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Preliminary Investigation of the Associations between Psychological Flexibility, Symptoms,

and Daily Functioning in People with Chronic Abdominal Pain

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Abstract

Objective: Acceptance and Commitment Therapy, based in the psychological flexibility model, may benefit people with chronic abdominal pain. The current study preliminarily investigates associations between psychological flexibility processes and daily general, social, and emotional functioning in chronic abdominal pain. **Methods**: An online survey comprising measures of psychological flexibility processes and daily functioning was distributed through social media. **Subjects**: 89 participants with chronic abdominal pain were included in the analyses. **Results**: All investigated psychological flexibility processes significantly correlated with pain interference, work and social adjustment, and depression, in the expected directions ($|r|$=.35-.68). Only pain acceptance significantly correlated with gastrointestinal symptoms, r=-.25. After adjusting for pain in the analyses, pain acceptance remained significantly associated with all outcomes, $|\beta|$=.28 to .56, but depression. After adjusting for pain and pain acceptance, only cognitive fusion remained significantly associated with anxiety, β=-.27, and depression, β=.43. When contrasting GI-specific anxiety with psychological flexibility processes, pain acceptance was uniquely associated with pain-related interference and work and social adjustment, and cognitive fusion and committed action were uniquely associated with depression. **Conclusions**: Psychological flexibility processes were positively associated with daily functioning in people with chronic abdominal pain. Acceptance and Commitment Therapy may provide benefit for these people. Further studies with experimental designs are needed to examine the utility of ACT for people with abdominal pain.

Key words: Psychological Flexibility, Acceptance and Commitment Therapy, Chronic abdominal pain, Gastrointestinal disorders, Daily functioning

1. Introduction

Chronic abdominal pain (CAP) is defined as continuous or intermittent abdominal discomfort lasting for at least 6 months [1]. The aetiologies of chronic abdominal pain are widely varied, including conditions with a clear anatomical, physiological, or metabolic cause, as well as those without any clear source. CAP, like other chronic pain conditions, may arise from similar processes of central sensitisation. It is also commonly associated with motility abnormalities, which is associated with conditions such as constipation, diarrhea, bloating, and crampiness etc. [2]. CAP is prevalent and associated with significant personal and social impact. The prevalence of abdominal pain is reported as around 25% in adult population in cross-sectional surveys [3,4,5]. CAP is among the most common complaints in primary care [6]. National surveys of the burden of GI disease [7,8,9] consistently identify abdominal pain as among the most common symptom prompting an outpatient clinic visit.

CAP and associated symptoms may lead to significant psychological and social challenges for the people who suffer from them. Conditions of chronic abdominal distress and pain, including related conditions such as irritable bowel syndrome (IBS), dyspepsia, Inflammatory Bowel Disease (IBD) [10], and functional constipation [11], are consistently associated with depression, anxiety, and decreased quality of life [12,13,14,15]. CAP is also associated with suicide [16]. Abdominal pain can lead to substantial health care costs with annual GI-related treatment costs of US$16.6 billion in the United States [17] and €28.4 billion across Europe [18].

Although there is relatively little evidence for effective treatments for primary CAP in adults, psychological treatments such as cognitive behavioural therapy (CBT) have been widely used in conditions where abdominal pain is a primary symptom. For instance, a recent systematic review identified 7 RCTs of CBT for IBD [19], and meta-analyses of these

suggested a significant treatment effect for health-related quality of life in people with IBD

at follow-ups. Systematic reviews [20,21] also identify CBT as the most frequent modality of

psychological treatments for IBS with medium to large effect sizes for symptom severity

(d=.73), mental health (d=.41), and daily functioning (d=.55) when compared with controlled

conditions. Although broadly-defined CBT has been shown as the best evidence-based

psychological treatment for IBS, it does not appear superior to placebo [22]. Intriguingly,

studies show that catastrophising (a key focus of the CBT approach) may not moderate [23]

or mediate [24] treatment outcomes, in forms of CBT for abdominal pain.

Among the developments within CBT, Acceptance and Commitment Therapy (ACT)

[25], may provide an additional option or an advance in treatment for CAP. The therapeutic

aim of ACT is to facilitate psychological flexibility (PF). PF is the capacity to be directly,

consciously, and fully in contact with the present moment and to persist or change one's

behaviours, in line with one's values, to achieve one's goals [25]. The PF model includes six

interrelated core processes: acceptance, cognitive defusion, present awareness, self-as-

context, values, and committed action [25].

Systematic reviews of Randomised Controlled Trials (RCTs) of ACT for chronic pain in

general supported the effectiveness of ACT for a variety of outcomes including physical

functioning, global disease impact, anxiety, depression, emotional distress, life satisfaction,

and show effects on components of PF [26,27], with small to large effect sizes.

