Pain Acceptance in Adolescents: development of a short form of the CPAQ-A

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Abstract

Objective

Acceptance of pain is a predictor of pain-related disability and treatment outcome in adolescents with pain. This variable has been previously measured using the Chronic Pain Acceptance Questionnaire for Adolescents (CPAQ-A, McCracken, Gauntlett-Gilbert, & Eccleston, 2010). We set out to create a short, 8-item, form of this instrument that retained its factor structure and clinical utility.

Methods

We used data collected from two independent samples of adolescents attending residential treatment for disabling chronic pain (N = 187 and N = 159). Both groups completed the 20-item CPAQ-A and indices of functioning and distress. We carried out item reduction and Confirmatory Factor Analysis (CFA) on the first sample, repeating this on the second sample and examining the new scale's correlations with clinically relevant variables.

Results

An 8-item scale was created with 4 items assigned to each established factor (Pain Willingness, Activity Engagement). CFA confirmed this factor structure and it replicated in Sample 2. The new scale (the CPAQ-A8) was sensitive to treatment, and correlated as well with clinically important variables as its full length version. Some items in the new scale differed from the adult CPAQ-8.

Conclusions

Measures of pain acceptance have been previously developed and validated in pediatric and adult samples. This study showed that pain acceptance can be indexed by a brief, yet factorially valid, short form of the CPAQ-A that uses fewer than 50% of the items of the full-length scale and has demonstrated acceptable validity and sensitivity to treatment.

(250 words)

Introduction

Adolescent pain is a common problem, and for a significant minority it can become a distressing and disabling health issue (King et al., 2011). The value of psychological approaches in supporting adolescents in chronic pain is long established with psychological interventions leading to improvements in physical functioning, pain intensity, school attendance, family relationships and mood (Eccleston, Malleson, Clinch, Connell & Sourbut, 2003; Eccleston et al., 2016; Janicke & Finney, 1999).

One such psychological intervention is Acceptance and Commitment Therapy (ACT) and, following its rise in popularity and evidence base (Hayes, Levin, Plumb-Vilardaga, Villatte, & Pistorello, 2013), the processes targeted within ACT have been investigated to understand positive clinical outcomes within adolescent chronic pain (Feinstein et al., 2011; Martin et al., 2015; Wallace, McCracken, Weiss & Harbeck-Weber, 2015; Wicksell, Melin, Lekander & Olsson, 2009). This follows a pattern within the adult pain literature that has demonstrated that treatment outcomes are improved by changes in cognitive defusion (McCracken, Gutiérrez-Martínez & Smyth, 2013), values based action (Vowles & McCracken, 2008) and other processes addressed within ACT interventions (McCracken & Morley, 2014). Of these processes “acceptance” is perhaps the most widely researched in both adolescents in pain (e.g. Casier et al., 2013; Kalapurakkel, Carpino, Lebel & Simons, 2014) and adults in pain (e.g. Elander, Robinson, Mitchell & Morris, 2009; Vowles, McCracken & Eccleston, 2007). However, research on pain acceptance has included multiple definitions of the concept, helpfully reviewed by Lauwerier et al. (Lauwerier et al., 2015), as the word “acceptance” has many different aspects and connotations.

Two underpinning concepts represent the ACT definition of pain acceptance – pain willingness, which is the willingness to permit pain to be present without immediately trying to terminate or reduce it, and activity engagement, which is the willingness to persist with important activities, even if they entail pain (McCracken, Vowles, & Eccleston, 2004). Conversely, a lack of pain willingness leads to rapid and concerted efforts to eliminate or reduce pain (even where this is largely impossible), and low activity engagement entails avoiding or postponing activities that hurt (even where they may be important). This is a highly specific, behavioural, definition of ‘acceptance’ that is quite different to other uses of the term, and also to many of the everyday language understandings of the word. This behavioural definition has been adopted in an attempt to define a specific concept that is useful in a treatment model, rather than implying that this is the only, or correct, understanding of ‘acceptance’. Whilst other uses of the term acceptance can include a cognitive state (e.g. “I accept that my pain isn’t going away”), a stage of adjustment, or an emotional shift, ACT defines acceptance as a behavioural posture, in the present moment, taken towards the aversive experience of pain.

