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A Developmental Analysis of the Factorial Validity of the Parent-Report Version of the Adult Responses to Children's Symptoms in Children Versus Adolescents With Chronic Pain or Pain-Related Chronic Illness

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Abstract: The widely used Adult Responses to Children's Symptoms measures parental responses to child symptom complaints among youth aged 7 to 18 years with recurrent/chronic pain. Given developmental differences between children and adolescents and the impact of developmental stage on parenting, the factorial validity of the parent-report version of the Adult Responses to Children's Symptoms with a pain-specific stem was examined separately in 743 parents of 281 children (7–11 years) and 462 adolescents (12–18 years) with chronic pain or pain-related chronic illness. Factor structures of the Adult Responses to Children's Symptoms beyond the original 3-factor model were also examined. Exploratory factor analysis with oblique rotation was conducted on a randomly chosen half of the sample of children and adolescents as well as the 2 groups combined to assess underlying factor structure. Confirmatory factor analysis was conducted on the other randomly chosen half of the sample to cross-validate factor structure revealed by exploratory factor analyses and compare it to other model variants. Poor loading and high cross-loading items were removed. A 4-factor model (Protect, Minimize, Monitor, and Distract) for children and the combined (child and adolescent) sample and a 5-factor model (Protect, Minimize, Monitor, Distract, and Solicitousness) for adolescents was superior to the 3-factor model proposed in previous literature. Future research should examine the validity of derived subscales and developmental differences in their relationships with parent and child functioning.

***Perspective:** This article examined developmental differences in the structure of a widely used measure of caregiver responses to chronic pain or pain-related chronic illness in youth. Results suggest that revised structures that differ across developmental groups can be used with youth with a range of clinical pain-related conditions.*

***Key words:** Pediatric pain, parental behaviors, chronic pain, children, adolescents, Adult Responses to Children's Symptoms, factor analysis.*

An understanding of child chronic and recurrent pain necessitates understanding of the social and familial context in which pain is experienced.[2,9,12,33] Caregiver behaviors exert a powerful influence on child pain behaviors.[3,6,40,45] Specifically, solicitous and protective behaviors (eg, positive

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reinforcement for pain behaviors such as activity restriction) have been associated with a variety of negative outcomes among children and adolescents with recurrent/chronic pain.[5,6,13,25,30,39,40,44,49] Protectiveness has also been associated with caregiver emotional distress, catastrophizing, and helplessness.[39]

For more than 2 decades, the predominant measure used to assess parental responses to pediatric chronic pain was the Illness Behavior Encouragement Scale (IBES[46]), which assessed solicitous responding to abdominal pain and symptom complaints. To capture a wider range of parental response styles, the Adult Responses to Children's Symptoms (ARCS) was developed as an extension of the IBES.[48] Initial factor analysis suggested a 3-factor structure (Protect, Minimize, and Encourage & Monitor). Among mothers of youth (aged 8–15 years) with recurrent abdominal pain, Protect scores were associated with higher child gastrointestinal symptoms, health care costs, and self-reported parent protective behaviors.[44] The validity of the other subscales is less established. To date, only 1 study examined the factorial validity of the ARCS in a sample of youth (aged 8–17 years) with various chronic pain conditions. Although the 3-factor model provided good fit to the data, several modifications to the original measure were required.[5] Moreover, this reanalysis did not include exploratory factor analysis (EFA) of the revised measure, which is typically conducted in measure development work. To date, research has not examined other factor structures beyond the original 3-factor model that would likely account for a greater percentage of variance in parental responses.

Use of the ARCS has led to important insights into the relationship between caregiver behaviors and pediatric chronic pain,[6,13,25,32,40,42,44] including the influence of behavioral interventions on parental responses.[27,28,31,35] However, studies examining the psychometric properties of the ARCS included youth (eg, 8–17 years) spanning various developmental stages who were treated as a homogeneous group. It is unclear whether the scale performs differently in children versus adolescents, which may affect interpretation of research data in studies conducted among both children and adolescents. Adolescence is a unique developmental period wherein autonomy from caregivers and reliance on peers substantially increases.[50] The incidence of most types of chronic pain increases throughout childhood and adolescence.[24] Moreover, the demands and impact of parenting a child with chronic pain likely change as children progress toward adulthood.

This study is the first to examine the factorial validity of other factor structures of the ARCS beyond the original 3-factor model. It is also the first study to apply a developmental analysis to the measurement of caregiver responses to child pain and symptom complaints by examining the factorial validity of the ARCS *separately* in caregivers of children versus adolescents with chronic pain or pain-related chronic illness. In light of important developmental differences between children and adolescents and the potential impact of developmental stage on parenting processes, it was hypothesized that the underlying structure of the ARCS might differ between children and adolescents.

