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Treatment of Chronic Pain for Adults 65 and Over: Analyses of Outcomes and Changes in Psychological Flexibility Following Interdisciplinary Acceptance and Commitment Therapy (ACT)

[1]Whitney Scott, PhD, [2]Aisling Daly, BA, [1]Lin Yu, MSc, & [1, 2]Lance M McCracken, PhD

[1]Institute of Psychiatry, Psychology & Neuroscience; King's College London, London UK

[2]INPUT Pain Management, Guy's and St Thomas' NHS Foundation Trust & Psychology Department

Corresponding Author:

Professor Lance M McCracken
Health Psychology Section
King's College London
Guy's Campus
5th Floor Bermondsey Wing
London SE1 9RT UK
Tel: +44 (0)2071885410; Fax: +44 (0)2071880184;
E-mail: Lance.McCracken@kcl.ac.uk.

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Abstract

Objective: The purpose of this study was to examine the effectiveness of Acceptance and Commitment Therapy (ACT) for older adults with chronic pain. Secondarily, we examined the associations between changes on processes of psychological flexibility and treatment outcome variables.

Subjects: Participants were 60 adults with chronic pain aged 65 and older selected from a larger consecutive sample of 928 adults of any age. All participants had longstanding pain that was associated with significant distress and disability.

Methods: Participants completed measures of pain, functioning, and depression, and processes of psychological flexibility at baseline, immediately post-treatment, and at a nine month follow-up. Treatment consisted of a two or four week residential program based on principles of ACT delivered by an interdisciplinary team. Treatment was designed to increase daily functioning by enhancing key processes of psychological flexibility, including openness, awareness, and committed action.

Results: Participants showed significant improvements in functioning and mental health at posttreatment. Participants also showed significant increases in pain acceptance and committed action from pre- to post-treatment. Small effect sizes were observed for most treatment outcome and process variables in the pre-treatment to follow-up intervals; however, these improvements were not statistically significant. In secondary analyses, changes in facets of psychological flexibility were significantly associated with improvements in social functioning and mental health.

Conclusion: This study supports the potential effectiveness of ACT for chronic pain among older adults. Future research is needed to determine how to maximize the impact of this treatment, particularly through greater impact on psychological flexibility.

Key Words: Chronic Pain; Older Adults; Acceptance and Commitment Therapy

Introduction

Many older people have chronic pain and suffer considerably from its effects. For years experts have highlighted the need to study the pain experience of older people and to develop better treatment approaches (1-3). This is based on an increasing burden of health conditions as we age, accumulating problems with mobility and cognitive functioning, potentially reduced social support, sensitivity to medications, and poly-pharmacy, coupled with under-treatment of pain within those of older age (1, 4, 5). There are suggestions that there may be biases that block access and resourcing of pain services for older people, both among service providers and older people themselves. Such biases can include beliefs that pain is simply to be expected or normal for older people and that it is best not to complain (1). There are signs of progress in this area, such as recent well-designed studies (6) and evidence-based guidelines (7). At the same time, this area of research is regarded as "in its infancy" (2).

There are data to suggest that older people with chronic pain appear at disproportionately low rates in specialty pain services (8, 9). Just under 3%, or 14 out of 470, of patients attending a specialty service for pain in the UK were over 65 (8). There are also data to suggest that older adults seeking specialty services for chronic pain may differ from younger adults, for example, in having greater physical and fewer psychosocial problems (9). Certainly, it is important to understand whether older people seeking treatment for chronic pain have different needs than younger people, if they are accessing specialty services when they need them, and if they are gaining benefits that are similar to those gained by younger people.

The evidence for treatments for chronic pain, particularly psychologically-based treatment, in older people is accumulating slowly, although the picture is not altogether clear and positive. In an early trial, a predominantly physiotherapy-based treatment significantly improved the physical activity and functional capacity of older people with low back pain (*n* = 170); however, the addition of a motivational counselling intervention had no additional benefits (10). Another early study showed no benefits for older people in a community setting (*n* = 218) from a group chronic pain self-management course in comparison to an education only control condition (11). Comparable results were obtained in a somewhat similar approach involving cognitive behavioral pain management specifically designed for older people (*n* = 95) compared with a waiting list. Here some changes in beliefs were observed but there were no benefits with regard to pain, daily activities, or stress (12) (see also (13).

A review of the effectiveness of cognitive and behavioral treatment for chronic pain in older people concluded that, based on 16 separate treatment comparisons, these treatments produce a small or near medium sized effect on reported pain but no effect on depression, physical functioning, or medication use (14). More encouraging results were achieved in a more recent study by Nicholas and colleagues (6). They showed that in people age 65 and older (*n* = 141), cognitive behavioral therapy (CBT) plus exercise, relative to an exercise attention control, produced significant improvements in pain-related distress, disability, and physical performance at post treatment and a one-month follow-up. This success appears to be an exception in a pattern of studies generally showing mostly mixed or not yet convincing results.

There is a relatively new development within CBT for chronic pain distinguished by its focus on a process called psychological flexibility. Psychological flexibility includes acceptance of or openness to experiences as opposed to avoidance, awareness of experiences and perspective taking rather than being stuck in unhelpful thinking patterns, and an active focus on goals and values rather than a focus on problems or disengagement (15, 16). The psychological flexibility model assumes that greater levels of acceptance, awareness, and engagement in goal-directed behavior will be associated with better health and functioning (16, 17). In the model, variables reflecting the components of acceptance, awareness, and engagement are described as treatment 'process' variables, while variables such as physical and social functioning and mental health reflect important treatment 'outcomes'.