Research in the adult literature has shown pain acceptance to be a potent variable in the prediction of distress, disability and treatment outcome (McCracken & Gutiérrez-Martínez, 2011; McCracken & Vowles, 2014). Pain acceptance in adults has been largely indexed using the Chronic Pain Acceptance Questionnaire (CPAQ, McCracken, 1998). This questionnaire has been transformed from a 34-item instrument, to 20 items, and then to an 8-item questionnaire over 12 years (Fish, McGuire, Hogan, Morrison, & Stewart, 2010), attesting to its popularity and consistent use in research. In 2010, McCracken et al. (2010) published a version of the 20-item scale for adolescents, the CPAQ-A. This scale has been used in cross-sectional research with children with JIA (Feinstein et al., 2011) and headache (Kalapurakkel et al., 2014), and it has shown acceptance to be a predictor of positive treatment outcome in two studies of chronic pain (Gauntlett-Gilbert, Connell, Clinch, & McCracken, 2013; Weiss et al., 2013). Given the success of the concept of pain acceptance in adults, future research may show an important role for pain acceptance in other adolescent conditions and contexts.

The CPAQ-A remains the only instrument that specifically measures pain acceptance, as defined by ACT, in adolescents. Other measures index different concepts of acceptance – for example the Pain

Response Inventory has an ‘acceptance’ subscale, which includes items such as “tell yourself ‘that’s life’” (Walker, Smith, Garber & Slyke, 1997). These may be useful but are orthogonal to the ACT concept. An adolescent version of the Psychological Flexibility in Pain (PIP) scale is reported as in construction, and is ACT-consistent, but it has not yet been published (Wicksell, Kanstrup, Kemani, Holmström, & Olsson, 2015).

The CPAQ-A, therefore, provides the only existing measure of the ACT concept of pain acceptance in adolescents. We set out to create a short version of the CPAQ-A for researchers and clinicians who want to use the instrument in an applied context, this will be particularly useful where it is used in combination with other instruments or administered on multiple occasions. The potential value of this short form is indicated by the adult version of the CPAQ-A that has been successfully reduced to a short form, the CPAQ-8, and widely adopted – a search of Google Scholar on August 12, 2018 indicated Fish et al. (2010) had been cited 132 times.

Our aim was to create a short form of the CPAQ-A with the same factor structure, and then to inspect its validity in the prediction of distress and disability. We decided to construct an 8-item scale, following the success of the adult CPAQ, where the 20-item CPAQ was reduced to the CPAQ-8, retaining its factor structure (Fish et al. 2010). Following McCracken, Gauntlett-Gilbert and Eccleston (2010) and Fish et al. (2010) we predicted that higher pain acceptance as measured by the CPAQ-A8 would lead to better emotional, social and physical functioning as assessed by all 7 subscales of the Bath Adolescent Pain Questionnaire (BAPQ, Eccleston et al., 2005).

Methods

Participants

All participants were adolescents (11yrs – 18yrs) who had relatively long-standing chronic pain conditions. Functional disability was relatively highly, shown by levels of disruption to schooling (see demographic characteristics in Table 1; values are expressed as medians where there was substantial positive skew). They were referred to the national specialist service after suboptimal treatment response in their local area. To get to the programme, and thus the point where they completed these research data, they underwent a joint medical and psychological assessment that confirmed their diagnosis of non-malignant chronic pain, and also their motivation and consent for intensive residential pain rehabilitation treatment. Participants' specific diagnoses were subsequently assigned to a range of 6 potential categories that have previously used in research on adolescent chronic pain (Gauntlett-Gilbert, Connell, Clinch and McCracken, 2013; Kemani, Kanstrup, Jordan, Caes, & Gauntlett-Gilbert, 2018). Diffuse / Localised Idiopathic Pain, Complex Regional Pain Syndrome and Back Pain were the commonest diagnoses. Adolescents were accompanied by one parent at the treatment service.

