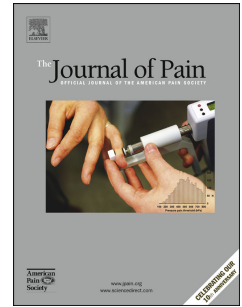# Accepted Manuscript

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Change in "Self-as-Context" ("Perspective-taking") Occurs in Acceptance and Commitment

Therapy for People with Chronic Pain and is Associated with Improved Functioning

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Disclosure

Abstract

Acceptance and Commitment Therapy (ACT) is based on the Psychological Flexibility (PF) model, which includes a therapeutic process, referred to as "self-as-context" (SAC). This study investigates whether ACT is associated with an effect on SAC and whether this effect is linked to treatment outcomes in people with chronic pain. 412 adults referred to a pain management center participated in the study. Participants completed measures of treatment processes (SAC, pain acceptance) and outcomes (pain-related interference, work and social adjustment, depression) before treatment, upon completion of treatment, and at nine-month follow-up. Paired sample t-tests and analyses of meaningful change were conducted to examine changes in processes and outcomes. Regression analyses with residualized change scores from process and outcome variables, and bivariate growth curve modeling were used to examine the association between change in SAC and change in outcomes. Participants significantly improved on all process and outcome variables at post-treatment (d=.38 to .98) and nine-month follow-up (d=.24 to .75). 42.0% to 67.5% participants showed meaningful improvements on each outcome at post-treatment and follow-up. Change in SAC was associated with change in outcomes (β=-.21 to -.31; r=-.16 to -.46). Results support a role for change in SAC in treatment as the PF model suggested.

Perspective

This study shows the delivery of a treatment for chronic pain based on Acceptance and Commitment Therapy was associated with improved self-as-context (SAC) and improved

functioning for people with chronic pain, and increases in SAC were associated with improved

functioning. These results can inform future treatment development.

Introduction

Acceptance and Commitment Therapy (ACT) is regarded as a "third-wave" cognitive behavioral therapy (CBT).[9] ACT is distinguished by its primary focus on Psychological Flexibility (PF)[8]. PF is defined as the capacity to be directly, consciously, and fully in contact with the present moment without needless defense, and to persist or change one's behaviors in the service of one's goals. The PF model is a model of general functioning and well-being that includes six, interrelated, core processes: acceptance, cognitive defusion, being present, self-as-context (SAC), values, and committed action. These are sometimes summarized as "open, aware, and active".[10] Simply put, acceptance is goal-direct engagement without impractical resistance to unwanted experiences. Cognitive defusion involves contacting one's thoughts in a way that can reduce their influence on our behavior. Being present involves being directly aware of ongoing events. SAC entails an experience of taking a perspective from which to observe one's psychological experiences, a sense of separation from or containing one's psychological experiences. Values are the qualities we want reflected in our behavior, what we want to achieve and how we want to achieve it. Committed action is the ability to flexibly persist in actions guided by goals and values.

Accumulating evidence supports of the effectiveness of ACT in chronic pain. In a systematic review of RCTs of ACT for adults with chronic pain, ten trials were identified, and small to large effect sizes were found on various measures of physical and psychological functioning favoring ACT.[7] At the same time the effectiveness of ACT for chronic pain can be improved. One way to do this is to examine the treatment processes underlying ACT, tease out the active ingredients, and enhance these treatment processes in treatment development and

delivery.

Most processes within the PF model have been examined in chronic pain, including acceptance, present-focused awareness, cognitive defusion, values, and committed action in both preliminary retrospective studies and in prospective treatment outcome studies [14, 15, 26, 29, 30, 31]. These studies include most recently a focus on cognitive defusion[17], and decentering[18, 16]. Decentering is a process that reflects the ability to observe one's thoughts and feelings, in a detached manner, as temporary events in the mind, as neither necessarily true nor reflections of the self.[6] These particular processes touch on SAC, in that they entail distancing or separation from one's psychological experiences, but they do not fully investigate SAC in its entirety as it is considered within the PF model.

