Reliability and Validity of the Children's Health Survey for Asthma

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ABSTRACT. *Objective.* **Describe the psychometric properties of the Children's Health Survey for Asthma (CHSA)— a condition-specific, self-report, functional health measure for parents of children 5 to 12 years of age with chronic asthma.**

Method. **Data from two cross-sectional and one longitudinal study were used to assess internal consistency reliability, test–retest reliability, and validity of the CHSA. Over 275 parents and guardians of children with asthma completed the CHSA in one of three studies. The combined samples included a heterogenous mix of respondents by child age and race/ethnicity and parental marital and socioeconomic status. Five domain scores were computed: physical health, activity (child), activity (family), emotional health (child), and emotional health (family). Raw scale scores were transformed from 0 to 100 with higher scores indicating better or more positive outcomes.**

Results. **Across the three samples, mean scale scores ranged from a low of 61.5 (emotional health of the child) to a high of 86.1 (activity [family]). Internal consistency reliability for each of the scales was high (Cronbach's α = .81–.92), and test–retest reliability (correlation between forms) ranged from .62 to .86. Significant differences in mean scores for four of five scales were noted between those with low versus moderate to high recent symptom activity.**

Conclusion. **In three tests, the CHSA displays strong reliability and validity. Descriptive statistics demonstrate a range of scale scores. Internal consistency is good to excellent and short-term test–retest reliability is good for each of the five scales. Construct validity is demonstrated by the ability of CHSA to distinguish levels of disease severity, defined by symptom activity. *Pediatrics* 1999;104(6). URL: http://www.pediatrics.org/cgi/content/full/104/6/e71; *child, pediatric, asthma, functional outcomes, quality of life, health status, family.***

ABBREVIATIONS. QOL, quality of life; AAP, American Academy of Pediatrics; CHSA, Children's Health Survey for Asthma; PFT, pulmonary function test; FEV_1, forced expiratory volume in 1 second.

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In the past few decades, a number of patient-centered outcome measures have been developed and tested extensively for adults; such measures have been termed quality of life (QOL), functional outcome, or health status measures. Adult measures are now used widely, particularly in research projects and increasingly in practice applications aimed at improving the quality of care by assessing outcomes from the point of view of the patients.[1,2]

However, in comparison to work for adults, the development of measures for children is in its infancy.[3] Such tools are needed to enable patients and parents to provide input on how they view their QOL and their capacity to function in normal social roles. For example, can children participate in normal school activities? Can they play with friends? Can they live a life free of painful symptoms? There are currently at least three generic health status or QOL measures for children that have been validated and are available for use.[4–6] Generic measures are those that are applicable to a range of conditions, typically cover a broad spectrum of health concepts, and are useful in generalizing across populations and interventions. In contrast to generic measures, condition-specific instruments focus on distinct diagnostic groups, provide detail on outcomes related to a target disease or condition, and should be particularly sensitive to changes in a condition over time. Less work has been done on the development of condition-specific measures for children.

In response to this gap, the American Academy of Pediatrics (AAP) launched the Functional Outcomes Project to develop and test measures for children with chronic conditions. The first condition targeted in this effort is asthma. In pediatrics, measuring the QOL for children with asthma has been of particular interest, both out of concern for the quality of care children with asthma receive and as an indicator of how well the health care system for children with special needs performs. Although children are generally free from chronic disease, asthma is an exception.[7,8]

Several pediatric asthma-specific measures have been published,[9–11] although no gold standard instrument has emerged.[3,12] Limitations of existing measures include the lack of longitudinal data to assess sensitivity to change over time, difficult administration procedures, lack of attention to the emotional and/or social effects of asthma, and limited evidence of generalizability to populations at greatest risk for asthma.[13]

The asthma instrument of the AAP is the Chil-

dren's Health Survey for Asthma (CHSA). The development of the CHSA began in 1992. An expert work group of pediatricians and specialists in asthma, allergy, immunology, and pulmonology provided input on clinical aspects of the condition. Focus groups with parents contributed information on issues of interest and concern to families living with asthma. One-on-one cognitive interviews were conducted asking parents to think aloud as they read and responded to each individual CHSA item. These interviews provided additional assessment of questionnaire readability, terminology, design, comprehension, and recall. A more detailed description of the initial instrument development process and pilot test has been published elsewhere.[14]

The CHSA:48 is a paper-and-pencil measure completed by parents of children 5 to 12 years of age with chronic asthma. The instrument includes a broad spectrum of child- and family-focused items divided into five scales (physical health, 15 items; activity [child], 5 items; activity [family], 6 items; emotional health [child], 5 items; and emotional health [family], 17 items) as well as questions about health care utilization, asthma triggers, and family demographics. All scale items require subjects to respond on a 5-point Likert-type scale, with higher scores indicating better or more positive outcomes. Two-, 4-, and 8-week recall versions have been tested. The reading level of the CHSA has been reviewed professionally and assessed to be at the sixth grade level.

To date, the measure has undergone a series of psychometric tests in a variety of settings in the United States, including the Pediatric Asthma Care PORT II project.[15] In this article, we report on the reliability and validity of the CHSA: Content validity: Are issues of importance to parents, children, and physicians related to pediatric asthma addressed within the CHSA? Internal consistency reliability: Do items within each of the five subdomains of the CHSA fit together as one construct? Test–retest reliability: Under conditions in which their child's asthma seems to be clinically stable, do respondents to the CHSA give similar answers from one time to another? Construct validity: Do domain scores on the CHSA correlate with other ratings of the child's health status related to asthma?

