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Observational study

The Survey of Pain Attitudes: A revised version of its pediatric form

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HIGHLIGHTS

- Pain beliefs have been hypothesized to play a key role in understanding pediatric pain.
- The Peds-SOPA could help us understand the role that pain beliefs play in the adjustment to pediatric pain.
- Additional work could make the Peds-SOPA scales more reliable and valid.
- Results provide critical psychometric information about a revised version of the Peds-SOPA.
- Evidence presented will be helpful to pediatric pain researchers.

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ABSTRACT

Background and aims: Valid and reliable measures of patients' pain beliefs are needed by clinicians and researchers to better understand the efficacy and mechanisms of pain treatments. The objective of this work was to address this need by further developing the pediatric version of the Survey of Pain Attitudes (Peds-SOPA), one of the most commonly used measures of pain beliefs.

Methods: A convenience sample of three hundred and seven adolescents (mean age = 14.35; SD = 1.62; 59% girls) participated in the study. They rated the intensity of their worst pain experienced in the 3 months prior to the assessment and completed both the Functional Disability Inventory and a revised version of a pediatric version of the Survey of Pain Attitudes (Peds-SOPA-R).

Results: Factor analyses confirmed a seven-factor solution of the questionnaire, and the revised version demonstrated improvements in the internal consistency of several of the scales (values ranged between adequate and good: 0.71–0.87), except for the Medical Cure scale which showed an internal consistency value of 0.65. The results support the validity of the Peds-SOPA-R scale scores by showing, as predicted, positive relationships between beliefs thought to be maladaptive (e.g., the belief that one is unable to function because of pain) and pain intensity and disability, and negative relationships with beliefs thought to be adaptive (e.g., the belief that exercise is beneficial for pain management) and these criterion variables.

Conclusions: These findings will be helpful to researchers who wish to study the role that pain beliefs play in adjustment to pain in youth.

Implications: The results provide critical psychometric information about a revised version of one of the most used questionnaires to assess pain beliefs. The evidence presented will be helpful to researchers who want to study the role that pain beliefs play in adjustment to chronic pain in young people.

1. Introduction

Pain beliefs, defined as the attributions individuals make about pain and its impact [1], have been shown to influence adjustment to pain, as well as to treatment adherence and treatment outcome in adults [2]. Pain beliefs have also been hypothesized to play a key role in understanding pediatric pain (e.g., [3,4]). However, while there has been a fair amount of research demonstrating the

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importance of catastrophizing in adjustment to pain among young people (e.g., [5,6]), there is as yet relatively little research studying the role that other pain-related beliefs, such as those that have been demonstrated to be important in adults (e.g., [7–9]), may play in pediatric populations.

Recently, Engel and colleagues [10] introduced the pediatric version of the Survey of Pain Attitudes (Peds-SOPA), a measure of pain beliefs based on one of the most commonly used measures of such beliefs that had been developed for use in adults with chronic pain [7]. The Peds-SOPA assesses seven different pain-related belief domains, and has been shown to be reliable and valid for assessing young people's pain beliefs [10,11]. For example, Engel et al. [10] reported a negative association between pain intensity and the belief that one can control pain, and the Peds-SOPA measure of this pain belief was subsequently shown to prospectively predict pain intensity one year later in a longitudinal study [11]. Thus, the Peds-SOPA could be instrumental for advancing our knowledge regarding the role that pain beliefs play in adjustment to pediatric pain, as it assesses a number of pain beliefs and attitudes that have been demonstrated to have important relationships with key pain outcomes (e.g., pain intensity, disability) and adherence to treatment in adults (e.g., [12–15]).