Currently there are many studies of self in chronic pain. The results of these studies, however, are not well organized, and the conceptualization of the self within the PF model could remedy this.[33] One barrier to further applying this model was the lack of an appropriately designed measure, but such a measure now exists.[32] In the development study for this measure it was found that the dimension it assesses reflecting SAC, or "contextual self," significantly correlated with daily functioning in people with chronic pain. It now remains to extend these findings prospectively and in relation to treatment outcome.

The aim of the study is to investigate (a) whether ACT is associated with an effect on SAC as expected and (b) whether this effect is positively associated with outcomes in treatment process analyses of ACT, in people with chronic pain. In this study we use data from a cohort of adult participants in an interdisciplinary ACT-based treatment for chronic pain from measures administered at baseline, post treatment, and at nine-month follow-up. Significant changes in

SAC were predicted as well a significant associations between changes in this process and changes in key outcomes, including pain-related interference, work and social adjustment, and depression.

Methods

Sample

Participants were adults consecutively attending a specialty pain management service in central London between August 2014 and June, 2016. The total initial sample included 426 people. Of these 14 did not consent to have their data used for research, 32 did not provide data at post-treatment. Another 167 participants did not provide follow-up data. Only participants who provided baseline and follow-up data were included in the regression analyses (n=213). All participants who provided data at baseline were included in bivariate growth curve model analysis. (n=412). Patients completed standard baseline assessment measures on the first day of treatment, the last day, and at the nine-month follow-up. They also provided their background information, including sex, age, years of education, ethnic category, pain duration, pain location, and employment status.

Among participants who provided data at baseline, 68.2% (n=281) of the participants were women. Average age was 47.15 (SD=12.34) years old. Mean years of education was 13.77 (SD=4.06) years. The majority was from a white ethnic group (n=326, 79.1%), followed by black (n=35, 8.5%), Asian (n=24, 5.8%), mixed (n=17, 4.1%), and other (n=8, 1.9%). Median pain duration was 106.0 months (range: 4-744). The most common primary pain site was back (n=363, 88.1%), followed by lower limbs (n=325, 78.9%), neck (n=263, 63.8%), upper shoulder

or upper limbs (n=252, 61.2%), pelvic region (n=207, 50.2%), head, face or mouth (n=153, 37.1%), abdominal region (n=136, 33.0%), chest (n=105, 25.5%), and anal or genital region (n=68, 16.5%). About half of the participants were out of work due to (n= 208, 50.5%), followed by retired (n=58, 14.1%). 14.3% (n=59) of the participants were working full-time, and 9.5% (n=39) part-time due to pain. 8.7% (n=36) of the participants were homemakers, carers, and volunteers. Others (n=7, 1.7%) were not working due to other reasons

Among participants who provided complete data at all time points, 70.4% (n=150) of the participants were women. Average age was 46.85 (SD=11.88) years old. Mean years of education was 14.07 (SD=4.24) years. The majority was from a white ethnic group (n=171, 80.3%), followed by black (n=19, 8.9%), mixed (n=9, 4.2%), Asian (n=7, 3.3%), and other (n=5, 2.3%). Median pain duration was 103.50 months (range: 12-552). The most common primary pain site was back (n=183, 85.9%), followed by lower limbs (n=166, 77.9%), neck (n=133, 62.4%), upper shoulder or upper limbs (n=126, 59.2%), pelvic region (n=103, 48.4%), head, face or mouth (n=76, 35.7%), abdominal region (n=70, 32.9%), chest (n=53, 24.9%), and anal or genital region (n=38, 17.8%). About half of the participants were out of work due to pain (n= 97, 45.5%), followed by retired (n=29, 13.6%). 15.0% (n=32) of the participants were working full-time, and 11.3% (n=24) part-time due to pain. 9.9% (n=21) of the participants were homemakers, carers, and volunteers. Others (n=6, 2.8%) were not working due to other reasons. All participants whose data were used gave consent for their data to be used for research. The database was granted ethics and Research and Development Department approval.

