

Development of the Healthy Pathways Child-Report Scales

Katherine B. Bevans · Anne W. Riley ·
Christopher B. Forrest

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Abstract

Purpose The Child Health and Illness Profile (CHIP) has separate child (6–11 years) and adolescent (12–21 years) editions that measure youth's self-assessed health, illness, and well-being. The purpose of this study was to revise the CHIP by combining the two editions to create the Healthy Pathways Child-Report Scales.

Methods We modified the original CHIP domains of Comfort, Risk Avoidance, Satisfaction, and Resilience to reflect advances in child health conceptualization. Classical test and item response theory psychometric analyses were conducted using data collected from 2,095 children (49% boys, 80% White, 17% African-American, 3% Hispanic, Age: $M = 10.6$, $SD = 1.0$) in grades 4–6 at 34 schools.

Results After minor revisions, 16 of the 17 scales were found to measure unidimensional self-assessed health, illness, and well-being constructs comprehensively, but with a minimal number of items. Scales were unbiased by age, gender, survey modality, and geographic location. Construct validity was demonstrated by the instrument's

capacity to differentiate among children with and without chronic illnesses and to detect expected age and gender differences.

Conclusions The Healthy Pathways Child-Report Scales may be used to reliably and accurately assess unidimensional aspects of health, illness, and well-being in clinical and population-based research studies involving youth in transition from childhood to adolescence.

Keywords Child health scales · Health-related quality of life · Self-assessed health · Item response theory · Item banks · Children's health and illness profile

Abbreviations

CHIP	Child health and illness profile
CHIP-CE	Child health and illness profile-child edition
CHIP-AE	Child health and illness profile-adolescent edition
IRT	Item response theory
SHCN	Special health care need
ADHD	Attention deficit hyperactivity disorder
DIF	Differential item functioning

K. B. Bevans (✉)
The Children's Hospital of Philadelphia, 3535 Market Street,
Room 1449, Philadelphia, PA 19104-4399, USA
e-mail: bevans@email.chop.edu

A. W. Riley
Johns Hopkins Bloomberg School of Public Health,
615 N. Wolfe Street, E4539, Baltimore, MD 21205, USA

C. B. Forrest
The Children's Hospital of Philadelphia, 3535 Market Street,
Room 1453, Philadelphia, PA 19104-4399, USA

Introduction

Health measurement and patient-reported outcome science are in the midst of major transitions, fueled by enhanced statistical methodologies and technological capabilities. At the same time, the scientific evidence for the continuity of health from childhood through mid-life and beyond has stimulated investment in understanding children's health

and how it changes over time as a function of both development and contextual influences [1]. However, the measurement of health during this phase of life has received relatively little attention. Many instruments fail to adequately capture the emerging aspects of health relevant for children as they transition into adolescence. Instruments sensitive to the changing priorities, social influences, and health-relevant behaviors of emerging adolescents are essential to understanding which children are most at risk for declines in health, which aspects of health are most susceptible to decrements, and which factors serve to maintain positive health assets through this period and in adult life.

To meet this demand and take advantage of the advances in health measurement, the child and adolescent editions of the Child Health and Illness Profile were reevaluated. The reliability and validity of the CHIP (Child and Adolescent Editions) were supported in the initial development work and further in the effective application of the CHIP in a number of studies in the United States [2–7] and abroad [8–10]. However, one significant limitation of the CHIP measurement system is uncertainty in which edition (child or adolescent) is most appropriate for use with young adolescents (aged 10–12). Further, the two editions result in some discontinuity in the measurement of health during this important transitional period. A revision of the CHIP was needed to ensure greater sensitivity to the unique health issues of children entering adolescence. This revision, reported here, is the Healthy Pathways Child-Report Scales. The Healthy Pathways Child-Report scales were developed to be unidimensional to support their eventual use in item banking and computerized adaptive tests and to otherwise enhance the usability of the measure by ensuring that each of the health, illness, or well-being scales could be used independently of others [11, 12]. Each scale score is intended to measure a single construct. This differs from the CHIP, which was designed to produce sub-domain scale scores, which were averaged to create domain scores. In addition to these methodological considerations, Healthy Pathways scales expanded the CHIP conceptualization of health and illness and added items to scales known from prior use of the CHIP to have limited utility or poor psychometric characteristics. Thus, the Healthy Pathways Child-Report Scales were designed to assess youths' perspectives on their health, illness, and well-being during the transition from childhood to adolescence in a psychometrically sound and theoretically grounded manner.

Modifications to the CHIP conceptual framework

The CHIP conceptual framework was the starting point for the Healthy Pathways scale development. Original CHIP

domains include Satisfaction (with one's health and self), Comfort (the experience of physical and emotional symptoms and restrictions in activity due to illness), Resilience (behaviors and family involvement that protect health), Risk Avoidance (behaviors that pose risks to future health), and Achievement (developmentally appropriate role functioning in school and with peers) [13, 14]. We continued to focus on the measurement of Achievement as an important dimension of quality of life for children but now consider the Achievement domain an outcome of health rather than health itself. This is consistent with other models of health as a resources the enable achievement of desired goals [15].

Focusing on the four core domains of child health from the CHIP, we revised the measurement model in several ways and made no attempt to produce multidimensional domain scales, focusing instead on the unidimensional constructs. First, the Comfort domain, which was originally composed of physically experienced symptoms (e.g., pain, fatigue, and somatic complaints) and emotional distress symptoms (e.g., anger, anxiety, and depression) was expanded to include a third construct called "reactions to stress," which are particularly distressing, involuntary responses to interpersonal and social challenges, shown to be an critical aspect of youth health [16]. Such responses as ruminating about problems and having intrusive thoughts are indicators of prolonged and maladaptive mental, behavioral, and physiological responses to stressors, an important but rarely assessed aspect of health [17–19].

Second, the Satisfaction domain was broadened to encompass global indicators of life satisfaction and happiness, while retaining the original focus on general self worth. In addition, we chose to expand the satisfaction concept by measuring self-appraisal in an area that is considered particularly salient during the child-to-adolescent transition, satisfaction with physical appearance/body image. The inclusion of a body image scale reflects pre-adolescents' and adolescents' preoccupation with physical appearance and the acquisition of secondary sexual characteristics. In line with this expanded conceptualization, we renamed this dimension subjective well-being to better reflect the broader concept of children's appraisal of their lives and overall happiness.

Third, the CHIP Risk Avoidance domain assessed the tendency to take risks, behaviors that pose a threat to future health, such as smoking, drinking, and risky sexual activity, and behaviors that threaten social development, such as aggression and being a victim of bullying. Because risk behaviors that threaten future health do not occur at high rates among pre-adolescent children, who were two-thirds of our sample, we were not able to administer the individual risk behaviors scale. However, the CHIP threats to

Table 1 Health constructs measured by the Healthy Pathways Child-Report Scales

Domain/sub-domain	Description
Comfort	
Physical comfort	Physically experienced distress such as pain, fatigue, and somatic complaints
Emotional comfort	Emotions and mood with emphasis on anxiety, anger, and depression
Negative stress reactions	Distress experienced involuntary when presented with a social problem
Energy	
Physical activity	Involvement in activities that promote physical fitness
Balanced nutrition	Eating foods that promote health and avoiding those that threaten future health
Vitality	Feelings of vim, vigor, pep, energy, and healthfulness
Resilience	
Peer connectedness	Making friends, quality of friendships, having friends you can trust
Family connectedness	A feeling of belonging in one's family
Teacher connectedness	Perceptions that teachers care about you as a person and about your learning
Active coping	Social problem-solving such as how you manage conflict with a friend or getting a bad grade
Risk avoidance	
Aggression/bullying	Verbally or physically hurting peers
Peer hostility/bully victim	Being bullied by peers
Subjective well-being	
Life satisfaction	Evaluation of one's life, having fun, feeling happy
Self-worth	One's satisfaction with their self
Body image	Assessment of body image
Achievement	
Academic performance	Assessment of how well you do in academic endeavors like school work, reading, math
School engagement	The degree to which children are interested and invested in learning and strive for knowledge and mastery

achievement scale was separated into two homogeneous sub-scales, aggression/bullying toward others and perceived peer hostility/bully victim.