Inclusion criteria for the study were defined by the acceptance criteria of the clinical service. These specified that all participants (11 yrs – 18yrs) had treatment-refractory idiopathic chronic pain causing substantial disruption to their functioning. The service was not diagnosis-specific. All adolescents had to have adequate spoken English to participate in the clinical programme. Adolescents were excluded from participation in the clinical service, and thus this study, if they had particularly severe comorbid mental health problems, or risky psychosocial circumstances (e.g. child protection issues, current family crisis), that would interfere with participation with rehabilitation. Participants who could not fill out the questionnaires due to literacy problems were also not eligible for the study. As adolescents only became eligible for the study when they had passed the criteria for the clinical service, we did not know how many were excluded by the criteria above; we also did not record the number that refused consent to participate.

*** Table 1 about here, please ***

Procedure

Participants were recruited from attendees at a UK national specialist adolescent pain rehabilitation programme, who completed standardised questionnaire packs at several time points as part of their treatment. Either at assessment, or at the start of treatment (a three-week residential programme, as described below), written, informed consent was sought from the adolescent and their parent for these clinical data to be used for research. If an adolescent reached the start of treatment, where data were initially collected, this meant that clinicians had already determined that they met inclusion / exclusion criteria below. If they gave consent, this entailed no new commitments or procedures; rather, it permitted standard clinical data to be incorporated, anonymised, into a research database. Ethical approval was granted by the local NHS research ethics committees, and also by the relevant hospital R&D department. The data in this study were collected on the morning of the first day of treatment; adolescents completed a battery of questionnaires, in the presence of their parents and on-site clinical staff who could supply help, encouragement and prompt participants to 'try again' at missing items. Sample 1 (n = 187) and 2 (n = 159) each represent data that were accrued over 4-5 years of data collection (2005 – 2015). The samples were separated by a time point where a number of other variables in the questionnaire battery and database (not used in this study) were changed; thus the separation point is arbitrary, from the point of view of this study. In order to analyse the sensitivity of proposed scales to treatment, we also used post-treatment data for the questionnaire under examination from Sample 2. These data were recorded on the morning of the last day of the 3-week residential pain rehabilitation programme; a description of this treatment and previous outcome data can be found in Gauntlett-Gilbert et al. (2013).

Measures

Demographics and pain characteristics

Adolescents reported their "usual pain" on a 0 – 10 numerical rating scale, anchored at 0 "no pain at al" and 10 "worst pain possible" (Birnie et al., 2018). They reported their educational status, and education missed (weeks missed, and the average number of half days of school missed per week).

Chronic Pain Acceptance Questionnaire for Adolescents (CPAQ-A; McCracken, Gauntlett-Gilbert, & Eccleston, 2010)

The CPAQ-A is a twenty-item self-report questionnaire measuring the concept of 'acceptance' as it is defined within Acceptance and Commitment Therapy (Hayes et al., 2013). It is an adolescent adaptation of the adult instrument, the CPAQ, with a simplified rating scale (0 – 4, "never true" to "always true") and with the item wording simplified in 14 of the 20 questions. The CPAQ-A was designed to reflect two facets of acceptance, that is, (1) Pain Willingness, the willingness to let pain be present without immediately trying to stop the experience – e.g. (reverse keyed) "before I can make any real plans, I have to get some control over my pain" and (2) Activity Engagement, the willingness to persist with actions in the presence of pain, e.g. "when pain increases, I can still do things I have to do". The full-scale score and subscales demonstrate adequate internal consistency (alpha 0.87 – 0.75 in the original validation study) and the factor structure of the questionnaire has been supported in independent research (Wallace, Harbeck-Weber, Whiteside, & Harrison, 2011)

Bath Adolescent Pain Questionnaire (BAPQ; Eccleston et al., 2005)

The BAPQ includes seven subscales that were specifically designed to index functioning, distress and developmental progress in adolescents with chronic pain and rheumatological conditions. Two subscales measure Physical Functioning and Social functioning (both nine items), four index distress and coping (Depression, Anxiety, Pain Specific Anxiety and Family functioning, 6 – 12 items) and a single scale measures the adolescent's perceived level of personal development (Development). All scales apart from Development use a five-point Likert scale, from "never" to "always". The Development subscale asks adolescents to rate themselves relative to their same-aged peers, and uses a five point Likert scale from "very behind" to "very ahead", anchored in the middle by "same". All subscales are internally consistent (alphas 0.79 – 0.89 in the original validation study) and the scale has been demonstrated as valid in pain treatment research (e.g. Cohen, Vowles & Eccleston, 2010; Gauntlett-Gilbert et al 2013; Palermo et al., 2016).

