The Parent Report Form of the CHIP–Child Edition
Reliability and Validity

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Background: Valid, comprehensive instruments to describe, monitor, and evaluate health from childhood through adolescence are almost nonexistent, but are critical for health resource planning, evaluation of policy, preventive, and clinical interventions, and understanding trajectories of health during this important period of life.

Objectives: The objectives of this study were to describe the development, testing, and final versions of the Parent Report Form of the Child Health and Illness Profile–Child Edition (CHIP-CE/PRF), designed to measure the health of children 6 to 11 years old from the caregiver perspective.

Methods: Parents (N = 1049) completed a version of the CHIP-CE/PRF in 4 locations in the United States, either in clinic waiting rooms or their homes. They differed in race/ethnicity, socioeconomic level, and native language.

Results: The Parent CHIP-CE is feasible; parents with a 5th-grade reading level complete the 76-item PRF in 20 minutes. Its domains (Satisfaction, Comfort, Risk Avoidance, Resilience, and Achievement) measure structurally distinct, interrelated aspects of health. Domain reliability is high: internal consistency = 0.79–0.88; retest reliability (ICC) = 0.71–0.85. Validity is supported. The scale scores are sensitive to predicted age, gender, and socioeconomic status differences in health.

Conclusion: The CHIP–Child Edition/Parent Report Form is a psychometrically sound, conceptually based measure of child health that works well in diverse populations. It produces scores that parallel those of children on the CHIP-CE/CRF and adolescents on the CHIP-AE and allows health to be consistently assessed from childhood through adolescence. It should meet many needs for describing, monitoring, and understanding child health and evaluating outcomes of interventions.

Parents contribute in many basic ways to the health of their children and are usually very cognizant of their well-being. Parents identify children's healthcare needs, seek timely services for them, implement medical treatments, and monitor the effectiveness of care. The parental perspective on child health is so basic that until recently, parents have been the only reporters of child health status, with little recognition that they are proxy reporters with all the limitations thereof.[1,2] However, it is critical to develop parallel parent and child health status instruments because children and parents provide different perspectives that must be assessed to understand these differences and to obtain the most accurate picture of child health, the influences on it, and its trajectory into adolescence.

The relative dearth of child health measures reflects, at least in part, the challenges of developing instruments that demand sensitivity to developmental differences, proxy report issues, child dependency, and the unique distributions of conditions that affect children.[3,4] In the mid-1990s, the only validated child health instruments available in the United States were the Child Health Questionnaire (CHQ)[5] and the Functional Status instrument, now the FS-II Revised.[6] The CHQ conceptualizes health as physical, emotional, and social functioning, and includes both a parent report instrument for children 6 to 17 and a youth report for 10 to 17 year olds. The FS-IIR was developed to assess the symptomatology and impairment associated with chronic illnesses in children.[6] Its reliability and validity for this purpose have been well established, but it is not applicable to community populations.

METHODS

The development of the Parent Report Form (PRF) of the Child Health and Illness Profile–Child Edition (CHIP-CE;

"Child CHIP") was informed by experience in developing the CHIP-AE, an adolescent version of the CHIP, clinical experience, and the contributions of expert reviewers. Items were selected and modified based on the direct input of a pilot sample of mothers and fathers, half of whom had children with a serious chronic illness.

A 187-item version was completed by a sample of 248 mothers (slightly more than half of whom were black) who were recruited from 6 outpatient pediatric settings in greater Baltimore. Subsequent to that initial field test, the version used in study 1 reported here was developed.

Three field studies were conducted in 4 different locations in the United States. The first study involved recruitment through clinical sites on the east and west coasts of the United States. The subsequent studies were conducted in school settings on the East Coast.

Samples

A group of 1049 parents of children 6 through 11 years old constitute the total sample available (Table 1). Mothers comprise 94% of the respondents. In each of the sites and overall, parent respondents were fairly evenly distributed across each year of children's ages and by child gender. Economic status and race/ethnicity differed substantially in the different sites, and although some sites had mostly low-income and minority families (Rhode Island, Baltimore City), there are sufficient numbers of higher income families of minority racial/ethnic status and lower income white families to examine the independent effects of poverty and race. In the total sample, half the families were defined as poor because

their household income was below 200% of the federal poverty definition. Minority parents constituted 47% of the overall sample. Of the 10% of parents who did not speak English as their native language, most spoke Spanish.

Only an English version was tested here. To ensure parents could read English sufficiently well to complete the CHIP-CE/PRF on their own, interviewers were instructed to review and discuss the consent form and their responses to the demographic items.

Measures

Parent Report Form of the CHIP-CE

The focus of this report is the final 76-item Parent Report Form (PRF-76), which produces 5 domain scores and 12 subdomain scores. The CHIP-CE domains are constructs that describe the child's health:[7] Satisfaction (with one's health and self), Comfort (the experience of physical and emotional symptoms and restrictions in activity as a result of illness), Resilience (behaviors and family involvement that enhance health), Risk Avoidance (behaviors that pose risks to health), and Achievement (developmentally appropriate role functioning in school and with peers). These domains and their final subdomains are described in Table 2. All are true scales in which items converge to measure a distinct construct.[8] Higher scores indicate better health. An additional domain of medical disorders and impairing conditions is assessed in an optional module, Disorders, which is a checklist of acute illnesses and of conditions and disorders that a doctor has identified.