Fourth, the CHIP Resilience domain, which has a strong conceptual foundation, but is very challenging to operationalize [20], seeks to assess the depth of children's ability to cope with demands, maintain health, and engage in health enhancing activities. Healthy Pathways retained CHIP's Active Coping and Family Involvement (here, Connectedness) scales, as well as scales that assess how connected the child feels to his peers. We added a teacher connectedness scale, because of the salience of belonging in school to the social dimension of child health, and the known empirical associations between teacher connectedness and school success [21, 22]. Teacher connectedness is a vital component of reliance among young adolescents who increasingly seek and benefit from the support of extra-familial adults [22]. These social connections provide a sense of belongingness and help "buffer" people from the negative effects of stressors [23, 24]. The Active Coping scale comprises effective strategies for solving socially demanding and self-concept threatening problems and minimizing their impact [25].

Lastly, we added a fifth domain called Energy, which in the CHIP included scales previously categorized as Resilience. Energy comprises aspects of health related to energy management and feelings of vitality and healthfulness. Scales included balanced nutrition (i.e., energy intake) and physical activity (i.e., energy expenditure), both from the original CHIP, and a new construct of vitality (i.e., feelings of being energetic), which was a modification of the CHIP's satisfaction with health sub-domain. A child's energy level contributes significantly to the extent of internal resources available to meet the demands of life [20]. The health, illness, and well-being constructs that are assessed by the Healthy Pathways Scales are presented in Table 1.

Methods

Participants

The Healthy Pathways Child-Report Scales were administered as part of a longitudinal study of the relationships between child health and school performance (Project Healthy Pathways). The psychometric analyses presented

herein were conducted using the 1st wave of data. Participants were 2,095 students in grades 4–6. Children were recruited from regular education classrooms in 34 elementary (4th–5th grade, Age: $M = 10.2$, $SD = 0.8$) or middle (6th grade, Age: $M = 11.6$, $SD = 0.6$) schools in Maryland (2 school districts) and West Virginia (1 school district). Informed parental consent was obtained for 74% of students eligible to participate; 99% of students with parental consent completed the scales. Student participants were 49% boys, 81% White, 17% African-American, 3% of another race, and 3% Hispanic. Approximately 21% of children were living in poverty as indicated by U.S. Census Bureau poverty thresholds for 2006, and 39% were living in single parent households. There were no significant differences between the demographic characteristics of participating children/families and those reported by the U.S. Census Bureau for residents in the communities in which the study was conducted.

Parent self-administered questionnaires from which we derived information on family demographics and children's chronic disorders were returned for 71% ($N = 1,517$) of the student sample. There were no substantive differences in children's self-assessed health between those whose parents returned completed questionnaires and those whose parent did not (all effect sizes $<.15$).

Procedures

Students in 25 out of 34 participating schools completed questionnaires on their school's desktop computers using a web-based audio computer-assisted self-administered questionnaire. In the remaining nine schools, limitations of the school system's network security prohibited web-based collection of data. In these schools, children completed their questionnaire using paper and pencil. Children in 4th and 5th grade completed the paper-and-pencil questionnaire as a survey administrator read the questions aloud. Sixth-grade students completed the survey by reading the items silently. All data collection was monitored by research staff and a school staff member. Study procedures were approved by the local Institutional Review Boards and those located at the Children's Hospital of Philadelphia, the Johns Hopkins Bloomberg School of Public Health, and Marshall University.

Measures

Healthy Pathways Child-Report Scales

The majority of items included on the Healthy Pathways Child-Report Scales were derived from the CHIP. The development of additional items was heavily influenced

by other preceding works including the KIDSCREEN [26, 27], the AddHealth Survey [28], and the Response to Stress Questionnaire [16], for which items have undergone extensive cognitive testing and validation. Items were selected from these validated measures or generated by a panel of test developers, child health experts, and clinicians (e.g., pediatricians, psychologists, and nurses). Items were pilot tested with 200 seventh-grade students in 2005. Analysis of these data including inspection of item and scale properties (e.g., frequency of missing data, range, means, standard deviations, Cronbach's alpha, and principal component analyses) resulted in removal of 2 physical comfort items (itchy skin and earache), 1 emotional comfort item (cry a lot), and 1 self-worth item (well coordinated). These items were removed because they failed to adequately contribute to any of the health, illness, or well-being constructs as evidenced by poor factor loadings and/or improvement in a scale's internal consistency reliability resulting from their removal. The final health scales ($n = 17$), each containing 3–9 items, were produced in 2006.

Children with special health care needs screener

Parents were administered the Children with Special Health Care Needs Screener (CSHCN), a non-categorical measure of long-term health problems that increase a child's need for medical care [29]. In addition, parents responded to the Disorders checklist from the CHIP [14] to indicate whether their child has been diagnosed with asthma or attention deficit hyperactivity disorder (ADHD).

Statistical and psychometric analyses

Advanced psychometric methods including both traditional (i.e., classical) and modern (i.e., IRT) procedures were used throughout the instrument development process [27, 30, 31]. All items had 5-point Likert scale response categories, which were reverse scored when necessary so that higher scores indicated better health (e.g., less physical discomfort, more positive self-worth). The general characteristics of each item were assessed using response frequencies, mean, standard deviation, and skewness. We evaluated the unidimensionality of scales by estimating internal consistency reliability and conducting one-factor confirmatory factor analyses using MPlus software [32]. Local independence was evaluated by examining residual correlations among items in the one-factor model.

Rasch-Masters partial credit models were fit to the data and model and item fit determined using Winsteps [11, 31]. We established item fit to the model through inspection of infit and outfit statistics and post hoc estimated empirical

item discrimination parameters. Item scores were used to calibrate item “difficulty” on a logit scale with a midpoint of 0. Difficulty parameters were inspected to determine whether items supported the comprehensive measurement of the underlying latent construct with minimal gaps and redundancy.

Tests of uniform differential item functioning (DIF) were conducted to identify systematic errors due to group bias based on gender [male ($n = 1,023$) vs. female ($n = 1,072$)], grade level [4th ($n = 745$) vs. 5th ($n = 665$) vs. 6th ($n = 685$)], mode of survey administration [paper and pencil ($n = 838$) vs. computer-based ($n = 1,257$)], and state [Maryland ($n = 1,333$) vs. West Virginia ($n = 762$)]. Significant DIF contrast values as evidenced by the Mantel-Haenszel significance test indicate that one group of respondents is scoring higher or lower than another group of respondents on an item after adjusting for the overall scores of the respondents [33, 34].

Once scale composition was established based on results of the psychometric analyses, scale scores were calculated by averaging constituent items such that all scale scores ranged from 1 to 5 with higher scores indicating better health. Discriminative validity was evaluated by testing for expected gender- and grade-level differences in children’s health and disparities among children with and without SHCNs, asthma, and ADHD [34–39]. Between-group effect sizes (ES, d) were calculated and considered meaningful if greater than 0.2 [40].