Analytic strategy

We characterised the sample by calculating descriptive statistics on demographic variables (e.g., age, gender ethnicity). We undertook a series of Confirmatory Factor Analyses using the software package AMOS 24.0 (Arbuckle, 2016). We initially examined Sample 1, forcing the whole scale into a single factor and then dividing it into its two established factors for comparison. Our target was to create an 8-item form of the CPAQ-A, mindful of the success of the shortened adult CPAQ-8. Thus, we undertook item reduction by examining (1) the item-total correlation, and (2) the standardised factor loading for each item. This approach was taken from Fish et al., 2010; we followed their approach considering the 'potential removal' of items with factor loadings and item-total correlations of <0.5. By choosing four items from each factor that maximised these coefficients, we aimed to create a new, 8-item, two-factor scale. We included We subjected this to CFA and examined its model fit using a range of coefficients.

We used CFA coefficients, and recommended / desired values for acceptable model fit, taken from the broader literature (Blunch, 2012; Byrne, 2016). We report χ^2 (lower values better, coefficient also influenced by N), and then root mean square error of approximation (RMSEA , preferably < 0.8, best < 0.6), as well as the Tucker-Lewis Index, Comparative Fit Index, Goodness of Fit Index, and Adjusted Goodness of Fit Index (TLI, CFI, GFI and AGFI respectively, all preferably > 0.9). We also report the Akaike Information Criterion (AIC, smaller values better).

Using Sample 2, we carried out a CFA on the new scale in order to provide an independent test of model fit. We went on to examine concurrent validity in this sample, studying the new scale as a potential predictor of distress and functioning (at the pre-treatment point), and comparing it to the full-length CPAQ-A. We explored this in correlation analyses, and then examined how the new CPAQ-A8 performed in multiple regression analyses that examined its role as a predictor of key clinical variables (BAPQ subscales). We were also interested in how sensitive the full-length scale, and shortened scale, were to treatment. Thus, we calculated repeated-measures effect sizes for both versions of the scale, comparing pre-treatment and post-treatment scores on the 3-week residential programme describe above. We used an effect size calculation that has been shown to be correct for related observations / repeated measures data (Dunlap et al. 1996, summarised in Nakagawa & Cuthill, 2007), reporting a statistic equivalent to Cohen's *d* (Nakagawa and Cuthill, 2007).

Results

In Sample 1, we initially carried out a CFA on the full-length CPAQ-A, specifying a single factor. Coefficients are in Table 2; as anticipated, model fit was poor by all parameters (row 1 of Table 2). Using the established two factors, model fit improved, with an acceptable RMSEA, but with other fit indices being inadequate (TLI, GFI, AGFI all < 0.9; row 2 of Table 2).

We established the shortened scale by examining the item-total correlations and standardised factor loadings of the 20 CPAQ-A items. The four items from each factor with the highest values on both criteria were chosen for the new scale, the CPAQ-A8. All standardised factor loadings for these items were > 0.7, with item-total correlations between 0.52 and 0.37. Thus, with regard to Fish et al.'s (2010) 'potential removal' criteria of < 0.5 factor loading, all items were above this threshold. In contrast, of the 20 original items, only 3 had an item-total correlation of > 0.5; we selected these items and then carried on choosing the next highest-scoring items to create an 8-item scale. A CFA of this 8-item scale was then carried out, with the items allocated to their appropriate factors. As can be seen in row 3 of Table 2, the model fit improved, with TLI, CFI, GFI and AGFI all > 0.9, although RMSEA increased slightly. We examined the modification indices and found that covarying the error terms between two items within the Activity Engagement factor (items 2 and 5 in the new CPAQ-A8), model fit improved even further (Byrne, 2016).

The new scale correlated with the full-length CPAQ-A at r = .93 (p < 0.001). The subscales and total score of the new scale were internally consistent (see Table 3).