TABLE 1. Characteristics of the Sample of Parents and Their Children

	Study 1		Study 2		Study 3	
	California	Rhode Island	Maine	Baltimore City	Baltimore County	Total
Parents' age: mean, standard deviation	39.9, 7.23	33.0, 7.33	36.6, 6.34	40.3, 10.62	40.0, 6.56	37.6, 7.62
Mother (or mother figure) respondents (n, %)	246 (100%)	220 (100%)	252 (87.8%)	58 (98.3%)	201 (87.8%)	977 (93.9%)
Total group	246 (23.4%)	220 (21.0%)	287 (27.4%)	66 (6.3%)	230 (21.9%)	1049 (100%)
Children's age: mean, standard deviation	8.57, 1.69	8.55, 1.73	8.67, 1.45	8.79, 1.53	8.05, 1.51	8.49, 1.60
Daughters (n, %)	125 (50.8%)	116 (52.7%)	148 (51.6%)	37 (56.1%)	123 (53.5%)	549 (52.3%)
200%+ above poverty line*	156 (67.0%)	7 (4.1%)	130 (50.8%)	7 (12.5%)	159 (78.7%)	459 (50.0%)
<200% of poverty line	77 (33.0%)	164 (95.9%)	126 (49.2%)	49 (87.5%)	43 (21.3%)	459 (50.0%)
Race:						
White	72 (29.3%)	41 (19.2%)	265 (92.7%)	0	170 (76.6%)	548 (53.2%)
Black	100 (40.7%)	45 (21.0%)	4 (1.4%)	61 (98.4%)	20 (9.0%)	230 (22.3%)
Hispanic	31 (12.6%)	90 (42.1%)	2 (0.7%)	0	6 (2.7%)	129 (12.5%)
Other	43 (17.5%)	38 (17.8%)	15 (5.2%)	1 (1.6%)	26 (11.7%)	123 (11.9%)

*Income group status is calculated for year data were collected, as total family income either <200% or ≥200%. For California and Rhode Island samples, the 1998 HHS poverty guideline was $8050 per person + $2800 per additional person in the home. For Maine and Baltimore City and County samples, the 1999 HHS poverty guideline was $8240 per person + $2820 per additional person in the home. Data on income is missing for 131 (12.5%) of respondents.

TABLE 2. CHIP-CE: Parent Report Form (PRF) Domain and Subdomain Descriptions*†‡

Satisfaction domain: The parents' assessment of the child's well-being and self-esteem (11 items)
   1. *Satisfaction with health:* overall perceptions of well-being and health
   2. *Self-esteem:* general self-concept
Comfort domain: Parents' assessment of the child's experience of physical and emotional symptoms and positive health sensations and observed limitations of activity (22 items)
   1. *Physical comfort:* positive and negative somatic feelings and symptoms
   2. *Emotional comfort:* positive and negative emotional feelings and symptoms
   3. Restricted *activity:* restrictions in day-to-day activities as a result of illness
Resilience domain: Parents' assessment of family support, child's coping abilities, and the child's physical activity levels (19 items)
   1. *Family involvement:* level of activities with family and perceived family support
   2. *Social problem-solving:* active approaches to solving an interpersonal problem
   3. *Physical activity:* level of involvement in activities related to fitness
Risk avoidance domain: Parents' assessment of the degree to which the child does not engage in behaviors that increase the likelihood of future illness or injury or that interfere with social development (14 items)
   1. *Individual risk avoidance:* avoidance of activities that threaten individual health and development
   2. *Threats to achievement:* avoidance of behaviors that typically disrupt social development
Achievement domain: Parents' assessment of the extent to which the child meets expectations for role performance in school and with peers (10 items)
   1. *Academic performance*: school performance and engagement
   2. *Peer relations*: relationships with peer group

*Higher scores indicate better health on all domains.
†Domains are the same as those reported on by children on the CHIP-CE/CRF and adolescents on the CHIP-AE.
‡The 45-item CHIP-CE/PRF is scored only at the domain level.

The number of CHIP-CE items was iteratively reduced, based on analyses of each item's contribution to domain and subdomain scales, from 146 in study 1, to 115 in study 2, to 78 in study 3. Finally, 2 more items were dropped after study 3 for the same reason. The 44-item Disorders domain was also tested in each study. Most edits were simplification of item wording, but each revision also included new items.

A computerized scoring program sums of all the items within each subdomain and domain, weighting them equally, and handles missing data by imputing the average item score within each scale if no more than 30% of the items are missing. Standard scores were established, with all domains and subdomains having a mean score of 50 and standard deviation of 10. Standard scores are expressed in standard deviation units so scales of varying lengths can be directly compared.