Results

Item descriptive statistics

Details of all item descriptive characteristics, their wording, response formats, and scoring are presented in “Appendix A”. Missing data rates for all items were 2% or smaller. As is typical for child health status instruments administered in the general population [10, 27], many items were negatively skewed. However, all response categories were endorsed for every item. The largest item-level floor effect was observed for “In the past 4 weeks, how often did you eat raw vegetables?” (44% endorsed “never”), and the largest ceiling effect was observed for “When was the last time you destroyed something belonging to someone else at school?” (82% endorsed “never”).

Unidimensionality

Internal consistency was supported by Cronbach’s alpha statistics for all scales except balanced nutrition ($\alpha = .56$) (Table 2). The one-factor CFA model fits the data well for 15 of the 17 scales according to two indices that provide

different and complementary information about model fit, the root mean error of approximation (RMSEA) and the comparative fit indices (CFI). These fit statistics provide information about fit adjusted for model parsimony (RMSEA) and relative to a null model (CFI) [41]. Guided by suggestions provided by Hu and Bentler [42], acceptable model fit was defined by the following criteria: $RMSEA \leq 0.1$ and $CFI \geq .9$.

The original version of the peer connectedness scale was a poor fit for the one-factor CFA model resulting from the relatively poor factor loading (.47) of a single item, “Thinking about the past 4 weeks, have you done things with other girls and boys?” ($CFI = .88$, $RMSEA = .12$). The scale was found to be sufficiently unidimensional after this item was removed ($CFI = .99$, $RMSEA = .06$).

Consistent with its poor internal consistency reliability, the balanced nutrition scale was a poor fit for the one-factor CFA model ($CFI = .57$, $RMSEA = .18$) and despite attempts to remove items, scale unidimensionality was not achieved.

Local independence

Within each scale, item-to-item residual correlations from the one-factor CFA models were examined to test for local independence, which is the assumption that observed items are independent of each other given an individual score on the underlying latent variable (i.e., one of the Healthy Pathway scales). Two items from the emotional comfort scale were found to be locally dependent with a residual correlation of .47: “In the past 4 weeks, how often did you feel really worried?” and “Thinking about the past 4 weeks, have you felt under pressure?” The one-factor model for emotional comfort was significantly improved through the removal of the “pressure” item (CFI changed from .90 to .94; $RMSEA$ from .10 to .07). Residual correlations were $<.20$ for all other item pairs within scales indicating that all remaining items met the local independence assumption.

Estimated Rasch parameters and model fit

Scales were revised based on results of the preceding analyses. Thereafter, all scales except for balanced nutrition, which failed to meet the assumption of unidimensionality, were fit to the Rasch-Masters partial credit model. All but two items had satisfactory fit statistics. The degree to which children reported “talking to a friend” as a means of coping with a social or school-related problem failed to adequately discriminate among children with varying levels of active coping capacities ($INFIT = 1.23$; $OUTFIT = 1.31$; $a = 0.62$). The frequency with which children “kept remembering what happened” in response

Table 2 Scale descriptive statistics, confirmatory factor analysis results, and internal consistency reliability coefficients

	Scale descriptive statistics				Results of one-factor CFA analyses			α
	<i>n</i>	Mean (SD)	Floor (%)	Ceiling (%)	CFI	RMSEA	Factor loadings (range)	
Comfort								
Physical comfort	2,095	3.67 (0.67)	0.00	1.19	0.93	.07	.44–.61	.74
Emotional comfort	2,093	3.90 (0.73)	0.05	4.97	0.91	.10	.52–.70	.80
Negative stress reactions	2,081	3.30 (0.95)	1.92	4.33	0.93	.05	.56–.69	.77
Energy								
Physical activity	2,086	3.85 (0.81)	0.34	9.73	0.99	.01	.51–.82	.74
Nutrition	2,080	2.96 (0.70)	0.48	0.70	0.57	.18	.17–.66	.56
Vitality	2,095	3.95 (0.69)	0.05	6.73	0.95	.10	.52–.75	.77
Resilience								
Peer connectedness	2,091	4.05 (0.73)	0.29	6.17	0.99	.06	.60–.75	.86
Family connectedness	2,090	3.75 (0.84)	0.14	4.35	0.97	.07	.62–.77	.85
Teacher connectedness	2,089	4.04 (0.81)	0.10	13.12	0.94	.10	.55–.82	.86
Active coping	2,083	3.65 (0.81)	0.53	4.80	0.91	.10	.56–.73	.82
Risk avoidance								
Aggression/bullying	2,082	4.43 (0.84)	0.19	50.77	0.99	.07	.54–.72	.72
Peer hostility/bully victim	2,085	4.21 (0.92)	0.67	34.68	0.94	.08	.53–.83	.76
Subjective well-being								
Life satisfaction	2,085	4.20 (0.69)	0.10	15.88	0.97	.10	.62–.75	.83
Self-worth	2,093	3.97 (0.86)	0.72	17.82	0.99	.01	.70–.83	.76
Body image	2,091	3.87 (0.88)	0.38	12.15	0.95	.10	.55–.67	.75
Achievement								
Academic performance	2,086	3.91 (0.72)	0.19	5.03	0.97	.08	.57–.82	.82
School engagement	2,090	2.97 (1.00)	5.31	3.35	0.99	.09	.61–.84	.83

Comparative fit index (CFI) was used to evaluate the fit of the specific model in relation to a null model in which the covariances among all indicators are fixed to 0. CFI \geq .90 indicates adequate fit

Root mean square error of approximation (RMSEA) was used to assess model fit adjusted for model parsimony. RMSEA \leq 0.10 indicates adequate fit

to a stressful event was unpredictable among children at both high and low levels of negative stress reactions (IN-FIT = 1.19; OUTFIT = 1.24; $a = 0.69$). As a result, these items were removed from their respective scales.

Item fit statistics and parameters for the final scales are presented in Table 3. Each scale covered a broad range of estimated ability level (theta) in its underlying latent construct. Average coverage was 8.6 logits. The scale with the largest range in theta was life satisfaction (ranged from -4.7 to 6.0 logits), and the scale with the smallest range was aggression/bullying (ranged from -2.8 to 2.6 logits). Scale-level ceiling effects greater than 10% of the sample were observed for the aggression/bullying (51%), peer hostility/bully victim (29%), self-worth (18%), life satisfaction (16%), and body image (12%). Minimal floor effects ($<1\%$ of the sample) were observed for all scales. On average, item difficulties (deltas) covered 1.1 logits with the largest coverage observed for physical comfort (ranged from -0.9 to 1.3 logits) and the smallest for

self-worth (ranged from -0.1 to 0.1 logits). As shown in Table 3, there was minimal redundancy in items.