METHODS

Instrument Development

This report examines data from four studies performed to further instrument development. These tests will be referred to as study I, study II, study III, and study IV. Each test will be discussed in detail below.

Elements of several studies have been used to reduce the questionnaire from its original long version (CHSA:71) to the current length of 48 core scale items (Fig 1). Data from different sources were used simultaneously to assess content validity and to examine psychometric properties to create an instrument less burdensome to respondents and more practical for research and clinical application. To reduce the list of questions, each item was reviewed on the criteria listed in Table 1.

These stringent criteria guided a >30% reduction in questionnaire length, leading to the current version of the measure, CHSA: 48. While studies I–IV used the 71-item version, the assessments of reliability and validity reported in this paper are drawn from the 48 items in the now reduced version.

Instrument Testing

Dimensions of Testing

After the preliminary pilot test and substantial instrument revision, the CHSA has been used in additional studies with heterogeneous samples and different modes of questionnaire administration. Data from two cross-sectional and one longitudinal study were used to assess psychometric properties of the instrument (Table 2):

Testing Projects

Study I

An expert review sampled: 1) a group of parents (n = 102) drawn from mailing lists of Chicago-area Parents of Asthmatic Children support groups; and 2) a randomly selected group of AAP members (general pediatricians and subspecialists in allergy, immunology, and pulmonology; n = 76). Each expert was asked to rate the importance of every item included on the CHSA:71. Parents and physicians rated almost all items very highly, corroborating previous evidence from focus groups and cognitive interviews supporting the content validity of the measure.

Study II

The AAP conducted a cross-sectional study between February 1995 and January 1996 in the practices of five general pediatricians and pediatric asthma specialists across the US. During an office visit for asthma or well-child care, parents (n = 100) self-administered the CHSA:71 (using an 8-week recall period). Physicians completed a corresponding medical information form providing data on co-morbidities, medication use, and clinical/functional asthma severity. Families were study eligible if the child met the age criteria (5–12 years of age), if the child was diagnosed previously with asthma, and if the parent could write/read/speak English and was willing to give informed consent. The institutional review board of the AAP approved the study.

Study III

This collaborative project between the AAP and Arkansas Children's Hospital Center for Applied Research and Evaluation included parents (n = 102) of children between 3 and 12 years of age who experienced an asthma-related hospitalization at Arkansas Children's Hospital. Data collection took place from March 1996 to February 1997. Parents/guardians were contacted by a researcher from Arkansas Children's Hospital Center for Applied Research and Evaluation 2 months after hospital discharge. Respondents were asked to complete by telephone a modified version (including a subset of 9 of the 17 emotional health [family] items) from the CHSA:71, using an 8-week recall period. Information from the child's medical record was also available. Average questionnaire completion time was ~20 minutes. The study received approval from the University of Arkansas for Medical Sciences institutional review board.

Study IV

This project involved preparatory testing of the CHSA before use of the measure in larger PAC PORT II clinical trials.[15] Data were collected from February 1997 to February 1998. Parent–child pairs (n = 74) were recruited for participation through asthma clinics at two Chicago hospitals and patient lists from a local managed care organization. Eligibility required that the child be diagnosed previously with asthma, free from major co-morbidities (eg, cystic fibrosis, congenital heart disease, bronchopulmonary dysplasia), enrolled in no other asthma study presently or in the following 2-month period, and accompanied by a parent/guardian who could read, speak, and write in English. At four times over the 2-month study period (baseline, 48 hours, 4 weeks, and 8 weeks postbaseline), parents completed, in person, the self-report CHSA:71 (2-week recall period) and a series of other questionnaires addressing asthma history and social demographics. Findings from baseline and 48-hour follow-up data collection will be reported here. Children performed spirometry according to American Thoracic Society protocol,[16] using DX spirometry system software at each data collection point. Scores establishing the degree of disease burden were constructed from items included on a symptom-free day instrument, medication use form, and spirom-