Acceptability/Feasibility Questionnaire

In study 1, parents completed a 4-item questionnaire immediately after they finished the CHIP, which asked how much they liked it, whether it was too long, if they would do it again, and how hard the questions were to answer.

Validation Instruments

When the validation instruments were administered in study 1, only 4 subdomains, in a total of 3 domains, could be evaluated because valid, comparable instruments were not available to test other subdomains. The Restricted Activity subdomain of the Comfort domain was tested against the 3 Role Limitations scales of the CHQ Parent Form 50.[5] For the 2 subdomains of Satisfaction, we relied on the General Health Perceptions and Self-Esteem scales of the CHQ, respectively. For the subdomain of Threats to Achievement in Risk Avoidance, the Aggressive Behavior Scale of the Child Behavior Checklist was used.[9]

Procedures for Studies 1, 2, and 3

All aspects of these studies were approved by the human research review board at the Johns Hopkins Bloomberg School of Public Health and by the participating schools and institutions. Confidentiality of all data has been maintained, and no individuals can be identified.

Study 1 (Oakland, CA, and Providence, RI)

Two sites were involved. In a group model HMO in Oakland, California, the sampling frame included all patients aged 6 to 11 years (and their mothers) who lived within 20 miles, had made a visit in the previous 12 months, and had a telephone number. From each age–gender cell, 50 parents were sent letters inviting them and their child to participate and were subsequently contacted by phone. Over 75% agreed to participate and an interviewer went to their home. In the

second site, Hasbro Children's Hospital in Providence, Rhode Island, mothers and children at well-child visits were asked to participate, and if they agreed, they completed the assessment there.

Recruitment continued in both sites until there were 20 parents in each of 12 child age–gender cells. Parents signed the consent form and completed the CHIP on their own, along with several criterion validity instruments, which took approximately 1 hour. The demographic profiles of these samples demonstrate that they are generally representative of families in the California HMO and in Rhode Island's Medicaid program.

Study 2 (Waterville, ME, and Baltimore City, MD)

After item reduction and additions to the Resilience and Achievement domains based on the previous field test, the CHIP was completed by parents of children in the 2 elementary schools in rural Waterville, Maine, and one in urban Baltimore, Maryland. In Maine, arrangements were made with the schools and parent–teacher associations before the beginning of the school year. In Baltimore City, there was no parent organization with which to work.

In both sites, parents were sent an explanation of the study and asked to complete and return the CHIP in a postage-paid envelope or return the stamped postcard indicating they declined. Fewer than 10 parents in each school declined, but not all returned the CHIP. Nonresponders were reminded by phone and mail and sent another copy of the CHIP. In Maine, 287 parents (64% of those eligible) returned the CHIP-CE/PRF and 66 mothers did so in Baltimore City (24% of eligible parents).

Study 3 (Baltimore County, MD)

The same general procedures were followed for parents of children in a suburban school, except that the parent CHIP was sent home with the students. Teachers forwarded the sealed, returned CHIPs to the school nurse who helped coordinate. Here, 230 parents (78% of those eligible) returned the CHIP-CE/PRF. Additionally, 83% of these parents also completed a readministration of the CHIP-CE/PRF 2 weeks later. To minimize burden, only the 5 domains were readministered because the stability of the Disorders module has been previously demonstrated.[10]

Data Analyses

All reliability analyses and structural validity tests were conducted at the conclusion of each field test. Results are based on analyses of combined samples when items in subdomains remained the same to obtain the largest, most diverse sample.

Using data from studies 2 and 3, internal consistency was assessed for the full sample and the 4 age–gender groups at the domain and subdomain levels using Cronbach's alpha[11]

(minimum criterion = 0.70). Two-week test–retest reliability was assessed by the intraclass correlation (ICC)[12] (criterion = 0.60) in study 3 only.

Ceiling and floor effects for the 5 domains were calculated as the percentage of respondents who had the highest and lowest possible score, respectively, using data from study 3. This provides an estimate of the extent to which the PRF is sensitive to changes at the extremes of very good and very poor health.

Criterion validity was calculated using Pearson's product-moment correlations to estimate the relationship of each criterion measure to its respective subdomain. Construct validity was more directly tested by examining hypotheses based on known sociodemographic differences in health using data from studies 2 and 3. At the domain level, we expected that child health on the PRF would differ in the following ways: Gender: sons, as compared with daughters, would have higher risks and worse academic performance,[13] but better Comfort.[14] Age: older children, compared with the 6 to 7 year olds, would have worse Risk Avoidance[13] and Comfort.[10] Low-income status: poor children were expected to have worse health on all domains than other children.[15–17]

In each study, construct validity was also examined in terms of factor structure using a correlated common-factor model, Principal Axis Factoring (PAF), with oblique Procrustes rotation, with items targeted to load on the appropriate subdomain.[18] We expected the hypothesized constructs (subdomains) to be separate factors, with items loading at 0.40 or higher. The PAF results are based on the final PRF-76 with the study 3 sample.