Differential item functioning

The item difficulty contrast by gender was statistically significant for a single item on the Vitality scale, “How often do you feel really strong?” (contrast = -0.45 , $P < .0001$) (Fig. 1). When boys and girls had comparable levels of vitality, boys were more likely than girls to indicate that they had a high degree of body strength. In contrast, modest although sub-threshold DIF was observed for two other items on the Vitality scale, “How often do you feel really healthy?” (contrast = $.23$) and “How is your health?” (contrast = $.31$). Because both of these items were slightly easier for girls than for boys, the detected DIF of Vitality items essentially did not change the total test score level due to cancellation across items with DIF in opposing directions [34]. Figure 2 displays the

Table 3 IRT item parameters

Domain/item	Fit statistics			Item difficulty parameters					
	INFIT	OUTFIT	<i>a</i>	Average	Response categories				
					1	2	3	4	5
Comfort									
Physical comfort									
Wake up tired	1.01	1.02	.99	1.26	.12	.52	1.01	1.44	2.02
Cough	1.09	1.09	.87	0.42	−.29	.19	.72	1.05	1.57
Trouble falling asleep	1.02	1.01	.99	0.16	−.27	.17	.53	.88	1.43
Pain that bothered you	0.91	0.91	1.11	−0.01	−.40	−.09	.46	.90	1.51
Headache	1.01	1.00	.99	−0.01	−.47	.01	.51	.96	1.50
Stomach ache	0.95	0.93	1.07	−0.24	−.57	−.14	.39	.90	1.47
Sore throat	1.02	1.00	.98	−0.67	−.81	−.15	.32	.83	1.33
Trouble breathing	1.07	1.08	.98	−0.91	−.44	−.26	.09	.42	1.09
Emotional comfort									
Grouchy	1.09	1.07	.90	0.51	−.17	.20	.76	1.43	2.44
Moody	1.10	1.08	.89	0.29	−.19	.01	.65	1.33	2.16
Trouble relaxing	1.06	1.08	.92	0.12	−.31	.00	.56	1.18	2.01
Feel worried	0.89	0.88	1.12	−0.04	−.67	−.18	.49	1.10	2.12
Feel sad	0.86	0.86	1.15	−0.12	−.50	−.20	.35	1.09	2.08
Nervous	1.02	1.01	.97	−0.14	−.52	−.16	.45	1.20	2.10
Feel afraid	0.99	0.94	1.02	−0.62	−.80	−.41	.23	.79	1.77
Negative stress reactions									
Thoughts about problem pop into head	1.00	1.00	0.99	0.48	−1.11	−.24	.35	.96	2.32
Hard to concentrate when I have problems	0.95	0.95	1.07	0.16	−1.24	−.37	.21	.76	1.93
Think about problem while trying to sleep	0.94	0.93	1.09	0.04	−1.24	−.43	.13	.68	1.77
Can't remember what happened	1.06	1.09	0.93	−0.27	−1.43	−.48	.01	.47	1.45
Mind goes blank	1.09	1.07	0.90	−0.42	−1.59	−.60	−.05	.44	1.39
Energy									
Physical activity									
Muscle strength exercises	1.22	1.21	.84	0.60	−.57	−.16	.78	1.73	3.26
Play hard	1.12	1.10	.89	0.18	−.80	−.18	.38	1.33	2.97
Run hard	0.76	0.75	1.27	−0.26	−1.54	−.74	.09	1.11	1.47
Play active games	0.87	0.88	1.13	−0.52	−1.57	−.87	−.02	1.01	2.59
Vitality									
Feel physically fit	0.99	1.00	1.02	0.49	−.16	−.26	.70	1.85	3.26
Body strength	1.02	1.01	.98	0.25	−.65	−.45	.67	1.84	3.22
Feel healthy	0.85	0.85	1.16	−0.18	−1.55	−.54	.36	1.59	2.98
Overall health	0.96	0.95	1.05	−0.23	−1.15	−.16	.38	1.45	2.90
Feel energetic	1.13	1.16	.82	−0.33	−.90	−.73	.42	1.58	2.77
Resilience									
Peer connectedness									
Talk about everything with friends	1.05	1.05	.93	0.40	−.45	.26	1.15	1.98	3.11
Rely on friends	1.03	1.04	.98	0.26	−.70	−.26	.73	1.54	2.79
Good at making friends	1.12	1.13	.87	0.16	−.98	.11	.70	1.53	2.60
Spend time with friends	0.99	0.97	1.02	0.14	−1.38	.09	.68	1.57	2.86
Friends help each other	0.90	0.86	1.12	0.12	−1.34	−.19	.63	1.57	2.81
Had fun with friends	0.83	0.76	1.17	−0.35	−1.67	−.44	.24	1.15	2.50
Get along well with friends	1.04	1.05	.94	−0.54	−2.55	−.60	.33	1.44	2.71
How many friends	1.01	1.05	.98	−0.68	−3.20	−.19	.45	1.29	2.50

Table 3 continued

Domain/item	Fit statistics			Item difficulty parameters					
	INFIT	OUTFIT	<i>a</i>	Average	Response categories				
					1	2	3	4	5
Family connectedness									
Talk about next day with parents	1.08	1.07	.90	0.79	-.28	.09	.79	1.33	2.36
Talk about feelings with parents	1.06	1.05	.93	0.65	-.39	.16	.69	1.30	2.28
Do fun things together	0.77	0.76	1.29	0.21	-.87	-.23	.41	1.15	2.19
Parents help with schoolwork	1.25	1.36	.75	0.16	-.46	-.01	.51	.95	1.75
Parents listen to your ideas	0.85	0.83	1.17	0.07	-.79	-.40	.40	1.04	2.01
Eat meals together	1.18	1.27	.83	-0.42	-.92	-.40	.26	.84	1.50
Parents treat you fairly	0.86	0.83	1.13	-0.68	-1.25	-.60	-.10	.57	1.61
Get along with parents	0.99	1.00	1.01	-0.76	-1.23	-.73	.05	.73	1.76
Teacher connectedness									
Teachers have time for me	1.14	1.14	.82	0.69	-.83	-.01	.94	2.02	3.84
Teachers listen to my suggestions	0.96	0.95	1.05	0.56	-.83	-.20	.70	1.90	3.73
Teachers respect my ideas/opinions	0.82	0.81	1.20	0.43	-.98	-.40	.58	1.75	3.76
Teachers treat me fairly	1.04	1.06	.95	-0.19	-1.15	-.47	.24	1.39	3.27
Teachers care about me	0.89	0.86	1.11	-0.28	-1.33	-.63	.19	1.26	3.06
Teachers care about my learning	1.16	1.17	.92	-1.22	-1.58	-1.02	-.39	.61	2.45
Active coping									
Talk to the teacher	1.13	1.15	.83	0.49	-.39	.01	.41	1.12	2.41
Tell myself things will get better	0.88	0.90	1.13	0.10	-.99	-.26	.27	1.01	2.24
Try to see the good in the situation	0.89	0.89	1.14	0.04	-1.09	-.25	.28	.99	2.26
Think of ways to fix the problem	1.07	1.08	.91	0.03	-.87	-.25	.27	.96	2.20
Turn to family/other adults	0.92	0.91	1.11	-0.14	-.96	-.32	.14	.79	1.93
Keep feelings under control	1.09	1.10	.89	-0.25	-.95	-.41	.18	.83	1.84
Calm myself down	1.01	1.01	1.00	-0.26	-1.00	-.37	.09	.76	1.86
Risk avoidance									
Aggression/bullying									
Picked on other kids	1.04	0.93	.96	0.40	-.14	.23	.59	1.04	2.27
Threatened to hurt someone	0.89	0.79	1.08	0.17	-.18	.03	.40	.86	2.14
Physically attacked someone	1.01	0.93	.94	-0.17	-.55	-.18	.26	.80	1.97
Destroyed things	1.06	1.08	1.00	-0.40	-.40	.07	.26	.76	2.05
Peer hostility/bullying-victim									
Afraid of other boys and girls	1.38	1.33	0.66	-0.84	-1.48	-.75	.07	1.33	3.01
Other made fun of you	0.84	0.81	1.17	0.82	-1.09	-.18	.81	1.95	3.80
Others bullied you	0.76	0.74	1.19	-0.28	-1.68	-.77	.14	1.06	3.10
Subjective well-being									
Life satisfaction									
Enjoyable life	0.94	0.93	1.09	0.31	-.89	-.48	.69	2.30	4.51
Feel happy	1.00	1.02	.98	0.24	-1.95	-.79	.88	2.47	4.75
Satisfied with life	0.91	0.92	1.11	0.14	-.80	-.57	.52	2.11	4.29
Have fun	1.04	1.02	.95	-0.13	-1.70	-.68	.53	2.19	4.15
Pleased to be alive	1.12	1.18	.92	-0.57	-1.39	-.77	.20	1.41	3.49
Self-worth									
Proud of yourself	1.02	1.01	.98	0.09	-2.30	-1.21	.49	2.21	4.21
Happy with the way you are	1.06	1.04	.94	-0.01	-1.96	-.88	.39	1.87	3.82
Like yourself	0.90	0.87	1.12	-0.07	-2.10	-1.04	.34	1.75	3.73