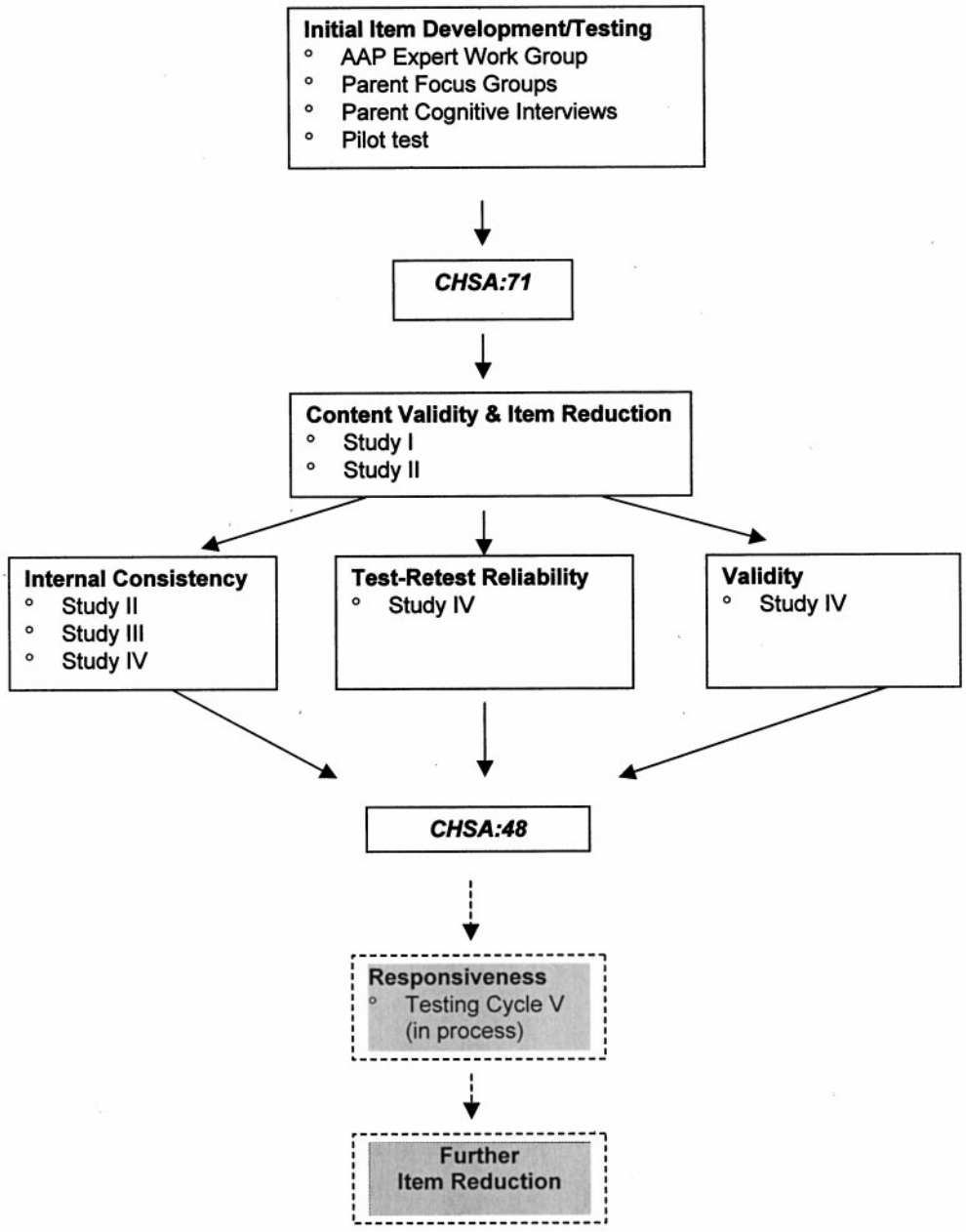

Fig 1. Process of instrument development, testing, and reduction for CHSA.

TABLE 1. Criteria Used in the Process of CHSA Item Reduction

Criterion	Source of Data
Low expert review rating (bottom 50%)	Study I
High ceiling effect (item mean >4.0 on a 5-point scale)	Study II
Low item–total scale correlation (<.60)	Study II
Improved scale α coefficient if item deleted	Study II
Low item covariance (<mean) with majority of other scale items	Study II

TABLE 2. Studies Assessing Various Psychometric Aspects of the CHSA

Test	Psychometric Assessment	Study Design
Study I	Content validity	Cross-sectional
Study II	Internal consistency reliability	Cross-sectional
Study III	Internal consistency reliability	Cross-sectional
Study IV	Internal consistency reliability	Longitudinal
	Test–retest reliability	
	Validity	

etry assessment (see below). Parent respondents who completed the entire study were paid 80 dollars for their participation and children received gift certificates. The study was performed under the auspices of the internal review boards of the AAP, Rush-Presbyterian-St Luke's Medical Center, and Cook County Hospital.

Analytic Plan

Descriptive Statistics

Basic descriptive statistics (mean, standard deviation, range, and percentage of responses at floor/ceiling) were examined for individual items and scales. In this report, all scale computations were based on the reduced item instrument, therefore, only scale items included in CHSA:48 were used in the analyses presented below.

Reliability Testing

Tests of internal consistency reliability included item–total correlation, Cronbach's α for each scale overall, and α if an item was deleted for individual scale items. To examine test–retest reliability, we used both intraclass correlation coefficient (measure of average similarity of actual baseline and 48-hour administration scores[2]) and correlation between forms of the subsample of children who were judged to be clinically stable over the designated analysis period. The 2 physician authors (K.B.W. and E.N.G.), who had no clinical interaction with child participants, independently rated each child's clinical stability between baseline and the 48-hour follow-up using data from: 1) parent-completed medication use form; 2) parent-completed symptom-free day measure; and 3) researcher-administered pulmonary function test (PFT). The test–retest analyses include only those children who received a clinical stability rating of no change (86.5%; $n = 64$). Disagreements over individual patient scores (<20% of all cases) were resolved through clinician discussion until consensus was achieved.

Differences in Scale Scores by Selected Covariates

Independent samples t tests were used to assess differences in scale scores by selected demographic variables from study IV data. Demographic items with more than two response choices were dichotomized for analyses as follows: child age (5–9 years vs 10–12 years), child race/ethnicity (black vs other), maternal education level (high school graduate or less vs some college or more), yearly family income (<$30 000 vs $30 000+), health insurance status (private insurance vs other), and marital status (married vs unmarried).