The type of treatment most specifically designed to improve psychological flexibility is Acceptance and Commitment Therapy (ACT) (15). ACT has growing evidence for effectiveness for helping people with chronic pain (18, 19), and there is preliminary evidence that this approach may specifically help older people with chronic pain (8, 20-22). In secondary analyses of data from a randomized controlled trial comparing ACT with conventional CBT for chronic pain it was shown that older adults (n=21) were more likely to respond to ACT while younger adults were more likely to respond to conventional CBT (21).

In a previous study we showed that participation in an intensive ACT-based interdisciplinary pain management course was associated with improvements in core outcome variables--pain, physical and psychosocial disability, and depression-- at both post treatment and a three-month follow-up in 40 older adults with chronic pain (8). In this study we also

demonstrated that processes of psychological flexibility, namely general acceptance, pain acceptance, mindfulness, and values-based action improved significantly following ACT-based treatment. Moreover, processes of psychological flexibility were associated with better physical, psychosocial, and emotional functioning at pre-treatment (8). This pattern of findings is similar to those observed in younger adults with chronic pain (18, 23). These findings suggest that processes of psychological flexibility are also relevant targets of intervention for older adults with chronic pain. These preliminary results from this type of treatment with older adults have not been replicated. In addition, these data were based on a small sample of individuals chosen for the study based on a liberal definition of older people (age 60 and older), did not include the cognitive fusion/defusion and committed action components of psychological flexibility, and only examined cross-sectional associations of processes with patient functioning outcomes at pre-treatment.

The purpose of the current study was to replicate and extend earlier work on ACT for pain in older people by examining this treatment approach in a different setting, with different treatment providers, in a larger sample, using an older age inclusion criterion (65 years and older), and over a longer follow-up period. The current study also investigated a more comprehensive set of processes of psychological flexibility, and prospectively examined the associations between changes on these process variables and improvements in patient functioning. As with the previous study the data analyzed here were extracted from a large database of adults attending and completing treatment in a specialty pain center in the UK, but this time in the capital, London, rather than in a small city, Bath. As with the previous study (8), the current observational study was conducted in an actual practice setting, used

current routine assessment, selection, and treatment delivery procedures, and was not designed as a controlled research trial. We predicted that older adults would show significant improvements on key functional outcomes (physical and social functioning, mental health, and depression) and on psychological flexibility process variables (represented here by measures of pain acceptance, general acceptance, cognitive fusion, decentering, and committed action) at post-treatment and follow-up. We also predicted that improvements in psychological flexibility processes would significantly correlate with improvements in outcomes, including daily functioning, thus supporting the potential role of psychological flexibility in relation to daily functioning in older adults with chronic pain.

Methods

Participants

Participants were consecutive adult referrals to a two or four-week interdisciplinary pain management program in London, United Kingdom. Participants were selected for the treatment if: (a) they had pain for longer than three months; (b) pain was associated with significant levels of distress and disability; and (c) they were deemed likely to benefit from the program, for example, by demonstrating a willingness and ability to participate in a group setting and to engage with the treatment goals to increase their functioning rather than reduce their pain. People with cognitive impairment and/or poorly controlled psychiatric co-morbidities that could interfere with their engagement with the group-delivery format were excluded. Treatment selection was decided through interview and observation-based assessment by a specialist psychologist and physiotherapist, who also conducted a physical examination or performance tests as needed. Again, this is the routine assessment and selection process within the service to assure that the treatment is offered

only to those who need it and are likely to benefit. Selection for treatment was at the discretion of the assessing clinicians on a case-by-case basis, rather than on the basis of cut-off scores on measures of distress and disability.

Participants referred to the two-week program were also candidates for a neuromodulation procedure. Therefore, these participants were also evaluated by a consultant pain physician to determine their medical suitability for neuromodulation, including the presence of localized neuropathic pain, in addition to the above-described assessment for suitability for the interdisciplinary treatment. Participants who were referred for assessment for the four-week program were not candidates for a neuromodulation procedure. We did not collect data on the number of patients assessed and ultimately offered treatment for the present study. However, data from a clinical audit of the service suggest that approximately 39% of patients who are referred to the service and assessed using the above-listed criteria are offered the treatment under study here. For the purpose of the present study, a subsample of individuals aged 65 and older was selected from the total sample that attended the pain management program.

The total sample of individuals beginning treatment was 928 prior to participant selection on the basis of age. From this sample, 64 individuals (6.9%) were aged 65 and older. All of these 64 individuals provided written informed consent to have their data used for research purposes. Of these 64 participants, four did not complete the treatment and did not provide post-treatment data. Therefore, the final study sample consisted of 60 participants. The mean age of participants was 69.33 years (SD = 4.24 years). Participants had a median pain

duration of 166.0 months (range = 31– 592 months). The most common pain sites reported were pain in the lower back (41.7% of patients) and lower limbs (21.7%). Further background details are included in Table 1.