Table 3 continued

Domain/item	Fit statistics			Item difficulty parameters					
	INFIT	OUTFIT	<i>a</i>	Average	Response categories				
					1	2	3	4	5
Body image									
Happy with body	1.04	1.02	.96	0.56	-.24	.13	.67	1.14	2.18
Worried about appearance	0.95	0.91	1.08	0.27	-.53	.09	.47	1.04	2.13
Like how you look	1.06	1.05	.90	0.12	-.70	-.20	.49	1.09	2.11
Jealous of how others look	0.88	0.85	1.08	-0.25	-.94	-.25	.25	.69	1.71
Happy with clothes	1.09	1.08	.92	-0.69	-1.26	-.42	.11	.74	1.71
Achievement									
Academic performance									
Grades	1.08	1.14	0.93	0.47	-.87	.06	.65	1.67	3.50
Remembering things learned	1.16	1.16	0.81	0.30	-.70	-.12	.68	1.62	2.97
Math performance	0.99	0.96	1.02	0.10	-.89	-.25	.50	1.43	2.84
Reading performance	1.14	1.12	0.84	-0.02	-1.08	-.26	.57	1.52	2.85
Homework performance	0.89	0.86	1.13	-0.30	-1.41	-.56	.21	1.25	2.72
Schoolwork performance	0.70	0.69	1.33	-0.56	-2.59	-.91	.08	1.33	3.06
School engagement									
Bored at school	1.20	1.20	.87	0.59	-2.14	-.75	.34	1.31	2.95
Excited by school work	0.84	0.82	1.18	0.12	-2.75	-1.10	.05	1.25	2.62
Interest in school work	0.84	0.84	1.17	-0.30	-3.26	-1.51	-.26	1.12	2.53
Look forward to school	1.09	1.07	.90	-0.42	-2.89	-1.36	-.30	.88	1.94

test characteristic curve (the expected scale score as a function of Θ) for the Vitality scale. The expected scale score did not substantially differ between boys and girls across the full range of the construct.

No significant differential item functioning was observed by grade level, mode of survey administration, or geographic location.

Construct validity

Table 4 shows differences in the Healthy Pathway scale scores among children by gender, school type (elementary

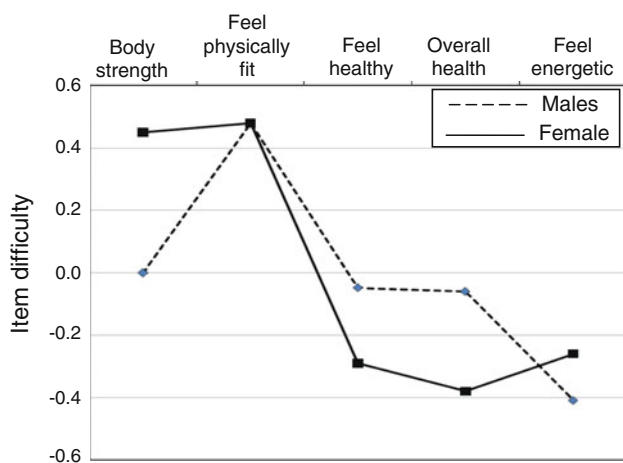


Fig. 1 Differential item functioning analysis of energy items: Item difficulty for boys and girls. *Notes:* Statistically significant DIF by gender was observed for “body strength.” Two additional items, “feel healthy” and “overall health”, tended to exhibit DIF in the opposite direction

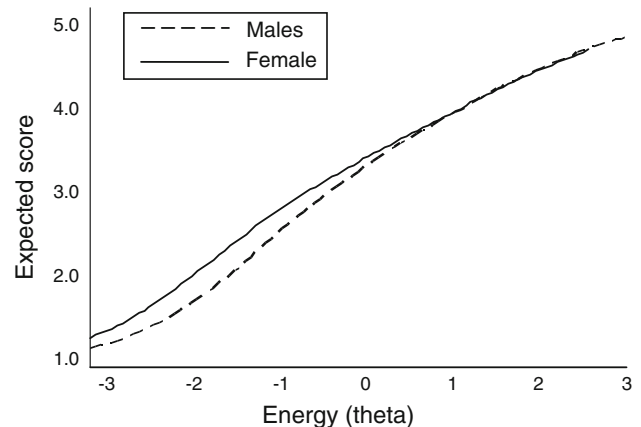


Fig. 2 Energy expected scale score for boys and girls by ability level (theta)

Table 4 Known group comparisons (effect sizes) of Healthy Pathways scale scores by gender, school type, special health care need (SHCN), asthma, and attention deficit hyperactivity disorder (ADHD)

	Gender	Elementary versus middle	SHCN	Asthma	ADHD
Physical comfort			−0.21	−0.39	−0.25
Emotional comfort	0.36				−0.24
Reactions to stress					−0.28
Physical activity	0.47				
Vitality	0.25	0.32			
Peer connectedness			−0.24		−0.36
Family connectedness			−0.24		
Teacher connectedness		0.21			−0.22
Active coping	−0.33				
Aggression/bullying	−0.32				
Peer hostility/bully victim			−0.20		−0.35
Life satisfaction			−0.27		
Self-worth					
Body image	0.40				
Academic performance		0.31	−0.29		−0.50
School engagement	−0.34	0.27			

Positive effect sizes indicate that boys, elementary school students, and children with a special health care need, or specific disorder experience more positive health. Note that all scale scores are coded so that higher values indicate greater health and well-being, and less illness. Effect sized <.20 were omitted

vs. middle), and presence of a special healthcare need, asthma, and ADHD. Scale score means and standard deviations for the subgroups are presented in “Appendix B”. These results are consistent with previously reported group differences [34–40].

Discussion

This study described the development and psychometric validation of the Healthy Pathways Child-Report Scales. Based primarily on the CHIP, the scales merged the child and adolescent editions of the CHIP with the intent of improving the measurement of self-assessed health, illness, and well-being among children transitioning into adolescence. We employed modern measurement techniques in the development and validation of the scales because these methods provide essential information about the degree to which items cover a full range of underlying latent constructs without redundancy, support the identification of items that are biased against subgroups in the population, and provide the foundation for the development of item banking and computerized adaptive tests. With the exception of the KIDSCREEN [27], the Healthy Pathways Child-Report Scales are the only broad self-reported child health instrument that has been developed using modern measurement techniques.

Our findings demonstrate that 16 of the 17 Healthy Pathways Child-Report Scales are reliable, simultaneously

comprehensive and efficient, and free of gender, age, modality, and geographic location bias. The scales are meaningful in that they are effective at differentiating children based on gender, age, and presence of a long-term medical condition. Consistent with prior research, boys were more likely than girls to experience emotional comfort [38] and positive body image [36, 37] and to engage in physical activity [39] and aggressive behavior [43, 44]. Conversely, girls were more likely to employ active coping strategies such as seeking support from family or friends to deal with a stressful situation [45]. Girls also reported higher levels of school engagement than boys.

