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# Willing and Able: A Closer Look at Pain Willingness and Activity Engagement on the Chronic Pain Acceptance Questionnaire (CPAQ-8)

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**Abstract: An 8-item version of the Chronic Pain Acceptance Questionnaire (CPAQ-8) has recently been proposed and validated. The aims of this study were to further investigate the reliability and validity of the CPAQ-8 in a new sample. Questionnaires were completed by 550 people with chronic pain (478 online survey, 72 paper survey). A demographic and pain history questionnaire was administered along with the CPAQ-8 and measures of pain self-efficacy, pain catastrophizing, psychological flexibility in pain, anxiety, and mood. In addition, 105 respondents completed the CPAQ-8 within 6 weeks to provide test-retest reliability data. The 2-factor structure of the CPAQ-8 (Activity Engagement [AE] and Pain Willingness [PW]) was confirmed and had reasonable-to-good scale score reliability and test-retest reliability. Pain acceptance as measured by the CPAQ-8 was associated with less depression, anxiety, pain interference, fear of reinjury, pain catastrophizing, and psychological inflexibility in pain, and higher levels of satisfaction with life, pain self-efficacy, and general acceptance. Furthermore, pain acceptance fully mediated the relationship between reported pain severity and emotional distress (anxiety and depression) and partially mediated the relationship between pain severity and pain interference in a structural equation model. The test-retest reliability after 4 to 6 weeks ranged from .68 for PW to .86 for AE; the overall score correlation was .81. We conclude that the CPAQ-8 is a reliable and valid measure of pain acceptance and that the 2 subscales of the measure each make an individual contribution to the prediction of adjustment in people with chronic pain.**

***Perspective:* *The present study provides further evidence for the reliability and validity of the CPAQ-8. Support was found for the 2 related subscales, PW and AE, which appear to work in synergy to influence levels of pain interference and emotional distress in people living with chronic pain.***



***Key words:*** *Chronic pain, pain acceptance, psychological flexibility, pain measurement.*

Chronic pain affects a substantial proportion of the population[4] and is associated with an increased psychological[43] and economic burden.[44] Psychological variables are well-known influences on pain perception and pain adjustment,[20] especially processes that lead to avoidance of activity in order to reduce pain.[12] Acceptance and Commitment Therapy (ACT) seeks to enhance psychological flexibility: "the ability to contact the present moment more fully as a conscious human being, and to change or persist in behavior when doing so serves valued ends."[23] Evidence is accumulating for the effectiveness of ACT for a range of conditions,[29,42] especially chronic pain.[13,31,50,54,56] The Society of Clinical Psychology (APA Division 12) has recently stated that there is "strong research support" for ACT in the treatment of chronic or persistent pain.[49]

There are 6 interrelated ACT processes that together are considered to constitute psychological flexibility (acceptance, cognitive diffusion, being present, self as context, values, and committed action). Acceptance in the context of chronic pain involves being able to experience ongoing pain without attempts to avoid, reduce, or otherwise control it.[32] Acceptance is the antithesis of experiential avoidance, which is manifest when individuals

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get absorbed by repeated attempts to control and avoid pain, with the result that pain becomes more dominant and disruptive, while valued activities are neglected.[22]

The Chronic Pain Acceptance Questionnaire (CPAQ)[32] represents one of the ways that acceptance has been operationalized and measured in the context of chronic pain. The CPAQ measures 2 facets: 1) engaging in valued daily activities in the presence of pain (activity engagement [AE]); and 2) disengaging from the struggle to control or avoid pain (pain willingness [PW]).[32] A short-form of the CPAQ, the CPAQ-8, has recently been developed and validated,[18] showing the same factor structure as the 20-item version and with good reliability and validity. Given that psychometric testing is an incremental process, further evaluation of the measure, including an assessment of test-retest reliability and replication of results reported in Fish et al,[18] is warranted.

Though the factor structure has been questioned,[36] the dimensionality of the CPAQ and variations including the CPAQ-8 and CPAQ adolescent version (CPAQ-A)[53] have support from a number of studies employing confirmatory factor analysis.[2,18,52,53,59] Nevertheless, some concerns about the utility and relative contributions of each subscale have been raised by researchers,[36,59] and reports from studies using Spanish[45] and Chinese[38] translations of the CPAQ suggest that the 2 subscales are uncorrelated and independent, while evidence from other studies using the original English measure suggests 2 related factors.[18,33,52,59]

One question that has yet to be explored in relation to the CPAQ concerns whether artifactual dimensions may be attributed to item format or wording. In particular, the inclusion of reverse-scored items can result in the appearance of factors that do not reflect theoretically meaningful dimensions.[6,9,19,46] The AE subscale consists solely of positively worded items, while those from the PW subscale are all negatively worded in the CPAQ, CPAQ-A, and CPAQ-8. However, no study has yet tested whether the 2 identified factors are a result of positively and negatively worded items rather than substantively meaningful factors.

The current study offered the following incremental advances: 1) it examined the internal structure of the CPAQ-8, including the meaningfulness of, and relationship between, factors; 2) it assessed the test-retest reliability of the CPAQ-8; and 3) it investigated the associations between scores on the CPAQ-8 and key cognitive-behavioral variables identified in the chronic pain literature[24] and contextual cognitive-behavioral variables such as general acceptance, pain self-efficacy, fear of movement (re)injury, and psycholological flexibility in pain. In addition, this study explored indirect effects of AE and PW (separately and in combination), as measured by the CPAQ-8, in the association between pain severity and physical and psychological functioning.

# Method

## *Procedure*

Ethical approval was received from the senior author's Research Ethics Board and informed consent was obtained from each participant. The study had 3 independent samples: paper-and-pencil, online, and a subset of the online sample that was used for test-retest purposes. The paper-and-pencil sample consisted of members of a chronic pain information and support organization who responded to postal questionnaires. Online participants completed a survey made available on the web (Surveymonkey.com).[17] Links to the questionnaire were advertised through chronic pain discussion groups, forums, and websites. A subset of the online sample also responded to e-mails inviting them to complete a follow-up online questionnaire 4 to 6 weeks after the first administration of the CPAQ-8.

Inclusion criteria were that participants be over 18 years of age and have chronic pain, as per the definition provided by the International Association for the Study of Pain, for at least 3 months. The questionnaire took approximately 20 to 25 minutes to complete and responses were anonymous unless respondents opted to be contacted about further related research, in which case personal details were stored securely.