Methods

Participants

Participants included 743 caregivers (92.7% mothers) of children and adolescents (468 girls, 275 boys) aged 7 to 18 years (mean age = 12.75 years, standard deviation = 2.79 years). Participants were allocated to developmental groups (ie, "child group" and "adolescent group") based on definitions put forth by the Standards for Research in Child Health, an international initiative to enhance the reliability and relevance of randomized clinical trials in childhood and adolescence.[47] Specifically, the child group included caregivers of children between the ages of 7 and 11 years (n = 281), and the adolescent group included caregivers of children between the ages of 12 and 18 years (n = 462). Splitting the sample at 12 years is justified based on developmental differences that emerge at this age (eg, beginning of the period of Formal Operations in Piaget's Stages of Cognitive Development marked by the onset of abstract thinking[36]).

Data were pooled from 3 multisite research studies that included caregivers of children and adolescents with recurrent/chronic pain or pain-related chronic illness (inflammatory bowel disease). This includes both data from published studies[25-28,48] and ongoing data collection. The research was conducted at 5 sites: 2 in Seattle, WA (Seattle Children's Hospital and University of Washington), 1 in Tacoma, WA (Mary Bridge Children's Hospital), 1 in Morristown, NJ (Goryeb Children's Hospital/Atlantic Health System), and 1 in Nashville, TN (Vanderbilt University). Four sites collected data from caregivers of children with recurrent and chronic pain (eg, functional abdominal pain, musculoskeletal pain; n = 558), and 1 site collected data from parents of children diagnosed for at least 3 months with inflammatory bowel disease (Crohn's disease or ulcerative colitis; n = 185).

Across all research studies from which data were pooled, the following common inclusion criteria were used: 1) child or adolescent had a primary presenting complaint of chronic or recurrent pain (persistent pain ≥3 months) or was diagnosed with inflammatory bowel disease at least 3 months prior, 2) child or adolescent was within 7 to 18 years of age (ie, 7–17, 8–18, or 10–17 years), and 3) caregiver was able to read and comprehend questionnaires in English. Caregivers were excluded if their child or adolescent had a comorbid chronic illness (diabetes, arthritis, cancer), developmental delay, or cognitive impairment. Caregivers of children and adolescents were typically recruited through physician referral from pediatric gastroenterology and multidisciplinary pain clinics. Participants were also recruited through pediatric clinics and community-posted flyers. The data included from all research studies were collected as part of site-specific institutional review board approved protocols. Informed consent was obtained from each participant during original data collection.

Measures

Demographic Information

Caregivers provided demographic information including their child's age, sex, and race.

ARCS

The ARCS was developed to provide assessment of parent behavior in the context of child chronic and recurrent pain.[48] Composed of 29 items, the ARCS assesses a wider range of parent behaviors as compared to its predecessor, the IBES,[46] which solely assesses solicitous responding during episodes of abdominal pain and other symptoms. Items were derived from the IBES and the Significant Other Response Scales of the West Haven-Yale Multidimensional Pain Inventory,[23] a measure developed for use with adults. In addition, items were based on semistructured interviews with 145 mothers of children with recurrent abdominal pain (aged 8–18 years) who described how they responded, or wished they had responded, to recent episodes of their child's pain.

On the ARCS, caregivers are required to indicate how often they engage in various behaviors using a 5-point Likert-type scale with the anchors "never" and "always." The stem used was specific to parental responses to their child's aches or pains. In the initial development paper, factor analysis using principal components extraction with oblique rotation resulted in 3 factors (Protect, Minimize, and Encourage & Monitor). The 3 subscales have shown adequate internal consistency.[48] The validity of the Protect subscale has also been established; among mothers of children aged 8 to 15 years with recurrent abdominal pain, protectiveness has been shown to be associated with reporting of their own protective responses to episodes of their children's abdominal pain as assessed by 28-day diaries, number of health care visits for gastrointestinal symptoms, and higher health care costs.[44] Moreover, ARCS Protect scores have been shown to be associated with child pain and functional disability[5] as well as less parent psychological flexibility.[32] Conversely, less support has been found for the reliability and validity of the Minimize and Encourage & Monitor subscales,[5] which has been cited as a reason for their exclusion in previous research.[25,30] In the only examination of the factorial validity of the ARCS, the 3-factor model provided good fit to the data among a large sample of children and adolescents with a variety of complex chronic pain conditions,[5] albeit with several modifications to the original measure (removal of items 5, 27, and 29; addition of several error covariances; allowing several items to cross-load).

Procedure

Across all research studies from which data for the current study were pooled, demographic information was provided and the ARCS was completed by caregivers at a baseline visit (ie, prior to random assignment or participating in any other aspects of the studies, including intervention or subsequent assessments).

Data Analysis

Statistical analyses were conducted using Stata, version 12.1 (StataCorp LP, College Station, TX), and SPSS, version 19 (IBM Corp, Armonk, NY). Factor analysis was conducted using a 2-step approach, with EFA followed by confirmatory factory analysis. To split the sample, we applied a stratified randomization algorithm. Within each developmental group, half of the sample was randomly assigned to EFA and the other half to confirmatory factor analysis (CFA). EFA and CFA were then conducted within each developmental group and with the 2 groups combined.