*** Table 2 about here, please ***

We repeated the CFA, on the new set of 8 items, using the data in Sample 2 (Table 2, row 6). Coefficients again indicated a good fit, albeit with RMSEA slightly above 0.8. Examination of the modification indices again indicated that covarying the error of two items (3 and 5 in the new scale) within the Activity Engagement factor improved fit still further (Table 2, bottom row). Internal consistency remained satisfactory (pain willingness α = .86, activity engagement α = .74, total score α = .83). In sample 2 the new scale correlated with the full length CPAQ-A at $r = .94$ ($p < 0.001$). The Activity Engagement and Pain Willingness subscales correlated at $r = .45$ ($p < 0.001$). The total score was significantly, but modestly, negatively correlated with 'usual pain' ($r = -.21$, $p < 0.01$). Raw scores for the CPAQ-A8 can be seen in Table 3.

*** Table 3 about here, please ***

We examined the validity of the new scale by looking at its relationship to indices of distress and functioning from the BAPQ. Table 4 shows correlations between BAPQ subscales and the new CPAQ-A8 (Sample 2), shown alongside the same coefficients for the full-length CPAQ-A. The new, shorter instrument had equivalent relationships with clinically important variables; the average correlation between the CPAQ-A8 and all 7 dependent variables was 0.48; for the full-length CPAQ-A, it was also 0.48, despite the latter using more than double the number of items.

*** Table 4 about here, please ***

Within Sample 2, we also examined the sensitivity-to-treatment of the full and shortened scales. We used the data from the beginning and end of a three-week residential pain rehabilitation programme, and calculated repeated-measures effect sizes for both instruments (using the method of Dunlap et al. 1996, summarised in Nakagawa & Cuthill, 2007). Repeated measures effect size for the CPAQ-A8 was $d = 0.76$, whereas for the full length CPAQ-A it was $d = 0.82$.

The original CPAQ-A was shown to account for a majority of the variance in indices of distress and functioning, after demographic and pain variables were accounted for (McCracken et al., 2010). In the current data set, we observed some significant correlations between BAPQ subscales and (1) pain and (2) demographic variables. Thus, we performed a similar analysis to the original CPAQ-A paper, carrying out hierarchical regression analyses with the seven BAPQ subscales as dependent variables (in Sample 2). Four pain / demographic variables were entered in an initial block (age, sex, age at onset of pain, usual pain) and CPAQ-A8 was entered into a second block. The results can be seen in Table 5. The CPAQ-A8 is a highly significant predictor in all seven equations; ΔR^2 associated with the CPAQ-A8 block, after pain and demographic variables were accounted for, ranged from .09 to .38. Usual pain also had a significant role in predicting physical functioning; sex was related to both forms of anxiety (females experiencing more anxiety) and age at onset was significantly associated with depression.

*** Table 5 about here, please ***

Discussion

This study explored whether it was possible to create a shorter form of the CPAQ-A that was psychometrically sound, retained its factor structure, and performed similarly to the full-length version. We carried out item reduction in an initial sample and found that the CPAQ-A8, an eight-item version of the CPAQ-A, produced a good fit to the overall model with four items fitting well to each factor. This factor structure replicated in a second, independent sample, and the CPAQ-A8 correlated with indices of distress and functioning just as well as the full-length version. It was sensitive to treatment and accounted for significant and unique amounts of variance in a series of regression equations that took distress and functioning as dependent variables.

This research explored whether we could remove a substantial proportion of the items from the CPAQ-A without adversely affecting its factor structure or internal consistency. The two factors underpinning pain acceptance – that is, Pain Willingness, and Activity Engagement – have been extensively researched in the adult literature and when combined are important to understanding distress and disability in adult chronic pain (McCracken & Vowles, 2014; Veehof, Trompetter, Bohlmeijer, & Schreurs, 2016). For example, McCracken, Vowles and Eccleston (2004) found that either Pain Willingness or Activity Engagement accounted for significant variance across all 9 measures of pain-related disability or distress. Notably, the pattern of results was not consistent across the subscales as they related differentially with 5 of the 9 measures. Further exploration and clarification will likely come from examining the different aspects of pain acceptance. So far, studies in adolescent pain have focused on the 'total' score of the CPAQ-A, and it has been highly informative, for example, to understand that this combined concept and total score are active ingredients in adolescent pain treatment (Gauntlett-Gilbert et al., 2013). However, treatment targeting could clearly be improved by examining which of the two separate factors carries more weight in predicting good outcome. The two factors correlate significantly, but are clearly non-equivalent ($r = .45$; 79% of variance non-overlapping). Thus, the fact that the CPAQ-A8 can measure these two different factors, in such an abbreviated form, is of value to future research in adolescent pain. The two factors and total scores had adequate internal consistency, with alphas varying between .73 and .86 across our samples. These coefficients are lower than the values reported in Wallace's study of the full-length CPAQ-A (Wallace et al., 2011 - .83 to .91), but Cronbach's alpha drops as the number of items in a scale decreases, and values in this study are similar to those in the original CPAQ-A paper (.75 to .86) and to the adult CPAQ-8 (.77 to .89).