## *Participants*

The online sample consisted of 716 people. One hundred fifty-two respondents exited the survey before completing any questions at all, while another 48 answered demographic questions and some of the questionnaire before exiting. All of these individuals (n = 200) were excluded. A further 27 cases had more than 15% of the CPAQ-8 questions missing and thus were removed. An additional 11 cases were excluded for the following reasons: 1 reported cancer as a primary cause of pain; 1 person was under the age of 18; 2 reported that they had not experienced pain in the previous 3 months; and 7 were found to be repeat participants. Excluding these respondents led to a final online sample of 478. Similar criteria were applied to the 77 paper-and-pencil respondents, resulting in the exclusion of 5 cases (n = 72). Thus, the total number of respondents was 550 (approximately 67% of the original online sample and 94% of the paper-and-pencil respondents). Only 1 statistically significant difference in the sociodemographic items was observed between those included and those who started the survey but were excluded for any reason: those excluded were less likely to be working.

The 478 respondents that comprised the online sample were from a number of different regions including the USA (30.1%), Ireland (30.1%), England (21.4%), Canada (6.4%), Australia (5.4%), Scotland (3.5%), Wales (1.4%), and New Zealand (1%). A subset of these respondents (n = 105) constituted the test-retest sample. The 72 paper-and-pencil respondents all resided in Ireland. Sociodemographic characteristics and pain-related information for all groups are summarized in Table 1.

When the online and paper-and-pencil samples were compared and tested for differences in sociodemographic and pain-related characteristics, the paper-and-pencil sample was found, after Bonferroni correction, to be significantly older than the online sample (means = ages 53 and 43, respectively, $t [548] = 6.26$, $P < .001$, $r = .35$). However, no differences were found for total pain duration, number of sites of pain, or pain

**Table 1. Sample Characteristics**

| | Internet Sample | Paper-and-Pencil Sample | Test-Retest Subsample |
|---|---|---|---|
| | Mean (SD) or % n = 478 | Mean (SD) or % n = 72 | Mean (SD) or % n = 105 |
| Age (years) | 42.8 (12.3) | 52.63 (14.1) | 47.3 (10.36) |
| Pain duration (months) | 191.6 (1106.1) | 141.55 (118.6) | 162.28 (168.60) |
| Female | 80.5 | 73.2 | 85.6 |
| Married/cohabiting | 49.8 | 52.8 | 53.3 |
| Primary pain location | | | |
| Lower limbs | 12.3 | 18.1 | 15.3 |
| Upper limbs | 6.1 | 4.2 | 4.9 |
| Chest | 1.4 | 1.4 | 1.0 |
| Back and neck | 39.5 | 51.4 | 36.3 |
| Abdomen | 5.3 | 5.6 | 1.0 |
| Head | 5.1 | 8.3 | 2.9 |
| Joints/bones/muscles | 17.3 | 7.0 | 31.5 |
| Other | 13.0 | 4.0 | 7.1 |
| Work status affected by pain | 57.8 | 64.6 | 62.1 |
| Not working | 52.3 | 72.2 | 58.9 |
| Working full-time | 20.4 | 15.3 | 20.0 |
| Working part-time | 16.3 | 4.2 | 17.9 |
| Studying | 11.0 | 4.2 | 3.2 |
| Education level | | | |
| Primary | 2.7 | 5.6 | 2.9 |
| Secondary/high school | 30.5 | 58.3 | 35.9 |
| Tertiary/college | 66.7 | 36.1 | 61.2 |
| Primary cause of pain | | | |
| Arthritis/osteoarthritis | 7.2 | 7.0 | 7.9 |
| Fibromyalgia | 31.3 | 11.1 | 42.9 |
| Headaches/migraine | 3.5 | 6.9 | 1.0 |
| Nerve damage/pain | 14.1 | 27.8 | 16.2 |
| Disc problems | 7.4 | 18.1 | 1.0 |
| Sciatica | 1.6 | 0 | 0 |
| Postsurgical pain | 2.0 | 0 | 2.9 |
| Traumatic injury | 8.6 | 5.6 | 8.6 |
| Neuropathy | 2.0 | 6.9 | 2.9 |

NOTE. Participants could endorse multiple sites and causes of pain.

severity. In comparison to the paper-and-pencil sample, the online sample were more likely to answer yes to the question "Have you been diagnosed with depression or anxiety?" [$\chi^2$ (1, N = 545) = 8.96, *P* = .003, Cramer's V = .13]; to have reached tertiary level education [$\chi^2$ (1, N = 537) = 24.85, *P* < .001, Cramer's V = .22]; to be working [$\chi^2$ (1, N = 524) = 8.90, *P* = .003, Cramer's V = .13]; and were less likely to be retired [$\chi^2$ (1, N = 524) = 25.17, *P* < .001, Cramer's V = .22]. The samples did not differ in terms of gender composition, marital status, or likelihood of being in receipt of disability payments. Effect sizes for sample differences were small to moderate. Given the small size of the paper-and-pencil sample, modest differences in terms of sociodemographic characteristics, and evidence of invariance of the CPAQ-8 across paper-and-pencil and online samples,[18] the 2 groups were combined for all analyses.

## *Measures*

### Demographics and Chronic Pain details

Participants were asked to supply details regarding age, gender, occupational status, and relationship status as well as duration of chronic pain, site(s) of chronic pain, and cause of chronic pain. Some details about medical and alternative treatment were requested, with items modeled after a survey of chronic pain in Europe.[4]

### Acceptance

The Acceptance and Action Questionnaire-II (AAQ-II)[5] contains 10 items and is designed to assess acceptance of undesirable thoughts and feelings. The AAQ-II also has been described as a measure of experiential avoidance, general acceptance, or psychological flexibility and contains statements such as: "My painful experiences and memories make it difficult for me to live the life that I would value"; and "I am in control of my life." Participants rate statements on a scale from 1 (never true) to 7 (always true). Total scores range from 10 to 70, with higher scores denoting greater psychological flexibility. A unidimensional factor structure was confirmed in the development study,[5] as well as in subsequent research with a chronic pain sample.[32] Good scale score reliabilities have been reported[5,33] (ie, Cronbach's alpha coefficients were .83 and .89, respectively), and construct validity is suggested by predicted relationships with measures of emotional distress and related constructs such as pain acceptance and mindfulness.[33]

## Anxiety and Depression

The Hospital Anxiety and Depression Scale (HADS)[63] contains 14 items and was designed for use in medical outpatient clinics. This measure evaluates severity of anxiety and depression without contamination of scores by reports of physical symptomatology. Each item is scored from 0 to 3 with total scores ranging from 0 to 21 for both anxiety and depression. Higher scores indicate greater levels of each construct. The HADS possesses good psychometric properties and has been assessed for use in musculoskeletal patients[41] and people living with spinal cord injury,[61] though in both instances item 7 ("I can sit at ease and feel relaxed") was found to be somewhat problematic. Administration of the HADS in an Internet sample also has been shown to provide valid data.[1]

## Fear of Movement/(re)injury

The Tampa Scale for Kinesiophobia (TSK)[26] assesses fear of movement and (re)injury and consists of 2 subscales: Harm (eg, "I'm afraid that I might injure myself accidentally") and Fear Avoidance (eg, "No one should have to exercise when he/she is in pain"). For this study, a 13-item version[10] was used. Items are rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree), with total scores ranging from 13 to 52. Higher scores indicate more fear.