We removed ARCS items 5, 27, and 29 per the previous published validation study[5] before conducting any analyses. Missing values for ARCS items ranged from 2 to 13. Among the original 747 participants, few had missing data; 4 caregivers missed more than 5 items, 3 caregivers missed 5 items, 7 missed 3 items, 7 missed 2 items, and 54 missed one item. A total of 672 (90%) participants completed all 29 ARCS items. The most frequent missing items were 15, 16, 18, and 25. Given the small amount of missing data, we dropped participants with more than 5 missing items. As such, the final sample consisted of 743 parents, with 369 allocated to EFA (139 for child sample; 230 for adolescent sample) and 374 allocated to CFA (142 for child sample; 232 for adolescent sample). Similar to other research examining the factorial validity of measures in pediatric pain,[29] missing data were accounted for by applying the hot-deck imputation method.[1]

We first conducted EFA on the ARCS items to explore whether an item was strongly and differentially correlated with latent subscales (factors). Items were dropped if the factor loadings were below the recommended .32 threshold and if 2 items loaded at or above .32 on more than 1 factor.[43] Based on these criteria, we systematically removed items one at a time and analyses were rerun. Each prior analysis informed decisions about which items to subsequently remove. Items were removed until clean solutions were attained, defined as factor loadings that were >.32 and no cross-loading items. In addition, factor structures that included a factor with less than 3 items loading onto it were not retained.[7]

EFAs were conducted using principal axis factoring.[8] In order to choose a factor structure, we used the criteria that eigenvalues were ≥1.0.[7] In addition, the initial scree plot was also used to determine the initial number of factors to retain. EFA produced loading matrices that were rotated using 2 methods, orthogonal rotation and oblique rotation, to determine the factor structure, with the latter allowing correlated factors. Given that neither rotation significantly changed the factor loadings, an oblique rotation was ultimately used and reported herein based on previous research suggesting that parental responses measured by the ARCS are not orthogonal.[5,48] Items were allocated to the factor to which they loaded most highly. We ran the factor analysis using Pearson correlation matrix (reported in Tables 2, 3, and 4). A sensitivity analysis using rank-based Spearman correlation matrix was also conducted.

Using results from EFA, multiple-factor measurement models (ie, CFA) were conducted using the validation samples, separately for the child and adolescent groups. This was done in order to test the adequacy of fit of the hypothesized models from EFA and to compare fit indices for identified factor structures across developmental groups. CFA was conducted within a structural equation modeling (SEM) framework, and coefficients were estimated using maximum likelihood estimation. CFA was conducted using Stata, version 12.1.

Fit indices were used as the primary indicators to select a final model structure for the child and adolescent samples. We examined the root mean squared error of approximation (RMSEA) and coefficient of determination. An RMSEA of .06 or less indicates good fit whereas an RMSEA above .10 indicates poor fit. Coefficient of determination for SEM measures the amount of variation accounted for in the endogenous constructs by the exogenous constructs, and a value of 1 is considered perfect fit. The comparative fit index and the Tucker-Lewis index were used to assess the goodness of fit of the specified multiple-factor measurement models; values close to 1 indicate good fit. Item loadings in the final CFA were then used to calculate subscale/factor scores. In addition to fit indices, scree plots, reliability of subscales (Cronbach's alpha), and interpretability of factors (eg, number of items loaded onto each factor, conceptual divergence from other factors) were examined to inform decisions about superiority of models. These additional criteria were especially applied when fit indices of model variants were highly similar within developmental groups.

We took the more principled approach toward this analysis, in which hypotheses were identified a priori via EFA and then tested via CFA. We opted not to conduct post hoc model modification purely based on modification indices as such an approach is data driven and vulnerable to chance and sample size. It should be noted that modifying the models essentially changes the hypotheses and the analysis becomes exploratory such that the resultant models require testing with additional data. Indeed, many authors have cautioned against sole use of the modification index.[19,21,38] Finally, subscale scores for the final child and adolescent models were compared between youth with inflammatory bowel disease and youth with chronic pain using independent samples t-tests.

Results

The random split was performed using Stata, version 12.1. No significant differences were found on ARCS items or demographic variables between split halves of the 2 samples. Participant characteristics are shown in Table 1. The majority of caregivers were mothers (91.8–94.3% across samples). The majority of their children were white (90.5–92.9%) and female (60.5–64.5%).

EFA

Child Sample

For the child sample, EFA with iterated principal factor extraction method resulted in 7 factors with eigenvalues above 1.0 and 60.9% variance explained. Examination of the scree plot was suggestive of only a 3-, 4-, or 5-factor structure. To contrast the 3-, 4-, 5-, 6-, and 7-factor models, 5 additional EFAs using the iterated principal factor extraction method with oblique rotation were conducted forcing 7, 6, 5, 4, and 3 factors, respectively. However, the 7-, 6-, and 5-factor models consisted of factors with only 2 items; therefore, they did not meet our criteria for inclusion[7] and were not tested in the CFA stage. Item loadings derived from the rotated pattern matrices from these analyses were used to allocate items to latent factors in the subsequent CFAs.