RESULTS

Feasibility

Generally, parents were very positive, with 82.9% indicating that they "liked" or "liked the CHIP a lot," and nearly all answering "maybe" or "yes" they would complete it again. Only 1.4% found the questions "hard" or "very hard" to answer. Based on analyses in the Grammatique program, the final version has a 5th-grade reading level. The low rate of missing data in all administrations of the PRF attests to its readability. Only 1.4% of the PRFs in study 3 were unable to be fully scored based on the 70% subdomain completion criterion. Parents can complete the CHIP-CE/PRF-76 in approximately 20 minutes based on extrapolation from observed completion times for the 146-item CHIP administered in study 1.

The rate of completion by parents of participating school children (studies 2 and 3) varied dramatically. By far the lowest response rate (24%) was obtained in an urban school in which 88% of responding parents lived in poverty. Based on data provided by children 8 to 11 years old who completed the CHIP-CE CRF, no demographic factors were

significantly associated with PRF completion, but parent completers had younger children who were healthier in Comfort, Resilience, and Achievement ($P < 0.001$).

There were no floor effects on any of the 5 domains, indicating that even the least healthy children could receive a worse score if their health deteriorated. Ceiling effects were absent or small, ranging from none for Comfort to 6.3% or respondents on Risk Avoidance. Thus, the scores of even the healthiest children could improve.

Reliability

The internal consistency reliabilities of the domain scales are excellent, ranging from .79 to .88, as summarized in Table 3. The subdomain internal consistency ranged from .68 to .88 and was similar for parents' reports of daughters and sons, and younger and older children.

Table 3 also demonstrates that the domains have very good stability over a 2-week period, with ICCs well above 0.60.[12] The subdomains are also quite stable over time, except for the restricted activity subdomain of Comfort with an ICC = .36, indicating significant change over the 2-week period or poor reliability.

As is frequently observed in retests, there are significant improvements in children's health over the 2-week

period in 4 of the 5 domains of health. Parent reports of young children's health were less stable than those for older children, with lower ICCs on 11 of the 12 subdomains. However, even for the younger children, all the subdomains had ICCs above .60, except for restricted activity. (Age and gender analyses are available in the Technical Manual.[19])

Validity

All criterion validity tests but one demonstrated strong relationships. The correlation between CHQ Satisfaction and the CHIP-CE Self-esteem subdomain was .58 ($P < 0.001$; .62 for parents of children aged 8–11). The CHIP-CE satisfaction with health subdomain correlated with CHQ Health Perceptions at .41 ($P < 0.001$). The threats to achievement subdomain of Risk Avoidance was correlated at .66 ($P < 0.001$) with the Aggression scale of the Child Behavior Checklist. However, the correlation between the restricted activity subdomain of Comfort with the combination of the 3 Role Limitations scales of the CHQ was only .22 (statistically significant; $P < 0.05$), but weak, demonstrating that these scales are measuring different aspects of limitations of activity as a result of illness.

Differences in health associated with children's age, gender, and family poverty status are summarized in Table 4.

TABLE 3. Domain and Subdomain Internal Consistency and Test—Retest Reliability—76-item PRF*

Domain/Subdomain (no. of items)	Cronbach's Alpha Coeff.[†]	Initial Test Mean, Standard Deviation	Two-Week Retest Mean, Standard Deviation	Intraclass Correlation Coefficient[‡]
Satisfaction (11 items)	.84	4.32, 0.38	4.30, 0.39	.79
Satisfaction with health (7)	.74	4.27, 0.38	4.23, 0.39	.78
Satisfaction with self (4)	.86	4.42, 0.53	4.41, 0.50	.71
Comfort (22 items)	.88	4.35, 0.37	4.41, 0.38[‖]	.71
Physical comfort (9)	.76	4.45, 0.45	4.49, 0.43	.63
Emotional comfort (9)	.85	4.07, 0.53	4.19, 0.54[¶]	.74
Restricted activity (4)	.88	4.79, 0.41	4.75, 0.42	.36
Resilience (19 items)	.79	4.20, 0.35	4.26, 0.37	.80
Family involvement (8)	.75	4.33, 0.45	4.38, 0.42[§]	.78
Social problem-solving (5)	.81	3.93, 0.71	4.06, 0.68[¶]	.74
Physical activity (6)	.71	4.25, 0.44	4.27, 0.46	.75
Risk avoidance (14 items)	.82	4.45, 0.38	4.54, 0.35[¶]	.84
Individual risk avoidance (4)	.68	4.18, 0.53	4.30, 0.53[¶]	.70
Threats to achievement (10)	.80	4.56, 0.39	4.63, 0.35[¶]	.82
Achievement (10 items)	.83	4.07, 0.52	4.12, 0.52[§]	.85
Academic performance (5)	.86	4.08, 0.72	4.13, 0.67	.77
Peer relations (5)	.75	4.07, 0.53	4.11, 0.53	.82

*See text for comparison with 45-item version.
[†]N = 583 parents from studies 2 and 3 (Maine and Baltimore City and County).
[‡]N = 190 parents at each time point from study 3 (Baltimore County).
[§]$P < 0.05$;
[‖]$P < 0.01$;
[¶]$P < 0.001$ comparisons of test and retest, within measures analysis of variance.