Procedure

Patients completed standard baseline assessment material on the first day of the treatment program during which they reported on background information, including their sex, age, ethnicity, living situation, years of education, employment status, pain location and duration, medications, and medical co-morbidities. The pre-treatment assessment also included self-report measures of pain intensity, daily functioning, depression, and measures of a number of processes of psychological flexibility. Participants completed the same measures during the final week of treatment and at a nine month follow-up assessment. The research database and study were granted ethics and National Health Service Research and Development approvals prior to commencing data collection.

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).

Health Status

The SF-36 (24) is a standardized measure of health status that contains 36 items. The SF-36 yields eight subscale scores assessing several domains of life functioning. The physical and social functioning, and mental health subscales were used for the present study. Higher

scores on these subscales indicate better functioning in these domains. The SF-36 has been validated and is widely used as a measure of health status and functioning among patients with chronic pain (25). The SF-36 subscales have also shown good internal consistency (Cronbach's $\alpha \geq 0.82$ for all subscales) when used with older adults, and to validly distinguish between older adults with and without a longstanding disability (26).The SF-36 demonstrated at least adequate internal consistency in this sample (Cronbach's $\alpha = 0.82$, 0.65, and 0.79, for Physical, Social, and Mental Health scales, respectively).

Depression

The Patient Health Questionnaire (PHQ-9) (27) was used to measure the severity of patients' symptoms of depression based on standard DSM-IV diagnostic criteria. On this measure, patients report on the frequency with which they have experienced nine different symptoms of depression over the past two weeks from 0 (not at all) to 3 (nearly every day). Higher total scores indicate greater depression symptom severity. The PHQ-9 has been well validated among patients with chronic health conditions (27). In older adults, the PHQ-9 has shown good internal consistency (Cronbach's $\alpha = 0.83$), and has demonstrated utility in distinguishing between older adults with and without a depressive disorder (28). The PHQ-9 demonstrated good internal consistency in this sample (Cronbach's $\alpha = 0.85$).

Pain Acceptance

The 20-item Chronic Pain Acceptance Questionnaire (CPAQ) (29) was used to measure acceptance of chronic pain, including patterns of performing desired activities in the presence of pain and refraining from struggles to control pain. Participants are asked to rate each item on a numerical scale from 0 (never true) to 6 (always true). Higher total scores indicate greater acceptance of pain. Data support the reliability and validity of the CPAQ for

use in patients with chronic pain (30). The CPAQ demonstrated good internal consistency in this sample (Cronbach's α = 0.85).

General Acceptance

The Acceptance and Action Questionnaire (AAQ-II) (31) was used as a measure of general psychological acceptance, or willingness to experience difficult feelings and emotions, particularly when doing so enables an individual to pursue meaningful activities. On this measure, participants are asked to rate seven items on a seven point scale from 1 (never true) to 7 (always true). All items are keyed in the negative direction and are reversed prior to producing the total score. Once reverse scored, higher scores reflect greater acceptance. Previous research supports the internal consistency, temporal stability, and construct validity of the AAQ-II, including among patients with chronic pain (31, 32). The AAQ-II showed excellent internal consistency in this study (Cronbach's α = 0.90).

Cognitive Fusion

The 13-item Cognitive Fusion Questionnaire (CFQ) (33, 34) was used to measure cognitive fusion, which reflects the process of thought content dominating over experience and action, and a lack of distinction between the content of thoughts and the people or situations to which they refer. In contrast, cognitive defusion, the opposite of cognitive fusion, is similar to what participants are trained to do in mindfulness methods, where they learn see thoughts as just thoughts, as ultimately transient, and as not necessarily reflections of reality. On the CFQ, participants are asked to rate items on a seven-point scale with the endpoints 1 (never true) and 7 (always true). Once summed, higher total scores reflect greater cognitive fusion. The CFQ has previously been validated for use among

individuals with chronic pain (34). The CFQ demonstrated acceptable internal consistency in this study (Cronbach's α = 0.74).

Decentering

The Experiences Questionnaire (EQ) (35)was used to assess processes related to the 'awareness' facet of psychological flexibility. The EQ contains a 14-item decentering scale and a 6-item rumination scale. Decentering reflects the ability to observe one's thoughts and feelings as temporary objective events in the mind, rather than as 'true' reflections of the self or one's circumstances (36). On the EQ, participants are asked to rate each item on a five-point scale ranging from 1 (never) to 5 (all the time). The rumination items are reversed before summing all of the items to produce a total score. Higher scores on this measure indicate greater decentering. Data support the internal reliability of the EQ among individuals with chronic pain and suggest that scores on the EQ uniquely contribute to the prediction of outcomes such as mental health and social functioning (37). The EQ demonstrated good internal consistency in the current sample (Cronbach's α = 0.80).

Committed Action

The 18-item Committed Action Questionnaire (CAQ) (38) was used to measure committed action, or flexible persistence in goal-directed behavior. On the CAQ, participants are asked to rate the extent to which each item applies to them on a seven-point scale ranging from 0 (never true) to 6 (always true). The item pool includes four positively phrased items and four negatively phrased items. Negatively keyed items are reverse scored prior to producing a total score, so that higher scores on the CAQ reflect greater committed action. Previous research supports the reliability and validity of the CAQ among patients with chronic pain (38). The CAQ demonstrated good internal consistency in the present study (Cronbach's α =

0.87).

