

Development and Preliminary Validation of the Child Pain Anxiety Symptoms Scale in a Community Sample

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Objective To develop, and provide initial validation of, a 20-item Child Pain Anxiety Symptoms Scale (CPASS), a modified version of the adult 20-item Pain Anxiety Symptoms Scale. **Methods** A community sample of children and adolescents ($N = 959$) aged 8–18 years completed the CPASS and measures of pain catastrophizing, anxiety sensitivity, and general anxiety. Factor structure was assessed using exploratory and confirmatory factor analyses (EFA and CFA). **Results** EFA yielded a one- and a three-factor solution using 17 items of the CPASS. CFA supported a hierarchical model for both a 20-item four-factor solution (based on the adult literature) and a 20-item slightly modified four-factor solution. The CPASS showed excellent internal consistency (Cronbach's $\alpha = .903$) and good construct, discriminant, and concurrent validity. **Conclusions** This study provides support for the relevance of pain anxiety in a community sample of children and adolescents and offers preliminary validity and reliability for the CPASS.

Key words adolescents; Child Pain Anxiety Symptoms Scale; children; community sample; factor analysis; pain anxiety; validation.

Introduction

Pediatric pain is ubiquitous: recent reports suggest 53.7% of children report experiencing pain in the past 3 months (Asmundson & Wright, 2004) and 25–30% of children experience chronic pain (Perquin et al., 2000; Roth-Isigkeit, Thyen, Stoven, Schwarzenberger, & Schmucker, 2005). Advances in our understanding of pediatric pain mechanisms and management depend upon the availability of psychometrically sound tools to assess the sensory, affective, and cognitive dimensions of pain experience.

In contrast to the abundance of sensory measures of pediatric pain (see Stinson, Kavanagh, Yamada, Gill, & Stevens, 2006 for a review), there is a relative dearth of valid instruments designed to measure other dimensions and related features of pediatric pain (Palermo, 2000). The Pain Catastrophizing Scale for Children (PCS-C) (Crombez

et al., 2003) measures the extent to which children magnify, worry, and feel helpless about their pain experience. The Faces Affective Scale (Kuttner & Lepage, 1989; McGrath et al., 1996) measures pain unpleasantness. Recently, multidimensional measures of pediatric and adolescent pain have been developed (see Palermo, 2009 for a review). For example, the Bath Adolescent Pain Questionnaire (BAPQ) (Eccleston et al., 2005) assesses various domains of impairment in adolescents with chronic pain, including physical, social, and psychological functioning. The Pain Experience Questionnaire (Hermann, Hohmeister, Zohsel, Tuttas, & Flor, 2008) assesses pain severity, pain interference, affective distress, and social support in children with chronic pain.

One domain of pediatric pain experience that has not received much empirical attention is pain anxiety. Pain

anxiety, as conceptualized by McCracken and colleagues (McCracken, Zayfert, & Gross, 1992), refers to the thoughts, feelings, behaviors, and physical sensations that accompany the experience and anticipation of pain. Unlike pain catastrophizing, which is limited to negative pain-related cognitions, pain anxiety comprises the following reactions to pain: cognitive (increased difficulty concentrating when experiencing pain), emotional (fear of consequences associated with experiencing pain and fear of amplification of the pain), physiological (bodily reactions to the experience of pain such as increased heart rate) and behavioral (active efforts to avoid the onset and exacerbation of pain).

In adults, high levels of pain anxiety are associated with many aspects of the pain experience, from pain severity and disability to coping responses (Coons, Hadjistavropoulos, & Asmundson, 2004; McCracken & Dhingra, 2002; McWilliams & Asmundson, 1998). The construct of pain anxiety allows for a more thorough understanding of the biopsychosocial correlates of pain than do general measures of anxiety (Zvolensky, Goodie, McNeil, Sperry, & Sorrell, 2001). Preliminary investigations of pain anxiety in children suggest it is a significant predictor of pain-related disability among children with chronic pain (Martin, McGrath, Brown, & Katz, 2007).

Although the BAPQ has a 7-item pain-specific anxiety subscale that can be used with adolescents, it was not developed for use in children. An empirically valid measure of pain anxiety in children would make it possible to target interventions specifically directed at changing troublesome pain-related thoughts, feelings, and behaviors that contribute to increased suffering and disability.

The present study reports the preliminary validation of the CPASS (an adapted version of the adult 20-item Pain Anxiety Symptoms Scale (PASS-20; McCracken & Dhingra, 2002) in a community sample of children aged 8–18 years. The goals of the current study were to (1) adapt the PASS-20 for use in children as young as 8 years of age (CPASS) and (2) evaluate the psychometric properties of the CPASS; namely, its factor structure, reliability, and construct, discriminant and concurrent validity.