## Pain Acceptance

The CPAQ[32] is a 20-item inventory measuring acceptance of pain. This measure has 2 subscales: AE and PW. Participants rate items on a scale from 0 (never true) to 6 (always true). Higher scores denote greater AE and PW. Studies indicate satisfactory-to-excellent reliability ($\alpha$ = .72–.91) and validity is suggested by strong correlations with measures of avoidance, distress, and daily functioning.[18,32,55,61] Recent confirmatory factor analyses offer further support for the 2-factor structure of the CPAQ.[52,59] The items comprising the short version of the CPAQ, known as the CPAQ-8,[18] are contained within the full version of the scale.

## Pain Catastrophizing

The Pain Catastrophizing Scale[47] is a 13-item scale with a 0- ("not at all") to 4- ("all the time") point response format. The scale appears to have 3 components: 1) rumination (eg, "I anxiously want the pain to go away"); 2) magnification (eg, "I become afraid that the pain will get worse"); and 3) helplessness (eg, "It's terrible and I think it's never going to get any better"). The overall score ranges from 0 to 52 with higher scores indicating more catastrophic thoughts or feelings. Support has been found for the 3-factor structure following confirmatory factor analysis, with evidence of convergent and discriminant validity in undergraduate, adult community, and pain outpatient samples.[39,40] The scale also evidences adequate test-retest reliability.[28]

## Pain Severity and Interference

The Brief Pain Inventory (BPI)[11] was initially developed for assessing cancer-related pain but has since been validated in a sample with chronic nonmalignant pain.[48] The BPI has 2 subscales capturing the extent to which pain interferes with various aspects of life (7 items including, for example, general activity, mood, walking ability, normal work, and relations with other people) and level of pain severity (4 items). Respondents rate their pain severity or interference on a scale from 0 (no pain) to 10 (pain as bad as you can imagine). Higher scores indicate greater interference or more severe pain. Good scale score reliability has been reported for each subscale ($\alpha$ = .85 for the Severity and .88 for the Interference scale), and expected relationships between these subscales and a measure of disability have been reported.[48]

## Pain Self-Efficacy

The Pain Self-Efficacy Questionnaire (PSEQ)[35,36] measures pain specific self-efficacy beliefs. This scale has 10 items (eg, "I can enjoy things, despite the pain") to which people respond using a 7-point scale from 0 (not at all confident) to 6 (completely confident). Scores range from 0 to 60 with higher scores denoting stronger pain self-efficacy beliefs. The PSEQ has satisfactory psychometric properties with reliability and validity reflected in strong correlations with relevant measures of pain-related disability and coping strategies.[36]

## Psychological Inflexibility in Pain

The Psychological Inflexibility in Pain Scale (PIPS)[60] is a 16-item measure with 2 subscales capturing avoidance of pain and related distress, and cognitive fusion with pain. The latter construct refers to acting on presented thoughts as if they were true. Participants are asked to rate statements such as "I cancel planned activities when I am in pain" (avoidance subscale) or "I need to understand what is wrong in order to move on" (cognitive fusion subscale) from 1 (never true) to 7 (always true). A 2-factor solution emerged in the scale development study following principal components analysis, with the resulting subscales having Cronbach's alpha coefficients of .90 (avoidance) and .75 (cognitive fusion).[60] Correlation analyses showed that the avoidance subscale was significantly related to 4 subscales of the Multidimensional Pain Inventory (MPI) including pain severity, interference, life control, and affective distress as well as the subscales of the short-form health survey (SF-12) and a quality of life question. Cognitive fusion showed a similar pattern of correlations, though no statistically significant association with the MPI affective distress subscale was found. Participants with continuous pain reported higher scores on both subscales than those with recurrent pain, while those with whiplash had significantly higher avoidance and total scale scores.[60] A recent follow-up study resulted in validation of a 12-item version of the PIPS (henceforth labeled PIPS-12 and used for analysis in this study) following exploratory and confirmatory factor analysis.[55] Evidence for construct validity was provided by strong correlations with the CPAQ and the TSK.[55]

## *Data Analytic Procedures*

The sequence of testing outlined in the current study adhered to the stages of construct validation identified and elaborated by Benson.[3] First, the substantive stage reflects the definitions and operationalization of the theoretical and empirical domains of the construct. The CPAQ-8 is described as a measure of acceptance and seems to capture 2 nuances of this process: AE and PW.

The second stage required an investigation of the internal structure of the CPAQ/CPAQ-8, which has support from a number of studies including some employing confirmatory factor analysis (CFA).[18,52,59] However, no study has tested the interpretation that the 2 factors of the CPAQ, and by extension the CPAQ-8, are a result of positively and negatively worded items rather than substantively meaningful factors. Furthermore, questions have been raised about the exact nature of the relationship between the subscales, with some studies suggesting 2 related factors and others finding 2 independent, unrelated factors.[2,38,45]

Finally, the meaningfulness of the construct under examination, in this case, pain acceptance, needs to be established in terms of its relationship with other variables. Measures have been included that reflect some of the prominent cognitive-behavioral constructs identified in chronic pain literature.[24] Support has been found for a model in which pain acceptance variables mediated the relationship between pain severity and outcomes, which is consistent with a contextual interpretation.[18] However, this model should be replicated for purposes of cross-validation. McCracken[30] articulated the need to consider acceptance in the context of chronic pain as the mutual interaction of AE and PW, and thus a model in which pain acceptance is the mediator (rather than PW and AE separately) will be tested.

In Fish et al[18] and the current study, cross-sectional data are used to explore relationships among variables in a logically specified mediational sequence. The terms mediator and mediation are used throughout to suggest plausible indirect/directional effects, the temporal and causal sequence of which will need to be confirmed using longitudinal or intervention data in future research.