Treatment Program

The treatment applied principles and methods of ACT within an interdisciplinary rehabilitation context. The aim of the treatment is to improve overall patient functioning. Those in the two-week treatment course (*n* = 22) are concurrently under consideration for a neuromodulation-based treatment and their two-week treatment has the additional aim of leaving them in a better position to benefit from a subsequent procedure, typically implantation of a spinal cord stimulator. For the four-week program (*n* = 38), treatment was delivered over four full days per week. Individuals in the neuromodulation program received four full days of treatment for two weeks.

For all participants, treatment was provided in a group format 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: (a) openness to experiencing pain and unwanted feelings, (b) present-focused awareness, and (c) increasing values-based and committed action. Treatment does not explicitly focus on reducing or controlling pain, unwanted feelings, or negative thoughts. A relatively unique emphasis in this treatment is on experiential exercises, metaphor, mindfulness practice, cognitive defusion techniques, and other values-based methods (16, 39, 40). These, in addition to more conventional goals-focused methods, are used across the psychology, physical and occupational therapy, and educational sessions. In the pre-neuromodulation program, some of the sessions also focus on education about the neuromodulation treatment. The residential interdisciplinary

treatment program under study here is commissioned and paid for within the provision of the National Health Service in England.

Data analysis

Data analyses were conducted using SPSS version 21 (41). Means and standard deviations were computed for pre- and post-treatment and follow-up assessment measures. Independent samples *t*-tests were computed to examine differences on assessment variables for treatment completers and non-completers and patients with and without missing data. Mixed ANOVAs were computed to examine potential differences on outcome and process measures across assessment time points between groups completing either a 2-week or a 4-week program; non-significant effects of treatment length justified combining the groups in subsequent analyses.

Paired samples *t*-tests were computed to determine the statistical significance of changes on assessment variables from pre- to post-treatment and follow-up. With the exception of physical functioning, all of the variables in these analyses were considered to be normally distributed. Log natural transformations were used to address non-normality of physical functioning scores at each assessment time point. A Bonferroni correction for multiple comparisons (n = 20) was applied; therefore, results were interpreted as significant at $p < 0.003$. Within-subjects effect sizes (Cohen's d) were computed as the difference between pre- and post-treatment or follow-up means divided by the pooled standard deviation. Consistent with Cohen's guidelines, effect sizes were interpreted as small (>0.20), medium (>0.50), or large (>0.80) (42).

We also examined the clinical significance of changes for the following outcome variables: pain intensity, physical and social functioning, mental health, and depression. For these analyses, participants whose raw change scores were greater than one half of a standard deviation from their baseline score for each respective outcome variable were coded as 'clinically improved'. A systematic review has previously shown that across a number of chronic conditions one half of a standard deviation reliably discriminates people who achieve a minimally important difference following treatment (43). Those whose scores did not improve by one half of a standard deviation were coded as 'not clinically improved', while those who worsened by greater than half of a standard deviation were coded as 'clinically worsened'. Frequencies were tabulated to identify the proportion of individuals in these categories for each outcome variable.

For correlation analyses, residualized change scores were first computed for all variables. For each variable, the baseline value was used to predict the post-treatment or follow-up value of the variable in a regression analysis, and the residualized change score was computed as the difference between the post-treatment or follow-up score with the baseline covaried out. Pearson correlations were then computed to examine the associations between residualized change scores on treatment outcome and process variables based on the psychological flexibility model. Scatter plots for all variable pairs involved in correlation analyses were examined for linearity. None of the variable pairs were considered to have significant nonlinear associations. Hierarchical multiple linear regression analyses were then computed to examine the shared and unique contributions of change in treatment process variables to change in treatment outcomes. Changes in pain intensity were controlled for in the first step of each of these analyses. Treatment process variables

were entered in the second step of the regression equation. For these analyses, only treatment outcomes showing significant improvements were examined as dependent variables. Moreover, only change scores for treatment process variables that were significantly correlated with change in the treatment outcomes in zero-order correlations were entered, simultaneously, into the equations as independent variables. Given these requirements and the secondary nature of the treatment process analyses, we chose a less conservative significance level ($p \leq 0.05$) for variables to be included in the regression analyses compared to the Bonferroni-corrected significance level ($p < 0.003$) for our primary treatment outcome comparisons.

To maximize sample size for all analyses, pairwise deletion was used to address missing values on study variables. Therefore, the sample size varies slightly across the t-tests, correlations, and regression analyses, depending on the variables being examined. Degrees of freedom and sample sizes are reported throughout the analyses to reflect these minor differences.

Results

Independent-samples t-tests were computed to compare participants who provided data at follow-up (n = 30) with those who did not in terms of age, years of education, duration of pain, and the treatment outcome and process variables assessed at post-treatment. No significant differences were found on any of the variables.

Between groups differences

A series of mixed ANOVAs were computed to investigate any differences on the outcome and process measures, at any of the three time points, between groups completing either a 2-week or a 4-week program. No significant differences between groups were found, with the measure of cognitive fusion at follow-up the closest to approaching significance, $F(1, 25) = 1.01$, $p = .11$. All of the variables in these analyses were considered to be normally distributed, with the exception of physical functioning where a Mann-Whitney U test revealed no significant differences between groups ($p > .05$). As there were no differences between the two-week and four-week treatment groups, these two groups were combined for all of subsequent analyses.