Measures

Pain intensity

Participants rated their pain intensity on average over the past week on a standard scale from 0 (no pain) to 10 (extremely intense pain).

Self Experiences Questionnaire (SEQ)

The SEQ is a 15-item self-report measure of SAC, also called "contextual self," within the PF model.[32] Contextual self refers to a sense of self that is not based in self-evaluations, or a sense of self that is separate from and containing one's thoughts and feelings. This is also like "perspective taking" or taking the point of view of an observer of one's psychological experiences. Examples of the items from this new measure include "Although I can get caught up with my thoughts, emotions and sensations, I can also separate from them"; "I can experience a distinction between my experiences and the "I" who notices these experiences. All items are rated on a scale from 0, "never true", to 6 "always true". This measure was developed in our previous study, and reported adequate internal consistency and validity.[32] The reliability of the SEQ in the current study was good, α= .90, confirming the unidimensional structure of the SEQ. The baseline score of the SEQ significant correlated with the baseline score of CPAQ-8, r=.41, p<.001, consistent with the PF model, and supporting the construct validity of the SEQ.

Chronic Pain Acceptance Questionnaire (CPAQ-8)

The CPAQ is 20-item measure of the interrelated activity engagement and willingness or openness components of pain acceptance.[19] All items are rated on a 0-6 scale from "never true"

to "always true". Higher total score indicates greater acceptance of pain. A shorter version of the CPAQ was used here, the CPAQ-8.[4] The reliability of the CPAQ-8 in the current study was acceptable, α= .68. The reliability of activity engagement subscale is good, α= .86, while the reliability for pain willingness subscale is lower, α= .68. The reliability of CPAQ-8 for this sample is slightly lower than previous studies. However a similar pattern has been reported in previous study. In a validation study of CPAQ-8 with multiple samples, Cronbach's alpha coefficients ranging from .69 to .86 for subscales and total scale were reported across samples, with pain willingness subscale showing lower reliability.[4] The relatively low reliability of CPAQ-8 may mean that correlation results here underestimate actual relations with other variables due to measurement error in CPAQ-8.

Brief Pain Inventory (BPI)

The BPI is a self-report measure of pain that includes seven items that assess pain-related interference. This interference is rated for general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life. All items of the interference scale are rated on a 0-10 scale from "does not interfere" to "completely interferes". The total score forms a unidimensional scale. It has demonstrated reliability and validity.[2] The reliability of the BPI in the current study was good, α= .86.

Work and Social Adjustment Scale (WSAS)

The WSAS is a 5-item self-report measure, which assesses the impairment of functioning in terms of work, home management, social leisure, private leisure and personal or family

relationships. All items are rated on a 0-8 scale from "no impairment" to "very severe impairment". The total score forms a unidimensional scale. It was reported as a reliable and valid measure of impaired functioning.[21] The reliability of the WSAS in the current study was good, α= .85.

Patient Health Questionnaire (PHQ-9)

The PHQ-9 is a 10-item self-report scale for assessing the severity of depressive symptoms. The first nine items represent symptoms of depression and are rated on a 0-3 scale from "not at all" to "nearly every day". The tenth item, not forming part of the total score, is rated on a scale of difficulty arising from the symptoms from "not difficult at all" to "extremely difficult". The total score of the first nine items reflects the severity of depression with higher score reflecting higher severity. It is reported as a reliable and valid measure of depression severity.[13] The reliability of the PHQ-9 in the current study was good, α= .84. Anyone who scores 10 or above may be considered to be screening positive for clinically significant symptoms of depression.

Treatment Program

The treatment applied principles and methods of ACT in an interdisciplinary rehabilitation setting. The aim of the treatment is to improve overall patient functioning. The standard treatment was delivered over 4 full days per week for 4 weeks. Treatment was provided in a group format with 9 to 11 participants per group, and was delivered by a team of psychologists, occupational and physical therapists, nurses, and physicians. Treatment methods,

including physical exercise, skills training, and education, were designed to explicitly enhance the key processes of psychological flexibility. These, in addition to more conventional goals-focused methods, and practical skills training are integrated across the psychology, physical and occupational therapy, and educational sessions. Table 1 provides an overview of the 4-week standard residential treatment. The residential, interdisciplinary, ACT-based treatment program under study here is commissioned and paid for within the provision of the National Health Service in England.