Validity Testing

To explore the measure's ability to distinguish levels of disease burden or severity, independent samples t test and analysis of variance with least significant difference (.05 level) post hoc tests were used. Variables to measure three dimensions of severity were constructed: asthma symptom activity, medication use, and PFT. The symptom activity variable was created from three items on the symptom-free day instrument (number of days child experienced wheezing or tightness in the chest or cough in the last 2 weeks; number of days in the past 2 weeks that child had a cough that was not from a cold; and number of nights in the past 2 weeks in which the child woke up because of asthma, wheezing, tightness in the chest, or cough). Possible values for each item ranged from 0 to 14. The item with the highest number of days was used to determine the symptom activity score. Categories of symptom activity were defined as follows: low = 0 to 2 days, moderate = 3 to 10 days, high = 11+ days. For the current analyses, the moderate and high categories were collapsed because of the small number of children in the high group ($n = 7$). The medication use variable was computed from two items on the medication use form (In the past 2 weeks, how often did your child use an inhaler to take bronchodilator medicine? and In the past 2 weeks, how often did your child use a nebulizer?). Values for each of the items ranged from 1 to 6 (1 = never and 6 = every day), and the item with the highest score was used to determine the medication severity score. The categories of medication use severity were defined as follows: low = 1 to 2; medium = 3 to 4; and high = 5 to 6. Finally, the PFT variable was determined by forced expiratory volume in 1 second (FEV_1) percentage predicted (pre-β-agonist) scores and categorized as follows: mild = ≥80% of predicted; moderate = 61% to 79% of predicted; and severe = ≤60% of predicted. For the current analyses, the moderate and severe FEV_1 categories were collapsed because of the small severe subsample ($n = 6$). All statistical analyses were performed using SPSS software (SPSS Inc, Chicago, IL).

RESULTS

Demographic Characteristics

Basic demographic characteristics for the samples from studies II to IV are presented in Table 3.

Descriptive Statistics for CHSA:48 Scales

Basic descriptive information about the five scales for studies II to IV is presented in Table 4. Computed scores were transformed giving each scale a minimum score of 0 and a maximum score of 100. For all CHSA:48 scales, higher scores indicate more positive outcomes or better health status.

Overall, mean scores ranged from the low 60s to upper 70s. In all three studies, the lowest scores were reported in the emotional domains and the highest in the activity domains. A relatively low percentage of patients scored the maximum possible total of 100, indicating low ceiling effect for all scales.

Internal Consistency Reliability Testing

Item–total correlations are detailed in Table 5 along with Cronbach's α for overall scales and individual αs for the scale if an item was deleted. In addition to high item–total correlations for the majority of items, Cronbach's α levels are consistently high in each of the three samples, especially for the physical health (range: .91–.92), activity [child] (range: .87–.89), and emotional health [child] (range: .87–.91) scales. One individual item in the emotional health (family) subscale (I am confident that I can handle a severe attack of my child's asthma) performed poorly. Very low or negative correlations were found, likely attributable to the item's positive phrasing among several negatively worded questions. Because the item's content was deemed important, it will be retained and reworded in future versions of the CHSA.

Test–Retest Reliability

Forty-eight hour follow-up data from study IV were used to examine test–retest reliability. For each of the five scales correlation between forms ranged from a low of .62 to a high of .86; intraclass correlation coefficients ranged from a low of .60 to a high of .85 (see Table 6).

Differences in Scale Scores by Selected Covariates

In an exploration of potential differences in mean scale scores (study IV) by selected covariates (eg, maternal level of education, family income, health insurance status, study recruitment site, parental marital status, child race/ethnicity, child gender, and child age), no differences were noted by child race/ethnicity, and few differences were noted by child age or gender. At baseline data collection, mean activity (child) scores were significantly higher (indicating more positive outcome) for boys (85.4) than for girls (71.7), and mean emotional health (child) scores were significantly higher for children 5 to 9 years of age (74.5) than for children 10 to 12 years of age (60.3).

Among the demographic characteristics used to approximate family socioeconomic status, few differences were observed. At baseline, mean physical health scores were higher for children whose parents were married, had a mother with at least some college education, had private insurance, or had a family income >$30 000. Mean scores for the emotional health (child) scale were also higher among those from the families with married parents.

TABLE 3. Demographic Characteristics of Study Samples (II to IV)

	Study II (n = 100)		Study III (n = 102)		Study IV (n = 74)	
Respondent (%)						
Mother	78.4		86.3		87.8	
Father	9.8		8.8		5.4	
Other	6.9		4.9		6.8	
Missing	4.9		-0-		-0-	
Child gender (%)						
Male	40.6		35.3		51.4	
Female	59.4		64.7		48.6	
Child age (y)	Mean = 8.9; range = 5–12		Mean = 7.3; range = 3–12		Mean = 9.1; range = 5–12	
Child race/ethnicity (%)						
Black	35.1		66.7		74.3	
White	51.5		33.3		1.4	
Asian	1.0		-0-		1.4	
Spanish or Hispanic	9.3		-0-		17.6	
Other	4.1		-0-		4.1	
Missing	-0-		-0-		1.4	
Parent age (y)	Father	Mother	Father	Mother	Father	Mother
	Mean = 38.5; range = 25–66	Mean = 35.3; range = 24–57	*	*	Mean = 38.4; range = 22–56	Mean = 37.1; range = 21–74
Percentage missing	20.1	7.0			25.7	4.1
Parent marital status (%)						
Married	52.6		38.2		47.3	
Single	17.9		33.3		28.4	
Separated/divorced/widowed	29.5		28.4		20.3	
Missing	-0-		-0-		4.1	
Highest level of education completed (%)	Father	Mother	Father	Mother	Father	Mother
High school graduate or less	41.8	39.8	59.0	52.0	40.6	44.6
Some college or more	55.8	60.2	34.7	48.0	37.9	54.1
Don't know	2.5	-0-	6.3	-0-	1.4	-0-
Missing	-0-	-0-	-0-	-0-	20.3	1.4
Respondent employment status (%)	*		*			
Employed outside the home					58.1	
Full-time homemaker					10.8	
Unemployed					21.7	
Other					6.9	
Missing					2.8	
Total household income (%)			*			
<$14 999	38.9				28.4	
$15 000–29 999	33.3				35.1	
$30 000–60 000	20.0				24.3	
>$60 000	7.8				10.8	
Missing	-0-				1.4	
Child stopped breathing or was intubated because of asthma (%)	12.2		14.7		5.4	
Child ever used steroids >4 times in a 6-mo period (%)	39.5		42.2		25.7	
Child ever been hospitalized for asthma (%)	*		*		48.6	
Child ever been taken to emergency room/ emergency department for asthma (%)	*		*		81.1	
Anyone in child's family had allergies, asthma, or eczema (%)	86.0		*		87.8	
Smoker in child's primary household (%)	28.6		36.3		39.2	