Pre-treatment correlations between psychological flexibility processes and outcome variables

At pre-treatment, all of the psychological flexibility process variables, with the exception of decentering, were significantly correlated with depression and mental health, in the expected direction (Table 3). Committed action, general acceptance, and cognitive fusion were significantly correlated with social functioning. Pain acceptance, committed action, and general acceptance were significantly correlated with physical functioning. Pain acceptance was significantly correlated with pain intensity.

Treatment changes on outcome and process variables

Mean values and standard deviations for all outcome and process measures at pre-treatment, post-treatment, and nine-month follow-up are presented in Table 4. Paired samples t-tests were conducted to analyze the difference between pre- and post-treatment,

and pre-treatment and nine-month follow-up data for all measures. Significant improvements from pre- to post-treatment were observed for pain, physical functioning, social functioning, mental health, and depression. Similarly, significant improvements were observed for the processes of pain acceptance and committed action from pre- to post-treatment (all *p*-values ≤ 0.001; Bonferroni corrected alpha: $p < 0.003$). Effects sizes (*d*) across the variables ranged from small to large. The average effect size was 0.56 across all of the comparisons, with a range from 0.04 for decentering to 0.97 for mental health. No significant change was found for general acceptance, decentering, or cognitive fusion.

Applying the Bonferroni corrected alpha ($p < 0.003$), no significant changes were seen from pre-treatment to follow-up on any treatment outcome or process variable. However, small to medium effect sizes were observed during this period, with an average effect size of 0.29 across all of the outcome and process variables. Effect sizes ranged from 0.09 for decentering to 0.50 for physical functioning.

Clinical significance of treatment changes

The number of patients experiencing clinically significant improvements on the outcome measures from pre- to post-treatment and pre-treatment to follow-up is presented in Table 4. On average across the outcome measures, 54.76% of patients experienced a clinically meaningful improvement from pre- to post-treatment. The proportion of patients showing clinically meaningful improvements during this time period ranged from 48.3% for social functioning to 65.3% for mental health. At follow-up, an average of 39.6% of patients reported significant improvement compared to pre-treatment. The proportion of patients

showing clinically meaningful improvements during this interval ranged from 34.4% for social functioning to 43.3% for pain intensity and physical functioning.

Correlations between changes in treatment process and outcome variables

Pearson's product-moment correlations were computed to investigate the associations between changes on the measures of psychological flexibility and changes on treatment outcome measures from pre- to post-treatment and from pre-treatment to follow-up (Table 5). During the pre- to post-treatment interval, improvements in general acceptance were significantly correlated with improvements in social functioning and mental health; improvements in committed action were significantly correlated with improvements in mental health and depression. During the pre-treatment to follow-up interval, improvements in general acceptance were significantly correlated with improvements in pain intensity, social functioning, mental health, and depression; improvements in pain acceptance were significantly correlated with improvements in pain intensity, mental health and depression (Table 6).

Regression analyses examining change in process variables as predictors of change in treatment outcomes.

A series of multiple regression analyses were conducted to determine the shared and unique contributions of changes in process measures to changes in treatment outcomes. Only outcome variables with significant changes ($p \leq 0.05$) from pre- to post-treatment or pre-treatment to follow-up were included in these analyses as dependent variables. Additionally, only change in process variables that were significantly correlated with change

in the dependent variables in the zero-order analyses were entered in the regression equations. In total, four separate regression analyses were computed.

Pre- to post-treatment change in mental health was the dependent variable for the first analysis (Table 7). Change in pain was entered in the first step, but did not significantly predict change in mental health. Changes in general acceptance and committed action were entered in the second step, and significantly contributed an additional 23% of the explained variance in changes in mental health. Examination of the beta weights from the final equation indicated that change in committed action was the only significant unique predictor of change in mental health, $\beta = 0.34$, t (53) = 2.59, $p < 0.05$. In the next analysis, pre- to post-treatment change in social functioning was the dependent variable. Change in pain was entered in the first step, but did not significantly predict change in social functioning. Change in general acceptance was entered in the second step, and significantly contributed an additional 12% of the variance in social functioning. Examination of the beta weights from the final equation indicated that change in general acceptance was the only significant unique predictor of change in social functioning, $\beta = 0.36$, t (54) =2.75, $p <0.01$. Pre- to post-treatment change in depression was the dependent variable for the third analysis. Change in pain was entered in the first step and significantly contributed 7% of the variance in change in depression. Including committed action in the second step contributed a further 13% of the explained variance. The beta weights from the final equation indicated that both changes in pain, $\beta = 0.29$, t (56) = 2.40, $p < 0.05$, and committed action, $\beta = -0.36$, t (56) = -3.03, $p < 0.01$, uniquely contributed to change in depression.

In the final analysis, pre-treatment to follow-up change in depression was the dependent variable. Change in pain was entered in the first step and significantly contributed 15% of the variance in depression. Changes in general acceptance and pain acceptance were entered in the second step, and significantly contributed an additional 20% of the variance. Examination of the beta weights from the final equation indicated that change in general acceptance was the only significant unique predictor of change in depression, $\beta = 0.50$, $t(25) = 2.45$, $p < 0.05$.