Adolescent Sample

For the adolescent sample, EFA with iterated principal factor extraction method resulted in 6 factors with eigenvalues above 1.0 and 57.7% variance explained. Examination of the scree plot was suggestive of only a 4- or 5-factor structure. To contrast the 3-, 4-, 5-, and 6-factor models, 4 additional EFAs using the iterated principal factor extraction method with oblique rotation were conducted forcing 6, 5, 4, and 3 factors, respectively. However, the 6-factor model consisted of factors with only 2 items; therefore, they did not meet our criteria for inclusion[7] and were not tested in the CFA

Table 1. Participant Characteristics

Variable	Child Sample (n = 281)	Adolescent Sample (n = 462)
Child age (y), mean (SD)	9.72 (1.21)	14.60 (1.64)
Child gender		
Male	111 (39.5%)	164 (35.5%)
Female	170 (60.5%)	298 (64.5%)
Child race		
White	261 (92.9%)	418 (90.5%)
Black	6 (2.1%)	16 (3.5%)
Asian	4 (1.4%)	5 (1.1%)
Other (eg, Alaskan Native, Pacific Islander, Biracial)	6 (2.1%)	21 (4.5%)
Not reported	4 (1.4%)	2 (.4%)
Caregiver role		
Mother	265 (94.3%)	424 (91.8%)
Father	14 (5.0%)	34 (7.4%)
Grandparent	2 (.7%)	4 (.9%)
Site		
Seattle Children's Hospital	12 (4.3%)	138 (29.9%)
University of Washington, Mary Bridge Children's Hospital, Goryeb Children's Hospital/Atlantic Health System	146 (52.0%)	229 (49.6%)
Vanderbilt University	123 (43.8%)	95 (20.6%)
Pain group		
Inflammatory bowel disease	40 (14.2%)	145 (31.4%)
Chronic pain	241 (85.8%)	317 (68.6%)

Abbreviation: SD, standard deviation.
NOTE. Values are n (%) unless otherwise indicated.

stage. Item loadings derived from the rotated pattern matrices from these analyses were used to allocate items to latent factors in the subsequent CFAs.

Combined (Child and Adolescent) Sample

For the sample combining children and adolescents, EFA with iterated principal factor extraction method resulted in 5 factors with initial eigenvalues above 1.0 and 52.4% variance explained. Examination of the scree plot was suggestive of only a 4- or 5-factor structure; however, a 3-factor model was also examined in order to compare model variants to the originally proposed model. To contrast the 3-, 4-, and 5-factor models, 3 additional EFAs using the iterated principal factor extraction method with oblique rotation were conducted forcing 5, 4, and 3 factors, respectively. However, the 5-factor model consisted of a fifth factor composed of only 2 items; therefore, it did not meet our criteria for inclusion[7] and was not tested in the CFA stage. Item loadings derived from the rotated pattern matrices from analyses of the 4- and 3-factor models were used to allocate items to latent factors in the subsequent CFAs.

CFA

Child Sample

CFAs were conducted on the child-only sample to examine the comparative fit of the 4- and 3-factor models with item loadings informed by EFA; as such, we fitted models with 4 and 3 correlated latent factors. Similar to the models derived for the combined (child and adolescent) sample and the adolescent-only sample, the 4-factor model was characterized by separate Distract and Monitor factors as opposed to 1 combined Encourage & Monitor factor, as proposed in the original 3-factor model.[48] The final 4- and 3-factor models consisted of 23 and 22 items, respectively.

Fit indices yielded from the 2 CFAs were compared, revealing that the model with 4 latent factors had similar fit (RMSEA = .075, coefficient of determination = .993, comparative fit index = .811, Tucker-Lewis index = .787) to the 3-factor model variant (RMSEA = .074, coefficient of determination = .987, comparative fit index = .834, Tucker-Lewis index = .814). All coefficient estimates were significant at the $P < .05$ level. Given that fit indices were highly similar across the 4- and 3-factor models, reliability of subscales (Cronbach's alpha) and interpretability of factors (eg, number of items loaded on each factor, conceptual divergence from other factors) were compared to inform decisions about the superiority of each model. The fit indices for the 4- and 3-factor models were in the acceptable/adequate range. A 4-factor model (in lieu of a 3-factor model) was chosen as the final child model because the fourth factor, Distract, was consistent across all models, was conceptually distinct from all other items, and had acceptable internal consistency. The EFA factor loading matrix for ARCS items for the final 4-factor model for the child model is shown in Table 2. The mean, median, standard deviation, score range, and alpha coefficient for each of the newly derived factors of the final 4-factor model for the child sample obtained through the EFA/CFA procedures are reported in Table 5.

