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Parent perceptions of adolescent pain expression: The adolescent pain behavior questionnaire

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Abstract

Pain behaviors provide meaningful information about adolescents in chronic pain, enhancing their verbal report of pain intensity with information about the global pain experience. Caregivers likely consider these expressions when making judgments about their adolescents' medical or emotional needs. Current validated measures of pain behavior target acute or procedural pain and young or non-verbal children, while observation systems may be too cumbersome for clinical practice. The objective of this research was to design and evaluate the Adolescent Pain Behavior Questionnaire (APBQ), a parent-report measure of adolescent (11–19 years) pain expressions. This paper provides preliminary results on reliability and validity of the APBQ. Parent-adolescent dyads ($N=138$) seen in a multidisciplinary pain management clinic completed the APBQ and questionnaires assessing pain characteristics, quality of life, functional disability, depressive symptoms, and pain catastrophizing. Principal components analysis of the APBQ supported a single component structure. The final APBQ scale contained 23 items with high internal consistency ($\alpha=0.93$). No relationship was found between parent-reported pain behaviors and adolescent-reported pain intensity. However, significant correlations were found between parent-reported pain behaviors and parent- and adolescent-reported functional disability, pain catastrophizing, depressive symptoms, and poorer quality of life. The assessment of pain behaviors provides qualitatively different information than solely recording pain intensity and disability. It has clinical utility for use in behavioral treatments seeking to reduce disability, poor coping, and distress.

Keywords

Pain behaviors; Adolescents; Chronic pain; Assessment

1. Introduction

Assessment of chronic pain is often limited to adolescent and parent ratings of pain intensity and impairment. However, parents may use pain expressions to assess their child's wellbeing and to inform their decisions regarding interventions or accommodations.

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Conflict of interest

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Adolescence is a developmental period where communication about chronic health problems can become problematic [1]; therefore, parents may rely on behavioral cues to evaluate health status and coping. To date, few well-constructed measures are designed to capture the range of pain behaviors in adolescents. The purpose of this study is to evaluate a new instrument developed to measure parent perceptions of their adolescents' pain behaviors.

Pain behaviors are observable ways of signaling pain [13,66] and include verbal and non-verbal behaviors [53]. Such behaviors can be under conscious and unconscious control [75], although initially Fordyce described them as learned, voluntary, and modifiable [13,66]. Disagreement exists about whether or not the construct is uni- or multi-dimensional, given the variety (e.g., gestures, vocalizations) and functionality of behaviors exhibited (e.g., pain-related limitations) [75], but recent work tends to support a single construct [53,75,].

The impact of pain expression can be important for patient and caregiver alike. Adults displaying increased pain behaviors report more depressive symptoms [20,28,30], greater disability [20,28, 37,48], higher pain intensity [20,28,37], and lower pain self-efficacy [37]. As for caregivers, findings in the pediatric literature suggest potential clinical relevance. Preschool children in daycare who showed the greatest facial expressions of distress after minor injuries received the most staff intervention, regardless of incident severity [72]. Similarly, pediatric nurses administered more medications to children who vocalized their pain compared to less expressive children [18]. Thus, while pain intensity is a subjective sensory experience, the response to pain is interactive [47] with parents serving as gatekeepers for medical interventions and activities of daily living. Presumably, their judgments and responses are likely informed by their adolescents' pain expressions.

The measurement of pain expression is complicated by consideration of a small range of behaviors [65,70] and the complexity of quantifying which behaviors to study [27]. Observational systems systematically assess pain behaviors [26] but require rigorous training and reliability of observers [26] which is impractical in clinical settings [53]. Recent recommendations [40] highlight several evidence-based measures for pediatric expressions of pain intensity, which typically target younger populations with acute or procedural pain [38,42,43]. They may not capture the spectrum of behaviors relevant to chronic pain, where the global pain experience encompasses sensory and affective qualities as well as complex psychosocial factors [47]. Thus, availability of a psychometrically- sound, validated instrument to assess adolescent pain behaviors would be helpful for clinical practice and would be a unique contribution to the literature. The primary objective of this study is to report on the development, reliability, and construct validity of the Adolescent Pain Behavior Questionnaire.

2. Materials and methods

2.1. Participants

Participants were adolescents and parents presenting to a large, Midwest multidisciplinary pediatric pain management clinic between February 2007 and July 2009. Of the 176 eligible patients, 156 parent-adolescent dyads (88.6%) agreed to participate in the research study. Patients were ineligible for participation if they had significant developmental delays or impairments (e.g., visually impaired). Inclusion criteria for the current study included: (1) primary presenting complaint of chronic pain (daily or almost daily pain >3 months), (2) patient age between the years of 11 and 19, and (3) patient and parent ability to read and to comprehend questionnaires written in English. Patients were typically referred from a variety of medical subspecialties (e.g., orthopedics, rheumatology) and primary care pediatricians, usually after other treatment attempts failed to substantially reduce symptoms

or pain was more severe than expected given the medical condition. The study proceeded in two phases; Institutional Review Board approval was obtained for both phases of this study.