[Table 1 about here]

Statistical analysis

Skewness, Kurtosis, Histograms, and Q-Q plots for each variable were examined for normality. Scatter plots for all variables involved in correlation analyses were examined for linearity. The total scores of all measures were considered normally distributed. No obvious non-linear relation was found. One-way ANOVAs were conducted to examine the differences between those who did and did not provide complete data at each time point, including baseline (participants who only provided baseline data, n=32), post-treatment (participants who provided post-treatment data but not follow-up data, n=167), and follow-up (participants who provided follow-up data, n=213) in all background variables, process variables, and outcome variables. No statistically significant difference was observed in any of these variables at any time point, except for pain acceptance, with follow-up completers (M=23.58, SD=7.54) scoring significantly higher than those who did not complete follow-up (M=21.28, SD=7.90), t (372) = 2.86, p= .004. Therefore it is consider reasonable to only include participants who provided

follow-up data without creating a significant bias in the data. As the current study is early attempt to investigate SAC as measured by SEQ as a component process of the PF model a comprehensive investigation including all component processes of the PF model was deemed premature, as including all established variables within the model could obscure the role of the SEQ in the data and potentially discourage further study of the role of SAC within the PF model. A recent comprehensive examination of structure of the PF model using confirmatory factor analyses in a large chronic pain sample suggested a general factor reflecting openness explaining variance across all measures of PF.[27] Therefore, we included pain acceptance, a process that explicitly reflects openness in the PF model, alongside background variables, as a covariate, to investigate the relative independent role of the SAC in predicting functioning.

After these preliminary analyses, a series of paired-sample t-tests were conducted to compare baseline scores and post-treatment scores, as well as baseline scores and nine-month follow-up scores for measures of processes, including pain intensity, SEQ and CPAQ-8, and for measures of outcomes, including BPI, WSAS, and PHQ-9. Within-subject effect sizes (Cohen's d) were calculated using means at each time points divided by pooled standard deviations. Cohen's[3] thresholds for interpreting effect sizes were adopted: d=.20 is considered as small effect size, d=.50 medium, d=.80 large. Clinically meaningful changes were also examined for all outcome measures at post-treatment and 9-month follow-up. Participants whose raw change scores were greater than one half of a standard deviation from their baseline score for each outcome variable were coded as 'meaningfully improved'. Those whose scores did not improve by half a standard deviation were coded as 'not meaningfully improved', while those who worsened by greater than half of a standard deviation were coded as 'meaningfully worsened'.

In a systematic review of interpretation of minimal important difference in health-related quality of life[23], half a standard deviation was suggested as the threshold of meaningful change for health-related self-report measures for chronic diseases.

Standardized residualized change scores were calculated for the change from baseline to post-treatment for processes variables, and the change from baseline to nine-month follow-up for outcome variable, in order to address, to a certain extent, the sequence of process variables and outcome variables. For each variable, baseline scores were used to predict post-treatment or follow-up scores, and residualized change scores were calculated as the differences between predicted and observed scores. Next, Pearson correlations were conducted to examine the correlation between the change scores from process variables, and the change scores from all outcomes variables. Following the preliminary correlation analyses, a series of hierarchical multiple regressions with residualized change scores of process variables as independent variables and residualized change scores of outcome variables as dependent variables were conducted to examine the unique role of SAC in relation to changes in functioning.

Finally, bivariate growth curve modeling was conducted separately for scores from SEQ with each outcome to examine the association between change in SAC and changes in outcomes. All participants who provided data at baseline were included in analyses. For each model, background variables were controlled at baseline. Key parameters of bivariate growth curve model include intercept, representing individuals' average baseline level, and slope, representing individuals' average growth (change) rate. Covariance between the slope for SEQ and the slope for each outcome reflects the correlation between change in SEQ and change in each outcome over time.