Nevertheless, a number of findings suggest that additional work could make the Peds-SOPA scales even more reliable and valid. First, there are differences in the number of items per scale in the Peds-SOPA, ranging from two (for the Medication scale) to six (for the Control scale). Because a larger number of items that assesses the same domain tends to result in measures with more reliability, it is likely that the reliability of the Peds-SOPA scales with fewer items could be improved by adding more items, which could then improve their overall validity. Related to this issue, the internal consistency of some scales is less than ideal, with several falling below the standard cutoff deemed necessary for adequate internal consistency (0.70) in some samples [17]. Finally, the Peds-SOPA contains some items that are very similar [11]. While asking the same question in slightly different ways can result in greater measurement precision and reliability, it can also result in increased subject burden with relatively little additional information gained. For this reason, highly redundant items could be replaced by less redundant items in order to increase content validity (i.e., allow for the assessment of a wider perspective of the domain of interest). Finally, although the same factor structure of the measure has emerged in both American and Catalan samples [10,11], these studies treated the SOPA items as continuous. However, since the Peds-SOPA items are rated using three-point Likert-type scales, the item responses may not have ratio qualities, and would therefore best be treated as ranked or even categorical data for analyses [16].

The overall aim of this study was to further develop the Peds-SOPA in order to address some of the issues described above. Specifically, our goals were to (1) increase the internal consistency of several of the scales; (2) create scales with a more balanced number of items per scale by developing new items; and (3) replace some of the redundant items in order to reduce subject burden and increase content validity. We planned to evaluate the factorial structure, reliability and criteria validity of the resulting measure. We hypothesized that the original seven-factor solution would be confirmed in the revised version, and that more of the scales would evidence at least adequate internal consistency coefficients (i.e., alpha coefficients = 0.70 or greater). If valid, we hypothesized that the beliefs thought to be adaptive which have demonstrated significant associations with measures of pain intensity and disability in previous adult and pediatric samples (i.e., the scales measuring Pain Control and Exercise beliefs; [7,13,19,20]) would evidence negative associations with measures of pain intensity and pain-related disability. Similarly, we hypothesized that pain beliefs thought to be maladaptive and that have demonstrated significant associations with measures of pain and disability in previous research (i.e., the scales measuring Disability, Harm, Medical Cure, and Solicitude beliefs; [7,10–12,18,20,21]) would evidence significant positive associations with measures of pain and disability. Correlation coefficients although significant, are expected to be low, given (1) the nature of the population in this study (a sample of young people otherwise healthy) and (2) previous research in other samples showing that measures of pain beliefs tend to have low to moderate associations with other pain-related variables.

2. Materials and methods

2.1. Participants

The sample consisted of 307 adolescents (aged 12–20 years; mean age = 14.35, SD = 1.62; 59% girls). This convenience sample was recruited from 8 secondary schools in the province of Tarragona, a city in the southeast of Catalonia. Study inclusion criteria included (1) being able to read, write, and speak in Catalan and (2) being between 12 and 20 years old. Participants were excluded if they had an intellectual disability that interfered with participation in the study procedures. A total of 495 adolescents were enrolled into the study, of which 307 (62%) provided complete data, and made up the sample in the current study.

2.2. Procedure

Eighteen secondary schools were invited to participate and 8 of them accepted. A total of 668 letters were delivered to the children and parents of those schools and 495 agreed to participate. Either one of the parents could provide consent to allow his/her child to participate and adolescents older than 17 years old provided their own informed consent. Participants answered the questions during one hour within school time following the instructions provided by research staff. Three hundred and seven of these (62%) provided complete data for the revised form of the Peds-SOPA (Peds-SOPA-R), and were therefore included as participants in the current study.

2.3. The development of the Peds-SOPA-R

Like the original SOPA, the Peds-SOPA assesses seven pain-related belief domains: *Control* (which measures the extent to which the child believes she/he can control the pain), *Medical Cure* (the extent to which the child believes in a medical cure for the pain problem), *Solicitude* (the extent to which the child believes that others should be solicitous in response to their experience of pain), *Medication* (the extent to which the child believes that medication is an appropriate treatment for pain), *Emotion* (the extent to which the child believes that their emotions impact their pain), *Exercise* (the extent to which the child believes that exercise is beneficial for pain management), and *Disability* (the extent to which the child believes that one is unable to function because of pain). However, there are some important differences between the Peds-SOPA and the original SOPA. First, the Peds-SOPA has about half the number of items as the adult version: 29 vs. 57. Second, the "Harm scale" in the adult version was renamed as the "Exercise scale" in the Peds-SOPA [10], to reflect the changes in the content of the items after the adaptation for their use with young people.