2.2. Measures

2.2.1. Phase one of measurement development—The first step in the development of the parent-report Adolescent Pain Behaviors Questionnaire (APBQ), was to generate an item pool from various published measures of pain expression, including pediatric responses to postsurgical pain behaviors [63]; adult overt pain behaviors [27]; pediatric chronic pain behaviors reported in daily diaries [21]; and pain behaviors in language- and cognitive-impaired children [39,62]. Additionally, an expert panel of providers in pediatric chronic pain reviewed the items for conciseness and comprehensiveness, generating additional items as necessary. The review panel consisted of a board-certified pain management physician, two clinical psychologists with expertise in pediatric pain research, and a postdoctoral fellow specializing in pediatric chronic pain.

The measure was designed for parents, with future plans to develop a companion measure for adolescent self-report. For this reason, initial items were worded using language appropriate for the developmental and reading level of adolescents, which presumably enhanced parent understanding as well. Forty-eight items were initially created and broadly represented domains of facial expressions (e.g., wincing), vocalizations (e.g., sighs), physical actions or body gestures (e.g., walks with a limp), reactive pain behaviors (e.g., uses heat or cold), and pain-altered daily behaviors (e.g., change in sleeping patterns or school functioning). Instructions directed parents to evaluate how often their adolescents engaged in each particular behavior on a 6-point, Likert scale (0-Never to 5-Almost Always) when in pain. No specific recall period was designated for completion of this measure since the primary focus was the manner in which adolescents usually behave with chronic pain.

Items were worded in a manner so that a higher number represents a more frequent parent-reported observation of the behavior. This Likert format was used to maximize responsiveness, and the even number of scale ratings offered no neutral middle point to force a response in one direction or the other [7]. Parents were allowed to write additional comments and/or pain behaviors at the end of their questionnaire to capture behaviors unintentionally omitted.

The APBQ was evaluated for feasibility and utility and to ensure that all important items were included in scale development. In a preliminary study, a different sample of 60 adolescent-parent dyads completed the APBQ during their visit to a tertiary care multidisciplinary pain program. Adolescents were 12–18 years of age¹ and were required to have experienced at least one chronic pain condition for at least 3 months.

Results from the preliminary study suggested high internal consistency for the measure as a whole ($\alpha = 0.93$, $N = 52$) and were based predominantly on maternal report [95%, $N = 57$]. Seventy additional written remarks were analyzed to determine if one or more behaviors were consistently identified by parents. One item was added (“Irritable/moody”) based on 26 parents’ comments. One item was modified for clarity, changing “Asks for help” into two items, “Asks for healthcare provider (i.e., doctor, physical therapist)” and “Asks mom or dad for help.” Several of the comments ($N = 15$) were determined to be synonyms of existing APBQ items by expert panel consensus. The panel concluded that the remaining written

¹A lower age limit of 12 years was initially established for the APBQ during Phase One of the study. However, analysis of the APBQ for grade level readability (Flesch-Kincaid) resulted in a grade level of 6.2. Thus, for Phase Two, the lower age limit was reduced to 11 years to correspond with children typically in the sixth grade. Similarly, the upper age limit was extended to 19 years to accommodate adolescents who were still in high school at that age.

descriptions were either unique to a single adolescent (e.g., “Covers up with blanket”) or not developmentally appropriate for the sample (e.g., “Sucks thumb”). Finally, two existing items (“furrowed or wrinkled forehead” and “asks to be left alone”) were eliminated due to redundancy, and one was removed because it was too general and not developmentally appropriate for adolescents (“stops playing”).

After further conceptualization, and upon consensus of the development team, twenty items representing reactions to pain and pain-altered behaviors were eliminated from the questionnaire due to the existence of already well-validated measures in the pediatric literature assessing these domains (e.g., Pain Coping Questionnaire [51], Bath Adolescent Pain Questionnaire [9,12], Child Activity Limitations Interview [45], and the Functional Disability Inventory [73]). The behaviors included in this second phase of APBQ development represented only facial expressions, vocalization (verbal or non-verbal), and physical actions or gestures. Thus, the modified parent version of the APBQ included 26 items for further analysis during Phase Two (see Appendix).

2.2.2. Phase two of measurement development—The second phase of measurement development focused on conducting an exploratory factor analysis of existing items to determine the factor structure, as well as assessing reliability and construct validity of the APBQ. Additional measures were selected to evaluate construct validity based upon developmental appropriateness for the adolescent population and for their sound psychometric properties.