This study shows that the CPAQ-A8 can perform similarly to the full-length version. Clinicians and researchers need psychological measures that are strongly associated with distress and functioning; correlation analysis showed that the CPAQ-A8 was equivalent to its progenitor. Research has previously showed that treatment can substantially increase pain acceptance, both in adults and their adolescent children (Kemani, Kanstrup, Jordan, Caes, & Gauntlett-Gilbert, 2018). Here, we were concerned with whether the CPAQ-A8 was as sensitive to these changes as the CPAQ-A. Effect sizes were roughly equivalent when measured by the two scale versions, with the full-length CPAQ-A being slightly higher,whilst having more than double the number of items. Despite its brevity, the CPAQ-A8 has not suffered greatly in its ability to detect treatment-related change.

Although the goal of this study was not primarily to investigate the concept of acceptance, we carried out a number of regressions that demonstrated that acceptance, measured by the CPAQ-A8, was a powerful independent predictor of distress and functioning. As has previously been demonstrated, the ability to accept pain is important, independent of other potentially relevant variables such as pain levels and background demographics (McCracken et al., 2010). Our results showed that CPAQ-A8 was most powerful with regard to Pain-Specific Anxiety, Social Functioning and Depression (change in R^2 between .25 and .38). Whilst still a significant predictor, it had lesser impact on Family Functioning and Physical Functioning (change in R^2 .09 and .12, respectively). Of future interest would be studies that directly address potential differential impact of pain acceptance on measures of functioning. The adult CPAQ-8 was produced after much careful research. Thus, it is reasonable to question why we felt an adolescent version was necessary, and whether there is any substantial difference between adult and adolescent versions. Indeed, Clementi et al took the opposite approach and used the 20-item *adult* CPAQ in their study of adolescents' healthcare use and school absence (Clementi, Kao, & Monico, 2017), finding adequate internal consistency for the adult CPAQ and interesting results. The adult CPAQ and the CPAQ-A already differ in item wording and in scoring format. However, it is interesting to note that the adult CPAQ-8 and the adolescent CPAQ-A8 differ in terms of content. Whilst the majority of items are equivalent (albeit slightly reworded) across the two questionnaires, there are clear differences. Two items appear in the adult version that have no equivalent in the CPAQ-A8: (1) “My worries and fears about what pain will do to me are true”, and (2) “When my pain increases, I can still take care of my responsibilities”. The second item seems intrinsically less well suited to an adolescent population.

The absence of the first item may indeed be a benefit. Whilst this item clearly had value in the adult population, it could be argued that it is similar to non-acceptance concepts such as pain catastrophising (Pielech et al., 2014). Also, from within the ACT model, this item seems more to correspond to the process of 'defusion' (taking thoughts and beliefs as realities) than acceptance (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). In their place, the CPAQ-A8 has briefer and conceptually precise items, "I need to concentrate on getting rid of my pain", and "My life is going well even though I have pain" (though there is some similar phrasing to the latter in the CPAQ-8). We believe that the CPAQ-A8 is a superior instrument for adolescents, compared to the adult CPAQ-8, on the basis of its careful validation within adolescent samples, but also on the face validity of its items for the adolescent population.