Children with a special healthcare need (SHCN) reported modestly poorer physical comfort, vitality, life satisfaction, and peer interactions as evidenced by both reports of connectedness with peers and the frequency with which they are bullied, findings that are similar to other studies [27, 46]. Similar findings were evidenced for children with ADHD and as expected, these children experienced many health challenges [35, 47]. As expected, children with asthma experienced poorer physical comfort but did not differ from children without asthma on other indicators of health, illness, and well-being [48–50].

The development of item banks for children and youth is in its nascent stages of development [51, 52]. With this ultimate goal in mind, we believe that the Healthy Pathway scales will be expanded and modified over the next several years. We are publishing all the items, their characteristics, and the scale psychometrics to engage other investigators

in this process. Our findings suggest several potential areas for future development. For example, the balanced nutrition items were only minimally inter-correlated, suggesting that this scale may represent more than one latent construct (e.g., positive and negative nutrition behaviors). The nutrition items in the original CHIP were treated as an index, because they did not behave as a scale empirically [14]. Multiple dimensions of dietary behavior may emerge with the addition of other items including those pertaining to the ingestion of fast food or whole grains, or eating habits such as partaking in family meals [53].

The 3-item peer hostility scale may be strengthened with the addition of items that assess indirect or relational bullying such as spreading rumors or purposefully excluding someone. These experiences are associated with social and emotional problems, particularly among girls [44, 54, 55]. Expanding the peer hostility scale to include more commonly experienced types of bullying is also needed to reduce the scale's ceiling effect. Similarly, the aggression/bullying scale should be supplemented with items indicative of less severe problems. Ceiling effects should also be addressed for the self-worth, life satisfaction, and body image subscales by adding items indicative of extreme well-being, which are more likely to be endorsed with moderate responses (e.g., sometimes). Finally, although the majority of items were derived from validated instruments for which the items have undergone extensive cognitive testing (e.g., CHIP, KID-SCREEN), some items, particularly those that assess teacher connectedness and school engagement, could be improved through formal cognitive debriefing.

The Healthy Pathways measurement model will almost certainly be extended in the future to comprehensively assess the increasingly complex internal and social experiences of adolescents. Additional components of an adolescent health framework may include satisfaction with work/occupation (which was included in the adolescent edition of the CHIP), sexual self-concept, and connectedness with non-parent or non-teacher adults (e.g., coach or

mentor). An advantage of our approach to developing independent unidimensional scales is that additional scales may be added to the measurement system without reevaluating the original scales.

Finally, although scales were found to be free of bias based on gender, age, administration modality, and geographic location, future efforts should include attempts to validate the scales among race/ethnic minorities and urban residents. Item functioning should also be evaluated among children of a broader age range.

The Healthy Pathways Child-Report Scales represent a significant advance in the conceptualization and measurement of child health, illness, and well-being. Because the scales were developed using IRT methods, it is possible to obtain estimates of constructs that are independent of the particular set of items administered [11]. Thus, future development of the scales will include the addition of items to maximize coverage of the underlying health constructs, resulting in the creation of expanded item banks and computerized adaptive test versions of the instruments, which are increasingly recognized as the preferred strategies for assessing outcomes in clinical effectiveness research [31, 51, 52].

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Appendix A

See Table 5.

Table 5 Healthy Pathways Child-Report Scales items, response categories, source instruments, and descriptive statistics

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
Physical comfort							
In the past 4 weeks, how often did you wake up feeling tired?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)		✓		27.4	9.7	2.6 (1.3)
In the past 4 weeks, how often did you have a cough?	Always (1)-Almost Always (2)-Sometimes(3)-Almost Never (4)-Never (5)	✓	✓		7.6	18.3	3.3 (1.1)
In the past 4 weeks, how often did you have trouble falling or staying asleep?	Always (1)-Almost Always (2)-Sometimes(3)-Almost Never (4)-Never (5)	✓	✓		9.1	38.6	3.7 (1.3)

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
In the past 4 weeks, how often did you have pain that really bothered you?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		4.5	32.5	3.7 (1.1)
In the past 4 weeks, how often did you have a head ache?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		3.5	27.0	3.6 (1.1)
In the past 4 weeks, how often did you have a bad stomach ache?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		2.3	32.3	3.8 (1.0)
In the past 4 weeks, how often did you have a sore throat?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓			0.8	41.3	4.0 (1.0)
In the past 4 weeks, how often did you have trouble breathing?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		1.3	70.6	4.5 (0.9)
Emotional comfort							
In the past 4 weeks, how often did you feel grouchy?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		6.1	24.3	3.5 (1.1)
In the past 4 weeks, how often were you moody?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		5.9	34.1	3.7 (1.2)
In the past 4 weeks, how often did you have trouble relaxing?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		5.6	42.3	3.9 (1.2)
In the past 4 weeks, how often did you feel really worried?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓			3.5	39.4	3.9 (1.1)
In the past 4 weeks, how often did you feel really sad?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		3.0	42.1	4.0 (1.1)
In the past 4 weeks, how often did you feel nervous?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		2.2	35.6	3.9 (1.0)
In the past 4 weeks, how often did you feel afraid?	Always (1)-Almost Always (2)- Sometimes(3)-Almost Never (4)- Never (5)	✓	✓		1.5	58.4	4.3 (0.9)
Negative stress reactions							
Thoughts about the problems would just pop into my head.	Very Likely (1)-Likely (2)- Somewhat Likely(3)-Unlikely (4)-Very Unlikely (5)			<i>a</i>	16.3	13.0	2.9 (1.3)
It's really hard for me to concentrate or pay attention when I have problems in class.	Very Likely (1)-Likely (2)- Somewhat Likely(3)-Unlikely (4)-Very Unlikely (5)			<i>a</i>	14.5	19.6	3.2 (1.3)
When I try to sleep, I would not be able to stop thinking about the problem.	Very Likely (1)-Likely (2)- Somewhat Likely (3)-Unlikely (4)-Very Unlikely (5)			<i>a</i>	14.5	23.2	3.3 (1.4)
When things get bad in school, I can get so upset that I can't remember what happened or what I did.	Very Likely (1)-Likely (2)- Somewhat Likely (3)-Unlikely (4)-Very Unlikely (5)			<i>a</i>	11.5	32.1	3.5 (1.4)

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
My mind would go blank I wouldn't be able to think at all.	Very Likely (1)-Likely (2)-Somewhat Likely (3)-Unlikely (4)-Very Unlikely (5)			<i>a</i>	8.8	32.2	3.6 (1.3)
Physical activity							
In the past 4 weeks, how often did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>b</i>	5.9	22.3	3.5 (1.1)
In the past 4 weeks, how often did you play hard enough to start sweating and breathing hard?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)	✓	✓		5.5	32.3	3.8 (1.1)
In the past 4 weeks, how often did you run hard when you played or did sports?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)	✓			3.3	40.2	4.0 (1.0)
In the past 4 weeks, how often did you play active games or sports?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)	✓			2.3	44.1	4.1 (1.0)
Vitality							
How much of the time do you feel physically fit?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			4.4	29.6	3.8 (1.1)
How often do you feel <i>really</i> strong?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			2.4	27.3	3.8 (1.0)
How often do you feel <i>really</i> healthy?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓	✓		1.5	36.2	4.0 (0.9)
How is your health?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			1.4	41.2	4.1 (1.0)
How much of the time do you feel full of energy?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			1.2	37.7	4.1 (0.9)
Peer connectedness							
Thinking about the past 4 weeks, have you been able to talk about everything with your friends?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	7.8	27.2	3.6 (1.2)
Thinking about the past 4 weeks, have you been able to rely on your friends?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	4.3	40.8	4.0 (1.1)
How good are you at making friends?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			4.1	45.9	4.1 (1.1)
Thinking about the past 4 weeks, have you spent time with your friends?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	2.9	37.5	4.0 (1.0)
Thinking about the past 4 weeks, have you and your friends helped each other?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	3.1	40.5	4.0 (1.0)