Although evidence regarding ACT for CAP across gastrointestinal (GI) conditions

remains limited, several studies in ACT for specific GI conditions including CAP as a primary

symptom have produced promising results. One RCT of ACT has been conducted for the

treatment of stress in IBD [28]. Participants who received ACT showed 42% and 37%

reduction in stress scores at eight and twenty weeks, respectively, in comparison to the

control group whose stress scores remained stable. Also, the reduction in stress was associated with the increase in PF [28]. One uncontrolled study of ACT for IBS included a one-day workshop and a self-help manual [29]. The results showed that participants significantly improved in all outcomes investigated at post-treatment, including reduced avoidance behaviour (d=.32), symptom severity (d=.41), IBS impact on quality of life (d=.41), and GI-specific anxiety (d=.76). Participants continued to improve in all outcomes at six-month follow-up with small to large effect sizes (avoidant behaviour, d = .39; symptom severity, d = .47; IBS impact on quality of life, d = .55; GI-specific anxiety, d = 1.10). IBS acceptance, a specific form of a key component of the PF model, also improved significantly at post-treatment (d=.32), and the improvement continued at follow-up (d=.50). Finally, another uncontrolled study of ACT-based self-help treatment for IBS [30] similarly showed participant improvements in symptom severity, GI-specific anxiety, and IBS willingness, a component related to acceptance, at six-month follow-up.

Other forms of treatments that involve some similar elements as in ACT-based treatment have also produced promising results. In a recent review of "new psychological therapies" for IBS [31], several studies were identified investigating exposure- and/or mindfulness-based treatments. An RCT investigating the effect of an internet-delivered exposure- and mindfulness-based treatment for IBS showed that participants in the treatment group reported 42% reduction in symptoms as compared to 12% increase in the control group [32]. Participants in the treatment group also improved on all secondary outcomes with a large between group effect size for quality of life, compared to the control condition (Cohen's d= 1.21) [32]. The treatment gains were maintained in all outcomes with mainly large effect at 15-18 months follow-up [33]. In one uncontrolled study of mindfulness-based treatment for IBS, a significant reduction in the percentage of

participants meeting Rome IBS criteria at 6-month follow-up was observed, as well as correlations between mindfulness skills and GI-specific anxiety [34]. Two RCTs of mindfulness-based treatment for IBS [35, 36] were also identified and reported significant treatment effects for several outcomes including GI symptoms [35, 36], quality of life [35], and anxiety [35].

Among investigations of new psychological therapies for IBS, GI-specific anxiety (GSA) has been identified as a mediator of treatment outcomes [37, 38]. These findings are notable because the suggest an alternative model of the mechanisms underlying GI conditions, a potential point of comparison for the PF model, and an opportunity to preliminarily examine the relative utility of these two models for application to CAP.

While there are promising results from ACT for conditions that include CAP as a primary symptom, evidence for the direct associations between other PF processes, particularly the cognitive (cognitive defusion) and behavioural engagement (committed action) components, and treatment outcomes remains limited. If the contributions of these processes were better understood, they could guide future treatment improvements.

The primary aim of the study was to preliminarily explore the associations between PF processes, pain, GI symptoms, GSA, mood, and functioning in people with CAP. The PF processes here included pain acceptance, cognitive defusion, and committed action, and outcome variables included GI symptoms, pain-related interference, work and social adjustment, and depression. As ACT-based treatments for pain do not target pain reduction, but improvement of functioning, pain intensity was investigated as a co-variate, instead of process variable. An additional aim was to examine the relative role of each PF process in relation to these outcome variables, as well as the unique role of PF processes, independent from GSA, in relation to outcome variables. We predicted that (1) all of the PF processes

would significantly correlate with the outcome variables, (2) some PF processes would significantly correlate, independent from other PF processes, with the outcome variables, (3) some PF processes would significantly and uniquely correlate, with the outcome variables, independent from GSA. The prediction of "some" processes in each of these latter predictions is based on the known inter-correlated nature of the processes and results from previous studies. Which processes would best, uniquely and significantly, correlate with the outcome variables was exploratory, and thus a specific prediction was not made.