This study evidently has limitations, apart from those already listed. With regard to item selection, we set out to create an 8-item scale in the style of the adult CPAQ-A, rather than choosing a different length (which would have been arbitrary). However, it could be argued that we could have used statistical criteria to determine scale length. Also, we used a simple item selection procedure where we selected the eight items that had the best item-total correlations and factor loading. Other methods are available, such as iterative processes where items are removed systematically and the scale re-analysed. In Confirmatory Factor Analysis, the fit index abbreviated as RMSEA should ideally fall below 0.06; it did not do so in Sample 2. It is of note that in CFAs of the adult CPAQ-8, and the full length CPAQ-A, RMSEAs of > 0.06 were observed and treated as acceptable on the basis of the overall pattern of fit indices. Also, our model achieved the best fit when covarying errors from two items within the Activity Engagement factor. This means that the error covariance, not associated with the factor, was correlated between the two items, possibly with some other unknown factor. Such covariance is usually ascribed to issues such as similarities in wording; we note that both items include the phrase "even though I have chronic pain", which may account for the correlation in errors, though this phrase could also reasonably be said to be related to the issue of Activity Engagement.

Clearly the new instrument would also benefit from having test-retest data, which we were not able to derive from the current data set. Neither the original CPAQ-A paper, nor the subsequent validation paper, nor the report on the adult CPAQ-8, reported test-retest coefficients. However, the CPAQ-A has performed well in the detection of treatment effects in two treatment studies (Gauntlett-Gilbert et al., 2013; Weiss et al., 2013)

One further limitation was highlighted in the Lauwerier's review of acceptance instruments (Lauwerier et al., 2015); they noted that items labelled as indexing Pain Willingness were often reverse-keyed, and as such seemed to be better described as representing Pain Control. This is true of the new CPAQ-A8, where all four Pain Willingness items are reverse-keyed (e.g. "I need to concentrate on getting rid of my pain"). The tendency to reverse-score willingness items has likely arisen from the difficulties in phrasing items in an acceptable and comprehensible way for treatment-naïve patients. Before exposure to acceptance-based treatment, it can seem strange or counterintuitive to take a posture of active willingness towards pain – for example an item such as "I can let my pain be present without needing to change it" makes a good deal of sense after ACT or mindfulness-based treatment, but less so beforehand. Thus, investigators have tended to choose more immediately comprehensible reversed items (e.g. McCracken, Vowles & Eccleston, 2004). This is not necessarily a problem from the point of view of ACT theory, where control and acceptance are regarded as exact opposites; there is no deliberate reduction of pain control that is not regarded as an increase in willingness, in ACT theory (Hayes, Luoma, Bond, Masuda & Lillis, 2006). However, if future research were to show that pain control is not simply an opposite of acceptance, for example that it entailed factors that could not solely be described as 'anti-accepting', then the new scale would be open to criticism.

In summary the CPAQ-A8 performs well, given its relative brevity, and differs from the adult CPAQ-8 in ways that seem developmentally appropriate. Brief questionnaires reduce clinician and patient workload in a clinical setting and the brevity of the CPAQ-A8 is also useful in a research context, where repeat administration (for example in treatment process research) becomes less burdensome for participants. Future research could take advantage of this and explore the separate roles of Pain Willingness and Activity Engagement in mediating positive treatment outcomes.

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Appendix - New CPAQ-A8

0 – Never true
1 - Rarely True
2 - Sometimes True
3 - Often True
4 – Always True

1. I am getting on with my life no matter what my level of pain is	0	1	2	3	4
2. My life is going well, even though I have chronic pain	0	1	2	3	4
3. I am living a normal life with my chronic pain	0	1	2	3	4
4. I need to concentrate on getting rid of my pain	0	1	2	3	4
5. I do things that are important and things that are fun even though I have chronic pain	0	1	2	3	4
6. Keeping my pain under control is the most important thing whenever I am doing something	0	1	2	3	4
7. Before I can make any real plans, I have to get some control over my pain	0	1	2	3	4
8. I avoid situations where pain might increase	0	1	2	3	4