## *Analysis Strategy*

Following the strategy of Bryant,[7] the fit of competing models was assessed for pain acceptance (CPAQ-8) using CFA to establish the most appropriate factor structure. Correlations were examined to assess the degree of convergent and discriminant validity using the guidelines of Grewal et al.[21] Finally, a model examining indirect effects based on the one previously investigated by Fish et al[18] was tested for the purpose of cross-validation and adjusted to assess the mediating role of overall pain acceptance.

### CFA

For CFA, the total sample was randomly split in 2 (ensuring even proportions of paper-and-pencil and online responses in each) resulting in 2 subsamples: subsample 1 (calibration sample) and subsample 2 (validation sample). With subsample 1 (n = 275) CFA was employed to test the adequacy of the previously supported 2-factor model of the CPAQ-8. For purposes of comparison with the 2-factor model, a 1-factor model in which all items were specified to a single factor also was estimated. In the case of the CPAQ-8 all AE items are positively worded, while all PW items are negatively worded, which may affect factor structure. Thus, an additional model for item wording effects was assessed. Schriesheim and Eisenbach[46] state "…CFA should be considered the analytic method of choice in research on item format effects" and Brown[6] argues that of the 2 possible methods for testing such effects, the correlated uniqueness approach, whereby error covariances are freely estimated, is preferred. Thus, a 1-factor model also was specified with the inclusion of freely estimated error covariances for items that were negatively worded (reverse scored), as well as a model in which a method effect was specified for positively worded items. Subsample 2 (n = 275) was used to cross-validate the resulting model.

### Structural Equation Modeling (SEM)

SEM was conducted in 2 steps whereby the structural regression model was first specified as a measurement model before the structural components were investigated. SEM models were evaluated using a number of recommended goodness-of-fit indices: the bootstrap adjusted chi-square ($\chi^2$) and Bollen-Stine bootstrap *P* value (both of which are highly sensitive to sample size); root-mean-square-error-of-approximation (RMSEA), Tucker-Lewis index (TLI), comparative fit index (CFI), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), and the Akaike information criteria (AIC). Guidelines suggest that RMSEA values less than .08 reflect adequate fit, with values less than .06 indicating good fit.[8,25] For TLI, CFI, GFI, and AGFI, values closer to 1 are better, with values above .90 indicating acceptable fit and values above .95 suggesting good fit (except in the case of the AGFI, which adjusts for degrees of freedom and suggests good fit when it is above .80).[8,25] The consistent Akaike information criterion (CAIC) was used to compare models, as this index is based on AIC but takes sample size into account, with smaller values representing a better fit. Finally, the parsimony normed fit index (PNFI) also was evaluated when choosing between alternative models, with higher values indicating more parsimonious fit.[8]

# Results

## *Data Preparation and Preliminary Analysis*

Missing value analysis in SPSS (SPSS Inc, Chicago, IL) was conducted followed by the expectation maximization (EM) algorithm for imputing missing data for the overall sample, and separately for the test-retest data. For the total sample, missing data ranged from 0 to 4.7% missing per variable, and Little's missing completely at random (MCAR) test was statistically significant ($P < .001$), suggesting that data were not missing completely at random. Although there is no statistical way of determining that data are missing at random, EM is

**Table 2. Confirmatory Factor Analyses of CPAQ-8, Subsamples 1 and 2**

| Model | No. of Factors | No. of Items | $X^2$ (B-S) | Df | CMIN | RMSEA | 90% CI | PNFI | TLI | CFI | GFI | AGFI | CAIC Model |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsample 1 (N = 269) | | | | | | | | | | | | | |
| Model 1 | 1 | 8 | 205.04 | 20 | 10.25 | .19 | .16–.21 | .54 | .68 | .77 | .82 | .67 | 310.55 |
| Model 2 | 2 | 8 | 57.12 | 19 | 3.01 | .09 | .06–.11 | .63 | .93 | .95 | .95 | .90 | 169.23 |
| Model 2a | 2 | 8 | 39.76 | 18 | 2.21 | .07 | .04–.10 | .61 | .96 | .97 | .97 | .93 | 158.47 |
| Model 2b | 2 | 8 | 32.68 | 17 | 1.92 | .06 | .03–.09 | .58 | .97 | .98 | .97 | .94 | 157.98 |
| Model 3a | 1 | 8 | 22.17 | 14 | 1.58 | .05 | .00–.08 | .49 | .98 | .99 | .98 | .95 | 167.25 |
| Model 3b | 1 | 8 | 26.67 | 14 | 1.91 | .06 | .02–.09 | .48 | .97 | .98 | .98 | .94 | 172.24 |
| Subsample 2 (N = 266) | | | | | | | | | | | | | |
| Model 2 | 2 | 8 | 57.12 | 19 | 3.01 | .09 | .06–.11 | .63 | .93 | .95 | .95 | .90 | 169.23 |
| Model 2a | 2 | 8 | 28.16 | 18 | 1.56 | .05 | .00–.08 | .62 | .98 | .99 | .97 | .95 | 146.66 |
| Model 2b | 2 | 8 | 26.40 | 17 | 1.55 | .05 | .00–.08 | .59 | .98 | .99 | .98 | .95 | 151.48 |
| Model 3a | 1 | 8 | 21.39 | 14 | 1.52 | .05 | .00–.08 | .49 | .98 | .99 | .98 | .95 | 166.23 |
| Model 3b | 1 | 8 | 27.44 | 14 | 1.96 | .06 | .03–.09 | .48 | .96 | .98 | .97 | .93 | 172.27 |

Abbreviations: CMIN, likelihood ratio chi-square; PNFI, parsimony normed fit index.

a recommended approach when this is thought to be the case as it results in less biased parameters.[15] Once the imputation process was complete, the overall dataset was randomly split in half. The 2 subsamples did not differ on any sociodemographic or pain variables.

Field[16] suggests that in the case of large samples it is better to inspect the shape of distributions than to rely on skewness and kurtosis statistics. Thus, in addition to the relevant values, distributions were inspected visually. Assessing normality in this way revealed that a number of items appeared to be skewed, while some evidenced kurtosis. Fifteen cases (6 from subsample 1 and 9 from subsample 2) on 3 PIPS items were found to be univariate outliers as they had z scores with an absolute value greater than 3.29, and these data were excluded from further analysis.[16] Evidence of multivariate non-normality of data, as assessed using Mardia's coefficient, meant that analyses were performed using bootstrap maximum likelihood estimation.