Results

Preliminary analyses

Scores for SAC and pain acceptance both significantly improved from baseline to post-treatment with small (d = .38) and medium (d = .73) effect sizes respectively. The improvement maintained at nine-month follow-up again with small (d = .24) and medium (d = .75) effect sizes respectively. Pain rating also significantly reduced from baseline to post-treatment (d=.54), and the reduction remained at follow-up (d=.39). Scores for all outcome variables significantly improved from baseline to post-treatment with medium to large effect sizes (d=.53 to .98), and the improvement maintained at nine-month follow-up with medium effect sizes (d=.62 to .70). Table 2 shows the mean and standard deviation of each variable, mean and standard deviation of change score, t-test values, and effect size (d) for each pair of comparisons.

[Table 2 about here]

Clinically meaningful change

At post-treatment, 42.0% to 67.5% of the participants improved to a meaningful degree on each measure of outcome, and 6.6% to 9.4% worsened to a meaningful degree. At nine-month follow-up, 46.5% to 56.3% of the participants improved on the outcomes, and 7.0% to 14.1% participants worsened. Table 3 shows percentage of participants in each category of clinically meaningful change for each outcome.

[Table 3 about here]

Correlation, regression, and bivariate growth modeling

Change in pain and pain acceptance showed correlations with change scores from all outcome variables. In particular, SAC showed small to medium correlations with change scores from all outcome variables in the expected direction, with the strongest correlation observed between SAC and depression (r=-.30, p<.001). Notably, change in SAC showed significant correlation with change in functioning (BPI, WSAS) to similar magnitude as change in pain, and larger correlation than change in pain for depression. Table 4 shows the results from Pearson correlation analyses.

[Table 4 about here]

Two multiple hierarchical regression models (model 1 & model 2) were examined with each outcome variables as dependent variables. None of the background variables contributed significantly to the variance explained in any of the models, thus they were not reported here. Change scores from SEQ significantly predicted change scores from all outcome variables (β=-.31 to -.21), after controlling for background variables and pain, and after pain acceptance was simultaneously entered into the equations (β=-.27 to -.17). Table 5 shows the results from regression analyses.

[Table 5 about here]

Bivariate growth curve modeling was used with scores from SEQ and each outcome respectively. The slope for SEQ significantly correlated with the slope for PHQ, r=-.46, p<. 001, and marginally correlated with the slope for WSAS, r=-41, p<.05. But the slope for SEQ did not correlate with the slope for BPI to a statistically significant extent, r=-.16, ns. These results indicate that change in SEQ was significantly correlated with change in depression and change in work and social adjustment over time, but not with change in pain interference. This pattern is

consistent with results from regression analyses with residualized change scores in terms of relative magnitude of correlations between SEQ and outcomes.

Analyses of participants that worsened

To further explore the basis for the cases that showed a worsening in functioning, the participants who reported meaningful levels of declining functioning on any outcomes at either time point were compared with other participants on background variables and residualized change scores from process variables including pain, pain acceptance, and SAC. Results from independent sample t-tests did not show significant baseline difference on any background variables, process variables, or pain between participants who worsened at post-treatment (n=35) and those who did not. However, unlike the majority of participants, the group that meaningfully worsened showed a reduction in SAC, t (210)= 2.80, p< .01, and a reduction in pain acceptance, t (210)=2.22, p< .05, at post treatment. Similarly, participants who worsened at follow-up (n=52) did not differ from the others on any background variables, process variables, or pain. However, once again, the group that meaningfully worsened showed a reduction in SAC, t (210)= 3.23, p< .01, and a reduction in pain acceptance, t (210)=2.05, p< .05, at follow-up.