TABLE 4. CHIP-CE Parent Report Form*: Means and Standard Deviations of Domain and Subdomain Standardized Scores by Demographic Characteristics[†]

Domain of health/Subdomain or Index	Total Group (N = 583)	Sons (n = 275)	Daughters (n = 308)	6–7 Year Olds (n = 172)	8–11 Year Olds (n = 411)	Poverty (n = 218)	Middle–High Income (n = 296)
Satisfaction domain	50.0, 10.0	49.4, 10.42	50.6, 9.59	50.7, 9.05	49.7, 10.38	48.0, 11.19	51.0, 8.63[§]
Satisfaction with health	50.0, 10.0	50.0, 10.50	50.0, 9.55	50.3, 9.38	49.9, 10.26	47.9, 11.01	51.3, 8.53[‖]
Satisfaction with self	50.0, 10.0	48.8, 10.21	51.0, 9.71[§]	50.9, 8.42	49.6, 10.58	48.7, 11.64	50.3, 8.94
Comfort domain	50.0, 10.0	50.2, 9.91	49.8, 10.10	50.7, 9.44	49.7, 10.22	47.7, 10.89	51.5, 8.69[‖]
Physical comfort	50.0, 10.0	50.3, 9.66	49.7, 10.30	51.4, 9.18	49.4, 10.27[‡]	46.9, 10.52	52.3, 8.88[‖]
Emotional comfort	50.0, 10.0	50.1, 10.57	49.9, 9.49	50.1, 9.86	50.0, 10.07	49.3, 10.67	50.1, 9.32
Restricted activity	50.0, 10.0	50.0, 9.77	50.1, 10.22	50.0, 9.67	50.0, 10.15	48.2, 10.70	51.8, 8.94[‖]
Resilience domain	50.0, 10.0	49.4, 10.60	50.5, 9.42	51.2, 9.83	49.5, 10.03	48.1, 10.07	51.2, 9.61[‖]
Family involvement	50.0, 10.0	49.5, 10.98	50.4, 9.03	52.3, 9.83	49.0, 9.93[‖]	48.7, 10.26	50.6, 9.51[‡]
Social problem-solving	50.0, 10.0	48.1, 10.87	51.7, 8.81[‖]	50.0, 9.93	50.0, 10.04	49.3, 10.01	50.5, 9.84
Physical activity	50.0, 10.0	51.6, 10.13	48.6, 9.68[‖]	50.2, 9.54	49.9, 10.20	48.0, 10.95	51.5, 8.86[‖]
Risk avoidance	50.0, 10.0	46.7, 11.04	52.9, 7.92[‖]	50.1, 9.27	50.0, 10.30	47.7, 11.81	51.3, 8.06[‖]
Individual risk avoidance	50.0, 10.0	47.2, 10.60	52.5, 8.74[‖]	49.3, 9.74	50.3, 10.10	49.2, 11.54	50.2, 8.55
Threats to achievement	50.0, 10.0	47.0, 11.01	52.7, 8.14[‖]	50.5, 9.58	49.8, 10.18	47.4, 11.66	51.6, 7.96[‖]
Achievement domain	50.0, 10.0	47.7, 10.85	52.1, 8.67[‖]	52.3, 8.57	49.1, 10.40[‖]	47.5, 10.25	51.7, 9.36[‖]
Academic performance	50.0, 10.0	47.7, 10.62	52.0, 8.96[‖]	52.4, 8.66	49.0, 10.35[‖]	47.6, 10.35	51.8, 9.46[‖]
Peer relations	50.0, 10.0	48.5, 10.93	51.3, 8.89[§]	51.1, 9.47	49.5, 10.19	48.4, 10.87	50.9, 9.23[§]

*N = 583 parents from studies 2 and 3 (Maine and Baltimore City and County).
[†]Data standardized to domain and subdomain mean scores = 50, standard deviation = 10.
[‡]$P < 0.05$;
[§]$P < 0.01$;
[‖]$P < 0.001$ in *t* test comparisons between subgroups.

According to parents, girls are dramatically healthier than boys in Risk Avoidance and Achievement, as predicted, but also in satisfaction with self and social problem-solving. Boys have better health only in physical activity. The predicted advantage for boys compared with girls on Comfort, consistently seen in children's reports, was not observed in parent reports. Girls' health was significantly better on the Disorders subdomains (data in Manual).[19] Parents reported younger children as healthier than older ones, but differences were significant only on 3 of the 12 subdomains (Table 4). Consistent with our predictions, but contrary to the children's reports, parents in every site reported that younger children had more physical comfort (fewer symptoms) than did older children.