## CFA of the CPAQ-8

For purposes of comparison, a 1-factor model (model 1) with all items loading onto a single factor was specified first. Fit statistics for CFA models are shown in Table 2 and indicate that this model had poor fit, with RMSEA above .08; TLI, CFI, and GFI below .9; and AGFI below .8. In contrast, the fit of a 2-factor model (model 2) was a significant improvement as indicated by a chi-square difference test, $\Delta\chi^2$ (1) = 147.92, $P$ < .001. Fit statistics were generally satisfactory: $\chi^2$ (19) = 57.12, RMSEA = .09 (.06–.11), TLI = .93, CFI = .95, GFI = .95, AGFI = .90, and CAIC = 169.23. However, the RMSEA was still quite high and modification indices (MIs) were inspected for possible sources of poor fit. The highest MI value was for the error terms of items 2 ("Keeping my pain level under control takes first priority whenever I am doing something") and 7 ("I avoid putting myself in situations where my pain might increase"), which were deemed to have sufficient overlapping content to allow error covariance (model 2a). This adjustment, again, led to significantly improved fit; $\chi^2$ (18) = 39.76, RMSEA = .07 (.04–.10), TLI = .96, CFI = .97, GFI = .97, AGFI = .93, and CAIC = 158.47. Lastly, modification indices also suggested that items 7 and 8, "My worries and fears about what pain will do to me are true," overlapped. In Fish et al,[18] it was decided not to allow this modification to the model; however, as this item pair has recurred in the new sample it seems unlikely that this is a chance pairing. A look at item content suggests that reasonable overlap and error was permitted to covary in model 2b, resulting in significant improvement in model fit: $\chi^2$ (17) = 32.68, RMSEA = .06 (.03–.09), TLI = .97, CFI = .98, GFI = .97, AGFI = .94, and CAIC = 157.98. This model was significantly better than 2a according to the chi-square difference test, $\Delta\chi^2$ (1) = 7.08, $P$ < .01 and CAIC, though the difference in CAIC was small.

This model was compared to 2, 1-factor models that incorporated possible wording effects[9] by specifying correlated error among negatively worded items (model 3a) or among positively worded items (model 3b). Both models were significantly better than model 2b according to the chi-square difference test; however, according to other indices, models 2b and 3b were almost identical, while 3a was slightly stronger. Interpretation is complicated when CAIC values were used to compare models, as model 2b was strongest (ie, it had the lowest CAIC value). These results appear to suggest a possible artifactual 2-factor structure resulting from a wording effect. Thus, a second factor may have emerged as a result of the way participants respond to negatively worded items (a method effect) rather than as a result of 2 theoretically salient dimensions.

However, this model was not replicated when tested in the validation sample. Fit indices are shown in Table 2 and a few observations are notable. First, model 2b was not significantly better than 2a in this sample when compared using the chi-square difference test. Second, model 2a had the lowest CAIC value of all models. When models 2a and 3a were compared they were found to be almost equivalent on most fit indices, with no statistically significant difference between models according to a chi-square difference test. Taken together with CAIC and PNFI values, which indicate that the 2-factor model is most parsimonious, the evidence seems to suggest that a 1-factor model with method effect does not provide an optimal representation of the data and that a 2-factor model should be retained.

**Table 3. Descriptive Statistics for CPAQ-8 in Subsamples 1 and 2**

| | Subsample 1 | | | Subsample 2 | | |
|---|---|---|---|---|---|---|
| CPAQ-8 | Activity Engagement | Pain Willingness | Total | Activity Engage | Pain Willingness | Total |
| α | .86 (.83–.89) | .74 (.69–.79) | .82 (.79–.85) | .85 (.82–.88) | .69 (.62–74) | .79 (.75–.83) |
| M | 12.38 | 8.53 | 20.91 | 12.39 | 8.75 | 21.13 |
| SD | 5.83 | 4.86 | 9.98 | 5.48 | 4.76 | 8.43 |
| Median | 13 | 8 | 21 | 13 | 9 | 21.50 |
| Mode | 17 | 9 | 19 | 12 | 7 | 22 |
| Percentiles | | | | | | |
| 25th | 8 | 5 | 14.81 | 8 | 5 | 14.96 |
| 50th | 13 | 8 | 21 | 13 | 9 | 21.50 |
| 75th | 17 | 12 | 27.50 | 16.25 | 12 | 27 |

## Reliability

Descriptive details and reliability coefficients for the CPAQ-8 in each subsample are shown in Table 3.

Scale and subscale mean scores and standard deviations were similar to those reported in the development study[18] with a tendency for lower means for PW than AE (despite the same possible range of scores). Adequate-to-good scale score reliability was indicated by Cronbach's alpha coefficients ranging from .69 to .86, with slightly lower reliability estimates for PW.

## CPAQ-8 Test-Retest Reliability

Test-retest reliability was assessed using the single measure intraclass correlation coefficients (ICCs), 1-way random effects model. ICCs were reasonable, ranging from .50 to .86, suggesting fair-to-good reliability. The single measure ICC for each item, subscale, and the total scale are shown in Table 4 and are similar to ICCs reported by Ning et al[38] and Rodero et al[45] based on administrations of the full CPAQ 2 weeks apart.

## Correlations

The relationship of the CPAQ-8 and its subscales to relevant validation measures including psychological inflexibility in pain, general acceptance, pain self-efficacy, catastrophizing, fear of movement/(re)injury, depression, anxiety, pain severity, and pain interference was examined using Pearson correlations (see Table 5). Due to the number of comparisons, correlations were considered to be statistically significant at a conservative $P < .001$. The CPAQ-8 and subscales did not correlate significantly with either age or pain duration. Moderate-to-high correlations in expected directions were observed between the CPAQ-8 (and subscales) and pain-related constructs including psychological inflexibility in pain, pain self-efficacy, catastrophizing, general acceptance, and fear of movement/re-injury. Further, higher pain acceptance was associated with less depression, anxiety, and pain interference. The magnitudes of the correlations obtained were generally consistent with those reported for the full CPAQ.[18]

When the magnitude of correlations between the CPAQ-8 subscales and the validation measures were compared, PW was found to be more strongly correlated with cognitive fusion (PIPS) and fear of pain/(re)injury (TSK) than AE, while AE was more strongly correlated with variables such as pain self-efficacy, depression, and pain interference.

## SEM

The CPAQ-8 development study[18] used SEM to test a model in which AE, and to a lesser degree, PW partially mediated the effect of pain severity on pain interference, depression, and anxiety. Given the process of respecification undertaken to achieve good fit in this initial study, the previously described model was assessed in the current study using the total sample (N = 550) for purposes of cross-validation and assessment of construct validity.