* Not collected.

Validity Testing

We assessed validity by evaluating whether CHSA scales were sensitive to differences in disease activity or severity using the three constructed severity variables described above (symptom activity, medication use, and FEV_1 [percentage predicted]). Figure 2 compares scale scores of children categorized as having low recent symptom activity versus moderate to high recent symptom activity. As illustrated, mean scale scores for children whose recent symptom activity was rated as low were consistently better and significantly higher (for all but the activity (child) scale) than for those designated as moderate to high.

Likewise, differences in mean scale scores by medication use severity (classified as low, medium, and high use) were in the expected direction (see Fig 3), although the differences were not as dramatic as those observed based on symptom activity. Analysis of variance and post-hoc tests (least significant difference) revealed statistically significant differences between mean scores among the low and high medication use groups for both the physical and emotional health (child) scales.

Using PFT scores as an indicator of asthma severity in conjunction with the CHSA:48 presents a more complex picture. CHSA:48 scales do not seem to be

TABLE 4. Descriptive Statistics for CHSA:48 Scales in Three Study Samples

	Mean	Standard Deviation	Minimum	Maximum	Valid N	% Floor	% Ceiling
Physical health							
Study II	63.22	19.94	10.00	98.33	94	-0-	-0-
Study III	70.66	22.03	18.33	100.00	101	-0-	3.0
Study IV	71.51	20.55	20.00	100.00	72	-0-	5.6
Activity (child)							
Study II	67.60	23.73	10.00	100.00	96	-0-	18.8
Study III	78.52	22.59	-0-	100.00	101	1.0	30.7
Study IV	78.63	20.95	30.00	100.00	73	-0-	27.4
Activity (family)							
Study II	72.60	22.73	8.33	100.00	97	-0-	17.5
Study III	73.00	21.89	4.17	100.00	102	-0-	16.7
Study IV	86.13	18.92	29.17	100.00	73	-0-	39.7
Emotional health (child)							
Study II	61.53	29.22	-0-	100.00	95	4.2	9.5
Study III	72.53	26.90	-0-	100.00	99	2.0	26.3
Study IV	68.70	28.06	-0-	100.00	73	2.7	21.9
Emotional health (family)							
Study II	61.40	20.22	20.59	94.12	97	-0-	-0-
Study III*	61.22	15.23	19.44	91.67	101	-0-	-0-
Study IV	66.77	17.65	25.00	100.00	74	-0-	1.4

* Study III Emotional health (family) scale computed based on 9 of 17 scale items.

as good at distinguishing severity based on FEV_1 % predicted (severity categorized as mild, moderate, and severe) as with medication use and symptom activity. Although mean scale scores are found in the expected direction (highest scores for mild, lowest scores for severe) for both the physical health and activity (child) scales, there is no similar or predictable relationship between severity and mean scores for the remaining three scales.

DISCUSSION

In multiple tests with diverse samples, the CHSA (a 48-item, condition-specific instrument for parents of children with chronic asthma) performed well. Psychometric tests, from several cross-sectional and one longitudinal study, involving >300 families of school-aged children with asthma, illustrate that the CHSA can reliably and validly capture a broad spectrum of asthma experiences.

Descriptive statistics indicate that CHSA domains tap a wide range of conditions. A low percentage of respondents scoring either the minimum or maximum for each scale reduces concern about floor and ceiling effects. Findings also indicate good to excellent internal consistency and short-term test–retest reliability. In tests of validity, CHSA scales (especially physical health and emotional health [child]) were sensitive to differences in disease severity when quantified as recent symptom activity and medication use. The CHSA was less successful at distinguishing disease severity based on FEV_1 scores, which might be expected given that PFTs target organ function at only one point in time, whereas CHSA items required respondents to synthesize their child's asthma experiences over a period. Other scholars have noted a somewhat weak relationship between spirometric assessment and common clinical indicators as well as global ratings of asthma-related health.[17,18] One explanation for these findings may be that National Heart, Lung, and Blood Institute guidelines for PFT classification, which are based on expert opinion for adults and have not been validated for the pediatric population, are inaccurate for gauging asthma severity in children. The findings also may indicate that the CHSA provides important information about a child's health status not obtainable simply from a test of lung function.