2.2.2.1. Additional Measures

Visual Analog Scale (VAS): The VAS is a self-report measure completed by the patient that provides an index of pain intensity [41]. It consists of a 10 cm line, anchored with the terms “no pain” and “worst imaginable pain” at the end points. Patients mark the place on the line that best represents their highest, lowest, and average pain intensity. Patients were instructed to rate their pain for the previous two weeks. Visual analog scales have been well-researched and validated for children 8 years of age and older [57,40]. The VAS was recommended for assessing both acute and chronic pain in a recent consensus statement about measurement of outcome domains in pediatric pain research [40]. Parents completed one VAS scale rating their perception of their adolescents’ average pain intensity. It was predicted that average pain intensity would show only a small positive correlation, if at all, with pain behaviors based on results in the pediatric literature [31,70–71]. While stronger correlations between these two variables are reported for adult pain patients [20,28,37], this same relationship has not been found thus far in the pediatric literature.

Functional Disability Inventory (FDI): The FDI [73] is a 15-item self-report inventory assessing difficulty with the performance of daily activities in home, school, recreational, and social domains. Items are rated on a 5-point-Likert scale, ranging from 0 to 4 (“No Trouble” to “Impossible”) and summed to create a total score with higher scores indicating greater pain-related physical disability. The FDI is one of the most commonly used measures of pediatric functional impairment and was created specifically for a chronic/recurrent pain population (e.g., gastrointestinal pain) [10]. It has been used with a wide range pediatric pain conditions [11,22,24,33,32,35,34,52,74] and is recommended for children above the age of 8. Parents also completed the FDI. The parent version is a reliable and valid instrument and shows sensitivity to changes in response to treatment [73].

Pain-related physical and functional impairment has sometimes been conceptualized as a component of pain behavior in other studies. It is viewed as a unique construct but related to the verbal and non-verbal expressions of pain currently defined as pain behaviors by this

study. Functional disability was expected to positively correlate with pain behaviors on the APBQ, a relationship found among adults with chronic pain [28,37,48].

Pain Catastrophizing Scale for Children and Parents (PCS-C/P): This 13-item questionnaire is an adaptation of the Pain Catastrophizing Scale, an instrument that has been previously used to study coping styles among adult chronic pain patients [15,58]. The PCS-C was created by rewording one item, simplifying the rating scale, and repeating the item stem at the beginning of each item. There is evidence of construct and predictive validity [6]. The parent version is adapted for caregivers and assesses the degree to which parents worry and catastrophize about their child's pain. Like the child version, the PCS-P is a 13-item, self-report measure. Respondents choose their responses on a 5 point-Likert scale ranging from "Not at all" (0) to "Extremely" (4). Items are summed to create a total score, with higher scores indicating increased worry. There is a good evidence for construct and criterion validity [16]. A significant positive relationship was hypothesized between the presence of pain behaviors and child- and parent-reported catastrophizing. This prediction is based on the link between patient catastrophizing and expression of pain behaviors in the pediatric literature [70] and the findings that parental catastrophizing is correlated with child functional disability [16], a domain also related to pain behaviors in the adult literature (see above).

Pediatric Quality of Life (PedsQL): The PedsQL [68] is a 23-item, self-report questionnaire assessing children's and adolescents' perceptions of health-related quality of life. A parent version parallels the adolescent version. Responses are made on a 5-point-Likert scale, from 0 (Never a problem) to 4 (Almost always a problem), which are later reverse scored and converted into scores ranging from 0 to 100. For this study, the total scale score of the PedsQL was utilized. Internal consistency of the total scale score has been shown to be quite good ($\alpha = 0.88$ child self report, $\alpha = 0.90$ parent proxy report). Higher scores reflect better quality of life. Evidence suggests that the PedsQL can differentiate healthy from chronically ill children and adolescents and is correlated with number of school absences and need for healthcare [69]. It was expected that poorer quality of life would be associated with greater expression of pain behaviors, based on similar findings among adults with chronic low back pain [56] as well as the negative correlation between adult pain behaviors and poorer global health status (a composite measure including the domains of physical function, emotional distress, social satisfaction and activities, and quality of life) [53].

Children's Depression Inventory (CDI): The CDI is comprised of 27 items assessing self-reported symptoms of depression in children and adolescents [29]. For each item patients choose 1 of 3 responses, representing varying symptom levels, that best describes their symptoms for the past two weeks. The CDI is a well-validated measure [55] and is frequently used to measure depressive symptoms in pediatric pain populations [5,22,24]. The age range for the CDI is 7 to 17 years. A few of our patients were older [$n = 17$ (12.3%) 18- and 19-year-olds]; however, the CDI was administered to all patients for the purposes of consistency, which has been done in comparable studies of pediatric chronic pain [9,23]. The CDI raw score was used in analyses to capture the variability of responses without the truncation associated with *T*-scores. Increased depressive symptoms were expected to correlate with greater parent perception of pain behaviors in the child, based on similar findings in the adult pain literature [19,28,30].