Discussion

The purpose of this study was to examine the potential effectiveness of ACT-based treatment for older people with chronic pain, and to investigate the associations between improvements in psychological flexibility processes and patient functioning. In line with our predictions, the results reported here partially support the effectiveness of this interdisciplinary treatment for people aged 65 and older with chronic pain. Significant improvements were observed from pre- to post-treatment on all of the outcome variables and for the process variables of chronic pain acceptance and committed action. Importantly, 40% to 66% of participants showed clinically meaningful improvements across outcomes at post treatment, while 5% to 22% of participants clinically meaningfully worsened on treatment outcomes. Small effect sizes were observed for all treatment outcome and process variables (with the exception of decentering) during the pre-treatment to follow-up interval; however, these changes were not statistically significantly.

In general, the medium to large effect sizes from pre- to post-treatment for pain, functioning, and mental health observed here are similar to those reported during the same

interval in a previous study of ACT for adults with pain aged 60 and older (8). In contrast, the pre- to post-treatment effect sizes for psychological flexibility processes, and the pre-treatment to follow-up effect sizes for all variables were generally smaller in the present study compared to those reported in our previous study (8). The older age of the current sample, longer-term follow-up (nine versus three months), and our examination of different psychological flexibility processes, including cognitive fusion, decentering, and committed action, may have accounted for different effect sizes across the studies, at least in part.

Interestingly, across both time periods, at post treatment and follow-up, treatment response did not vary as a function of treatment length (2 versus 4 week program). One point to remember is that these participants were not randomly assigned to these treatment lengths, they were assigned according to their differing circumstances. Nonetheless, future research with a larger sample is needed to determine the optimal length of this type of treatment for older adults, as well as to identify characteristics of older participants who worsen following this treatment.

Our finding of significant correlations among a number of the psychological flexibility processes and measures of functioning and mental health at pre-treatment is consistent with previous findings (8). Extending previous work, the current data provide partial support for the contribution of improvements in psychological flexibility to improvements in treatment outcomes in older adults. In the pre- to post-treatment regression analyses, even after controlling for changes in pain, improvements in general acceptance uniquely contributed to improvements in social functioning, and improvements in committed action

uniquely predicted improvements in mental health and depression. At follow-up, improvements in pain acceptance uniquely contributed to improvements in depression. Of course, the small sample size at the follow-up makes interpretation of the associations between changes on process and outcome variables difficult. Despite this challenge, these preliminary data suggest that improvements in general acceptance and committed action may facilitate improvements in functioning and mental health during treatment, while improvements in general acceptance following treatment may facilitate longer term improvements in depression. Future research is needed to examine the time course of changes on these process measures in relation to indices of patient functioning in a larger sample of older people.

Although the current data suggest the potential effectiveness of ACT for older individuals with pain, there is certainly room to improve, particularly in maintaining the magnitude of treatment improvements over the longer-term. The small effect sizes on the psychological flexibility process measures that are theoretically presumed to underlie ACT perhaps suggest an area for future treatment development in this group of patients. Among the process variables measured, decentering and cognitive fusion improved the least.

Decentering and defusion entail the ability to separate oneself from one's psychological experiences, along with an ongoing awareness of these experiences (15, 35, 36). In research on psychological flexibility and ACT for pain thus far, these processes have been less often assessed and less well studied compared to other processes in the model. Certainly there are challenges here. These processes are somewhat counter-intuitive and require a kind of

insight into one's own behavior that appears difficult to achieve. Hence the development of precise measures of these processes has been slow and these measures have only emerged recently. The absence of significant improvement here could reflect the difficulty associated with measuring these behavior patterns, or relative weakness of treatment delivery in addressing these processes in this population, particularly in a group treatment delivery format, or both. We might note here that in analyses of our full dataset including older and younger adults, the effect sizes for these processes are relatively small and generally not substantially larger than the effects observed here for the selected older group. Therefore, the observed lack of change on these processes does not appear unique to older people with pain. Future research is needed to enhance our measurement of these processes and to optimize treatment delivery so that larger effects are observed on these facets of psychological flexibility. The assumption from the model is that larger effects on these processes will be associated with larger effects in terms of patient functioning (15, 16). Of course, this assumption requires testing.

It is plausible that a number of age-related concerns specific to older adults that were not investigated here limited the potential magnitude of the effect sizes observed. For example, older adults with chronic pain may face a number of additional challenges that could impede treatment effectiveness, including role transitions, widowhood, caregiving responsibilities, medical comorbidities, and socio-cultural biases regarding ageing (44, 45). Future research would benefit from examining these factors in relation to outcomes for older adults attending psychologically-based treatment programs for chronic pain.

This study has several limitations. First of all, this study did not include a control condition, which limits the conclusions that can be drawn regarding the causal effects of the treatment studied here. Thus, we cannot be certain that the observed effects are due to the ACT-based intervention. Additionally, due to the correlational nature of the design, it is not possible to determine whether changes in psychological flexibility process variables preceded changes in functioning and mental health. A large, randomized-controlled trial with more frequent assessment of treatment outcome and process will be needed to determine the causal effect of this treatment for older adults with chronic pain and the mediating role of psychological flexibility processes in treatment outcome.