Methods

Development of the CPASS

The authors (G.P., A.L.M., J.K.) generated between one and three different, age appropriate versions of each of the PASS-20 items. One of the authors (G.P. or A.L.M.) then met individually with seven children (2 girls and 5 boys) aged 7–13 years who were known to one or more of the researchers. The children reviewed the various

wordings for each of the 20 items and were asked to choose their preferred wording, or if none was preferred, to suggest an alternative wording. Next, the seven children were brought together in a focus group format to discuss any issues identified in the one-on-one meetings and to come to a consensus about the best wording for each item. The meaning of specific phrases used in the CPASS (e.g., “when I feel pain”, “to relax my body”, “my body starts to shake”, and whether “I go immediately to bed”, and “I rest right away” have the same meaning) was also assessed during the focus group. The resulting 20-item CPASS (Table 1) has an average grade level readability below Grade 4 (Flesh–Kincaid Grade Level = 3.17; Flesh Reading Ease = 91.93; Dale–Chall Readability = 4.6) (RFP-Evaluation Centers, 2009). Readability indicators assess reading levels between Grade 4 and Grade 12; therefore, it is difficult to precisely characterise the readability of the CPASS below Grade 4.

Participants

Participants were recruited while visiting the Ontario Science Center, Toronto, ON, Canada (<http://www.ontariosciencecentre.ca>), between July 13 and August 7, 2009. The Ontario Science Centre is a science museum with interactive and educational games and exhibits for children and adults.

Questionnaires

Child Pain Anxiety Symptoms Scale (CPASS)

The CPASS is a modified, age-appropriate version of the PASS-20 (McCracken & Dhingra, 2002) that was developed for use with children from 8 to 18 years of age. Children are provided with the following instructions: “The following sentences have to do with how people think, feel, and act when they have pain. For each sentence, choose any number from 0 to 5 that best describes you when you have pain. 0 means that you never think, act, or feel that way. 5 means that you always think, act, or feel that way.” Total score ranges from 0 to 100, with higher scores indicating higher levels of pain anxiety.

Multidimensional Anxiety Scale for Children (MASC-10; March, Parker, Sullivan, Stallings, & Conners, 1997)

The MASC-10 is a short version of the 39-item Multidimensional Anxiety Scale for Children designed as a screening questionnaire for anxiety. The MASC-10 yields a global anxiety symptom score that includes items measuring physiological symptoms, social anxiety, harm avoidance, and separation/panic. Children rate the extent to which each of the statements is true about them on a

Table 1. Cronbach's alpha, corrected item-total correlations of the CPASS, and factor loadings of the one-factor and three-factor solutions generated by EFA using PAF and Oblimin rotation

CPASS Items	Mean (SD)	α item deleted		Item-total r		λ_1 -factor	λ_3 -factor		
		17-item	20-item	17-item	20-item		f1	f2	f3
1. I think that if my pain hurts too much, it will never get better.	1.00 (1.15)	.891	.902	.445	.445	.481		-.578	
2. When I feel pain I am afraid that something terrible will happen.	1.16 (1.17)	.887	.899	.573	.577	.598		-.557	
3. I rest right away when my pain hurts too much.	1.98 (1.56)	.893	.904	.410	.406	.464			.493
4. My body starts to shake when I am doing an activity that makes my pain worse.	1.19 (1.37)	.891	.902	.454	.467	.414			.532
5. I can't think straight or think clearly when I feel pain.	1.44 (1.40)	.886	.898	.573	.586	.641			.624
6. I will stop any activity when I start feeling pain.	1.75 (1.50)	.889	.901	.513	.510	.522			.600
7. When I feel pain, my heart beats faster.	1.49 (1.42)		.900		.511				
8. As soon as pain begins I ask my parents for medication.	1.31 (1.47)	.893	.904	.392	.400	.451	.467		
9. When I feel pain I think I might be really sick.	1.11 (1.20)	.887	.899	.566	.574	.682	.807		
10. When I feel pain it is hard for me to think about anything else.	1.53 (1.44)	.882	.896	.681	.683	.766	.534		
11. I don't do important activities when I hurt.	1.52 (1.38)	.889	.900	.501	.506	.571			.556
12. When I feel pain I feel dizzy or faint.	0.76 (1.12)		.901		.500				
13. Feeling pain is very scary.	1.32 (1.43)	.885	.898	.601	.609	.680	.590		
14. When I feel pain, I think about it all the time.	1.48 (1.43)	.883	.896	.670	.666	.749	.732		
15. When I feel pain, I feel like I am going to throw up.	1.04 (1.22)	.887	.899	.556	.571	.605	.691		
16. When my pain hurts too much I think I might not be able to move again.	0.57 (0.97)		.901		.480				
17. I find it hard to concentrate and pay attention when I feel pain.	1.50 (1.38)	.885	.898	.618	.614	.703			.434
18. I find it hard to relax my body after I feel pain.	1.57 (1.41)	.885	.898	.610	.612	.645	.409		
19. I worry when I feel pain.	1.54 (1.43)	.884	.897	.642	.641	.718	.549		
20. I try not to do activities that make me feel pain.	1.87 (1.59)	.891	.902	.469	.466	.492			.411