Table 2. EFA Factor Loading Matrix for ARCS Items for the Final 4-Factor Child Model

ARCS Item	Protect	Monitor	Minimize	Distract
1. Ask your child what you can do to help		.53		
2. Express irritation or frustration with your child			.56	
4. Talk to your child about something else to take your child's mind off it				.38
8. Bring your child special treats or little gifts	.36			
9. Try not to pay attention to your child			.45	
10. Ask your child questions about how he/she feels		.79		
11. Let your child stay home from school	.64			
12. Encourage your child to do something he or she enjoys (like watch TV or play a game)				.64
13. Tell your child that he/she doesn't have to finish all his/her homework	.58			
14. Tell your child there's nothing you can do about it			.36	
15. Give your child special privileges	.64			
16. Stay home from work or come home early (or stay home instead of going out or running errands)	.62			
17. Tell others in the family not to bother your child or to be especially nice to your child	.69			
18. Tell your child not to make such a fuss about it			.83	
19. Pay more attention to your child than usual	.59			
20. Let your child sleep in a special place (like in your room or on the couch)?	.44			
21. Tell your child that he/she needs to learn to be stronger			.65	
22. Let your child sleep later than usual in the morning	.68			
23. Keep your child inside the house	.63			
24. Try to involve your child in some activity				.72
25. Spend more time than usual with your child	.41			
26. Try to make your child as comfortable as possible		.70		
28. Check on your child to see how he/she is doing		.69		

NOTE. All original ARCS item numbers were unchanged for ease of comparability across models and studies. Weak loadings, defined as less than .32,[43] were suppressed. In addition to Items 5, 27, and 29, Items 3, 6, and 7 were removed because of poor loadings or high cross-loadings.

Adolescent Sample

CFAs were conducted on the adolescent sample to examine the comparative fit of the 5-, 4-, and 3-factor models with item loadings informed by EFA; as such, we fitted models with 5, 4, and 3 correlated latent factors. Similar to the models derived for the combined (child and adolescent) and child-only samples, the 4-and 5-factor models were characterized by separate Distract and Monitor factors as opposed to 1 combined Encourage & Monitor factor, as proposed in the original 3-factor model.[48] The 5-factor model was characterized by an additional factor, composed of 3 items that previously loaded onto the Protect factor.[48] We named this factor "Solicitousness" as it seemed to capture responses characterized by solicitous behaviors (eg, doing the child's chores for him/her, giving special privileges and gifts/treats) that are similar but distinct from items comprising the Protect scale. The numbers of items comprising the final 5-, 4-, and 3-factor models were 20, 23, and 23, respectively.

Fit indices yielded from the 3 CFAs were compared, revealing that the model with 5 latent factors had better fit (RMSEA = .052, coefficient of determination = .997, comparative fit index = .915, Tucker-Lewis index = .899) than the 4-factor variant (RMSEA = .058, coefficient of determination = .997, comparative fit index = .882, Tucker-Lewis index = .867) and the 3-factor model variant (RMSEA = .082, coefficient of determination = .988, comparative fit index = .747, Tucker-Lewis index = .718). Both the 4- and 5-factor models were in the good range and superior to the 3-factor model, which was in the acceptable/adequate range. All coefficient estimates were significant at the $P < .05$ level. The fit indices for the 5- and 4-factor models were in the good range; the fit indices for the 3-factor model were in the acceptable/adequate range. Based on these results, a 5-factor model was chosen as the final model for adolescents. The EFA factor loading matrix for ARCS items for the final 5-factor model for the adolescent model is shown in Table 3. The mean, median, standard deviation, score range, and alpha coefficient for each of the newly derived factors of the final 5-factor model for the adolescent sample obtained through the EFA/CFA procedures are reported in Table 5.

Combined (Child and Adolescent) Sample

CFAs were conducted on the combined (child and adolescent) sample to examine the comparative fit of the 4- and 3-factor models with item loadings informed by EFA; as such, we fitted models with 4 and 3 correlated latent factors. Similar to the models derived for the child- and adolescent-only samples, the 4-factor model was characterized by separate Distract and Monitor factors as opposed to 1 combined Encourage & Monitor factor, as proposed in the original 3-factor model.[48] The final 4- and 3-factor models each consisted of 24 items.