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
Thinking about the past 4 weeks, have you had fun with your friends?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	2.4	57.2	4.3 (0.9)
How often do you get along <i>well</i> with your friends?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			1.1	37.7	4.2 (0.8)
How many friends do you have?	None (1)-Very Few (2)-Some (3)-Many (4)-Very Many (5)	✓			0.8	52.9	4.3 (0.9)
Family connectedness							
In the past 4 weeks, how often did you talk to your parents about what you are going to do the next day?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			17.8	20.7	3.2 (1.4)
In the past 4 weeks, how often did your parents talk to you about how you are feeling?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	✓			14.9	23.6	3.3 (1.3)
In the past 4 weeks, how often did your parents spend time with you doing something fun?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)		✓		7.7	28.5	3.6 (1.2)
In the past 4 weeks, how often did your parents help you with your school work?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>new</i>	11.9	43.1	3.7 (1.4)
In the past 4 weeks, how often did your parents listen to your ideas?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)		✓		7.3	35.0	3.7 (1.2)
In the past 4 weeks, how often did your parents eat meals with you?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)		✓		5.0	55.6	4.2 (1.2)
Thinking about the past 4 weeks, have your parents treated you fairly?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	2.9	57.0	4.3 (1.0)
In the past 4 weeks, how often did you get along well with your parents?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)		✓		1.5	42.8	4.1 (0.3)
Teacher connectedness							
In the past 4 weeks, on how many days did teachers at your school have enough time for you?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>new</i>	5.3	28.9	3.7 (1.2)
In the past 4 weeks, on how many days did teachers at your school, listen to your suggestions?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>d*</i>	6.1	33.5	3.8 (1.2)
In the past 4 weeks, on how many days did teachers at your school, respect your ideas and opinions?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>e*</i>	5.3	34.1	3.8 (1.1)
In the past 4 weeks, on how many days did teachers at your school, treat you fairly?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>f*</i>	2.6	45.1	4.1 (1.0)

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
In the past 4 weeks, on how many days did teachers at your school care about you as a person?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>f</i> *	2.9	53.9	4.2 (1.1)
In the past 4 weeks, on how many days did teachers at your school, care about your learning?	No days (1)-Very few days (2)-Some days (3)-Almost every day (4)-Every day (5)			<i>new</i>	1.2	76.0	4.6 (0.8)
Active coping							
I would talk with the teacher or someone else who could help	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)	✓	✓		12.7	21.4	3.3 (1.3)
I would tell myself that things will get better	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)			<i>a</i>	6.6	24.4	3.6 (1.2)
I would try to see the good that could out of the situation	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)	✓	✓		5.5	24.5	3.6 (1.1)
I would try to think of ways to fix the problem or change the situation	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)			<i>a</i>	5.6	24.2	3.6 (1.1)
I would turn to my family or other adults to help me feel better	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)	✓	✓		6.3	35.5	3.8 (1.2)
I would keep my feelings under control when I needed to	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)			<i>a</i>	4.7	34.1	3.8 (1.1)
I would try to calm myself down	Very Unlikely (1)-Unlikely (2)-SomewhatLikely (3)-Likely (4)-Very Likely (5)	✓	✓		5.1	36.4	3.9 (1.3)
Aggression/Bullying							
When was the last time you picked on other kids at school?	In the past week (1)-In the past month (2)-In the past year (3)-More than a year ago (4)-Never (5)	✓			8.1	66.3	4.2 (1.3)
When was the last time you told someone at school you were going to hurt them?	In the past week (1)-In the past month (2)-In the past year (3)-More than a year ago (4)-Never (5)	✓			7.2	74.6	4.4 (1.2)
When was the last time you physically attacked someone at school?	In the past week (1)-In the past month (2)-In the past year (3)-More than a year ago (4)-Never (5)		✓		3.7	79.1	4.5 (1.1)
When was the last time you destroyed something belonging to someone else at school?	In the past week (1)-In the past month (2)-In the past year (3)-More than a year ago (4)-Never (5)	✓			2.6	81.8	4.4 (0.8)
Peer hostility/Bullying-victim							
Thinking about the past four weeks, have you been afraid of other girls and boys?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)			<i>c</i>	2.8	65.9	4.4 (3.9)

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
Thinking about the past four weeks, have other girls and boys made fun of you?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)			<i>c</i>	8.1	43.4	3.9 (1.7)
Thinking about the past four weeks, have other girls and boys bullied you?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)			<i>c</i>	4.4	67.0	4.4 (1.1)
Life satisfaction							
Thinking about the past 4 weeks, has your life been enjoyable?	Not at all (1)-slightly (2)-moderately (3)-Very (4)-extremely (5)			<i>c</i>	1.6	38.5	4.1 (0.9)
How often do you feel happy?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	√			1.0	30.7	4.0 (0.8)
How much of the time do you feel satisfied with your life?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)		√		1.7	45.4	4.2 (0.9)
How often do you have a lot of fun?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	√			1.0	45.5	4.2 (0.9)
Thinking about the past 4 weeks, have you felt pleased that you are alive?	Not at all (1)-slightly (2)-moderately (3)-Very (4)-extremely (5)			<i>c</i>	1.5	70.7	4.5 (0.8)
Self-worth							
How often are you <i>really</i> proud of yourself?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	√	√		2.3	30.3	3.9 (1.0)
Thinking about the past 4 weeks, have you been happy with the way you are?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	3.6	41.7	4.0 (1.1)
How often do you <i>really</i> like yourself?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)	√	√		3.9	46.0	4.1 (1.1)
Body image							
Thinking about the past 4 weeks, have you felt like changing something about your body	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	16.6	37.4	3.5 (1.7)
Thinking about the past 4 weeks, have you been worried about the way you look?	Never (1)-Almost Never (2)-Sometimes (3)-Almost Always (4)-Always (5)			<i>c</i>	9.6	40.1	3.7 (1.3)
How often do you <i>really</i> like the way you look?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)	√			6.0	34.5	3.8 (1.2)
Thinking about the past 4 weeks, have you felt jealous of the way other girls and boys look?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)			<i>c</i>	6.3	60.9	4.2 (1.2)
Thinking about the past 4 weeks, have you been happy with your clothes?	Always (1)-Almost Always (2)-Sometimes (3)-Almost Never (4)-Never (5)			<i>c</i>	2.1	55.2	4.3 (1.0)
Academic performance							