Parent information: A parent (usually the mother) provided basic demographic information, including parental education, family income, and history of other family members with chronic pain, their own pain history (number of pain conditions), and their own pain treatment history (number of pain conditions for which medical intervention was sought).

Additionally, parents provided an estimate in weeks of the adolescents' duration of pain problems.

2.3. Procedure

The modified APBQ and additional measures were administered as part of the comprehensive evaluation conducted by a multidisciplinary team which included the pediatric pain physician, advanced practice nurses, a clinical psychologist, and often a physical therapist. After obtaining a brief medical history, the nurse reviewed the consent form, presenting instructions for the adolescent and parent self-report measures. Completion of the battery of questionnaires was a standard part of the multidisciplinary assessment, and families were provided the option of giving consent for the use of their un-identified data for the purposes of research. During the behavioral medicine visit, the psychologist answered any questions and reviewed the questionnaires for completion. Adolescents completed the following measures: FDI, Peds-QL, PCS-C, VAS, and CDI. Their parents completed the parent versions of the FDI and PedsQL, the PCS-P, APBQ, VAS of their adolescent's average pain intensity, and parent information form.

2.3.1. Planned analyses—All data were entered and analyzed using PASW 17.0 software. First, descriptive data on patient demographics were run, including pain characteristics (intensity, duration, and location), depressive symptoms, functional disability, quality of life, and pain catastrophizing. Missing data for the APBQ were handled in the following manner. There were five parent-versions of the APBQ that were not completed in their entirety and eliminated from analyses (3.6%). Additionally, any questionnaire with more than 30% of omitted answers was not used in the analyses ($N = 1$, 0.7%). Otherwise, the mean item score was imputed for a missing item response [$N = 35$ imputed means, 1.0% of all item responses]. Patient pain history was obtained from secondary sources (i.e., chart review, evaluation reports) in the event of a missing data. Patients whose parents completed the APBQ ($N = 133$) and those whose parents did not complete the APBQ ($N = 5$) were compared on patient pain and demographic characteristics using t -tests to determine if there were any group differences.

A principal components analysis (PCA) was conducted to determine the factor structure of the APBQ. PCA was used rather than principal factor analysis (PFA) as this statistic is recommended for data reduction of items into fewer dimensions [14]. Data were assessed for the suitability for factor analysis using Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy. The Bartlett's test should be significant ($p < 0.05$) to consider factor analysis, and results of the KMO tests should be greater than 0.60 [61]. Factor extraction was based upon two techniques: the Kaiser criterion and scree test, with the number of factors based on the “elbow” or break in the plot. Items were retained if they loaded greater than 0.40 on a particular component.

After determining factor structure, we investigated item variances to ensure high diversity of responses on scale items. The squared multiple correlation for each item was reviewed, to determine the extent to which an item shares variance with all other items in the scale. Finally, reliability was assessed by computing Cronbach's coefficient alpha for the APBQ. Scale means and standard deviations were computed for the APBQ.

Additional analyses were conducted to assess the validity of the APBQ with instruments assessing other domains of pain related functioning and mood. Correlations were computed to explore the relationship between demographic (age), pain characteristics (pain duration, intensity), and pain behaviors. Due to the preliminary nature of this instrument, correction for multiple correlations was not done.

3. Results

3.1. Participant characteristics

Eighteen patients were not eligible to complete the study due to insufficient pain duration (<3 months duration) (11.5%). Participants were 138 adolescents referred to a tertiary pain clinic for management of chronic pain. Adolescents were predominantly Caucasian females with a mean age of 15.0, which is consistent with pain patients reported in comparable pediatric studies [17,33]. Further descriptive data about participants and their pain characteristics are found in Table 1. There was a significant difference in adolescent age between parents who completed the APBQ and those who did not ($t = -12.6$, $p < 0.001$). Parents who did not complete the APBQ were the caregivers of older adolescents ($M = 18.3$, $SD = 0.5$) compared to those who did complete the measure ($M = 14.9$, $SD = 2.0$). This is not unexpected since adolescents aged 18 or older can attend a visit without the presence of a parent or legal guardian. There were no significant differences in pain intensity or duration among the adolescents of parents who did or did not complete the measure.