Predictions of significantly worse health for poor children were upheld. Middle- to high-income parents reported better health for their children on all domains and 8 of the 12 subdomains, as well as for the Disorders module. Analyses within gender by socioeconomic status show that the effect is most pronounced for poor sons, who have worse health in 10 of the 12 subdomains; poor daughters are doing worse in 4 of the same 12 subdomains.

Parents identified 15.6% (n = 160) of children as having a major chronic illness on the CHIP Disorders module. Their health was significantly worse in the domains of Satisfaction and Comfort (all $P < 0.01$) than that of children without a chronic illness.

Subgroup analyses indicated similar psychometric properties across racial/ethnic groups. Consequently, no tests of item bias were conducted.

The targeted factor analysis (Table 5) demonstrates that the domain structure is generally robust as it was initially defined. The few items that do not meet the 0.40 criterion for the 12-factor solution shown did load above 0.40 on the 5-factor, domain-level solution. The low-loading items were also retained because they worked well in the CRF and/or are needed to provide continuity of measurement with the CHIP-AE across the age range 6 to 17 years.

Items targeted (and scored) on a specific subdomain are noted by an asterisk in Table 5. The factor structure supports 10 of the 12 subdomains well. However, the 4 items in the restricted activity subdomain load more highly on Physical Comfort, although they also perform well independently. Three school-related items in threats to achievement load

TABLE 5. Targeted factor analysis of CHIP-CE/Parent Report Form 76-Item Version

| Item | Satisfaction | | Comfort | | | Resilience | | | Risk Avoidance | | Achievement | |
	w/Health	w/Self	Physical	Emotional	Restricted Activity	Family Involve-ment	Social Problem Solving	Physical Activity	Individual Risk Avoidance	Threats to Achievement	Academic	Peer Relations
How is your child's health?	0.36*		0.38									
H/o[†] your child feel happy?	0.28*			0.27								
H/o your child have a lot of fun?	0.35*											0.22
H/o your child feel really strong?	0.57*											
H/o your child feel really healthy?	0.55*											
My child is physically fit.	0.34*	0.21			0.26							
My child is well coordinated.	0.36*				0.25							
My child really likes him-/herself.		0.79*										
My child really likes the way he or she looks.		0.70*										
My child is really proud of him-/herself.		0.68*										
My child feels loved and wanted.		0.69*										
H/o child have bad stomachache?			0.51*									
H/o child have a sore throat?			0.63*									
H/o have pain that really bothered him or her?			0.40*									
H/o have trouble breathing?			0.40*									
H/o child have skin that itched all day?			0.28*									
H/o is your child sick?	0.23		0.45*									
H/o child have a cough?			0.48*									
H/o child have an earache?			0.49*									
H/o child have a headache?			0.52*									
H/o child feel really sad?				0.57*								
H/o child cry a lot?				0.60*								
H/o child feel really worried?				0.73*								
H/o child feel grouchy?	0.22			0.58*						0.20		
H/o child feel afraid?				0.61*								

| Item | Satisfaction | | Comfort | | | Resilience | | | Risk Avoidance | | Achievement | |
	w/Health	w/Self	Physical	Emotional	Restricted Activity	Family Involve-ment	Social Problem Solving	Physical Activity	Individual Risk Avoidance	Threats to Achievement	Academic	Peer Relations
H/o have trouble falling asleep?				0.41*								
H/o child have trouble relaxing?				0.44*								
H/o child feel nervous?				0.57*								
H/o child seem moody?	0.20			0.62*								
H/o feel too sick to play at home?			0.69*									
H/o feel too sick to play outside?			0.82*									
H/o miss >1/2 day school-health?			0.70*									
H/o feel too sick to go to school?			0.83*									
H/o you listen to your child's ideas?						0.70*						
H/o you get along well with child?				0.25		0.37*						
H/o you spend time w/child doing fun?						0.50*						
H/o did you eat meals with child?						0.40*						
H/o child have adult to go to?						0.15*						
H/o talk w/child about next day?						0.68*						
H/o did you read with child?						0.51*						
H/o talk w/child about how feeling?						0.69*						
Child would talk to others for advice.							0.70*					
Child tries different ways to solve problem.							0.67*					
Child talk to friend about how feeling.							0.65*					
Child turns to family to help feel better.							0.56*					
Child gets help before problems too big.							0.61*					
H/o play active games/sports?								0.64*				
H/o run hard when played or in sports?								0.89*				
H/o play hard enough to sweat?								0.83*				