The results of psychometric testing are especially encouraging given the unique strengths shared by studies I to IV. Few pediatric asthma instruments before public release have been tested as extensively as the CHSA, with a series of studies and a longitudinal data collection component. The measure was tested on several samples, overrepresenting low income, minority, and inner-city respondents in the United States. The PAC PORT II longitudinal project (study IV) provided data from a public hospital clinic with a population of children particularly known to be at increased risk for asthma. It is important that asthma measures demonstrate validity and reliability for the populations that may stand to benefit the most from a better understanding of asthma's impact on daily life. Validity is not inherent to a measure, but variable, depending on the population studied.[19] Thus, additional evidence on the performance of the CHSA (as well as other QOL instruments) with different populations of children, especially those underserved and at-risk, is warranted.

Despite the progress made in methods to measure the health status of children with asthma, critical issues remain. Several additional tests of the CHSA are underway, and many other research groups are also advancing knowledge in the field.

Data are needed to examine whether the CHSA (and other asthma-specific measures) are sensitive to changes in a child's condition over time. Such studies require collection of longitudinal data to assess whether scale scores improve or worsen under conditions in which a child's asthma would be expected to improve or worsen. Such information is costly and difficult to collect. At the time of this writing, only one, small-sample study on the responsiveness of a measure to change in a child's asthma has been published.[11] However, a study, anticipated for com-

TABLE 5. Internal Consistency of the CHSA:48 in Three Study Samples

	Study II (n = 100)		Study III (n = 102)		Study IV (n = 74)	
	Item–Total Correlation	α*	Item–Total Correlation	α*	Item–Total Correlation	α*
Physical health—15 items		.91		.92		.92
Shortness of breath	.75	.90	.65	.91	.64	.92
Tightness in the chest	.73	.90	.62	.91	.67	.92
Wheezing without a cold	.47	.90	.69	.91	.54	.92
Cough	.41	.91	.63	.91	.61	.92
A cold that won't go away	.33	.91	.67	.91	.56	.92
Wheezing with a cold	.38	.91	.64	.91	.56	.92
Difficulty sleeping	.67	.90	.73	.91	.68	.92
Rapid heart rate or pounding of heart (attributable to medications)	.68	.90	.54	.91	.63	.92
Headache (attributable to medications)	.56	.90	.33	.92	.68	.92
Upset stomach/vomiting (attributable to medications)	.54	.90	.59	.91	.74	.91
Tightness in the chest (attributable to medications)	.73	.89	.75	.91	.72	.91
Irritable or fussy (attributable to medications)	.71	.90	.71	.91	.70	.91
Fatigue/tires easily (attributable to medications)	.67	.90	.69	.91	.66	.92
Difficulty paying attention or sitting still (attributable to medications)	.58	.90	.46	.92	.46	.92
Difficulty sleeping at night (attributable to medications)	.75	.89	.70	.91	.78	.91
Activity (child)—5 items		.89		.87		.87
Limited in school gym classes	.80	.85	.77	.81	.69	.85
Limited in playing sports or running outside	.82	.85	.80	.81	.73	.83
Limited in very strenuous activities	.79	.86	.77	.82	.77	.83
Limited in moderate activities	.76	.87	.71	.84	.77	.83
Limited in mild activities	.54	.91	.47	.89	.57	.87
Activity (family)—6 items		.85		.81		.86
Changed family plans or trips because not sure when attack could occur	.64	.82	.55	.79	.65	.84
Canceled social plans because child had a problem with asthma	.64	.82	.58	.78	.78	.83
Avoided activities or places that might trigger an attack	.57	.84	.55	.79	.69	.86
Lost sleep	.61	.83	.67	.76	.72	.84
Missed work or school	.62	.83	.46	.81	.66	.84
Normal routine was changed	.74	.80	.65	.77	.63	.85
Emotional health (child)—5 items		.91		.87		.90
Frustrated about having asthma	.78	.89	.59	.86	.72	.88
Is frustrated having to rely on asthma treatments	.72	.90	.77	.82	.79	.86
Is frustrated by having to limit activities because of asthma	.76	.89	.60	.86	.67	.89
Is upset about having asthma	.82	.88	.84	.80	.80	.86
Is upset by having to take asthma treatments	.78	.89	.67	.84	.75	.87
Emotional health (family)†—17 items		.90		.65		.86
Bothered by frequent trips to doctor's office or hospital	.61	.89	—	—	.61	.85
Bothered by finding a babysitter who can handle child's asthma	.61	.89	.49	.58	.37	.86
Bothered by getting child to take asthma medications	.57	.89	.30	.63	.49	.85
Bothered by having necessary equipment for asthma at home	.61	.89	.26	.64	.52	.85
Bothered by keeping house clean to avoid triggering attack	.55	.89	.44	.60	.55	.85
Child's asthma caused stress in family	.63	.89	.39	.61	.69	.85
Frustrated other people don't understand what it's like to have a child with asthma	.65	.89	.39	.61	.59	.85
Sometimes get angry and ask "Why my child?"	.62	.89	—	—	.58	.85
Have doubts if doing the right things in treatment of child's asthma	.57	.89	—	—	.55	.85
Confident about handling a severe attack of child's asthma	.10	.91	−.05	.69	−.03	.88
Sometimes lose hope that child will get better	.53	.89	—	—	.58	.85
Concerned about side-effects child could get from taking medicine for a long time	.48	.89	.35	.62	.48	.86
Worry about cost of child's medical care for asthma	.60	.89	—	—	.37	.86
Worry that child is not getting good medical care for asthma	.49	.89	—	—	.43	.86
Worry that asthma causes child to be left out from playing with other children	.58	.89	—	—	.64	.85
Cost of medical care for child's asthma causes stress in our family	.56	.89	—	—	.41	.86
Concerned about problems from asthma that child currently has or may have in future	.63	.89	.38	.62	.52	.85

*α values reported for individual items are α if item is deleted from scale.
† AAP/Arkansas project Emotional Health [family] scale computed based on 9 of 17 scale items.

pletion later this year, will provide such information on the CHSA.