## Measurement Model

Before the structural portion of a causal model can be assessed, the validity of the measurement portion of the model needs to be tested.[8,25] The measurement model for these predictions was specified such that all latent variables were allowed to intercorrelate freely. Scale items were used to indicate latent constructs. In this case, 4 PW items (CPAQ-8), 4 AE items (CPAQ-8), 4 pain severity items (BPI), 7 pain interference items (BPI), 7 HADS anxiety, and 7 HADS depression items were modeled as indicators of their respective latent constructs to assess the appropriateness of chosen

**Table 4. Intraclass Correlation Coefficients for the CPAQ-8**

| Item/Subscale/Scale | Single Measure ICC (95% Confidence Interval) (Four to Six Weeks Apart) |
|---|---|
| Item 1 | .66 (.54–.76) |
| Item 2 | .58 (.44–.69) |
| Item 3 | .71 (.61–.80) |
| Item 4 | .63 (.50–.73) |
| Item 5 | .78 (.70–.85) |
| Item 6 | .68 (.56–.77) |
| Item 7 | .54 (.40–.67) |
| Item 8 | .50 (.33–.62) |
| Activity engagement | .86 (.80–.90) |
| Pain willingness | .68 (.56–.77) |
| CPAQ-8 total | .81 (.73–.86) |

**Table 5. Correlations Between CPAQ Scales and Pain, Emotional Distress, and Pain-Related Variables in the Sample (N = 535)**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Total pain acceptance (CPAQ-8) | — | | | | | | | | | | | | | |
| 2. Activity engagement (CPAQ-8) | .86 | — | | | | | | | | | | | | |
| 3. Pain willingness (CPAQ-8) | .80 | .38 | — | | | | | | | | | | | |
| 4. Acceptance (AAQ-II) | .48 | .45 | .33 | — | | | | | | | | | | |
| 5. Psychological inflexibility (PIPS) | −.78 | −.62 | −.68 | .57 | — | | | | | | | | | |
| 6. Avoidance (PIPS) | −.79 | −.66 | −.66 | −.60 | .96 | — | | | | | | | | |
| 7. Cognitive fusion (PIPS) | −.38 | −.22 | −.43 | −.32 | .65 | .40 | — | | | | | | | |
| 8. Catastrophizing (PCS) | −.57 | −.49 | −.46 | −.60 | .64 | .63 | .37 | — | | | | | | |
| 9. Pain self-efficacy (PSEQ) | .72 | .72 | .45 | .50 | −.69 | −.72 | −.29 | −.50 | — | | | | | |
| 10. Fear of movement/reinjury (TSK) | −.46 | −.32 | −.45 | −.47 | .55 | .54 | .30 | .53 | −.41 | — | | | | |
| 11. Depression (HADS) | −.63 | −.63 | −.39 | −.63 | .66 | .66 | .27 | .60 | −.70 | .46 | — | | | |
| 12. Anxiety (HADS) | −.38 | −.33 | −.31 | −.71 | −.50 | .48 | .23 | .61 | −.41 | .43 | .57 | — | | |
| 13. Pain interference (BPI) | −.51 | −.50 | −.34 | −.38 | .52 | .52 | .27 | .48 | −.58 | .33 | .55 | .34 | — | |
| 14. Pain severity (BPI) | −.27 | −.28 | −.17 | −.19 | .28 | .28 | .16 | .32 | −.41 | .17 | .32 | .23 | .61 | — |
| M | 21.01 | 12.38 | 8.63 | 46.45 | 76.21 | 43.35 | 32.86 | 31.91 | 29.96 | 7.71 | 9.09 | 6.43 | 44.97 | 17.76 |
| SD | 8.70 | 5.65 | 4.81 | 12.37 | 17.18 | 13.22 | 6.03 | 3.02 | 11.95 | 8.42 | 4.31 | 4.16 | 15.39 | 6.68 |

Abbreviations: PCS, pain castastrophizing scale; M, mean; SD, standard deviation.
NOTE. All correlations were significant at $P < .001$ level.

indicator variables. Previously described error covariances among BPI interference items and the exclusion of HADS item 7 were permitted (see Fish et al[18]), with adequate model fit similar to that reported in the previous study: $\chi^2$ (445) = 1,147.93, RMSEA = .05 (.05–.06), TLI = .91, CFI = .92, GFI = .88, and AGFI = .85. Given the results of the individual CFA for the CPAQ-8, the error terms for items 2 and 7 were permitted to covary, resulting in slightly improved model fit: $\chi^2$ (444) = 1,120.02, RMSEA = .05 (.05–.06), TLI = .91, CFI = .92, GFI = .88, and AGFI = .85.

## *Structural Model*

A model in which the relationship between pain severity and outcomes was fully mediated by AE and PW was tested first, with reasonable-to-poor overall model fit: $\chi^2$ (448) = 1,356.09, RMSEA = .06 (.06–.07), TLI = .88, CFI = .89, GFI = .86, and AGFI = .83. Next, a partially mediated model was tested by adding direct paths between pain severity and pain interference, anxiety, and depression, resulting in significant improvement in model fit: $\chi^2$ (445) = 1,201.14, RMSEA = .06 (.05–.06), TLI = .90, CFI = .91, GFI = .87, and AGFI = .85. The parameter estimates for the path from pain severity to anxiety and the correlation between pain interference and anxiety were not statistically significant. Removal of this path and covariance resulted in a very slight decrement in model fit that remained adequate overall: $\chi^2$ (446) = 1,207.59, RMSEA = .06 (.05–.06), TLI = .90, CFI = .91, GFI = .87, and AGFI = .85. The final model suggested that the extent to which level of pain severity affects degree of pain interference in functioning and depression is partially mediated by PW and AE. However, the association between pain and anxiety was fully mediated by AE and PW. Mean standardized path coefficients from bootstrapped samples are shown in Fig 1. Bootstrapping of maximum likelihood estimates showed minimal bias of parameter estimates (estimated bias for all standardized path coefficients <.003).

McCracken[30] emphasizes that pain acceptance requires the combined action of AE and PW. Thus, the same structural model was re-tested, this time with the secondary latent factor pain acceptance (indicated by the latent variables PW and AE, each of which was indicated by the relevant CPAQ-8 items) mediating the relationship between pain severity and outcomes (see Fig 2). Model fit was mostly good: $\chi^2$ (448) = 1,127.83, RMSEA = .05 (.05–.06), TLI = .91, CFI = .92, GFI = .88, and AGFI = .85; however, parameter estimates for paths from pain severity to anxiety and depression were not statistically significant. Removal of these paths did not significantly change model fit: $\chi^2$ (450) = 1,129.00, RMSEA = .05 (.05–.06), TLI = .91, CFI = .92, GFI = .88, and AGFI = .86. The final model and mean standardized path coefficients from bootstrapped samples are shown in Fig 2 and demonstrate the partial mediation of the relationship between pain severity and pain interference, and full mediation of the relationships between pain severity and emotional distress (depression and anxiety).