Items 1, 2, 3, 5 – Activity Engagement. Items 4, 6, 7, 8 – Pain Willingness

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Table 1: Demographics

	Sample 1 (N = 187)	**Sample 2 (N = 159)**
Age	15.1 (3.3)	15.6 (2.1)
Gender (%)	68.2% F	74.9% F
Ethnicity (white %)	97.8%	95%
Pain duration (median)	4.0 yrs	3.2 yrs
Attending school full time	34.6%	33.6%
Weeks absent from education (median)	21	28
Number of half days missed per week	3.6 (2.5)	4.4 (2.6)
Average pain (0-10 NRS)	7.3	7.7
Diagnostic category		
- *Diffuse / localised idiopathic pain*	41.1	26.8
- *Complex Regional Pain Syndrome*	25.7	21.3
- *Back pain*	10.9	16.5
- *Abdominal pain*	6.9	11.8
- *Pain associated with hypermobility*	5.1	12.6
- *Other (e.g. headache)*	10.3	11.0

Table 2: Coefficients from Confirmatory Factor Analysis, Sample 1

Model	*No. of items*	*Chi2*	*df*	*RMSEA*	*RMSEA (90%)*	*TLI*	*CFI*	*GFI*	*AGFI*	*AIC model*
Sample 1										
1-factor CPAQ-A	20	920.14	170	0.156	0.146 – 0.166	0.375	0.440	0.532	0.422	1000.14
2-factor CPAQ-A	20	292.03	169	0.063	0.051 - 0.075	0.897	0.908	0.864	0.831	374.03
2-factor CPAQ-A8	8	37.90	19	0.074	0.039 – 0.108	0.953	0.968	0.953	0.912	71.90
2-factor CPAQ-A8 with correlated errors[1]	8	23.83	18	0.042	0.000 – 0.083	0.982	0.990	0.969	0.939	59.83
Sample 2										
2-factor CPAQ-A8	8	38.48	19	0.082	0.044 – 0.119	0.939	0.958	0.946	0.898	72.48
2-factor CPAQ-A8 with correlated errors[2]	8	29.74	18	0.066	0.014 – 0.106	0.961	0.975	0.955	0.909	65.74

1. Covarying the error terms between items 2 and 5 within the Activity Engagement factor
2. Covarying the error terms between items 3 and 5 within the Activity Engagement factor

Table 3: CPAQ-A8 scores in both samples

	Mean	SD	IQR	Alpha
Sample 1				
Total	23.2	5.1	20 – 27	.73
Activity Engagement	7.0	3.1	5 – 9	.84
Pain Willingness	16.2	4.0	13 – 19	.85
Sample 2				
Total	20.4	5.5	17 – 24	.83
Activity Engagement	7.0	3.3	5 – 9	.74
Pain Willingness	13.4	3.2	11 – 16	.86

Table 4: Correlations with functioning and distress

	CPAQ-A8	CPAQ-A (full length)
Social functioning	.53**	.52**
Physical functioning	.38**	.35**
Depression	-.53**	-.56**
General Anxiety	-.52**	-.54**
Pain-Specific Anxiety	-.64**	-.67**
Family Functioning	-.31**	-.27*
Development	-.49**	-.47**

- * $p < 0.01$, ** $p < 0.001$

Table 5: Hierarchical regression coefficients

Block	Predictor	Beta (final)	ΔR^2	R^2
Social functioning				
1.	Age	.04	.04	
	Age at onset	.04		
	Sex	.13		
	Usual Pain	.00		
2.	CPAQ-A8	.51***	.25	.30
Physical functioning				
1.	Age	.07	.07	
	Age at onset	.03		
	Sex	.01		
	Usual Pain	.18*		
2.	CPAQ-A8	.36***	.12	.19
Depression				
1.	Age	.09	.07	
	Age at onset	.16*		
	Sex	.05		
	Usual Pain	.01		
2.	CPAQ-A8	.51***	.25	.32
General Anxiety				
1.	Age	.03	.08	
	Age at onset	.11		
	Sex	.16*		
	Usual Pain	.02		
2.	CPAQ-A8	.48***	.22	.30
Pain-specific anxiety				
1.	Age	.02	.05	
	Age at onset	-.03		
	Sex	.14*		
	Usual Pain	.01		
2.	CPAQ-A8	.63***	.38	.42
Family functioning				
1.	Age	.13	.02	
	Age at onset	-.08		
	Sex	-.02		
	Usual Pain	-.02		
2.	CPAQ-A8	.30***	.09	.11
Development				
1.	Age	.11	.05	
	Age at onset	.04		
	Sex	.05		
	Usual Pain	.07		
2.	CPAQ-A8	.45***	.20	.25

- * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$