Discussions

The current study preliminarily investigated (a) whether ACT is associated with an increase in self report of SAC in people with chronic pain and (b) whether this increase is linked to better outcome results in treatment processes analyses of ACT. All scores from process and outcome measures significantly improved after treatment, and all improvements maintained at

nine-month follow-up. 42.0% to 67.5% participants demonstrated meaningful improvements on each outcome after treatment, and 46.5% to 56.3% at nine-month follow-up. Overall these data suggested positive medium-term benefits for the treatment. The ACT-oriented treatment was associated with both improved SAC and improved functioning. Changes in SAC were associated with changes in pain-related interference, work and social adjustment, and depression. These results are consistent with the hypothesis that "self-as-context" is positively associated with health and wellbeing.

On the positive side, this is the first longitudinal study investigating what we have called "contextual self" and is more generally called "self-as-context" or "perspective taking" in the context of ACT for chronic pain. The results resonate with a previous longitudinal study, in which the researchers observed association between self-discrimination behaviors (including elements of the self as theorized in ACT) and long-term wellbeing in a non-clinical sample.[1] They are also consistent with the increasing number of longitudinal and mediation studies that show that ACT for chronic pain improves patient functioning specifically through its proposed mechanisms or processes, enhanced psychological flexibility.[20, 26,29,31]

The ACT-oriented treatment here appeared to operate as theorized, in that the improvements in treatment processes underlying ACT showed correlations with improvements in functioning. In particular, SAC showed encouraging associations with pain-related interference, work and social adjustment, and depression. Notably, SAC showed relatively stronger association with depression, suggesting its potential impact on emotional functioning. This finding appears to be consistent with previous research. Significant associations between

rumination and depression have been reported in previous studies[12, 16, 22, 25] as have significant negative associations between decentering and depression[16]. These results appear to suggest that being entangled and consistently focused within one's thoughts can contribute to depression while being "disentangled" or "distancing" from one's thoughts may be beneficial. And this "disentangled" or "distancing" from one's thoughts (particularly self-related thoughts) is indeed a defining feature of self-as-context.

In addition, in an unplanned analysis, participants who worsened in their functioning following treatment differed from those who did not on changes in SAC from baseline to post-treatment. These participants who worsened also showed a decline in SAC, while the majority of participants improved, which also supports the proposed association between SAC and functioning.

Notably, while pain acceptance showed an improvement of relatively large effect size at post-treatment, and maintained the improvement at follow-up, the effect size for SAC was relatively small and the effect size dropped at follow-up. This may reflect the relative weakness in the methods used in treatment delivery. It is possible that some processes underlying ACT, including SAC in this case, were not sufficiently addressed. Within this treatment program, experiential exercises designed to facilitate the experience of SAC were delivered in a group-format by the psychologist, followed by experience sharing in the group, again under the guidance of the psychologist. To a certain degree this could be a challenge of group delivery situations such as is used here, where more individually focused shaping of this process could perhaps create a greater effect, although this is speculation. The relatively small improvement

in SAC could also simply be due to limitation of the measure in capturing this process. As mentioned, the SEQ is a measure of SAC that was newly developed in our previous study. Further refinement of the SEQ may be needed.

The current study naturally has its limitations. First, all participants are referrals to one multidisciplinary pain management center in central London. The result from this sample may not apply to people with chronic pain who are not referred to a pain management center, or chronic to pain populations in other geographical locations or other cultures. Further studies in other locations, cultures, and populations are needed to explore treatment effectiveness and treatment mechanism of ACT. In addition, only about half of the participants completed follow-up assessment, which may have limited the generalizability of these findings. However, since attrition was unrelated to our variables of interest, the potentially biasing effect on the data may have been minimal. Second, the current study is not an experimental study or randomized control trial; therefore causal relationships cannot be drawn between SAC and functioning. In other words, we cannot be certain that the ACT-oriented treatment led to a beneficial effect on functioning, nor that these operated through improving SAC. We simply report a pattern of results that is functionally consistent with the underlying model. Further study with fully controlled experimental manipulations and mediation analyses is needed to make definitive conclusions on the treatment mechanism underlying ACT. Third, this was a preliminary investigation of SAC within ACT, the first study investigating it with longitudinal design in chronic pain as far as we are aware. Conclusions on the role of SAC need to be drawn with caution. Further studies, including further refinement of SEQ and better controlled longitudinal studies of SAC will no doubt be done.