Note: α item deleted – Cronbach's alpha if item is deleted; CPASS – Child Pain Anxiety Symptoms Scale; EFA – Exploratory Factor Analysis; PAF – Principal Axis Factoring; Item-total r – Corrected Item-Total Correlation; λ – Factor Loadings Extracted from EFA. Three-factor solution – EFA using PAF with Oblimin rotation and polychoric correlations was performed on the original 20 items adapted from the adult PASS. Three items (7, 12, and 16) were deleted one at a time due to poor factor loading, yielding a 17-item scale with three correlated factors. One-factor solution: the one-factor solution was suggested by PA and Velicer's MAP test on the 17-item scale. For each of the 20 items, observed scores on individual items ranged from 0 to 5.

scale from 0 (never true about me) to 3 (often true about me). Total score ranges from 0 to 30, with higher scores indicating higher levels of anxiety. The MASC-10 has good internal consistency ($\alpha = .60-.85$), high test-retest reliability ($r = .79-.93$), good convergent validity (high correlation with other anxiety measures such as the Revised Children's Manifest Anxiety Scale), and good discriminant validity (absence of a significant correlation with depression measures such as the Children's Depression Inventory; March et al., 1997).

Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991)

The Childhood Anxiety Sensitivity Index is an 18-item scale assessing levels of anxiety sensitivity in children. Anxiety sensitivity is defined as the fear of anxiety-related sensations because they are believed to lead to harmful somatic, psychological, and/or social consequences (Reiss

& McNally, 1985). The scale is composed of 18 items such as "It scares me when my heart beats fast" and "It scares me when I feel like I'm going to throw up." Children are asked to rate how adversely they experience anxiety symptoms using a scale ranging from 1 (none) to 3 (a lot). Summing all items gives a total score ranging from 18 to 54, with higher scores indicating higher levels of anxiety sensitivity. The CASI has both good internal consistency ($\alpha = .87$) and test-retest reliability ($r = .76$; Silverman et al., 1991).

Pain Catastrophizing Scale – Children (PCS-C; Crombez et al., 2003)

The PCS-C is a 13-item self-report measure assessing pain catastrophizing. The scale was modified for use with children based on the adult PCS (Crombez, Eccleston, Baeyens, & Eelen, 1998; Sullivan, Bishop, & Pivik, 1995). For each item, participants are asked to rate

“how strongly they experience this thought” when they have pain on a scale from 0 (not at all) to 4 (extremely). Total scores range from 0 to 52, with higher scores indicating higher levels of pain catastrophizing. Preliminary results suggest that the PCS-C has good internal consistency ($\alpha = .90$) and correlates highly with pain intensity ($r = .49$) and disability ($r = .50$).

Pain Experience Questions

In order to gather specific information about the participants' pain experience, the following questions were asked: (i) what is the most painful experience you have had? (ii) have you ever had pain that lasted for three months or longer? (iii) if so, what type of pain was it? (iv) how often do you feel pain [no pain, less than once a month, once or twice a month, once or twice a week, everyday]?”

Procedure

The study was reviewed and approved by the Research Ethics Board at York University and the research division at the Ontario Science Centre. Research team members handed out flyers to potential participants and their parents in a common area of the Ontario Science Centre. Interested participants were directed to a testing room where the study aims and procedures were explained to each parent-child pair. Informed written consent/assent (on the computer) was obtained from the parent and child, respectively. Children then responded to demographic questions and completed the CPASS, PCS-C, CASI, and MASC-10 on laptop computers using MediaLab Research Software (v2008; Empirisoft Corporation, New York, NY). The order of administration of the questionnaires was randomized within participants, using the randomization option available in the software, to avoid potential order and fatigue effects. In general, younger children did not have difficulty using the computer or responding to questions on the computer. Research with children has shown that online or computer-based administration of questionnaires is as reliable and valid as paper administration (Truman et al., 2003; Young et al., 2009).

Data Analysis

Exploratory and Confirmatory Factor Analysis

Both EFA and CFA are recommended for scale development (Netemeyer, Bearden, & Sharma, 2003). In order to perform both EFA and CFA, the sample was randomly divided into two equal subsamples using SPSS version 16 (SPSS Inc, Chicago, Illinois).

EFA. Principal Axis Factoring (PAF; Hayton, Allen, & Scarpello, 2004; Horn, 1965; O'Connor, 2000; Velicer, Eaton, & Fava, 2000) with Oblimin rotation using polychoric correlations was performed on the 20 items of the CPASS. The following procedure was performed to generate an adequate factor solution (i.e., primary loadings > 0.40 and secondary loadings < 0.30 ; Costello & Osborne, 2005): EFAs tested six solutions to the data (one factor through six factors), and each solution was assessed for adequacy based on primary and secondary factor loadings. If no adequate solution was found, each item was evaluated based on its primary and secondary factor loadings; the item with the poorest fit across the six factor solutions was then deleted and the EFAs were rerun. This process was repeated until an adequate factor solution was found. Subsequently, Velicer's MAP test and parallel analysis (PA) were conducted on the polychoric correlation matrix of the retained items in the EFA to verify the number of factors to retain. Syntax for PA and MAP test were extracted from O'Connor's (2000) program and implemented in SPSS.