Following the analysis of the items included in the Peds-SOPA two groups of very similar items were identified (one with three and two with two items), belonging to the Medical Cure, Control and Solicitude scales, respectively. With the aim of replacing some and adding new items, we developed a pool of 49 new items, resembling those included in the original version of the questionnaire developed by Engel et al. [10]. Twenty-four items of the original

Peds-SOPA were preserved, 4 discarded because they had the same meaning than other items in the original Peds-SOPA, and 1 because previous work by Miró et al. [11] found a very low item-scale correlation. Thus we started with a set of 73 items (24 from the original questionnaire and 49 newly created). In order to select items for the final scales, we followed the two criteria that had been used by Engel et al. [10] and Jensen et al. [9]: (1) the item had to be correlated at .30 or greater with its parent scale (minus that item); and (2) there had to be a minimum difference of .10 between the item-parent scale correlation and the correlation between the item and each of the other scales. Given that just two items remained in the Medical Cure scale after applying these criterion in the Peds-SOPA development study [10], three additional items for that scale that met the first criterion were selected as long as the item-parent scale correlation was stronger than the correlation between the item and each of the other scales. Using these criteria, a pool of 35 items (5 for each scale) was used for the analyses.

2.4. *Measures*

2.4.1. *Pain beliefs*

Pediatric pain beliefs were assessed using the Peds-SOPA-R, described in the previous section. Children were asked to respond to the questionnaire items by indicating how much they agree with the belief statements on a 3-point Likert scale (0 = I do not agree with this, 1 = I am not sure, 2 = I agree with this). To obtain a score for each Peds-SOPA scale, the ratings of the items within each scale were averaged, after reversing the score of a few items. Examples of items are as follows: "I have learned I can control my pain" (Control scale); "The right doctor will know how to make me hurt less" (Medical Cure scale); "When I hurt, I want my family to treat me better" (Solicitude scale); "Medicine helps my pain" (Medication scale); "Bad feelings can make my pain worse" (Emotion scale); "Physical exercise can help to improve my pain" (Exercise scale); "Being in pain means that you cannot do what other people do" (Disability scale).

2.4.2. *Pain intensity*

Participants were asked to rate the intensity of the pain they had experienced during the three months before the assessment. Specifically, they were asked to rate their recalled worst pain intensity in the past three months for the most frequent pain problem using a 0–10 Numerical Rating Scale (NRS-11), where 0 means "No pain" and 10, "Worst possible pain". The NRS-11 has been shown to provide a valid and reliable measure of pain intensity when used with adolescents and children as young as 6 years old [22–24].

2.4.3. *Disability*

The 15-item Functional Disability Inventory (FDI) [25] was used to assess disability associated with the impact of illness on children's physical and psychosocial everyday functioning over the last 2 weeks. The level of difficulty that respondents have completing each activity item was assessed using a 5-point Likert scale (0 = "No trouble" to 4 = "Impossible"). Higher scores indicate more disability (possible range, 0–60) [25,26]. The FDI has been shown to be a reliable and valid measure of disability in youths as young as 8 years old [25–27]. The measure has also been used to assess disability in pediatric samples presenting with a wide range of chronic pain-related conditions such as back pain, fatigue, fibromyalgia and arthritis [28–32]. The Catalan version of the FDI has also demonstrated good psychometric properties [33], and its internal consistency was shown to be very good (Cronbach's alpha = 0.89) in the current sample.