In summary, self-related processes have been a longstanding interest in studies of chronic pain. This no doubt emerges from the obvious, deep, personal sense of loss, threat, and even disintegration felt by those most profoundly affected by chronic pain.[24,28] In the present study the delivery of an ACT-based treatment for chronic pain was associated with improved SAC and functioning, with medium-term benefits for people with chronic pain. This is a theoretically consistent result and therefore supports a heretofore little investigated component of the PF model. SAC changes from baseline to post treatment showed significant associations with changes in functioning achieved at follow-up. Further studies with experimental design and mediation analysis within RCTs are needed to investigate the causal relations of SAC as an underlying process of ACT, and functioning.

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Table 1 *Overview of the standard 4-week residential treatment.*

Table 2 *Mean, standard deviation of each variable at baseline, post-treatment and follow-up, and t value and effect sizes for each comparison.*

Table 3 *Clinical significance of change in outcome variables at post-treatment and follow-up.*

Table 4 *Correlations between changes in pain and process measures at post treatment in relation to change in outcome variables at follow-up.*

Table 5 *Hierarchical regression analyses or changes in SAC and acceptance at post treatment in relation to changes in pain-related interference, work and social adjustment, and depression at follow-up.*

Table 1 Overview of the standard 4-week residential treatment

Discipline	Number of Sessions	Total Session Time (hour)	methods
Psychology	22	22.5	Exposure-based and experiential exercises, metaphor, mindfulness practice, and motivational methods to facilitate the following: (1) Contact with "creative hopelessness" (control is a problem). (2) Acceptance (openness to experiencing pain and unwanted feelings) and avoidance reduction. (3) Cognitive defusion. (4) Self-as-context and awareness of the present moment. (5) Clarity in values identification, increasing values-based committed action.
Physiotherapy	24	25.75	Physical exercises designed to increase aspects of psychological flexibility. (1) Physiotherapists help patients do movements and physical exercises, to approach or feel physical sensations that represent a natural part of functional movements, to reverse goal-interfering avoidance of physical movement, to practice awareness of the experiences that appear when they do that, and to clearly see relations between physical movements, physical exercise and goals and values. (2) Also, a small amount of teaching on movement and pain.
Occupational therapy	16	18	Teaching and practice of value-based, motivational methods, and practical skills training. (1) Discussion and exercises for value clarification and goal setting. (2) Sleep education, including use of a sleep diary and calculation of sleep efficiency. (3) Other functional skills, such as communication, activity management, and return to work skills.
Doctor talk	3	3	Lecturing on pain mechanisms, diagnoses, and treatments. (1) Presentation of some general models of chronic pain. (2) Discussion of the practical limits of available treatments, particularly in relation to patient goals.
Nurse session	9	10.25	Lecturing and counseling on pain, medication, and health. (1) Pain medication education. (2) Individual medication reviews. (3) Responding to patient symptoms and complaints.

Friends and Family visit	1	2.5	This single session includes inviting friends of family who can attend to participate in treatment. (1) Education about chronic pain and the treatment program for visitors. (2) Discussion about the impacts of pain on relationships and how to work together to strengthen or improve relationships.