## Discussion

This study investigated the reliability and validity of the 8-item CPAQ-8 in a large, mixed, chronic pain sample accessed online and via postal survey. Results provide support for the dimensionality, reliability, and validity of the CPAQ-8, and demonstrate the influence of pain acceptance on the relationship between level of reported pain severity and outcomes including pain interference, depression, and anxiety. The 2-factor structure of the CPAQ-8 was confirmed using CFA, with 2 moderately correlated subscales resulting. While this model had good fit, a 1-factor model based on item wording had similarly good fit. However, other findings point to a 2-factor interpretation, including a moderate correlation

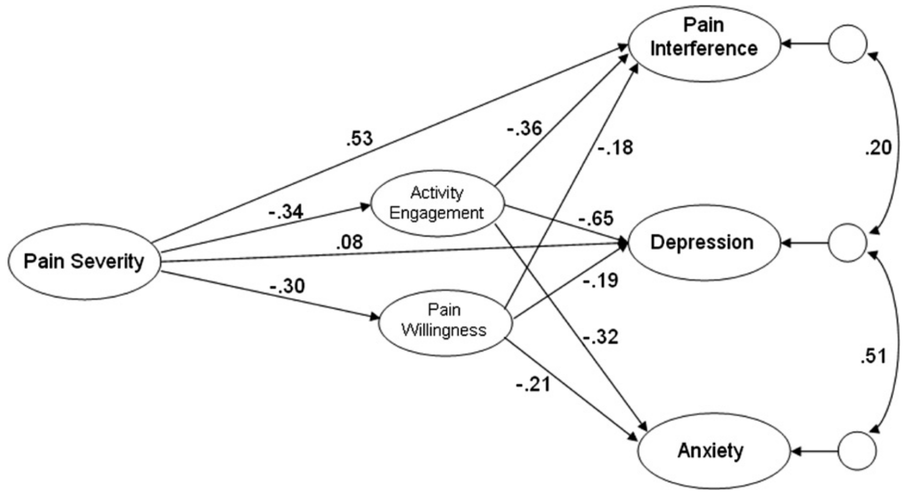


**Figure 1.** Cross validation—modified structural model showing mean standardized path coefficients from bootstrapped samples for the partial mediation of the relationship between severity and outcomes by pain acceptance variables (CPAQ-8 items).

between factors suggesting discriminant validity; theoretical meaningfulness and empirically demonstrated value of both subscales; differential relationships of the subscales with external variables; failure to support the superiority of the wording effect model in the validation sample; and the 2-factor structure offering a more parsimonious model.

The CPAQ-8 evidenced reasonable-to-good scale score reliability with Cronbach's alpha coefficients ranging from .69 to .86. Cronbach's alpha coefficients for CPAQ-8 PW were slightly lower than for AE (also see[18]). This slight difference is also often the case for the full form[18,32,37,59] and conforms to evidence suggesting that negative wording may affect reliability.[46] This difference in scale score reliability may partially account for findings indicating that AE is a stronger predictor of outcomes.[52]

Given the mixed findings of the confirmatory factor analysis, there appears to be no clear statistical indication of whether a 1-factor (with method effect for item wording) or 2-factor interpretation is preferred. Kline[25] notes that aside from statistical criteria in model evaluation, "other important considerations include model generality, parsimony, and theoretical plausibility." Thus, a number of other factors were taken into account when considering which model to pursue.

Firstly, across studies, the 2 subscales are only moderately intercorrelated ($r = .43$), suggesting a degree of discriminant validity. In studies of other measures, which incorporate analyses of wording effects, the appropriateness of a 2-factor structure has generally been rejected on the grounds that the resulting subscales were too highly correlated; for example, $r = .87$[6] or $r = .81$,[19] which, unlike in the case of the CPAQ-8, would suggest factorial redundancy.

Secondly, the PW factor represents a theoretically substantive construct that is proposed as a necessary adjunct to AE in the description of pain acceptance. PW reflects disengaging from the struggle to control or avoid pain,

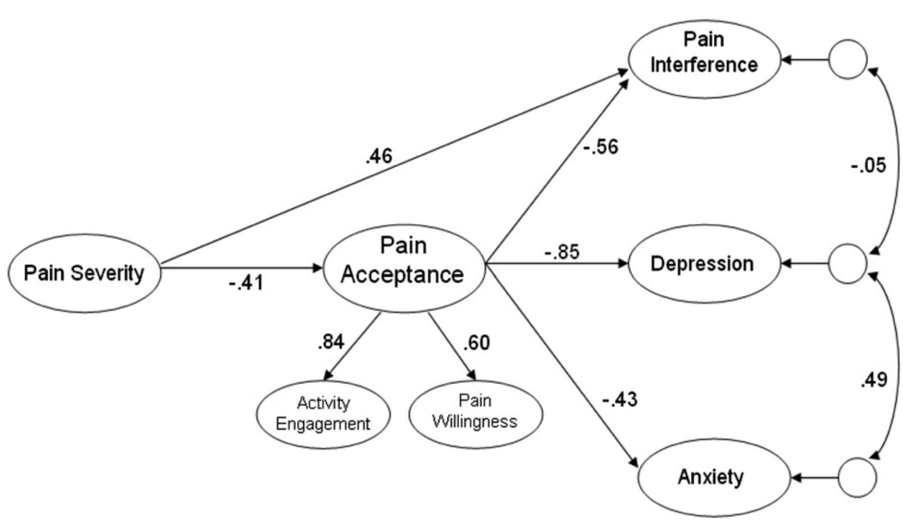


**Figure 2.** Structural model showing mean standardized path coefficients from bootstrapped samples for the mediation of the relationship between pain severity and outcomes by pain acceptance.

which is not the same as engaging in meaningful activities in the presence of pain. The alternative interpretation based on a single factor with wording effect would imply that the reverse scored PW items are simply capturing the opposite of AE. In his critique of the Penn State Worry Questionnaire,[34] for example, Brown[6] points to the "tenuous substantive meaning" of the second factor. However, such a criticism could not as easily be leveled at the CPAQ.