A further limit is our relatively small sample size. The participants were selected from adults referred to an interdisciplinary pain management center in London, among which only a small proportion were aged over 65 (6.9%); this obviously limited the power of statistical analyses. Power was further reduced for the follow-up analyses due to only 50% of participants providing follow-up data, thus limiting the potential reliability and generalizability of this set of analyses. This sample size and design also restrained our ability to investigate other potentially interesting questions, such as whether there are any subgroup differences in treatment effect within our sample, such as those linked to gender, domestic situation, pain type or location, or other moderator variables.

Our sample is not likely to be representative of the general population of people in this same age category. The sample was predominantly white with pain of longstanding duration, and perhaps not surprisingly retired, which further limits the generalizability of the results. A further limitation is that the treatment package was developed generally for

adults, rather than tailored for people over 65. This may have limited the treatment effectiveness for the investigated population. One argument against this point, however, is that previous research appears to suggest that treatments specifically designed for older people have not produced results that one would expect based on the data from younger adults (11, 12). Furthermore, a recent study suggests older adults with chronic pain are more likely to respond to ACT than other psychological treatments (21). Finally, the expected relations between ACT-related processes and outcomes were not found for certain processes. As discussed above, this could due to the small sample size, difficulty in the performance of the measures assessing these processes, or weakness in treatment delivery in addressing these processes.

In summary, the ACT-based treatment studied here was associated with improvements in functioning immediately post-treatment for people with chronic pain who are 65 and older. There was some support for the association between improvements in psychological flexibility processes and daily functioning and mental health in this sample during treatment and at the follow-up period. Mapping changes from the full set of facets of psychological flexibility onto the patterns of behavior change observed in treatments such as the one studied here is an ongoing challenge. Nonetheless, these preliminary data support the potential utility of continuing to measure and target psychological flexibility among older individuals with pain. Optimizing the impact of treatment on psychological flexibility processes and patient functioning is an important goal for future research.

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Table 1. Demographic characteristics of the sample (*n* = 60)

	n (%) or M (SD)
Age (Years)	69.33 (4.24)
Age range 60 to 69 years	40 (66.7%)
Age range 70 to 79 years	20 (33.3%)
Years education	13.44 (3.61)
Gender	
Male	23 (38.3%)
Female	37 (61.7%)
Ethnicity	
White	53 (88.3%)
Black	5 (8.3%)
Asian	2 (3.3%)
Living status	
With a partner	33 (55.0%)
Alone	17 (28.3%)
With partner and children	4 (6.3%)
With other relatives	3 (4.7%)
With child/children	2 (3.1%)
Missing	1 (1.6%)
Employment status	
Retired	45 (75.0%)
Unemployed	9 (14.1%)
Employed	4 (6.7%)
Homemaker	1 (1.6%)
Missing	1 (1.6%)

Table 2. Pain characteristics, medications, and co-morbidities of the sample (n = 60)

	n (%) or median (range)
Pain Duration (Months)	166.0 (31 – 592)[a]
Pain Location	
Lower back	25 (41.7%)
Lower limbs	13 (21.7%)
Generalised	11 (18.3%)
Neck region	3 (5.0%)
Upper shoulder or upper limbs	2 (3.3%)
Pelvic region	2 (3.3%)
Anal or genital region	2 (3.3%)
Head, face or mouth	1 (1.7%)
Abdominal region	1 (1.7%)
Medication	
Opioids	50 (83.3%)
Anti-Convulsants	12 (31.6%)
Tricyclic Anti-Depressants	11 (28.9%)
Non-Steroid Anti-Inflammatories	11 (28.9%)
Paracetamol	17 (44.7%)
SSRI/SNRI	3 (7.9%)
Hypnotics	1 (2.6%)
Anxiolytics	2 (5.3%)
Co-occuring health problems	
Heart disease	10 (23.3%)
High blood pressure	22 (50%)
Lung disease	2 (4.5%)

Diabetes	8 (18.2%)
Ulcer or stomach disease	6 (13.6%)
Kidney disease	3 (6.8%)
Liver disease	2 (4.5)
Anaemia or other blood disease	6 (13.6%)
Cancer	4 (9.1%)
Depression	13 (30.2%)
Osteoarthritis/degenerative arthritis	28 (63.6%)
Rheumatoid arthritis	8 (18.2%)
Other e.g. Irritable Bowel Syndrome, fibromyalgia, hernia	22 (51.2%)

[a] Pain duration showed a large dispersion and is thus reported in terms of the median and range.

Table 3. Correlations between measures of patient functioning and psychological flexibility at pretreatment

	Pain Intensity	Physical Functioning	Social Functioning	Mental Health	Depression
Pain acceptance	-0.27*	0.32**	0.20	0.49***	-0.41***
Committed action	-0.11	0.27*	0.25*	0.62***	-0.56***
Psychological acceptance	-0.23	0.32**	0.41***	0.61***	-0.51***
Decentering	-0.09	-0.05	0.01	0.19	-0.24
Defusion	0.04	-0.02	-0.21*	-0.44***	0.42***

Note: n = 58-59 for all correlations; *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$