Fit indices yielded from the 2 CFAs were compared, revealing that the model with 4 latent factors had better fit (RMSEA = .058, coefficient of determination = .996, comparative fit index = .882, Tucker-Lewis index = .867) than the 3-factor model variant (RMSEA = .069, coefficient of determination = .990, comparative fit index = .820, Tucker-Lewis index = .800). All coefficient estimates were significant at the $P < .05$ level. The fit indices for the 4-factor model were in the good range; the fit indices for the 3-factor model were in the acceptable/adequate range. The 4-factor model (in lieu of a 3-factor model) was chosen as the final model for children and adolescents combined. The EFA factor loading matrix for the final 4-factor model for the combined sample is shown in Table 4. Descriptive statistics and internal consistency

Table 3. EFA Factor Loading Matrix for ARCS Items for the Final 5-Factor Adolescent Model

ARCS Item	Protect	Solicitousness	Monitor	Minimize	Distract
1. Ask your child what you can do to help			.69		
2. Express irritation or frustration with your child				.48	
3. Do your child's chores or pick up your child's things instead of making him/her do it		.48			
4. Talk to your child about something else to take your child's mind off it					.76
8. Bring your child special treats or little gifts		.64			
10. Ask your child questions about how he/she feels			.74		
11. Let your child stay home from school	.64				
12. Encourage your child to do something he or she enjoys (like watch TV or play a game)					.55
13. Tell your child that he/she doesn't have to finish all his/her homework	.47				
14. Tell your child there's nothing you can do about it				.47	
15. Give your child special privileges		.68			
16. Stay home from work or come home early (or stay home instead of going out or running errands)	.60				
17. Tell others in the family not to bother your child or to be especially nice to your child	.50				
18. Tell your child not to make such a fuss about it				.73	
21. Tell your child that he/she needs to learn to be stronger				.55	
22. Let your child sleep later than usual in the morning	.71				
23. Keep your child inside the house	.66				
24. Try to involve your child in some activity					.79
26. Try to make your child as comfortable as possible			.54		
28. Check on your child to see how he/she is doing			.84		

NOTE. All original ARCS item numbers were unchanged for ease of comparability across models and studies. Weak loadings, defined as less than .32,[43] were suppressed. In addition to Items 5, 27, and 29, Items 6, 7, 9, 19, 20, and 25 were removed because of poor loadings or high cross-loadings.

Table 4. EFA Factor Loading Matrix for ARCS Items for the Final 4-Factor Model for the Entire Sample (Children and Adolescents Combined)

ARCS Item	Protect	Monitor	Minimize	Distract
1. Ask your child what you can do to help		.65		
2. Express irritation or frustration with your child			.54	
3. Do your child's chores or pick up your child's things instead of making him/her do it	.45			
4. Talk to your child about something else to take your child's mind off it				.67
7. Get your child something to eat or drink	.34			
8. Bring your child special treats or little gifts	.45			
10. Ask your child questions about how he/she feels		.78		
11. Let your child stay home from school	.67			
12. Encourage your child to do something he or she enjoys (like watch TV or play a game)				.64
13. Tell your child that he/she doesn't have to finish all his/her homework	.66			
14. Tell your child there's nothing you can do about it			.47	
15. Give your child special privileges	.61			
16. Stay home from work or come home early (or stay home instead of going out or running errands)	.68			
17. Tell others in the family not to bother your child or to be especially nice to your child	.65			
18. Tell your child not to make such a fuss about it			.80	
19. Pay more attention to your child than usual	.53			
20. Let your child sleep in a special place (like in your room or on the couch)?	.43			
21. Tell your child that he/she needs to learn to be stronger			.51	
22. Let your child sleep later than usual in the morning	.72			
23. Keep your child inside the house	.57			
24. Try to involve your child in some activity				.73
25. Spend more time than usual with your child	.36			
26. Try to make your child as comfortable as possible		.62		
28. Check on your child to see how he/she is doing		.80		

NOTE. All original ARCS item numbers were unchanged for ease of comparability across models and studies. Weak loadings, defined as less than .32,[43] were suppressed. In addition to Items 5, 27, and 29, Items 6 and 9 were removed because of poor loadings or high cross-loadings.

values for each of the newly derived 4-factor model for the combined (child and adolescent) sample obtained through the EFA/CFA procedures are reported in Table 5.

Individual Differences in Factor Scores

Means and standard deviations of the subscale scores for each developmental group and for the combined (child and adolescent) sample are shown in Table 5. Given that different items were removed because of weak and high cross-loadings across each sample, and given that factors were composed of different items, direct comparisons in subscale scores across developmental groups were not made.

Among each of the child and adolescent samples, compared to caregivers of youth with chronic pain, caregivers of youth with inflammatory bowel disease had significantly higher scores on the Protect ($t[45.92] = 4.21$, $P < .001$; $t[460] = 4.58$, $P < .001$) and Monitor subscales ($t[67.23] = 2.92$, $P < .01$; $t[327.35] = 4.75$, $P < .001$) and lower scores on the Minimize subscale ($t[73.45] = -3.55$, $P < .01$; $t[460] = -4.06$, $P < .001$). Caregivers of adolescents with inflammatory bowel disease versus chronic pain had higher scores on the Solicitousness subscale ($t[460] = 4.39$, $P < .001$). Caregivers of children with inflammatory bowel disease versus chronic pain had higher scores on the Distract ($t[64.73] = 2.58$, $P < .05$) subscale.

