with Spearman's rho correlations coefficient, was reliable (Spearman's rho = 0.6, $p < 0.01$).

CONTENT VALIDITY

There were significant correlations among the domains except for "asthma attack triggers" and "family support" (Table 6). The correlation coefficient be-

Table 6 Correlation Coefficient between Total Score, Summary Scale and Several Domains

| | Change in Daily Life | Family support | Asthma Attack Triggers | Restriction on participating in Daily Activity | Total Score | Summary Scale |
|--|----------------------|----------------|------------------------|--|-------------|---------------|
| Satisfaction with Daily Life | 0.256** | 0.330** | 0.213** | 0.462** | 0.612** | 0.583** |
| Change in Daily Life | | - 0.075** | 0.294** | 0.364** | 0.213** | 0.406** |
| Family Support | | | 0.029 | 0.052* | 0.211** | 0.554** |
| Asthma Attack Triggers | | | | 0.274** | 0.236** | 0.411** |
| Restriction on participating in Daily Activity | | | | | 0.374** | 0.588** |
| Total Score | | | | | | 0.583** |

Spearman's rho * $P < 0.05$ ** $P < 0.01$

An extremely high correlation coefficient among the five domains was not observed. The correlation coefficient between the total score of the 25 items of the JSCA-QOL v.3 and the summary scale was moderate (Spearman's rho = 0.583, $p < 0.01$).

tween "satisfaction of daily life" and "restriction in participating in daily activities" was the highest (Spearman's rho = 0.462, $p < 0.01$). An extremely high correlation coefficient among the five domains was not observed. Furthermore, the correlation coefficient between the total score of the 25 items of the JSCA-QOL v.3 and the summary scale was moderate (Spearman's rho = 0.583, $p < 0.01$).

DISCUSSION

The JSCA-QOL was developed to evaluate the QOL of school-aged children with asthma appropriately and efficiently. The present study shows excellent internal consistency reliability, eligible test-retest reliability and relevant validity.

Since lower response rates are common when researchers use the method of collecting questionnaire data by mail,¹⁹ we believe that the reply rate was comparatively good at 45.7% in spite of the voluntary nature of the investigation. The results of the present study are credible, although the rate of male participants in this study was higher than the general male incidence rate in Japan.²⁰ The subjects in this study were suitable for the development of a self-report questionnaire that measures the QOL of school-aged children/adolescents with asthma, who live in the community.

In all five domains of the JSCA-QOL v.3, the reliability coefficient exceeded 0.7 which is standard for internal consistency reliability. Also, a good result was obtained even for the stability through the test-retest of 93 children. In most articles on measurement tool development the sample number for test-retest reliability was 30–50.^{21–23} Therefore, the JSCA-QOL v.3 is a reliable tool for measuring the QOL of school-aged children with asthma in Japan.

Factor analysis can be used to test the content validity by either confirming or exploring the underlying factors in a multi-dimensional instrument. It is very important that an appropriate sample size is used for factor analysis, and we therefore used a

large sample size in the present study. We were well above one recommendation,²³ *i.e.*, that the number of individuals should exceed the items by at least 30. According to inter-factor correlation, "family support" correlated with "satisfaction of daily life" in opposition to the other four domains. It may be that the characteristic findings of school-aged children with asthma reflected the developmental tasks in this period.

In addition, except the correlation between "family support" and "asthma attack triggers", the five domains were significantly correlated with each other. In particular the correlation coefficient was highest in the "satisfaction of the daily life" and the "restriction in participating in daily activities" domains. As the pressure to conform to the norms of peer groups is a great source of stress for teenagers,²⁴ this result was very understandable for us. Moreover the difference in the correlation coefficient among the five domains indicated the discriminant validity of several factors.²⁵ Consequently the content validity of the JSCA-QOL v.3 was confirmed.

The correlation coefficient was high between the total QOL points and the summary scale. This means that the evaluation of the QOL overall was similar to the evaluation over the last few days. Furthermore, the sensitivity to disease was good since there was significant correlation between the "asthma attack triggers" domain and the severity of asthma.

The JSCA-QOL v.3 questionnaire can obtain measurement in about 10 minutes, because it is composed of only 26 items including a summary scale. Children can complete this questionnaire while waiting in outpatient clinics or hospitals. We believe that the JSCA-QOL v.3 is useful for quick and effective assessment of the QOL of school-aged children with asthma. Continuous measurement of the JSCA-QOL v.3 used together with an asthma diary is particularly powerful in preventing reduction in their QOL, because the health provider can recognize changes in children with asthma. For school-aged children, it is very important for health providers to know the level of the

domains "restriction in participating in daily activity" and "change in daily life", which characteristically reflect the developmental tasks in this period.^{26,27} The JSCA-QOL v.3 contributes by allowing a health provider assisting school-aged children with asthma to help them achieve their developmental tasks.

Finally, there is the possibility that subjects in the present study mainly included those with good compliance. The limitation of this study is that there were few data for severe asthma, because the research was voluntary. In future, action research including intervention using the JSCA-QOL v.3 for school-aged children with asthma is required.

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