3.2. Family characteristics

Demographic results revealed that parents of adolescents were well-educated, with a large proportion of mothers ($N = 100$, 75.7%) and fathers ($N = 83$, 65.9%) attending some college or technical school beyond a high school degree. Nearly half of the families reported at least one other family member experiencing chronic pain ($N = 67$, 49.6%). With regards to their own pain history, parents reported to have an average of 3.7 ($SD = 2.7$) pain conditions and sought treatment for an average of 2.7 ($SD = 2.5$) conditions.

3.3. Factor analysis

The 26 items were subjected to a principal components analysis (PCA). Prior to analysis, the data were evaluated for suitability for this statistical technique. Inter-item correlations revealed multiple items with correlations greater than $r = 0.30$. Results from Bartlett's test of sphericity reached statistical significance ($p < 0.001$), and the KMO measure of sampling adequacy was acceptable, 0.88.

PCA initially suggested the presence of seven components with eigenvalues greater than 1.0 based on the Kaiser criterion. However, inspection of the scree plot using the "elbow" guideline suggested a clear break after the first component. Thus, it was decided to retain a single factor structure, which accounted for 37.0% of the total variance among items. Alternative factor structures were considered (2 and 3 factor structures with oblique rotation) but did not enhance the meaningfulness or interpretability of the data and produced numerous complex items that did not clearly load on a single factor. One item did not load higher than 0.40 on the component ("17. Gets quiet") and was eliminated from further analysis (see Table 2).

3.4. APBQ Scale analyses

Corrected item-total correlations and the squared multiple correlation for each item were reviewed. Criteria for item elimination were: a corrected item-total correlation less than $r = 0.40$ or a squared multiple correlation less than $r^2 = 0.40$. The following two items were removed: "20. Hunched over or stooping" ($r = 0.34$) for violation of the first criteria, and "23. Walks with a limp" ($r^2 = 0.38$) for violation of the second criteria. Investigation of Cronbach's alpha suggested that the internal consistency would be unaffected if these items were deleted. The final scale contained 23 items (see Appendix), with remaining item-total correlations ranging from 0.46 to 0.71. Internal consistency reliability fell in the "very good" range ($\alpha = 0.93$) [7].

The APBQ had a total score mean of 51.33 (SD = 20.91). Review of the APBQ identified the most and the least commonly endorsed items: “9. Complains” ($M = 3.36$, $SD = 1.24$) and “16. Gets irritable or moody” ($M = 3.11$, $SD = 1.50$) versus “15. Yells” ($M = 1.18$, $SD = 1.29$) and “14. Whimpers” ($M = 1.33$, $SD = 1.47$). Item distributions were analyzed to identify significant skewed items. Two items, “14. Whimpers” and “15. Yells,” yielded highly skewed values (greater than 1.0). These items were not eliminated, however, due to their relatively high component loadings (0.68 and 0.69, respectively) and their strong item-total correlations ($r = 0.63$ and 0.67 , respectively).

3.5. Analyses between APBQ scores and patient characteristics

The relationship between APBQ pain behaviors, patient demographics (age), and pain characteristics (intensity and duration) was investigated. A small but significant positive correlation was found for age and pain behaviors ($r = 0.19$, $p < 0.05$). Older adolescents were viewed by parents as more likely to show expressions of pain. Correlations between the APBQ and parent- and adolescent- reports of pain intensity revealed divergent findings. A small but significant correlation was found between parent estimates of their adolescent's pain intensity and parent-report of pain behaviors ($r = 0.25$, $p < 0.01$). However, when correlated with adolescents' ratings of their own pain intensity, no significant relationship was found. With regards to pain duration, a positive relationship was found between pain behaviors and weeks since pain onset ($r = 0.17$, $p < 0.05$). Parents endorsed that their adolescents showed more pain expressions with a longer pain duration, but this relationship was quite small.

3.6. Tests of APBQ validity

The validity of APBQ was analyzed using other evidence-based instruments to assess depressive and anxiety symptoms, quality of life, and functional disability for adolescents with chronic pain. In line with our predictions, the APBQ correlated modestly but significantly with adolescent-reported catastrophizing and depressive symptoms based on raw CDI scores (see Table 3 for correlations). Thus, adolescents who described themselves as having more depressive symptoms and engaging in more pain catastrophizing were more likely to be viewed by their parents as showing pain behaviors. Adolescent-reported functional disability also significantly correlated with the APBQ ($r = 0.26$, $p < 0.002$), thus, greater self-report of pain-related impairments was associated with parents perceiving more behavioral expression of pain. The APBQ showed a significant negative correlation with the quality of life total scale score. Thus, adolescents who rated their overall health-related quality of life as less positive were characterized by their parents as more likely to engage in pain behaviors. Taken together, these results (1) generally support our *a priori* hypotheses related to construct validity measures, (2) suggest pain behaviors observed by others are not always good indicators of pain intensity as described by the adolescent patient, and (3) indicate that pain behaviors appear to be more closely associated with emotional distress (depression or anxiety) and disability.