CFA. CFA compared the following factor structures: (1) the original four-factor intercorrelated model of the PASS-20 (see Figure 1A for items making up the cognitive, physiological anxiety, fear, and escape/avoidance subscales of the adult original four-factor model; McCracken & Dhirga, 2002) and (2) factor solutions suggested by the EFA. CFA was conducted in Mplus (version 5.1, Los Angeles, CA; Muthen & Muthen). As recommended by Flora and Curran (2004), items were declared as ordinal indicators and model parameters were estimated using weighted least squares for means and variances (WLSMV). Following recommended procedures, multiple fit indices were used to determine the appropriateness of each model (Hu & Bentler, 1998). Although χ^2 is reported for interested readers, it is a problematic fit index since it is sensitive to sample size and violations of normality (Joreskog, 1969). Thus, model fit was determined based on statistical recommendations that Root Mean Square Error of Approximation (RMSEA) be below 0.08 for a reasonable fit (below 0.05 for a close fit), Comparative Fit Index (CFI) be equal to or greater than 0.95, and Tucker Lewis Index (TLI) be equal to or greater than 0.90 (Bentler & Chou, 1987; Browne & Cudeck, 1993; Hu & Bentler, 1998, 1999).

Reliability of the CPASS

Internal consistency of the CPASS was evaluated with Cronbach's alpha and item-total correlations.

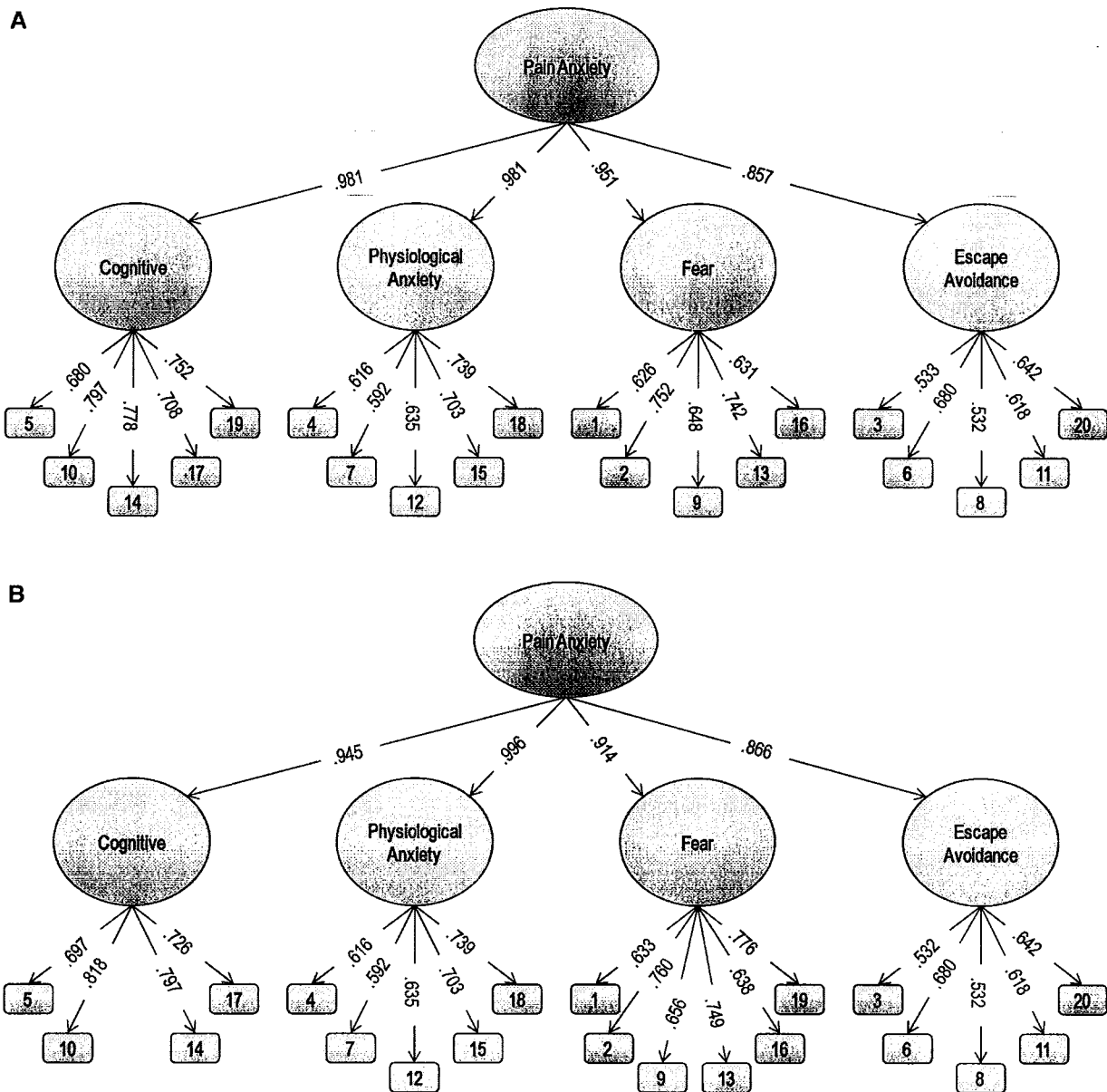


Figure 1. Structural factor models (CFA) of (A) the 20-item original four-factor solution and (B) the 20-item modified four-factor solution. Each model includes one higher-order factor (Pain Anxiety). Arrows represent standardized factor loadings, from each factor toward each of its respective items and from the higher-order factor to the first-order factors.