Item	Satisfaction		Comfort		Restricted Activity	Resilience			Risk Avoidance		Achievement	
	w/Health	w/Self	Physical	Emotional		Family Involvement	Social Problem Solving	Physical Activity	Individual Risk Avoidance	Threats to Achievement	Academic	Peer Relations
H/o have trouble walking 1 block?					0.74*							
H/o have trouble walking up stairs?					0.70*							
H/o child have trouble running?					0.73*							
H/o forget to look before crossing?									0.34*			
H/o do things that are dangerous?									0.57*			
H/o careless about own safety?									0.59*			
H/o child go outside w/o telling anyone?									0.25*			
H/o hang w/kids in trouble?										0.45*		
H/o does child pick on other kids?										0.54*		
H/o child get in trouble at school?									0.36	0.25*		
H/o trouble paying attention in school?									0.26	0.07*	0.41	
H/o get along well with teacher?									0.35	0.07*	0.23	
H/o threaten to hurt someone?										0.54*		
H/o break rules just to get away w/it?										0.53*		
H/o destroy something of others?										0.64*		
H/o does child steal something?										0.50*		
H/o does child lie or cheat?										0.56*		
H/o did child finish homework?											0.42*	
How did child do in schoolwork?											0.80*	
How did child do in math?											0.78*	
How did child do in reading?											0.70*	
H/well remember things from school?											0.77*	
H/o get along well with friends?												0.50*
H/o other kids pick on your child?											0.24	0.36*
How good is child at making friends?							0.21					0.63*

Item	Satisfaction		Comfort			Resilience			Risk Avoidance		Achievement	
	w/Health	w/Self	Physical	Emotional	Restricted Activity	Family Involvement	Social Problem Solving	Physical Activity	Individual Risk Avoidance	Threats to Achievement	Academic	Peer Relations
How many friends does child have?												0.61*
H/o no one wants to play w/child?												0.42*

[†]H/o-"How often does. . ." or "How often did your child. . ." or "How often do you. . . or How often do. . ." When timeframe is specified, it is usually, "in the past 4 weeks,"

more highly on the individual risk avoidance subdomain, but conceptually they belong in threats to achievement and are retained there. This placement is also consistent with the CHIP-AE. The correlations between domains range from 0.26 to 0.53, indicating significant relationships but none so strong as to suggest overlap.[19]

The Final CHIP-CE/PRF

The 76-item CHIP/CE PRF-76 generates a profile of 5 domain scores and 12 subdomain scores (see Table 2). The scale structure of the PRF is parallel to that of the adolescent report form of the CHIP (CHIP-AE).[10] A 45-item Parent Report Form (PRF-45) is also available that has the same items as the CHIP-CE Child Report Form (CRF). This version addresses the common requirement for a brief yet comprehensive health assessment and allows identical forms to be compared for parents and children. The ICC[12] between the PRF-76 and the 45-item PRF-45 versions are: Satisfaction = 0.96; Comfort = 0.96; Resilience = 0.83; Risk Avoidance = 0.93; and Achievement = 0.98. The internal consistency for the domains in the PRF-45 ranges from .68 (Resilience) to .82 (Satisfaction, Achievement).

The Disorders module subscales are based on the categories of disorders in the Johns Hopkins Adjusted Clinical Groups (ACGs) Case-Mix System[20] (For more information, see http://www.acg.jhsph.edu.). Computerized data entry and scoring programs are available. An Internet site (www.chip.jhu.edu) and Technical Manual provide additional information.[19]

DISCUSSION

The Parent Report Form of the CHIP-CE provides a conceptually based, psychometrically sound measure of the health of children 6 to 11 years old from the caregiver perspective. Preliminary evidence supports the PRF as a developmentally sensitive measure that provides a meaningful pattern or profile of scores across 5 domains and 12 subdomains of health. Most parents can complete the CHIP-CE/PRF-76 in approximately 20 minutes. An adequate response rate can be obtained in low- to middle-income communities by mailing the CHIP-CE/PRF to parents. However,

in subpopulations likely to have limitations in linguistic competence such as immigrants and the poor, a more intensive effort appears to be necessary, possibly having interviewers administer the CHIP-CE/PRF.

Domain reliability is excellent, and the construct validity is well-supported. The domain structure is generally coherent based on the targeted factor analysis, despite a few items that do not load as expected.

A number of intriguing findings were identified. The differences in health by age and gender need to be explored further, especially when they are inconsistent with child reports. Longitudinal research is necessary to determine which assessment is most predictive of future health and healthcare needs.

The PRF-76 is recommended for most applications because, with little additional time or burden, the subdomains can be scored, providing more detail on multiple aspects of health. For example, Resilience is a complex construct characterized by health-promoting and health-protective behaviors and situations, assessed in terms of family involvement, problem-solving, and physical activity level. Youth with the same domain score could differ substantially in the subdomains of Resilience, which could be important to their future health or for planning interventions. Likewise, children with similar poor Comfort scores could differ in whether their discomfort is primarily somatic or emotional. Comparisons with CHIP-AE subdomain data are also possible if the PRF-76 is used.

Although the PRF-76 is likely to be more informative, the PRF-45 is a robust instrument that quickly provides a good description of child health in the same 5 domains completed by children. These versions of the PRF are highly correlated, suggesting the PRF-45 is an excellent substitute when detailed information about health is not necessary.