Discussion

This is the first examination of developmental differences in the underlying structure of a measure of caregiver responses to pediatric chronic pain or pain-related chronic illness. The factorial validity of the ARCS[48] was investigated separately in caregivers of children and adolescents with chronic/recurrent pain or pain-related chronic illness as well as in both groups combined. This is also the first study to examine the factorial validity of other factor structures of the ARCS beyond the original 3-factor model. Results revealed that a 5-factor model (Protect, Solicitousness, Minimize, Monitor, and Distract) for adolescents and a 4-factor model (Protect, Minimize, Monitor, and Distract) for children and the combined (child and adolescent) sample were superior to the 3-factor model proposed in previous literature.[48] Although the addition of 1 or 2 more factors only slightly improved the variance among our study sample, the 5- and 4-factor models were deemed to represent a more comprehensive view of the underlying constructs and probably provide a better characterization of parental responses in the target population. Across the child and adolescent samples as well as the combined (child and adolescent) sample, we found that items previously combined into a single factor (Encourage & Monitor) loaded onto 2 distinct factors (Distract and Monitor). These results stand in contrast to previous research, are suggestive of developmental differences in the performance of this measure, and will be important to explore in more detail in future studies.

Although other measures of caregiver responses to pediatric chronic pain exist,[18,20] the ARCS, and particularly the Protect subscale, is among the most widely used. Parent protectiveness is associated with a

Table 5. Descriptive Statistics for ARCS Subscale Scores for the Final Models

ARCS Subscale	No. of Items	Mean	SD	Median	Range	Cronbach's Alpha
Child sample (4-factor model)						
Protect	11	12.10	7.50	11.00	0–41	.86
Monitor	4	12.85	2.74	13.00	3–16	.78
Minimize	5	3.60	2.75	3.00	0–19	.64
Distract	3	6.98	2.28	7.00	0–12	.61
Adolescent sample (5-factor model)						
Protect	6	7.75	4.40	7.00	0–23	.77
Solicitousness	3	3.89	2.33	4.00	0–11	.67
Monitor	4	12.47	2.95	13.00	1–16	.80
Minimize	4	2.86	2.41	2.00	0–13	.65
Distract	3	6.52	2.58	7.00	0–12	.74
Entire sample (4-factor model)						
Protect	13	17.65	8.81	17.00	0–47	.87
Monitor	4	12.61	2.88	13.00	1–16	.79
Minimize	4	2.94	2.40	3.00	0–16	.63
Distract	3	6.70	2.48	7.00	0–12	.70

Abbreviation: SD, standard deviation.

host of negative child outcomes, including functional disability,[6,13,40] school absence and impairment,[30] somatic[6,40] and depressive[5] symptoms, and greater health care utilization.[44] Moreover, protectiveness appears to be intertwined with caregivers' own mental health and is positively associated with caregiver anxiety, depression, and distress and less psychological flexibility and acceptance related to their child's pain.[32,39,49] Findings revealed that items comprising the Protect scale in the original model and the derived 4-factor child model loaded onto 2 distinct factors (Protect and Solicitousness) in the 5-factor adolescent model. It could be that the responses characterized by the Solicitousness scale are capturing more extreme and/or developmentally atypical types of protective parent responses at this later developmental stage. However, future research is needed to examine the relationships of these derived subscales with parent and child outcomes (eg, anxiety, catastrophizing, and distress).

Although previously conceived of as a single factor, distracting and monitoring responses consistently emerged as 2 separate dimensions in the final solutions. Operant theories of chronic pain hold that distracting responses serve to remove attention from pain behaviors and function to decrease them,[11,22] whereas monitoring responses, by increasing attention to pain behaviors, serve the opposite function. Distracting parent behaviors have been shown to reduce child pain behaviors in the context of acute[4] and chronic[45] pain. Conversely, distraction could be viewed as antithetical to recent acceptance and mindfulness-based approaches to the management of pediatric chronic pain, which emphasize exposure (versus distraction or avoidance) to moment-to-moment internal experience, even when the experience is perceived as aversive.[14] There may be developmental differences in the degree to which each of these responses is used by parents. To the younger child with newer-onset pain, distraction may be effective and adaptive; indeed, it is a particularly effective intervention for young children.[37] Conversely, it is possible that to the adolescent with chronic pain and illness behaviors that are more entrenched, distracting responses could be perceived as invalidating and function as a maladaptive form of avoidance. Further research using these newly separated factors (Distract and Monitor) is needed to better understand how distracting caregiver behaviors may relate to coping and functional outcomes in childhood versus adolescence.