2.5. *Data analyses*

We first computed descriptive statistics to describe the sample. Second, we performed a confirmatory factor analysis (CFA) to evaluate the Peds-SOPA-R factor structure, and then computed the Cronbach's alpha coefficients to evaluate the internal consistency of the different scales. Before performing the CFA, we examined the Skewness and Kurtosis of each item's distribution, and tested whether the data were suitable to be factored using Kaiser–Meyer–Olkin test (KMO) [34] and Bartlett's statistic [35]. The Weighted Least Square estimator using a diagonal weight matrix and with mean and variance-adjusted Chi-square-statistic (WLSMV) [16] was used as the factor extraction method since the items of the Peds-SOPA-R were considered ranked variables given that that questionnaire has just 3 possible answers. We also computed Chi-square (χ^2), Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), and Standardized Root Mean Residual (SRMR) to help evaluate the goodness of fit of the solution. Finally, we evaluated the Peds-SOPA-R's concurrent criteria validity by computing Pearson's correlations between scores on the Peds-SOPA-R scale scores and the validity criterion (pain intensity, pain related disability). All analyses were performed using SPSS 17.0 (IBM, http://www-01.ibm.com/software/analytics/spss/) apart from Skewness, Kurtosis, KMO and Bartlett's statistics that were evaluated using Factor 8.1 (http://psico.fcep.urv.es/utilitats/factor/), and CFA using Mplus 5.1 (http://www.statmodel.com/).

3. Results

3.1. *Participant characteristics*

Three-hundred and seven young people aged 12–20 years participated in this study (40% boys and 60% girls). A total of 286 (93%) of them reported that they had experienced pain somewhere in their body in the last three months, and 74 (26%) of these reported that they had chronic pain. Pain was labeled as chronic if it had lasted for three months or more [36,37]. In addition, those indicating that they had intermittent pain (i.e., had at least some pain-free periods) had to report a minimum of one pain episode each month in the previous three months in order to be deemed to have chronic pain. These criteria for defining chronic pain have also been used in other studies (e.g., [38,39]. Table 1 provides descriptive information about the sample and the most frequent pain locations reported by the study participants.

3.2. *Factor structure*

Histograms and measures of Skewness and Kurtosis indicated that the distributions of the 35 Peds-SOPA-R items had acceptable levels of Skewness from −1.08 to 0.95, whereas the levels of Kurtosis (from −1.71 to −0.27) showed a platykurtic (flat) distribution for some of the item responses, a bit far from the normal distribution. The factor structure of the Peds-SOPA-R was evaluated using CFA, specifically, using the WLSMV method that can deal with non-normal and non-ratio data. A KMO of 0.84 and a significant Bartlett's test of sphericity ($\chi^2 = 4047.4$, df = 595, $p < 0.001$) indicated that data were suitable for factor analyses. Individual item-scale correlations are shown in Table 2. Factor analyses confirmed the seven-factor solution described in the original Peds-SOPA with an excellent goodness of fit (χ^2 (126) = 225.71, $p < 0.001$; CFI = 0.96; TLI = 0.97; RMSEA = 0.05). Factor loadings are presented in Table 2. Loadings can range from −1 to 1. Loadings close to −1 or 1 indicate that the factor strongly affects the variable (item), whereas those

Table 1
Characteristics of the sample ($n = 307$).

Sex (*N*, %)		
Boys	125 (40%)	
Girls	182 (59%)	
Age (mean, SD)	14.35 (1.62)	
Pain in the last 3 months (*N*, %)		
Yes	286[a] (93%)	
No	21 (7%)	
Pain beliefs (Peds-SOPA-R; mean; SD)		(Range: 0–3 each scale)
Control	1.10 (0.54)	
Medical cure	1.27 (0.47)	
Solicitude	1.34 (0.60)	
Medication	1.23 (0.61)	
Emotion	1.16 (0.69)	
Exercise	0.99 (0.58)	
Disability	0.73 (0.55)	
Maximum intensity of the most frequent pain[b] (*N* = 281) (NRS-11; mean, SD)	7.87 (1.75)	(Range: 0–10)
Localization of the most frequent pain[c] (*N* = 279) (*N*, %)		
Head (exclude face)	63 (22%)	
Face/jaw/temple	5 (2%)	
Throat/neck	14 (5%	
Shoulder	10 (4%	
Chest	5 (2%)	
Upper arm	0 (0%)	
Elbow	1 (0%)	
Forearm	0 (0%)	
Wrist	10 (4%	
Hand	3 (1%)	
Abdomen	49 (17%)	
Hip	4 (1%)	
Groin/pubic area	10 (4%)	
Thigh	14 (5%)	
Knee	26 (9%)	
Calf	9 (3%)	
Ankle	13 (5%)	
Foot	7 (3%)	
Upper back	11 (4%)	
Mid back	17 (6%)	
Low back	8 (3%)	
Disability[d] (*N* = 291) (mean, SD)	11.45 (10.07)	