Table 5 continued

Scale/item	Response categories	Source instruments			Item descriptive statistics		
		CHIP-CE	CHIP-AE	Other	Floor (%)	Ceiling (%)	Mean (SD)
During the past 12 months, how would you describe your grades in school?	Below Average (D's or F's) (1)- Average (C's) (2)- Good (B's) (3)- Very Good (A's & B's) (4)- Excellent (A's) (5)			<i>b</i> *	3.3	18.4	3.7 (1.0)
In the past 4 weeks, how good were you at remembering things you learned in school?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			4.2	29.7	3.8 (1.1)
In the past 4 weeks, how did you do in math?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			4.0	37.8	3.9 (1.1)
In the past 4 weeks, how did you do in reading?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			2.4	33.5	3.9 (1.0)
In the past 4 weeks, how did you do on your homework?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			2.1	42.5	4.1 (1.0)
In the past 4 weeks, how did you do in your schoolwork?	Poor (1)-Fair (2)-Good (3)-Very Good (4)-Excellent (5)	✓			0.8	33.9	4.1 (0.8)
School engagement							
In the past 4 weeks, how often did you feel bored in school?	Always (1)-Almost Always (2)- Sometimes (3)-Almost Never (4)-Never (5)			<i>g</i>	22.9	9.2	2.6 (1.2)
In the past 4 weeks, how often did you feel excited by the work in school?	Never (1)-Almost Never (2)- Sometimes (3)-Almost Always (4)-Always (5)			<i>g</i>	18.3	12.0	2.9 (1.2)
In the past 4 weeks, how often were you interested in the work at school?	Never (1)-Almost Never (2)- Sometimes (3)-Almost Always (4)-Always (5)			<i>g</i>	12.0	12.9	3.1 (1.2)
In the past 4 weeks, how often did you look forward to going to school?	Never (1)-Almost Never (2)- Sometimes (3)-Almost Always (4)-Always (5)			<i>d</i> *	14.9	20.4	3.0 (1.0)

The wording of Healthy Pathways items and/or response categories may differ slightly from those included on the CHIP-CE and CHIP-AE. Instruments from which “other” items were derived include:

^a [16]

^b [56]

^c [57]

^d [58]

^e [59]

^f [28]

^g [60]

* Minor modifications were made to items or response categories derived from “other” instruments

Appendix B

See Table 6.

Table 6 Descriptive statistics and known group comparisons (effect sizes) for the Healthy Pathways scales by gender, school type, special health care need (SHCN), asthma, and attention deficit hyperactivity disorder (ADHD)

	Gender			School type			SHCN			Asthma			ADHD			
	Boys		Girls	ES	Elem	Mid	ES	Yes	No	ES	Yes	No	ES	Yes	No	ES
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Physical comfort	3.71 (0.67)	3.59 (0.67)	3.59 (0.67)	3.67 (0.69)	3.61 (0.63)		3.58 (0.69)	3.72 (0.65)	3.70 (0.65)	-0.39	3.46 (0.72)	3.70 (0.65)	-0.39	3.54 (0.75)	3.69 (0.65)	-0.25
Emotional comfort	4.03 (0.70)	3.77 (0.75)	3.77 (0.75)	3.90 (0.73)	3.89 (0.74)		3.85 (0.77)	3.95 (0.71)	3.92 (0.73)		3.84 (0.74)	3.92 (0.73)		3.77 (0.82)	3.93 (0.72)	-0.24
Reactions to stress	3.32 (0.70)	3.29 (0.95)	3.29 (0.95)	3.28 (0.96)	3.34 (0.93)		3.27 (0.96)	3.37 (0.91)	3.35 (0.93)		3.25 (0.94)	3.35 (0.93)		3.11 (0.98)	3.37 (0.92)	-0.28
Physical activity	4.05 (0.95)	3.67 (0.80)	3.67 (0.80)	3.88 (0.80)	3.80 (0.81)		3.79 (0.89)	3.89 (0.75)	3.86 (0.79)		3.84 (0.82)	3.86 (0.79)		3.79 (0.90)	3.86 (0.78)	
Vitality	4.05 (0.77)	3.87 (0.69)	3.87 (0.69)	4.02 (0.68)	3.81 (0.70)	0.32	3.86 (0.74)	4.03 (0.65)	3.99 (0.68)		3.84 (0.70)	3.99 (0.68)		3.96 (0.74)	3.97 (0.67)	
Peer connectedness	4.01 (0.74)	4.08 (0.71)	4.08 (0.71)	4.04 (0.75)	4.06 (0.68)		3.93 (0.79)	4.11 (0.67)	4.05 (0.72)		4.02 (0.70)	4.05 (0.72)		3.81 (0.88)	4.08 (0.69)	-0.36
Family connectedness	3.72 (0.86)	3.78 (0.83)	3.78 (0.83)	3.78 (0.85)	3.67 (0.83)		3.67 (0.88)	3.80 (0.80)	3.76 (0.84)		3.73 (0.86)	3.76 (0.84)		3.67 (0.88)	3.76 (0.84)	
Teacher connectedness	3.97 (0.84)	4.10 (0.77)	4.10 (0.77)	4.09 (0.80)	3.91 (0.81)	0.21	3.99 (0.83)	4.08 (0.77)	4.05 (0.79)		4.02 (0.83)	4.05 (0.79)		3.90 (0.87)	4.07 (0.84)	-0.22
Active coping	3.51 (0.83)	3.78 (0.78)	3.78 (0.78)	3.69 (0.82)	3.53 (0.80)		3.56 (0.86)	3.71 (0.76)	3.66 (0.80)		3.63 (0.85)	3.66 (0.80)		3.45 (0.91)	3.68 (0.78)	
Aggression/ bullying	4.29 (0.91)	4.56 (0.75)	4.56 (0.75)	4.47 (0.82)	4.32 (0.89)		4.42 (0.86)	4.47 (0.81)	4.46 (0.82)		4.38 (0.88)	4.46 (0.82)		4.34 (0.93)	4.47 (0.81)	
Peer hostility/ bully victim	4.29 (0.88)	4.12 (0.95)	4.12 (0.95)	4.22 (0.92)	4.18 (0.91)		4.11 (1.00)	4.29 (0.83)	4.25 (0.88)		4.14 (1.01)	4.25 (0.88)		3.95 (1.10)	4.27 (0.86)	-0.35
Life satisfaction	4.23 (0.70)	4.18 (0.67)	4.18 (0.67)	4.24 (0.67)	4.13 (0.72)		4.07 (0.78)	4.26 (0.63)	4.20 (0.69)		4.13 (0.71)	4.20 (0.69)		4.08 (0.81)	4.21 (0.67)	
Self-worth	4.01 (0.85)	3.94 (0.87)	3.94 (0.87)	4.00 (0.85)	3.92 (0.86)		3.87 (0.89)	4.03 (0.81)	4.00 (0.83)		3.87 (0.91)	4.00 (0.83)		3.86 (0.95)	4.00 (0.82)	
Body image	4.05 (0.77)	3.69 (0.94)	3.69 (0.94)	3.92 (0.87)	3.77 (0.88)	0.40	3.82 (0.89)	3.90 (0.85)	3.89 (0.86)		3.80 (0.90)	3.89 (0.86)		3.81 (0.95)	3.89 (0.85)	
Academic performance	3.86 (0.76)	3.96 (0.69)	3.96 (0.69)	3.99 (0.70)	3.76 (0.77)	0.31	3.82 (0.74)	4.02 (0.68)	3.95 (0.72)		3.97 (0.64)	3.95 (0.72)		3.64 (0.78)	3.99 (0.69)	-0.50
School engagement	2.79 (1.00)	3.14 (0.97)	3.14 (0.97)	3.03 (1.03)	2.81 (0.92)	0.27	2.90 (1.04)	3.01 (0.98)	2.98 (1.00)		2.91 (0.98)	2.98 (1.00)		2.94 (1.07)	2.98 (0.99)	

Positive effect sizes indicate that boys, elementary school students, and children with a special health care need, or specific disorder experience more positive health. Note that all scale scores are coded so that higher values indicate greater health and well-being, and less illness. Effect sizes <.20 were omitted

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