From the parents' perspective, parent responses on the APBQ showed significant relationships with parent-reported outcomes (see Table 4). Parent-reported functional disability was significantly correlated with the APBQ ($r = 0.41$, $p < 0.001$). Parent-reported poorer health-related quality of life showed a significant negative correlation with pain behaviors ($r = -0.63$, $p < 0.001$). The correlation between parents' own pain catastrophizing and pain behaviors was significant ($r = 0.53$, $p < 0.001$). Thus, parents who perceived more frequent adolescent pain behaviors were more likely to catastrophize about their adolescent's symptoms. Finally, parent pain history (number of pain complaints) and treatment history (number of pain complaints for which treatment was sought) were significantly related to the APBQ. Parents who described as having more of their own pain

conditions and being treated for more pain complaints endorsed increased behavioral expressions of pain in their adolescent.

4. Discussion

This study presents initial validation of a new instrument, the Adolescent Pain Behavior Questionnaire (APBQ). Principal components analysis suggests a single component as the best way to reduce the items and interpret the data, and scale analysis shows that the APBQ is internally reliable and valid. This instrument adds to the pediatric pain literature by measuring verbal and non-verbal ways of communicating chronic pain separate from coping responses or functional impairment. We chose to focus on adolescents, given the well-developed observational systems for younger and/or non-verbal children as well as the relatively large proportion of adolescents with chronic pain (e.g., [46,44]). The APBQ offers a less cumbersome assessment of pain behaviors than coding systems, but a more reliable and comprehensive method than single items or composite measures to approximate the construct [54] or short scales developed in non-clinical samples [70].

Evidence that pain behavior is one component of the global pain experience was found in the significant association between pain behaviors and emotional and physical functioning. In line with our hypotheses, higher levels of depressive symptoms, greater functional disability, poorer quality of life, and greater pain catastrophizing reported by adolescents correlated significantly with parent-report of increased pain expressions. These results are consistent with other adult and child studies of pain catastrophizing, which found relationships between pain behaviors and pain catastrophizing [25,59,70] as well as depression [20,30]. Moreover, given that functional disability has been the focus of considerable research and is identified as a key outcome measure in pain research [40], these correlations lend further support to the validity of APBQ.

Interestingly, parental catastrophizing about their adolescents' pain was significantly associated with parent-report of increased pain behaviors. These results suggest that the impact of pain expression may be bothersome to parents who tend to worry about their adolescent's pain symptoms. Experimental studies have found that children with high levels of pain catastrophizing engage in indiscriminate facial expressions of distress regardless of observer (parent vs. stranger) and may be incapable of suppressing pain behaviors in any situation [71]. For parents with a tendency to engage in pain-related worry about their adolescents, these pervasive displays of distress may only augment parent catastrophizing.

While a tendency to catastrophize may skew parents' perceptions, these impressions may still be the reality that guides parent decision-making. Research has shown that parent maladaptive responses to pain in the forms of increased attention or granting privileges are related to greater functional disability, particularly for children with higher emotional distress [4]. Anxious parents who perceive more pain behaviors in their adolescents may have difficulty resisting engaging in such behaviors, unintentionally promoting disability in their adolescents. Given the correlation between increased pain behaviors and greater distress (depressive symptoms, catastrophizing) in the current study, the impact of parent maladaptive responses to their children's pain symptoms may be quite problematic for adolescents who tend to show increased pain behaviors.

We found that parents with a greater number of their own pain conditions and being medically treated for more pain conditions were more likely to report increased observation of adolescent pain behaviors. Parents with their own pain history may be more accurate at noticing and reporting adolescents' pain expressions. While research suggests that observers generally tend to underestimate pain compared to ratings of the pain sufferer [49,50], there is evidence that observers who have lived with a family member with chronic pain are

generally more accurate and rate pain higher and closer to the sufferer [49]. A similar situation may occur between parent and adolescent pain sufferers, with implications for social modeling of positive or poor coping. Conversely, parents with their own pain history may misread their adolescent's cues, overestimating the behaviors they witness. Parents with a tendency toward catastrophizing *and* their own pain problems may be particularly vulnerable to overreaction and misinterpretation of adolescent behaviors.

A few limitations to this study should be considered when interpreting the results. Factor analysis was conducted with a relatively small sample, although no consensus exists regarding ideal sample size and a wide range of guidelines have been suggested [7,14,61]. Nevertheless, the generalizability of our results is limited, and the factor structure of the APBQ should be replicated in a separate, larger sample.