Table 4. Pre-treatment, post-treatment, and follow-up scores on study variables

	Pre-treatment		Post-treatment				Follow-up			
	M	SD	M	SD	*t*	Effect size (d)	M	SD	*t*	Effect size (d)
Outcome variables										
Pain	7.56	1.89	6.65	1.68	*t* (59) = 3.67, p ≤ 0.001	0.51	6.92	1.84	*t* (29) = 1.21, ns	0.27
Physical functioning*	20.50	15.67	32.33	22.56	*t* (59) = -6.45, p ≤ 0.001	0.61	34.00	27.56	*t* (29)= -2.16, p ≤ 0.05[a]	0.50
Social functioning	47.63	25.27	64.22	27.05	*t* (57) = -5.21, p ≤ 0.001	0.63	56.03	30.73	*t* (28) = -1.54, ns	0.31
Mental health	54.41	19.81	71.72	15.84	*t* (57) = -7.22, p ≤ 0.001	0.97	58.07	21.42	*t* (28)= -1.71, ns	0.32
Depression	12.14	6.40	8.25	5.66	*t* (59) = 5.73, p ≤ 0.001	0.64	9.63	7.65	*t* (29) = 2.26, p ≤ 0.05[a]	0.40
Process variables										
General acceptance	30.20	10.99	33.85	9.70	*t* (58) = -3.28, p ≤ 0.01[a]	0.35	33.57	11.39	*t* (29) = -1.96, ns	0.29

Pain acceptance	55.82	18.73	62.87	15.07	*t* (54) = -4.06, p ≤ 0.001	0.41	61.86	23.45	*t* (28) = -1.41, ns	0.25
Decentering	61.71	6.70	62.00	8.70	*t* (57) = -0.35, ns	0.04	61.97	7.94	*t* (29) = -0.46, ns	0.09
Fusion	44.59	12.37	42.91	12.69	*t* (55) = 1.54, ns	0.13	42.17	12.16	*t* (28) = 1.36, ns	0.22
Committed Action	65.46	15.67	70.35	11.69	*t* (58) = -3.50, p ≤ 0.001	0.35	67.23	15.87	*t* (29) = -1.52, ns	0.24

Note: *Log-transformed scores were used to compute t-values for physical functioning. Untransformed mean values are reported for ease of interpretation; [a] Bonferroni corrected alpha level: $p < 0.003$.

Table 5. Clinically significant change on outcome variables

	Pre- to post-treatment *n* (%)			Pre-treatment to follow-up *n* (%)		
	Significantly worse	No change	Significantly improved	Significantly worse	No change	Significantly improved
Depression	4 (6.7)	25 (41.6)	31 (51.8)	4 (13.3)	14 (46.6)	12 (39.8)
Pain intensity	13 (21.7)	16 (26.7)	31 (51.7)	5 (16.6)	12 (40.0)	13 (43.3)
Physical Functioning	4 (6.7)	22 (36.7)	34 (56.8)	3 (10)	14 (46.6)	13 (43.3)
Social Functioning	5 (8.6)	25 (43.1)	28 (48.2)	4 (13.7)	15 (51.7)	10 (34.4)
Mental Health	3 (5.1)	17 (29.2)	38 (65.3)	6 (20.5)	12 (41.2)	11 (37.5)

Table 6. Correlations between change scores on outcome and process variables from pre- to post-treatment.

	Pain	Physical Functioning	Social Functioning	Mental Health	Depression
Pain acceptance	-0.03	0.02	0.03	0.22	-0.24
Committed action	0.04	-0.14	0.10	0.41**	-0.35**
General acceptance	-0.18	0.22	0.34**	0.38**	-0.22
Decentering	0.05	0.03	0.13	-0.02	-0.08
Fusion	0.02	0.10	-0.22	-0.20	0.21

Note: n = 55-59 for all correlations; **$p \leq 0.01$

Table 7. Correlations between change scores on outcome and process variables from pre-treatment to follow-up.

	Pain	Physical Functioning	Social Functioning	Mental Health	Depression
Pain acceptance	-0.51*	0.11	0.26	0.58**	-0.36*
Committed action	-0.10	0.33	0.17	0.34	-0.31
General acceptance	-0.45*	0.31	0.38*	0.55**	-0.51**
Decentering	-0.22	0.02	-0.09	0.10	-0.14
Fusion	0.15	-0.12	-0.13	-0.20	0.28

Note: n = 28-30 *$p \leq 0.05$; **$p \leq 0.01$

Table 8. Change on process measures as predictors of change on outcomes from pre- to post-treatment.

	ΔR^2	Fchange	*df*	β
Mental Health				
Step 1	0.01	0.67	1, 55	
Pain intensity				-0.10
Step 2	0.23	7.89**	2, 53	
Committed action				0.34*
General acceptance				0.24†
Social Functioning				
Step 1	0.001	0.03	1, 55	
Pain intensity				0.10
Step 2	0.12	7.58**	1, 54	
General acceptance				0.36**
Depression				
Step 1	0.07	4.57*	1, 57	
Pain intensity				0.29*
Step 2	0.13	9.18**	1, 56	
Committed action				-0.36**

Note: † $p = 0.07$; *$p \leq 0.05$; **$p \leq 0.01$

Table 9. Change on process variables as predictors of change in outcomes from pre-treatment to follow-up.

	ΔR^2	Fchange	*df*	β
Depression				
Step 1	0.15	4.72*	1, 27	
Pain intensity				0.17
Step 2	0.20	3.71*	1, 25	
General acceptance				0.50*
Pain acceptance				0.01

Note:*$p < 0.05$