The CHSA and other instruments[5,9,17,20] use parent report, whereas other measures have been developed for child report, particularly the reports of older children.[4,11,21] The testing of an adolescent self-report version of the CHSA is underway. A critical question in the field is when should parent report instruments be used and when can (and should) children report for themselves. Although there is strong interest in this important issue, the empirical evidence to inform the debate is limited.[13,22] In general, correlations between children and parents are better for more objective behavioral items than for more subjective

TABLE 6. Test–Retest Reliability of the CHSA:48 in the Subsample of Children Judged to be Clinically Stable Over Time (Study IV)

Scale	Baseline Visit—48 Hours' Follow-up		
	Valid Number	Test-Retest *r* Between Forms	Intraclass *r* Coefficient (95% Confidence Interval, Lower to Upper Range)
Physical health	61	.86	.82 (.62–.90)
Activity (child)	62	.86	.85 (.75–.91)
Activity (family)	63	.82	.81 (.71–.88)
Emotional health (child)	64	.62	.60 (.41–.74)
Emotional health (family)	62	.81	.77 (.60–.87)

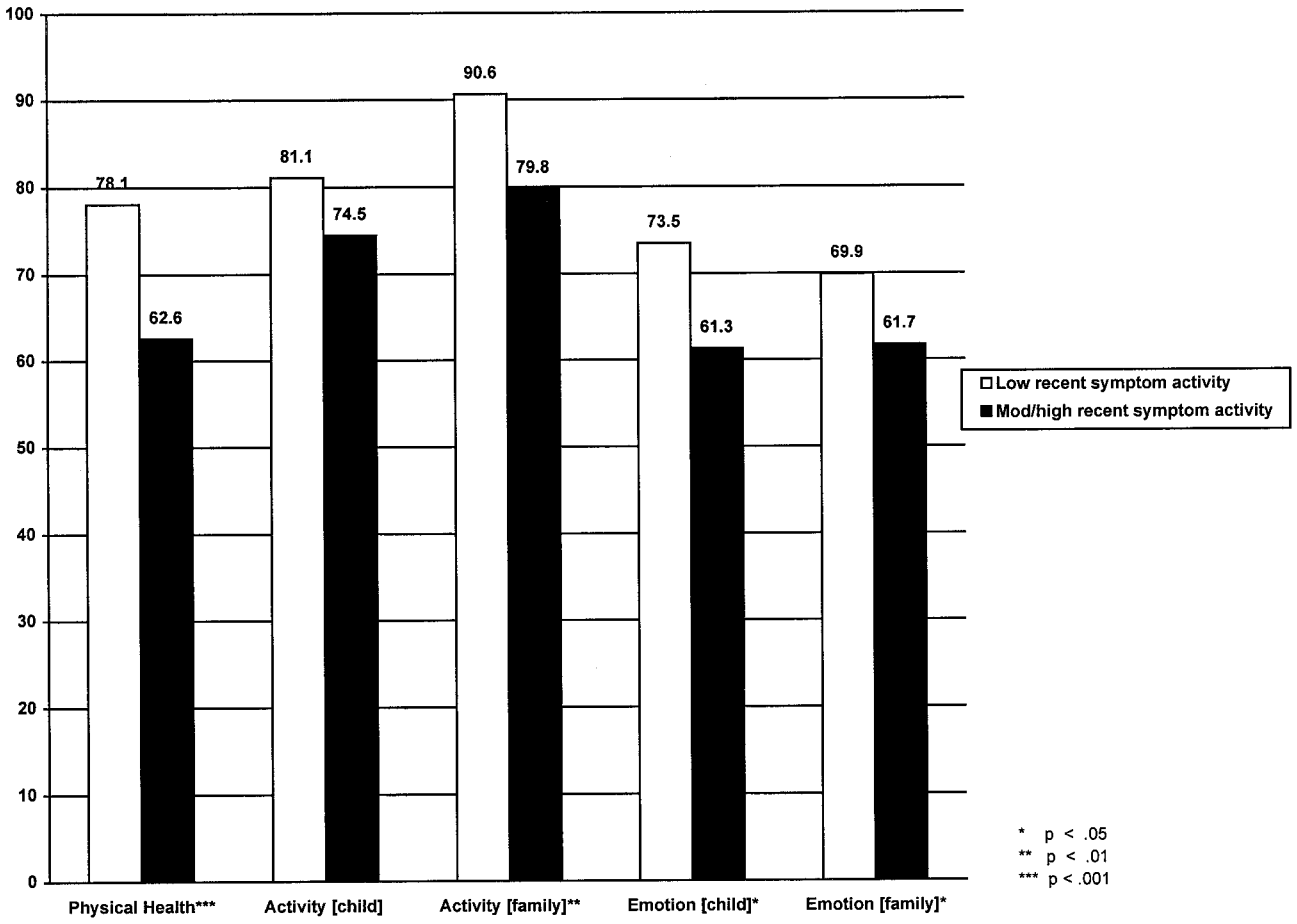

Fig 2. Differences in mean CHSA:48 scale scores by symptom severity (study IV baseline visit).

symptoms. Older children are found to be more reliable reporters, with the caveat that appropriately tailored methods must be used. Methods to obtain information from children, eg, administration by trained interviewers, are often more expensive than methods that can be used with adults, who can typically self-administer paper and pencil tests.