Construct, Discriminant, and Concurrent Validity

The construct validity of the CPASS was assessed by correlating total scores on the CPASS with two theoretically-related measures, the Pain Catastrophizing Scale for Children (PCS-C) and the Childhood Anxiety Sensitivity Index (CASI). We expected the CPASS to correlate moderately to highly with both the PCS-C and the CASI.

Discriminant validity was assessed by correlating the total score on the CPASS with a measure of general anxiety

(MASC-10). We therefore expected a low to moderate correlation between the CPASS and total score on the MASC-10. The magnitude of the linear relationship between variables was assessed using Pearson correlation coefficients.

Construct and discriminant validity were also evaluated by *t*-tests comparing the magnitude of the difference in correlation coefficients (Cohen & Cohen, 1983) between (1) the CPASS and CASI versus the CPASS and MASC-10 and (2) the CPASS and PCS-C versus the CPASS and

MASC-10. We expected the correlation coefficients between the CPASS and (1) CASI and (2) PCS-C to be significantly larger than the correlation coefficient between the CPASS and the MASC-10, as evaluated by *t*-tests.

Concurrent validity was assessed using multiple ordinal regression analysis. The frequency with which children reported feeling pain was regressed on total scores of the CPASS, CASI, MASC-10, and PCS-C.

Results

Recruitment and Withdrawal of Participants

A total of 1022 children were recruited for the present study. Of these, 12 children discontinued participation before completion of all questionnaires and the partial data they provided were not used. The data from four other children were excluded because of obvious inaccuracies (e.g., age input as 52 years). In addition, the data from 47 children were excluded because these children described their pain as emotional in nature (as opposed to physical, body location). The remaining 959 children ($N = 450$ males) aged 8–18 years (mean = 11.6, $SD = 2.6$) comprised the sample for the present study.

Descriptive Statistics

The majority of children self-identified as Caucasian (60% as Caucasian, 14% as Asian, 26% as other). Information from the Pain Experience Questions, including frequency, presence or absence of pain duration longer than three months, and type of pain experience across age groups, is presented in Table II. Twenty-five percent of children reported experiencing pain at least once or twice a week. Twenty-three percent of children reported having experienced pain that lasted for three months or longer.

Table II shows standard deviations and ranges of total scores on all measures in the overall sample and across age groups. Total score on the CPASS ($r = -.022$, $p = .502$), CASI ($r = .030$, $p = .346$), MASC-10 ($r = -.019$, $p = .563$), and PCS-C ($r = -.036$, $p = .261$) did not significantly correlate with age. Mean CPASS total scores were significantly higher in females (mean = 29.6, $SD = 16.3$) than males (mean = 24.4, $SD = 15.6$) [$t_w(951.4) = 5.07$, $p < .001$].

Factor Structure of the CPASS

The two randomly divided subsamples used to perform EFA ($N = 479$) and CFA ($N = 480$) did not differ significantly on age [$t(957) = -0.128$, $p = .898$], gender

Table II. Means, SD and score ranges of the CPASS, CASI, MASC-10, and PCS-C in the overall sample and across age-groups

	Age group (years)				
	8–9	10–12	13–15	16–18	Total
<i>N</i>	244	405	211	99	959
Gender					
Female	123	213	109	64	509
Male	121	192	102	35	450
Pain frequency					
No pain	57	71	37	14	179
>1 month	67	117	64	28	276
1–2 months	61	114	61	29	265
1–2 weeks	42	85	39	19	185
Everyday	17	18	10	9	54
Pain >3 months					
Yes	40	107	51	23	221
No	204	298	160	76	738
Type/location of pain					
Lower limb	4	25	16	1	46
Head, face, mouth	5	13	5	2	25
Upper shoulder/upper limb	3	11	6	2	22
Thoracic or abdominal	3	8	2	5	18
Cervical or lower back/spine	3	5	2	3	13
Unspecified	22	45	20	10	97
CPASS					
Mean	27.5	27.1	26.1	28.5	27.1
SD	16.9	16.7	14.1	16.7	16.2
Median	25	25	24	28	26
Min-Max	0–95	0–82	0–81	0–99	0–99
α (20-item CPASS)	.893	.912	.891	.923	.904
CASI					
Mean	27.7	28.3	27.9	29.4	28.2
SD	6.3	6.1	5.6	6.7	6.1
Median	28	27	28	29	28
Min-Max	18–51	18–47	18–46	19–53	18–53
MASC-10					
Mean	10.8	10.7	10.5	11.5	10.8
SD	6.3	5.6	5.2	5.4	5.7
Median	11	11	10	11	11
Min-Max	0–29	0–26	0–26	0–29	0–29
PCS-C					
Mean	18.1	18.3	17.2	17.9	17.9
SD	11.1	10.6	9.2	9.2	10.3
Median	16	16	15	17	16
Min-Max	0–52	0–51	0–47	2–51	0–52

Note: CPASS – Child Pain Anxiety Symptoms Scale; CASI – Childhood Anxiety Sensitivity Index; MASC-10 – Multidimensional Anxiety Scale for Children-10; PCS-C – Pain Catastrophizing Scale for Children.