Finally, a number of studies using the CPAQ point to the unique contribution of both subscales (including Fish et al[18]). In particular, multiple regression analyses point to the incremental validity of the PW subscale after accounting for the contribution of AE (eg, Wicksell's study[60]). Cluster analysis seems to suggest that high AE with low PW is not as beneficial as high scores on both subscales.[52] In addition, PW has been demonstrated to moderate and partially mediate the influence of pain intensity on physical quality of life,[14] while differential relationships have been found between PW and AE and positive and negative affect.[27]

Although evidence has shown that the current CPAQ and CPAQ-8 are reliable measures, further improvements in reliability may be gained from creating a version with only positively worded items, or by adding positively worded PW items and negatively worded activity engagement items. Inclusion of positively worded PW items would result in a measure of PW with potentially higher reliability estimates, and permit testing the role that wording effects may play in the measurement of these constructs. As neither factor contained both positively and negatively worded items, one of the more stringent tests for wording effects could not be conducted (ie, modeling the 2 substantive factors as well as additional wording factors in the same CFA model). Evidence suggests that use of mixed-worded formats (eg, use of positively and negatively worded items) affects cross-cultural measurement equivalence, in particular for East Asian participants.[62] This may account for the unexpected findings by Ning et al[38] who, in their attempt to validate a version of the CPAQ for use with Chinese participants, found that the PW subscale did not correlate significantly with measures of depression, anxiety, and functioning in contrast to research carried out with English-speaking samples.

The CPAQ-8 appears to be relatively stable with fair-to-good test-retest reliability 4 to 6 weeks later for the overall scale and subscales. Certain items, as well as the PW subscale, evidenced lower test-retest correlations; however, results appear similar to previously reported ICCs for the full measure.[38,45]

Chronic pain acceptance, as measured by the CPAQ-8, is associated with less depression, anxiety, pain interference, fear of (re)injury, pain catastrophizing, and psychological inflexibility in pain, and higher levels of pain self-efficacy and general acceptance. The small negative correlations with pain severity replicate findings for the full form and suggest that higher acceptance is not simply a product of less severe pain. The magnitude of correlations was generally in keeping with those reported in full-form CPAQ studies. The PW subscale had higher correlations with overall psychological inflexibility (PIPS) (and in particular the cognitive fusion subscale) and fear of movement/reinjury (TSK) than AE. As might be predicted, AE had slightly higher correlations with general acceptance, catastrophizing, and pain self-efficacy, suggesting unique roles for each factor.

Findings following SEM analysis suggest that acceptance is more than the sum of its parts and that the action of the 2 acceptance processes in combination is important.[30] Each subscale makes an individual contribution to the prediction of emotional distress and degree of pain interference; and in the proposed SEM model, acceptance partially mediates the relationship between pain and depression and pain and interference, and fully mediates the relationship between pain severity and anxiety and pain severity and depression. These findings generally replicate those reported in the CPAQ-8 development study, though the direct effect of pain on anxiety evident in that mediation model was not evident here. However, the pattern seen for overall acceptance differs from that seen for its individual factors. When modeled as a global construct, pain acceptance fully mediates the relationship between pain and emotional distress, and partially mediates the relationship between pain and pain interference. The influence of pain on interference/disability and emotional distress seems to depend on the degree of pain acceptance. Research using the CPAQ has clarified that activity avoidance (ie, activity disengagement) is most detrimental when it is combined with, or driven by, a need to control or eliminate pain (pain unwillingness).[52] When AE takes place, it can occur with a number of underlying qualities that suggest a lack of willingness (eg, denial, defiance, frustration, or anger); however, without PW, engagement cannot be considered acceptance.[30] Findings of the SEM analysis lend support to the described, subtle interactions between PW and AE.

While this study addresses shortcomings and recommendations of the development study, including cross-validating the CPAQ-8 items in a new sample and assessing test-retest reliability, it also suggests the need for further research. The psychometric properties of this measure now need to be assessed in various samples, and in particular among varied clinical samples. A number of limitations are noted in relation to the respondents. In particular, the test-retest sample had a higher incidence of participants reporting fibromyalgia. Although fibromyalgia was well represented as a pain condition across samples, it appeared to be more evident in Internet samples and, in particular, among the test-retest sample, which limits generalizability. This difference may reflect systematic variations in the diagnosis of fibromyalgia across countries and regions as the paper-and-pencil sample were Irish, while the Internet samples were international. Furthermore, study participants were accessed from a chronic pain support organization, or were actively seeking information or support online and may differ in meaningful and significant ways from the larger chronic pain population. Van Uden-Kraan et al[51] suggest that participation in online support groups has an empowering effect, which may include, among other things, participants' feeling better informed; reporting more optimism, control, self-esteem, and social well-being; and improved acceptance. Some differences were noted between the paper-and-pencil and online sample, which may reflect the different age profile of the 2 samples. More generally, online respondents may differ in other meaningful ways to clinical- or community-based chronic pain samples, and further validation in such samples is required. Finally, a high number of online participants did not provide usable data, and while a comparison between completers and those who provided sociodemographic data, but were later excluded, indicated little evidence of response bias, the high number of unusable responses should be borne in mind.

This study is based on cross-sectional, self-report data, which entails certain limitations. Despite the use of models that make causal predictions, the relationships noted are correlational, and use of SEM neither proves the models nor provides evidence of causality. Rather, results presented here provide support for the plausibility of these interpretations. The CPAQ-8 would benefit from an assessment of its predictive qualities in alternative contexts such as longitudinal or intervention studies wherein sensitivity to change could be assessed and more direct evidence of causal relationships might be acquired. Using the measure in intervention studies also is important for reasons related to the pragmatic philosophical underpinnings of ACT, which regard observable behavioral change as fundamental.

In terms of future research directions, a clearer idea of how variables from a contextual theoretical perspective relate to more traditional cognitive variables such as self-efficacy, catastrophizing, and fear of reinjury/movement in the context of chronic pain should be explored to clarify targets for therapeutic change and identify the most appropriate processes. For example, in this vein, recently reported analyses of randomized controlled trials including ACT for chronic pain (adults with whiplash,[57] adolescents,[56] and children[58]) showed that variables related to psychological flexibility mediated the effect of treatment on outcomes while pain, catastrophizing, self-efficacy, and kinesiophobia did not. In addition, while the current analyses support the potential value of therapeutic processes such as AE and PW, it is important to test the practical utility of each in experimental or intervention studies in which PW, AE, or the combination of both are examined. The ongoing validation and development of measures to capture facets of psychological flexibility is also required if therapeutic approaches like ACT are to be fully assessed and further developed.

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