No timeframe was specified in the instructions for completion of the APBQ. The current APBQ reveals *global* pain communications styles that span multiple contexts, activities, and interactions. All participants reported pain duration of at least three months, meeting the accepted definition for chronic pain (e.g., [46]). Thus, it is reasonable to assume that parents reported on behaviors different from an acute reaction to pain onset. However, identifying a timeframe may be an important enhancement to the measure for future use to clarify the scope and magnitude of the current pain experience and/or highlight pain perception and expression in different contexts (e.g. related to pain flare ups). In the future, we would instruct parents to complete the APBQ by evaluating their adolescents' pain behaviors for the prior four weeks.

Given the homogenous sample, the APBQ warrants further study in different cultural contexts to investigate its generalizability. As in other studies, current results are limited to maternal data. Inclusion of both maternal and paternal perceptions of adolescent pain behaviors in the future would further enhance the findings. Additionally, the measure would be augmented by the inclusion of an external validation method, such as patient- or provider-report of observed pain behaviors. Moreover, results should be interpreted in light of the fact that there is shared variance due to the same informant (parent) and same methods. Inclusion of emotion- focused items (e.g., gets moody or irritable) on the APBQ may be considered problematic given their overlap with global measures of distress or depression. However, these items should be retained in light of: (a) parents specifically identifying them as important pain behaviors during measurement development and (b) parents rating these items in the context of their presence during the chronic pain experience. Finally, there was no consideration of suppression effects with regards to pain behavior. Compared to involuntary, acute pain expressions, chronic pain may predispose patients to displays of amplified, suppressed, or simulated pain behaviors depending on the goals of communication and the functionality of the behaviors [75]. The APBQ was not designed to address these aspects of pain behaviors.

The APBQ is useful for clinical practice. Adolescents who present with pain behaviors in excess of their identified pain problems may be viewed as poor copers by medical personnel, although no specific research has linked distinct styles of coping (e.g., engaged vs. dependent vs. consistent) [3] with pain behaviors. In the adult pain literature, psychological interventions to improve coping and functioning also reduced overt expressions of pain and distress [64]. The addition of pain behaviors as an outcome measure in clinical care and research would require an assessment tool for evaluation, a need now filled by the APBQ.

Future research will focus on refining the APBQ and developing and validating a comparable adolescent version. Parents have a wealth of experience perceiving pain cues from their children, encoding these pain behaviors, and making judgments about the quality

and severity of the pain [50]. However, adolescent patients are likely better able to comment on their subjective pain [2,36,60] and can offer their own distinct impressions about their global pain experience. The presence of both parent and patient version would allow for external validation of parent impressions on the APBQ, the investigation of agreement between parent and patient ratings, and any factors (e.g., parent catastrophizing) that might moderate this agreement. Additionally, inclusion of a measure assessing parent responses to children's pain behavior (e.g., Adult Responses to Children's Symptoms [67]) will be important to understand how parent perceptions impact behavioral reactions to their adolescents.

The APBQ could be useful for assessing the longitudinal, interactive impact of chronic pain. Parents who witness repeated pain behaviors have to make ongoing decisions about adolescent participation in daily activities (e.g., school attendance). Over time, parents and adolescents may develop entrenched patterns of behavior, whereby the presence of pain behaviors may lead to habitual parent responses that could become resistant to change (see Dumas, 2005 [8] for example). The factors contributing to this complex process might include parent pain history and catastrophizing as well as child variables, all potential areas of clinical intervention. The APBQ provides a critical tool in the ongoing efforts to understand and to assess the impact of chronic pain on children and adolescents.

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Appendix A Adolescent Pain Behavior Questionnaire See Tables A1–A3

Table A1

Below is a list of common ways that children and teenagers *use their faces to express when they are in pain*. Please rate each behavior from 1 to 6 to show how often you notice your child making these facial responses when he/she has pain.

		Never	Hardly ever	Sometimes	Often	Very often	Almost always
1	Face changes color (red, pale)	1	2	3	4	5	6
2	Dazed/eyes glazed	1	2	3	4	5	6
3	Clenched jaw	1	2	3	4	5	6
4	Frowning	1	2	3	4	5	6
5	Circles under eyes	1	2	3	4	5	6
6	Wincing/grimacing	1	2	3	4	5	6
7	Tears in eyes	1	2	3	4	5	6

Table A2

Below is a list of common things that children and teenagers may *say or do when they are in pain*. Please rate each behavior from 1 to 6 to show how often you notice your child making this sound or asking this question when he/she has pain.