[$\chi^2(1) = .767$, $p = .381$], or total scores on the CPASS [$t(957) = -0.077$, $p = .938$], PCS-C [$t(957) = -0.859$, $p = .391$], CASI [$t(957) = 0.397$, $p = .692$], or MASC-10 [$t(957) = 0.016$, $p = .987$].

Table III. Iterations of the Procedure Used to Find Number of Factors in EFA

Iteration	Number of items in scale	Item number to be removed	Number of factor solutions on which item loaded poorly	Number of adequate solutions	Adequate factor solution
1	20	7 (When I feel pain, my heart beats faster)	5	0	No
2	19	12 (When I feel pain I feel dizzy or faint)	4	0	No
3	18	16 (When my pain hurts to much, I think I might not be able to move again)	4	0	No
4	17	n/a	n/a	1 (3-factor)	Yes

Note: Results of procedure used to arrive at an adequate factor solution (primary loadings > 0.40 and secondary loadings < 0.30) using exploratory factor analysis testing six solutions (one factor through six factors). Item number to be removed: In each of the six solutions tested, the item to be removed is the item that consistently did not have a sufficiently large primary factor loading (>0.4) on any factor in all six solutions. Number of factor solutions on which item loaded poorly: Among the six solutions tested, the number of solutions on which the item to be removed loaded poorly. Number of adequate solutions: among the six solutions tested, the number of solutions for which all items had adequate primary and secondary loadings.

Exploratory Factor Analysis

Results of the EFA are presented in Table III. Using the procedure outlined in the data analysis section, EFA yielded an adequate three-factor solution on the fourth iteration. The three-factor solution used 17 of the 20 items of the CPASS; all 17 items had adequate primary (>0.40) and secondary (<0.30) factor loadings and only the first three factors had an eigenvalue greater than 1. Items 7, 12, and 16 were removed during this process because of poor factor loading. Next, both Velicer's MAP test and PA were run on the 17 items retained in the EFA; the results suggested that a one-factor solution best fit the data. The scree plot from the EFA showed a steep slope between factors 1 and 2, a modest slope between factors 2 and 5, and a fairly flat slope thereafter. Factor loadings for the one-factor (accounting for 37.04% of the variance) and three-factor (accounting for 45.76% of the variance) solutions on the 17 items are presented in Table I.

Confirmatory Factor Analysis

Two stages of analysis were performed using CFA. In stage one, CFA was used to verify the first-order factor structure of the CPASS. For that purpose, the two solutions derived from EFA [i.e., 17-item one-factor (as suggested by MAP test and PA) and three-factor solutions] were tested. Because of the early stage of scale development, we also used CFA to verify the original four-factor model validated in adult populations using all 20 items (McCracken & Dhingra, 2002).

The 17-item one-factor solution and the 17-item three-factor solution provided poor fits to the data, and although, in comparison, the 20-item original four-factor solution showed a better fit, it was also poor. The inadequacy of these models led us to test a modified version of the 20-item original four-factor model by moving item 19 ("I worry when I feel pain") from the cognitive factor to the fear factor. This modification was made in order to

account for the possibility that children experience "worry" more as an emotional process than a cognitive one. This modified four-factor model yielded a good fit to the data based on TLI, CFI, and RMSEA.

In the second stage, we tested for the presence of a higher-order factor (namely, the construct of pain anxiety) that would correlate highly with each of the subscales. The decision to add a higher-order factor was based on (1) the expectation that the cognitive, emotional, physiological, and behavioral reactions to pain assessed in the CPASS belong to a single, unifying construct (pain anxiety) and (2) the high interfactor correlations in the 17-item three-factor ($r = .743-.935$; $p < .001$), the original 20-item four-factor ($r = .821-.965$; $p < .001$) and the modified 20-item four-factor ($r = .809-.953$; $p < .001$) solutions. The higher-order 17-item three-factor solution provided a poor fit to the data. The higher-order 20-item original four-factor solution provided a reasonable fit to the data. The higher-order 20-item modified four-factor solution provided a good fit to the data. These two higher-order factor solutions are modeled in Figure 1 and fit indices are presented in Table IV. All standardized loadings, from first-order factors to items and from the higher-order factor to first-order factors were statistically significant.

Reliability of the CPASS

Unstandardized Cronbach's alpha coefficients were used to estimate reliability of the CPASS. The CPASS showed excellent overall internal consistency (20-item: $\alpha = .903$), as well as good internal consistency for all age groups (see Table II). Deletion of any one item did not improve the overall reliability of the scale ($\alpha = .894-.903$). Corrected item-total correlation coefficients ranged from .390 to .683. Item-deleted Cronbach's alpha and corrected item-total correlations are presented in Table I.