Another issue in health status measurement needing additional study is the length of recall period used. Little is known about what constitutes the best recollection interval. Although methodologists may desire a shorter time to encourage optimal memory, qualitative evidence from our respondents suggests that parents favor a longer time over which to provide a more representative picture of asthma experience. Recollection periods tested in the CHSA have ranged from 2 weeks to 2 months. The mode of questionnaire administration also requires additional study. The CHSA is available as a self-report or interviewer-administered (in person or telephone) measure and analyses are currently in progress to examine potential differences based on administration method.

Comparisons of existing asthma-specific measures as well as comparisons of condition-specific and generic instruments are needed to advance the science of QOL research. Outcome measurement will be enhanced as instruments are used and critiqued by those beyond the developers themselves. Studies that directly compare two or more instruments are necessary to evaluate the relative strengths and weaknesses of different measures and different types of measures. Although the demand for functional outcome data continues to increase in the health services research and medical communities, there is likely a place for multiple instruments, both condi-

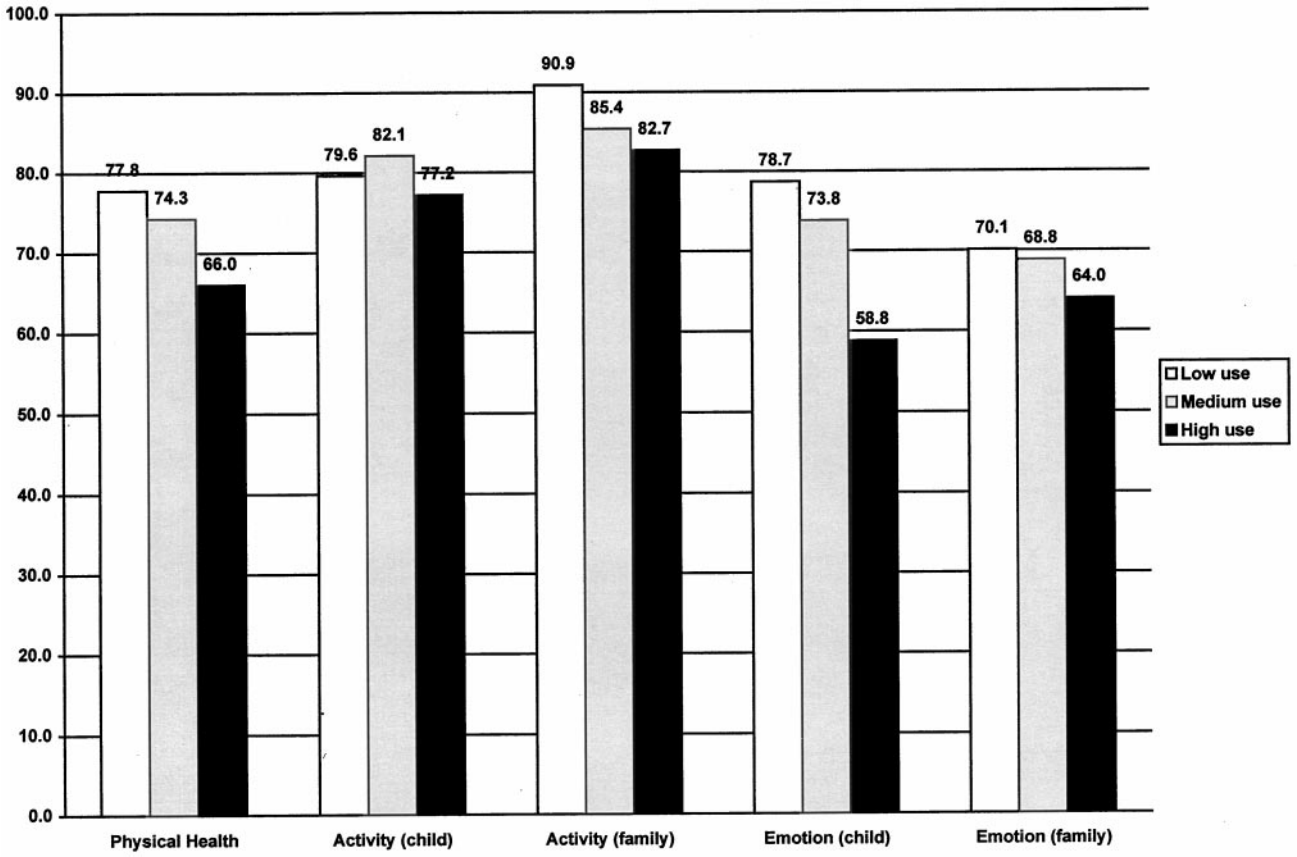

Fig 3. Differences in mean CHSA:48 scale scores by medication use severity (study IV baseline visit).

tion-specific and generic. The best measure will be dependent on individual project aims, methods, and the population under study.

Future directions for the CHSA include additional item reduction. Responsiveness tests (near completion) will be used to determine which items can be omitted without compromising the measure's breadth, reliability, or validity. A self-report instrument for adolescents with asthma is also in development as is a clinical version of the CHSA that is being tested as a tool for one-on-one use during an office visit to facilitate patient/parent education and intervention.

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