[a] Information missing in 54 cases of 286 that experienced pain in the last 3 months (there were 54 cases because this question was introduced after some students had completed some assessment forms, so 50 of 286 cases were not asked about that question, the other 4 cases did not answered to that question). Chronic pain is defined as pain lasting for more than 3 months.

[b] Information missing in 5 cases of 286 that experienced pain in the last 3 months.

[c] Information missing in 7 cases of 286 that experienced pain in the last 3 months.

[d] Information missing in 16 cases of 307 participants.

close to zero indicate that the factor has a weak influence on the variable.

3.3. *Reliability: internal consistency*

All the scales, except Medical Cure (Cronbach's alpha = 0.65), evidenced adequate to good internal consistency reliability indices, Control: 0.73; Solicitude: 0.83; Medication: 0.83; Emotion: 0.87; Exercise: 0.83 and Disability: 0.71.

3.4. *Criterion validity*

Table 3 presents the correlation coefficients between the Peds-SOPA-R scales and the measures of pain intensity and disability. As can be seen, the pattern of associations is as hypothesized (i.e., pain beliefs thought to be adaptive are negatively associated with pain intensity and disability, and pain beliefs thought to be maladaptive are positively associated with pain beliefs and disability), and all significant associations are in the hypothesized directions.

4. Discussion

The primary aim of this study was to develop and test a revised version of the pediatric version of the Survey of Pediatric Pain Attitudes that would yield improvements in the psychometric properties of the scales. The findings confirmed the original factor structure of the seven scales of the Peds-SOPA. The changes in the content of the scales, that is to say, the deletion of some similar items and the addition of new ones, resulted in an increase of the internal consistency properties for all of the scales except for the Medical Cure scale, although this scale had an alpha coefficient of 0.65, which can be considered adequate in research with large sample sizes. Moreover, the changes resulted in an improvement of the factor fit and the factor loadings.

In support of the criteria validity of the Peds-SOPA-R, the pain beliefs measured by the revised questionnaire demonstrated the predicted pattern of associations with pain intensity and disability. As it has been shown in previous studies with clinical (e.g., 4, 10) and schoolchildren samples (e.g., [11,40,41]) that what has been conceptualized as negative pain beliefs and attitudes (e.g., the belief that one is unable to function because of pain) was positively related with pain intensity and disability, and negatively with positive pain beliefs (e.g., the belief that exercise is beneficial for pain management).

The study has a number of limitations that should be considered when interpreting the results. First, the study sample represented a sample of convenience. Thus, we do not know how representative they are of children in general. Additional studies using other samples are needed to evaluate the reliability and generalizability of our findings. Relatedly, the sample came from a population of children who were attending school, and so were for the most part generally healthy. It is therefore not clear how well the Peds-SOPA-R items would perform in samples of children with clinical pain problems, such as chronic headache or abdominal pain. In addition, all of the data were obtained via self-report. It would be useful to determine the associations between the Peds-SOPA-R scales and objective measures of functioning, such as those that might be obtained from parent, teacher, or clinician reports. Also, all of the measures were obtained at a single assessment and thus no evaluation of the scales' test–retest stability was possible. Future studies should examine the stability of the Peds-SOPA-R, when possible. It would also be useful to examine the sensitivity of the Peds-SOPA-R scales to change over time and/or with treatment in longitudinal and experimental studies. In this scale development study, we eliminated items that appeared very similar to one another to both reduce assessment burden (by not asking respondents the same question multiple times) and to allow for a greater breadth of assessment of the different aspects of each belief domain. In hindsight, however, the elimination of items that appeared similar might have reduced our ability to assess in greater depth some of the key aspects of the domains, and also resulted in less internal consistency than could have otherwise been achieved. Therefore, future development of the Peds-SOPA might involve a re-introduction of some of the items that were eliminated in this version due to similarity, in order to increase the Medical Cure scale precision and reliability further. Finally, this study did not follow all the suggestions of the COSMIN[1] initiative [42,43] which recommends complete