Table IV. Summary of Model Fit Indices for Confirmatory Factor Analysis of CPASS

Model	χ^2	df	CFI	TLI	RMSEA
17-item					
One-factor	355.26	62	0.874	0.965	0.099
EFA-derived three-factor ^a	311.12	62	0.893	0.971	0.091
EFA-derived three-factor and one higher-order factor ^{a,b}	311.12	62	0.893	0.971	0.091
20-item					
One-factor	375.08	81	0.878	0.970	0.087
Original four-factor	331.32	80	0.896	0.974	0.081
Original four-factor and one higher-order factor	324.91	80	0.899	0.975	0.080
Modified four-factor ^c	296.29	81	0.911	0.978	0.074
Modified four-factor and one higher-order factor ^c	287.35	80	0.914	0.979	0.073

Note: χ^2 – Chi-Square Test of Model Fit; CFI – Comparative Fit Index; TLI – Tucker-Lewis Index; RMSEA – Root Mean Square Error of Approximation.

^aA 3-factor model and a 3-factor model with 1 higher-order factor are equivalent models; therefore their fit indexes are identical.

^bThe matrix of residual correlations among the latent factors (PSI) is not positive definite due to one of the first-order factors having a standardized loading on the second-order factor higher than 1.

^cThe modification to the original PASS-20 model was to switch item 19 (“I worry when I feel pain”) to the fear factor.

Table V. Correlations between pain anxiety, pain anxiety subscales, pain catastrophizing, anxiety sensitivity, and general anxiety

	PCS-C	CASI	MASC-10
20-item CPASS total	$r = .633$	$r = .605$	$r = .449$
Subscales: 20-item original CPASS			
Cognitive subscale	$r = .625$	$r = .544$	$r = .419$
Physiological Anxiety subscale	$r = .510$	$r = .514$	$r = .399$
Fear subscale	$r = .582$	$r = .553$	$r = .385$
Escape/avoidance subscale	$r = .422$	$r = .438$	$r = .315$
Subscales: 20-item modified CPASS			
Cognitive subscale	$r = .594$	$r = .505$	$r = .390$
Physiological Anxiety subscale	$r = .510$	$r = .514$	$r = .399$
Fear subscale	$r = .608$	$r = .577$	$r = .411$
Escape/avoidance subscale	$r = .422$	$r = .438$	$r = .315$

Note: All correlations are significant at $p < .01$.

Reliability of the subscales of the CPASS was also examined for both the original and modified four-factor solutions. Subscales of the original 20-item four factor ($\alpha = .671-.818$) and modified four-factor ($\alpha = .671-.795$) solutions showed moderate reliability.

Construct, Discriminant, and Concurrent Validity of the CPASS

The total score on the 20-item CPASS correlated moderately with pain catastrophizing (total score on the PCS-C; $r = .627, p < .001$) and anxiety sensitivity (total score on the CASI; $r = .599, p < .001$), suggesting good preliminary construct validity. The coefficient of determination (r^2) between pain anxiety (CPASS) and pain catastrophizing (PCS-C) and between pain anxiety (CPASS) and anxiety sensitivity (CASI) indicates the CPASS measures a

construct that shares approximately 39% of variance with pain catastrophizing and 36% with anxiety sensitivity, both indicative of a large effect size (Cohen, 1988). The CPASS correlated to a lesser extent with general anxiety (MASC-10; $r = .444, p < .001$), and the coefficient of determination (r^2) indicates the CPASS measures a construct that shares approximately 20% of variance with general anxiety (moderate effect size; Cohen, 1988). Correlation coefficients between the subscales of the CPASS and questionnaires measuring pain catastrophizing, anxiety sensitivity, and general anxiety are presented in Table V. For the 20-item original four-factor solution, the four subscales correlated moderately to highly with pain catastrophizing ($r = .422-.625$) and anxiety sensitivity ($r = .438-.553$) and moderately with general anxiety ($r = .315-.419$). For the 20-item modified four-factor solution, the four subscales correlated moderately to highly with pain catastrophizing ($r = .422-.608$), and anxiety sensitivity ($r = .438-.577$), and moderately with general anxiety ($r = .315-.411$). These results suggest that the CPASS subscales also have good construct validity.

A significant difference was found in the magnitude of the correlation coefficients (Cohen & Cohen, 1983) between pain anxiety and anxiety sensitivity ($r_{\text{CPASS-CASI}} = .61$) and pain anxiety and general anxiety [$r_{\text{CPASS-MASC-10}} = .45; t(956) = 6.06, p < .001$]. There was also a significant difference in the magnitude of the correlation coefficients between pain anxiety and pain catastrophizing ($r_{\text{CPASS-PCS-C}} = .63$) and pain anxiety and general anxiety [$r_{\text{CPASS-MASC-10}} = .45; t(956) = 6.61, p < .001$] (Cohen & Cohen, 1983). Similar results were found for the subscales of the CPASS using the same statistical method. For both the 20-item original and modified four-factor

solutions, all four subscales correlated more strongly with pain catastrophizing ($p < .01$) and anxiety sensitivity ($p < .01$) than with general anxiety. These results suggest that pain anxiety and its subscales share significantly more variance with anxiety sensitivity and pain catastrophizing (construct validity) than with general anxiety (discriminant validity).