Table 2 *Mean, standard deviation of each variable at baseline, post-treatment and follow-up, and t value and effect sizes for each comparison.*

	Baseline		Post-treatment						Follow-up					
	M	SD	M	SD	M change	SD	*t(df)*	d	M	SD	M change	SD	*t(df)*	d
Pain intensity	7.70	1.68	6.79	1.67	0.91	1.64	8.06(210)	0.54	6.96	2.20	.075	2.12	5.13(210)	0.39
Contextual self (SEQ)	49.65	14.33	54.86	13.40	-5.22	13.53	-5.61(211)	0.38	52.76	14.51	-3.38	13.78	-3.52(204)	0.24
Pain acceptance (CPAQ-8)	18.12	7.37	23.58	7.54	-5.46	8.19	-9.70(211)	0.73	23.97	8.57	-5.86	8.21	-10.34(209)	0.75
Pain-related interference (BPI)	7.66	1.54	5.96	2.00	1.70	1.94	12.79(211)	0.95	6.35	2.39	1.31	2.14	8.91(212)	0.70
Work and social adjustment (WSAS)	32.03	6.22	28.23	7.95	3.80	6.80	8.13(211)	0.53	26.81	10.37	5.15	8.86	8.47(212)	0.67
Depression (PHQ)	16.85	5.62	11.50	5.29	5.35	5.74	13.57(211)	0.98	13.26	6.61	3.63	6.05	8.75(212)	0.62

Note. All p<.001. When Bonferroni Correction applied (critical α=.025), all significant levels remained the same, expect for that of SAC, p=.001.

Table 3 *Clinical significance of change in outcome variables at post-treatment and follow-up.*

	Clinically meaningfully improved	Not clinically meaningfully improved	Clinically meaningfully worse	Clinically meaningfully improved	Not clinically meaningfully improved	Clinically meaningfully worse
BPI	63.2%	30.2%	6.6%	49.8%	43.2%	7.0%
WSAS	42.0%	48.6%	9.4%	46.5%	45.5%	8.0 %
PHQ	67.5%	25.9%	6.6%	56.3%	29.6%	14.1%

Table 4 *Correlations between changes in pain and process measures at post treatment in relation to change in outcome variables at follow-up.*

	Pain-related interference (BPI)	Work and social adjustment (WSAS)	Depression (PHQ)
Pain (0-10)	.25***	.23**	.18**
Pain acceptance (CPAQ-8)	-.18*	-.19**	-.18**
SAC (SEQ)	-.23**	-.22**	-.30***

Note. N=211. All changes calculated as residualized change scores.

*p<.05, **p<.01, ***p<.001.

Table 5 *Hierarchical regression analyses or changes in SAC and acceptance at post treatment in relation to changes in pain-related interference, work and social adjustment, and depression at follow-up.*

Block	Predictor	Δ R^2	β	R^2
Pain-related interference (BPI)				
1	Pain (0-10)	.06**	.20**	
2	SAC (SEQ)	.04**	-.21**	.10
1	Pain (0-10)	.06**	.19*	
2	Pain acceptance (CPAQ-8)	.04*	-.01	
	SAC (SEQ)		-.17*	.10
Work and social adjustment (WSAS)				
1	Pain (0-10)	.06**	.20**	
2	SAC (SEQ)	.04**	-.21**	.10
1	Pain (0-10)	.06**	.18*	
2	Pain acceptance (CPAQ-8)	.05**	-.12	
	SAC (SEQ)		-.17*	.11
Depression (PHQ)				

1	Pain (0-10)	.04*	-.13	
2	SAC (SEQ)	.09***	-.31***	.13
1	Pain (0-10)	.04*	.12	
2	Pain acceptance (CPAQ-8)	.09***	-.09	
	SAC (SEQ)		-.27**	.13

Note: None of the background variables (age, gender, ethnic group, years of education, and duration of pain) contributed significantly to the variance explained in any of the models, thus they were not shown in the table. The numbers of blocks indicate relative order of the shown blocks in hierarchical regression models. For each outcome measure, SEQ was first examined in model 1 where SEQ was entered in the last block of the hierarchical regression model, and then in model 2 where CPAQ and SEQ were simultaneous entered into the last block of the hierarchical regression model.

. *p<.05, **p<.01, ***p<.001.

- Acceptance and Commitment Therapy (ACT) includes a process "self-as-context" (SAC).
- Interdisciplinary ACT-based treatment for chronic pain appeared beneficial.
- The treatment was associated with improved SAC and improved functioning.
- Changes in SAC were associated with changes in depression and daily functioning.