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[1] The objective of the COSMIN initiative was *to develop a checklist of standards for evaluating the methodological quality of studies on measurement properties*. The work of the COSMIN group of experts resulted in a checklist of measurement properties that should be included in studies reporting on the development of measures.

Table 2
Factor loadings of the seven-factor structure of the Peds-SOPA-R.

	Control	Medical Cure	Solicitude	Medication	Emotion	Exercise	Disability
13	0.74						
18	0.68						
27	0.75						
32	0.73						
34	0.50						
1		0.39					
8		0.54					
25		0.65					
28		0.63					
31		0.83					
7			0.45				
19			0.91				
21			0.86				
24			0.85				
35			0.90				
5				0.69			
12				0.86			
14				0.77			
17				0.84			
20				0.90			
6					0.70		
15					0.91		
23					0.89		
26					0.87		
30					0.88		
3						0.67	
16						0.87	
22						0.91	
29						0.74	
33						0.67	
2							0.69
4							0.62
9							0.61
10							0.68
11							0.73

Note: Standard errors of factor loadings are from 0.08 to 0.02.

Table 3
Pearson's correlations between Peds-SOPA-R subscales and criteria variables.

	C	MC	S	M	E	EX	D
NRS-11	−0.13*	0.03	0.02	0.04	−0.04	−0.12*	0.23**
FDI	−0.23**	0.01	0.13*	0.10	0.08	−0.23**	0.31**

Pain attitudes, Peds-SOPA-R scales. C, control; MC, medical cure; S, solicitude; M, medication; E, emotion; EX, exercise; D, disability. Correlation values range: −1 and 1.

* $p < 0.05$.

** $p < 0.01$.

information about the following psychometric properties of a measure in scale development research: internal consistency, reliability, measurement error, content validity (including face validity), construct validity, structural validity, hypotheses testing, cross cultural validity, responsiveness, interpretability. While we were able to address a number of these characteristics in the current study, we were not able to address all of them. Future research should not only seek to evaluate the generalizability of our findings in additional samples of young people with pain, but should also evaluate those psychometric characteristics of the Peds-SOPA-R scales that we were not able to evaluate here.

5. Conclusions

Despite the study's limitations, the results provide critical psychometric information about a revised version of one of the most used questionnaires to assess pain beliefs and attitudes. The evidence presented here will be helpful to researchers who wish to study the role that pain beliefs play in adjustment to chronic pain in young people. Such a measure could also help clinicians and researchers to identify and monitor changes in beliefs important for modification of treatment, acceptance of interventions and influencing a young person's capacity to adapt to pain. The Peds-SOPA-R could be also useful for identifying the pain treatments that are most effective, based on their impact on the pain beliefs of the young person with pain; for example, to determine if cognitive restructuring is more effective for young people with high levels of maladaptive beliefs (or low levels of adaptive beliefs) than young people who evidence the opposite pattern before treatment. Such research using the Peds-SOPA-R could ultimately help clinicians select the best treatment for each patient.

6. Implications

Pain beliefs have been hypothesized to play a key role in understanding pediatric pain. The Peds-SOPA-R could be instrumental for advancing our knowledge regarding the role that pain beliefs play in the adjustment to pediatric pain. The evidence presented will be helpful to researchers who wish to study the role that pain beliefs play in adjustment to chronic pain in young people.

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Conflicts of interest statement

The authors declare no conflicts of interest associated with this paper.

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