		Never	Hardly ever	Sometimes	Often	Very often	Almost always
8	Whines	1	2	3	4	5	6
9	Complains/talks about hurting	1	2	3	4	5	6
10	Cries	1	2	3	4	5	6
11	Sighs	1	2	3	4	5	6
12	Groans	1	2	3	4	5	6
13	Asks mom or dad for help	1	2	3	4	5	6
14	Whimpers	1	2	3	4	5	6
15	Yells or screams when in pain	1	2	3	4	5	6
16	Gets irritable/moody	1	2	3	4	5	6
17	Gets quiet	1	2	3	4	5	6

Table A3

Below is a list of things that children and teenagers may *do when they are in pain*. Please rate the behaviors from 1 to 6 to show how often you notice your child making these actions and gestures when he/she has pain.

		Never	Hardly ever	Sometimes	Often	Very often	Almost always
18	Fidgeting or restless	1	2	3	4	5	6

		Never	Hardly ever	Sometimes	Often	Very often	Almost always
19	Tense body	1	2	3	4	5	6
20	Hunched over or stooping	1	2	3	4	5	6
21	Holding area of body that hurts	1	2	3	4	5	6
22	Moves slowly or protectively	1	2	3	4	5	6
23	Walks with a limp	1	2	3	4	5	6
24	Rubbing area of body that hurts	1	2	3	4	5	6
25	Avoids touching/bumping area of body that hurts	1	2	3	4	5	6
26	Flinches or jerks when pain area is touched	1	2	3	4	5	6

Scoring: Sum each item response across all 23 items to calculate a total APBQ score.

Table 1Descriptive data of participants ($N = 138$).

Variable	Percentage	<i>N</i>
Sex (% female)	75.4	104
Ethnicity (% Caucasian)	90.6	125
Pain locations		
Back pain	28.3	39
Abdominal/flank pain	23.9	33
Joint pain	12.3	17
Other pain problems	35.5	49
	Mean	SD
Pain duration (weeks)	118.4	168.9
Pain intensity (VAS)		
Highest	7.7	1.9
Lowest	3.3	2.4
Average	5.7	2.0

Table 2

Principal components analysis, one component suggested with item loadings.

Item number	Item	Component
12	Groans	0.760
16	Gets irritable or moody	0.742
11	Sighs	0.740
7	Tears in eyes	0.733
8	Whines	0.722
9	Complains/talks about hurting	0.690
19	Tense body	0.690
15	Yells or screams when in pain	0.687
6	Wincing/grimacing	0.680
14	Whimpers	0.676
10	Cries	0.670
4	Frowning	0.656
22	Moves slowly or protectively	0.636
13	Asks mom/dad for help	0.626
3	Clenched jaw	0.571
21	Holding area of body that hurts	0.559
18	Fidgeting or restless	0.512
2	Dazed/eyes glazed	0.509
25	Avoids touching/bumping area of body that hurts	0.507
26	Flinches or jerks when pain area is touched	0.503
24	Rubbing area of body that hurts	0.502
5	Circles under eyes	0.493
1	Face changes color	0.492
20	Hunched over or stooping	0.442
23	Walks with a limp	0.416
	% of variance explained	37%

Note. Only loadings above 0.4 are displayed.

Table 3

Correlations between parent-reported pain behavior and adolescent-reported depressive symptoms, pain catastrophizing, functional disability, and quality of life.

	APBQ	CDI	FDI	PCS	PedsQL
APBQ	1.00				
CDI	0.34**	1.00			
FDI	0.26**	0.33**	1.00		
PCS	0.27*	0.54**	0.46**	1.00	
PedsQL	-0.33**	-0.65**	-0.50**	-0.46**	1.00

Note. APBQ, Adolescent Pain Behavior Questionnaire; CDI, Children's Depression Inventory; FDI, Functional Disability Inventory – Child Version; PCS, Pain Catastrophizing Scale for Children; PedsQL, Pediatric Quality of Life Scale – Child or Adolescent Version.

* $p < .01$.
** $p < 0.001$.

Table 4

Correlations between parent-reported APBQ and parent-reported pain catastrophizing, functional disability, parent pain history, and quality of life.

	APBQ	FDI	PCS	Pain HX	Pain TXT	PedsQL
APBQ	1.00					
FDI	0.41**	1.00				
PCS	0.53**	0.22 [†]	1.00			
Pain HX	0.29**	0.15	0.18	1.00		
Pain TXT	0.19 [†]	0.16	0.03	0.84**	1.00	
PedsQL	-0.63**	-0.76**	-0.29*	-0.33**	-0.29**	1.00

Note. APBQ, Adolescent Pain Behavior Questionnaire, FDI, Functional Disability Inventory – Parent Version, PCS, Pain Catastrophizing Scale for Children–Parent Version, PedsQL, Pediatric Quality of Life Scale – Parent Version.

[†] $p < 0.05$.

* $p < 0.01$.

** $p < 0.001$.