Limitations

Instrument validation is an ongoing process of knowledge accumulation.[21] This first effort is limited in several ways. The sample, although large and diverse, is self-selected and does not represent the population of parents in the United States. Initial "normative" sample data on health instruments

are almost never derived from a true population sample.[22] No longitudinal data are available, precluding any estimate of the responsiveness of the scales to intervention or to life changes, an integral aspect of validity.[23] Future research will be required to address all of these issues.

CONCLUSIONS

The CHIP-CE/PRF provides a multidimensional measure of child health from the vantage of the primary caregiver that works well for community-dwelling children in all states of health and those of the major ethnic and racial groups in the United States. The PRF can be used without the CRF, and the opposite is also true.

It is now possible to assess needs, describe subgroup differences, and evaluate changes in health of populations of children and adolescents from 6 to 17 years of age using a consistent, conceptually based measure of health. Longitudinal studies of health in youth are extremely rare[24] but are critical for improving understanding and interventions. The Parent Report Form-76 has been professionally translated into all major European languages.

The CHIP instruments provide a valuable new means for evaluating the impact of health and social policies and health interventions, as well as for understanding the development of health as children mature into young adults. Much work must be done to produce such contributions, and we are hopeful that many investigators will collaborate in these efforts to foster and improve the context for promoting health and well-being of children and adolescents in the United States and beyond.

REFERENCES

1. Rajmil L, Fernandez E, Gispert R, et al. Influence of proxy respondents in children's health interview surveys. *J Epidemiol Community Health*. 1999;53:38–42.
2. Rothman ML, Hedrick SC, Bulcroft KA, et al. The validity of proxy-generated scores as measures of patient health status. *Med Care*. 1991;29:115–124.
3. Forrest CB, Simpson L, Clancy C. Child health services research: challenges and opportunities. *JAMA*. 1997;277:1787–1793.
4. Starfield B. Child health status and outcome of care: a commentary on measuring the impact of medical care on children. *J Chron Dis*. 1987;40:109S–115S.
5. Landgraf J, Abetz L, Ware JE. *Child Health Questionnaire (CHQ) A User's Manual*, 1st ed. Boston: The Health Institute, New England Medical Center; 1996.
6. Stein REK, Jessop DJ. Functional Status II(R): a measure of child health status. *Med Care*. 1990;28:1041–1055.
7. Starfield B. Measurement of outcome: a proposed scheme. *Milbank Mem Fund Q*. 1974;52:39–50.
8. Green B. A primer of testing. *Am Psychol*. 1981;36:1001–1011.
9. Achenbach TM. *Manual for the Child Behavior Checklist/4–18 and 1991 Profile*. Burlington, VT: University of Vermont Department of Psychiatry; 1991.
10. Starfield B, Riley A, Green B, et al. The adolescent child health and illness profile: A population-based measure of health. *Med Care*. 1995;33:553–566.
11. Cronbach LJ. *Essentials of Psychological Testing*, 4th ed. New York: Harper and Row; 1984.
12. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33:159.
13. Basen-Engquist K, Edmundson EW, Parcel GS. Structure of health risk behavior among high school students. *J Consult Clin Psychol*. 1996;64:764–775.
14. Goodman E, Amick BC, Rezendes MO, et al. Influences of gender and social class on adolescents' perceptions of health. *Arch Pediatr Adolesc Med*. 1997;151:899–904.
15. Montgomery LE, Kely JL, Pappas G. The effects of poverty, race, and family structure on US children's health: Data from the NHIS, 1978 through 1980 and 1989 through 1991. *Am J Public Health*. 1996;86:1401–1405.
16. Starfield B, Riley AW, Witt WP, et al. Social class gradients in health during adolescence. *Epidemiol Community Health*. 2002;56:354–361.
17. Halldorsson M, Kunst AE, Kohler L, et al. Socioeconomic inequalities in the health of children and adolescents. *Eur J Public Health*. 2000;10:281–288.
18. Browne MW. Oblique rotation to a partially specified target. *Br J Math Stat Psychol*. 1972;25:207–212.
19. Riley AW, Robertson JA, Forrest CB, et al. *Technical Manual for the Child Health and Illness Profile-Child Edition (CHIP-CE™) Parent and Child Report Forms*, 1. 0 ed. Baltimore: Johns Hopkins University; 2001.
20. Starfield B, Weiner J, Mumford L, et al. Ambulatory care groups: a categorization of diagnoses for research and management. *Health Serv Res*. 1991;26.
21. Anastasi A. Evolving concepts of test validation. *Annu Rev Psychol*. 1986;37:1–15.
22. Streiner DL, Norman GR. *Health Measurement Scales: A Practical Guide to Their Development and Use*. New York: Oxford University Press; 1994.
23. Hays RD, Hadorn D. Responsiveness to change: an aspect of validity, not a separate dimension. *Qual Life Res*. 1992;1:73–75.
24. Brooks-Gunn J, Berlin LJ, Leventhal T, et al. Depending on the kindness of strangers: current national data initiatives and developmental research. *Child Dev*. 2000;71:257–268.