Multiple ordinal regression analysis was used to examine the unique contribution of pain anxiety (20-item CPASS), anxiety sensitivity (CASI), general anxiety (MASC-10) and pain catastrophizing (PCS-C) to pain frequency (how often children reported feeling pain). Results showed that CPASS (OR = 1.01, $p = .028$) and MASC-10 (OR = 1.05, $p < .001$), but not PCS-C (OR = 0.99, $p = .375$), or CASI (OR = 1.02, $p = .052$), significantly predicted how often children reported feeling pain (never, less than once a month, once or twice a month, once or twice a week, or everyday; $\chi^2 = 65.52$, $df = 4$, $p < .001$). These results suggest that an increase in pain anxiety or general anxiety is associated with an increase in the odds of reporting higher pain frequency. Thus, pain anxiety predicts the frequency with which children experience pain, suggesting that the CPASS has good concurrent validity.

Discussion

The goals of the present study were to examine the factor structure, reliability, and validity of the newly adapted CPASS in a community sample of children aged 8–18 years. Results of the EFA suggested that both a one- and a three-factor solution using 17 of the 20 CPASS items provided the best fit. Subsequently, CFA was used to model the following solutions: (1) 17-item one-factor solution (derived from MAP test and PA in EFA); (2) 17-item three-factor solution (derived from EFA); (3) 20-item four-factor intercorrelated solution (derived from the adult literature); and (4) a modified 20-item four-factor solution in which item 19 was moved from the cognitive factor to the fear factor. Results suggested that of all the models evaluated, the higher-order modified four-factor solution provided a reasonably good fit to the data (Table IV). Nevertheless, both 20-item four-factor solutions are supported by first and second standardized loadings (Figure 1) and their fit indices were comparable to results of factor analytic studies on the adult PASS-20 (Roelofs et al., 2004).

Taken together, the results of the factor analyses suggest the original four-factor solution is adequate, but the modified four-factor solution provided the best fit to

the data. These findings suggest that pediatric pain anxiety, as measured by the CPASS, comprises four different factors that load on an overarching full scale factor. The original four-factor solution is consistent with factor analytic studies of the PASS-20 in both clinical (Coons et al., 2004) and community adult samples (Abrams, Carleton, & Asmundson, 2007). It is recommended that future factor analytic studies of the CPASS evaluate both the original and modified 20-item four-factor solutions and use CFA on both of these solutions. Furthermore, the modified 20-item four-factor solution suggests that children might conceptualize “worry” as part of a fear response and as such future studies might explore cognitive and emotional processing of worry in children.

The high level of internal consistency based on the total sample as well as across age groups indicates that the CPASS and its subscales (both the original and modified solutions) are reliable and can be used with both children and adolescents. Results also indicate that all CPASS items strongly relate to the construct of pain anxiety, as demonstrated by item-deleted Cronbach’s alphas and corrected item-total correlation coefficients. These results are similar to those of the adult PASS-20 ($\alpha = .75-.87$; corrected item-total correlation coefficient = .41–.72) (McCracken & Dhirga, 2002).

The CPASS and its subscales correlated significantly with pain catastrophizing and anxiety sensitivity at magnitudes comparable to what are found in the adult literature (McCracken et al., 1992; Williams & Asmundson, 1998). This suggests that despite some overlap in variance (~35–40%), these three constructs are distinct. Preliminary support for the discriminant validity of the CPASS and its subscales was evidenced by a lesser correlation between pain anxiety and general anxiety. The magnitude of these correlations is also comparable to those found in the adult literature (McCracken et al., 1992; Williams & Asmundson, 1998). Concurrent validity of the CPASS was evidenced by the significant association between the CPASS and reported frequency of pain.

There are several limitations to the present study. First, there is a possibility that in adapting an adult questionnaire to children, there may be existing dimensions that are not relevant to children or are not tapped by the adapted version. The decision to adapt the adult PASS to children was made in order to facilitate the (1) comparison between children and adults of the prevalence and role of pain anxiety in the pain experience and (2) examination of the relationship between parental and child pain anxiety. The results of the present study suggest that the CPASS

describes a construct that is relevant to children and adolescents. Second, the present results provide normative values of the CPASS only for community samples. Although psychometric studies of the CPASS are needed in clinical samples, the decision was made to validate the CPASS using a community sample in order to provide normative values that can be tracked over time and/or compared with clinical samples (after appropriate validation). In addition, the CPASS has the potential to serve as a screening tool for identifying typical individuals at high risk of developing intense reactions to pain in response to surgery, injury, accidents, or illness. Normative values on a community sample were needed for this purpose. Third, this study is cross-sectional in nature and thus no conclusions can be drawn on the temporal stability of the CPASS across age groups. Fourth, we did not assess pain intensity among children who reported experiencing pain for longer than three months. This information would have been helpful to qualify the persistent pain experiences of children. Fifth, pain experience questions were asked retrospectively raising the possibility of a recall bias. Notwithstanding these limitations, and with further evaluation of the psychometric properties of the CPASS, the availability of a pediatric measure of pain anxiety makes it possible to assess the usefulness and importance of this construct in children.

In summary, the CPASS appears to be a psychometrically sound measure of childhood pain anxiety, showing good preliminary reliability and validity. Further evaluation of its psychometric properties is warranted especially in children with acute and chronic pain.

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