Consistent with our hypotheses, developmental differences in the factor structure of the ARCS were supported in the present study, and future research should continue to explore developmental differences in parental responses to child pain, especially in the context of any item modifications to the ARCS. Nevertheless, although different factor structures emerged for children and adolescents, this examination was limited by the items that were originally included in the ARCS. Initial measure development did not apply a developmental framework to item selection but rather was based, in part, on downward extension of an adult measure[23] as well as semistructured interviews with mothers of patients with abdominal pain spanning several developmental stages (ie, aged 8–18 years).[48] In the present study, different items were removed in the final child and adolescent samples because of poor and high cross-loadings, suggesting differences in the relevance of these caregiver responses during early versus later developmental stages. Specifically, the item pertaining to doing the child's chores for him/her (Item 3) was dropped from the final child model but not the adolescent model. This is unsurprising given that such responsibilities typically become expected of youth later in childhood and into adolescence. In addition, items included in the final child model but not the adolescent model pertained to removing and directing attention to the child (items 9 and 19), allowing the child to sleep in a special place (item 20), and spending more time than usual with the child (item 25). This suggests that these types of parent responses are less relevant during adolescence and there may be other, more relevant domains that should be assessed during this later developmental stage. Further measure development may include modification of original ARCS items and/or the addition of new items that are informed by literature on developmental differences in pediatric pain as well as general child development.[36] Of particular importance to the period of adolescence may be inclusion of items tapping social and peer relationships and the social impact of chronic pain.[16,10]

There are several reasons why parents may engage in different forms of help seeking in caring and responding to a child versus an adolescent. Parents who catastrophize about pain are likely to endorse engaging in protective responses.[25] Additionally, protectiveness has been shown to be the underlying process through which parents' helplessness influences child functional disability.[39] The degree of perceived threat and helplessness might be highest when chronic pain is experienced earlier in development, when dependence on caregivers is greatest, and the onset of pain complaints first occurs.[2] On the other hand, protectiveness might increase as pain persists over time and illness behaviors become more entrenched during later developmental stages. Adolescence is marked by the transition toward self-management of pain and illness,[15] during a time when reliance on the peer group and autonomy increases. Furthermore, adolescents tend to report greater avoidant behaviors and functional disability as well as different patterns of fear avoidance than younger children.[41] This decreased reliance on parents as well as heightened avoidance and disability may also account for distinct patterns of parent responses in childhood and adolescence.[34] Future prospective research is needed to test these hypotheses, and the analytical method employed herein could be applied to other measures of caregiver responses to child pain.

The present study has limitations that might be addressed in future research. Although the sample included a range of chronic pain conditions or pain-related illness, the majority of individuals were white and had recurrent/chronic abdominal pain, similar to the original ARCS validation sample.[48] Abdominal pain may be unique; unlike other chronic pain types, it is more prevalent in childhood than adolescence.[24] In addition, inflammatory bowel disease was the only pain-related chronic disease studied; as such, there is a need for research to examine the factor structure of the ARCS in other pain-related chronic disease conditions (eg, cancer and sickle cell disease). Future research should also examine the developmental sensitivity of the ARCS in more diverse samples of youth and parents, including more fathers[17] and other ethnic groups. Measures of parent and child psychological factors (eg, pain catastrophizing, distress) were not included and should be examined in relation to the derived subscales. The current investigation only examined parent-reported responses to child pain, which may differ in important ways from children's own perceptions and differentially predict treatment response. A prevailing shortcoming of existing literature is the reliance on cross-sectional designs that preclude examination of temporal changes in parent behaviors across development. Only a few prospective studies have examined the sensitivity of the ARCS Protect subscale to assess changes in parent responses following intervention.[27,28,31] Longitudinal research is needed to assess the sensitivity of all derived ARCS subscales following intervention.

Some factors/subscales showed evidence of better internal reliability (eg, Protect and Monitor) than others (eg, Minimize), and the degree of internal consistency of some subscales (eg, Distract) differed across developmental groups. Future validation research is needed to expand upon these preliminary findings to examine the differential clinical utility of subscales for child and adolescent samples. Future research could also examine parent profiles using hierarchical cluster analysis and the ARCS, potentially in the context of other psychological fear-avoidance measures, as they may predict treatment response. Finally, some child clinical characteristics (eg, pain duration and frequency) were not uniformly collected across samples and available for analyses. It is likely that duration of pain/illness could influence caregiver responses to child symptom complaints, and these pain characteristics may differ as a function of developmental stage.

In summary, the present study is the first to apply a developmental analysis to the measurement of caregiver responses to child chronic pain and illness complaints and examine various factor structures of the ARCS beyond the originally proposed 3-factor model. Findings reveal that a 4-factor model for children and a 5-factor model for adolescents are superior to the 3-factor model proposed in past literature[48] and can be used with parents during these developmental stages. Although we recommend use of these derived factors for children and adolescents, the derived 4-factor model for the combined (child and adolescent) sample presented herein can be used uniformly across childhood and adolescence. Research is needed to further examine the validity of these derived subscales, particularly given that problematic items were removed from all final solutions. Given the consistent divergence of the Distract and Monitor factors across all models, it is recommended that these subscales be scored separately. This research highlights the need for consideration of developmental factors in pediatric pain research and offers an analytic approach for examining the sensitivity of our existing assessment tools. Integration of this revised measure into examinations of recent cognitive-behavioral models of pediatric chronic pain[1] may elucidate the complex interrelationships between caregivers and children in influencing trajectories of pain across the life span.

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