2. Methods

2.1 Participants

133 potential participants were recruited (potential participants who clicked the weblink to take part in the online survey) between 18 October 2018 and 13 January 2019. 126 potential participants were eligible. Among these, 110 gave their consent. Among the participants who consented to participate, 21 did not provide any data on any of the variables. Therefore, 89 participants were included in the main analysis. Participants who did and did not complete the survey were compared on all demographic variables, and process and outcome variables, where available. No difference between the two groups of participants was found in any of these variables. Participants who reported having been diagnosed with a specific GI condition, versus those not diagnosed, were compared on all process and outcome variables. Participants with diagnoses did not differ from those without in any of the process and outcome variables except for committed action. Participants with GI diagnoses (M=30.04, SD=7.64) reported more committed actions toward goals, compared to those without GI diagnoses (M=21.71, SD=9.01), $t(72)=2.33$, $p=.023$. Table 1 shows the demographic information of these participants.

[Table 1 about here]

2.2 Study design

An online survey was built using online survey tool Qualtrics to collect data on demographics and variables of interests. The study was then advertised on social media including Facebook, Twitter, and online forums for abdominal pain, and various GI conditions, with a weblink for the online survey. First, potential participants were screened based on their age and presence of chronic abdominal pain. Adults who had continuous or intermittent abdominal pain or discomfort for 6 months or longer were eligible to continue the survey. Next, potential participants were asked to provide their consent, and those who did were able to continue the survey. Participants provided demographic information and completed measures of processes and outcomes. There is currently no highly efficient way to examine all PF processes without a considerable burden on respondents. Therefore, three psychological processes (pain acceptance, cognitive defusion, and committed action) were selected to reflect PF in this study, as they are clearly core processes and derive from well-validated and brief measures.

2.3 Measures

Pain intensity. The average pain in the past week are rated on a 0-10 numerical scale.

Gastrointestinal Symptom Rating Scale (GSRS). The GSRS is a disease-specific instrument of 15 items combined into five symptom clusters depicting Reflux, Abdominal pain, Indigestion, Diarrhoea and Constipation. Symptoms are assessed on a seven-point scale ranging from 1 "absence of troublesome symptoms" to 7 "very troublesome symptoms".

The reliability and validity of the GSRS are well documented [39]. The reliability of the scale in the current study was, α=.79.

Visceral sensitivity index (VSI). The VSI is a self-report measure of GI-specific anxiety, including fear, anxiety, avoidance, worry, and hypervigilance responses to common GI-specific sensations [40]. All items are rated on a 1 to 6 scale "strongly agree" to "strongly disagree" with the statement presented. Higher total scores reflect lower level of GI-specific anxiety. The scale has good internal consistency and validity [41]. The reliability of the scale in the current study was, α=.92.

Brief Pain Inventory (BPI). The BPI interference scale is a self-report measure of the impact of pain on daily functioning (interference). Interference from pain is rated for general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life, with one item for each domain. All items of the interference scale are rated on a 0 to 10 scale from "does not interfere" to "completely interferes". The BPI interference scale is regarded as a reliable and valid index of pain-related interference with daily functioning [42]. The reliability of the scale in the current study was, α=.90.

Work and Social Adjustment Scale (WSAS). The WSAS is a five-item self-report measure that assesses what is referred to by the authors as "functional impairment" in terms of work, home management, social leisure, private leisure and personal or family relationships. All items are rated on a 0 to 8 scale from "no impairment" to "very severe impairment". The WSAS is regarded as a reliable and valid index of impairment in functioning attributable to an identified problem [43]. The reliability of the scale in the current study was, α=.90.

Patient Health Questionnaire (PHQ-9). The PHQ-9 is a ten-item self-report assessment for depression severity. 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 last item is rated on a scale of impact or difficulty 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 level of severity of depression. The PHQ-9 is regarded as a reliable and valid index of depression severity [44]. The reliability of the scale in the current study was, α=.89.

Chronic Pain Acceptance Questionnaire (CPAQ-8). The Chronic Pain Acceptance Questionnaire is a 20-item scale for accessing acceptance of chronic pain [45]. All items are rated on a 0 to 6 scale from "never true" to "always true". Higher score indicates greater acceptance of pain. An eight-item form has been validated and was used here [46]. The reliability of the scale in the current study was, α=.71.

Cognitive Fusion Questionnaire (CFQ-7). The CFQ is a self-report measure with seven items that assesses cognitive fusion, the tendency for behaviors to be dominantly regulated and influenced by cognition [47]. All items are rated on a 1 to 7 scale from "never true" to "always true". All items are positively keyed, with higher score reflecting higher level of cognitive fusion. The reliability of the scale in the current study was, α=.95.

Committed Action Questionnaire (CAQ-8). The CAQ is a self-report measure with 20 items that assesses committed action. All items are rated on a 0 to 6 scale from "never true" to "always true" [48]. A shortened and previously validated version of eight items was used

here [49]. Four items are positively keyed, four negatively. The reliability of the scale in the current study was, α=.84.

2.4 Statistical analysis

The required sample size was estimated using G*power (a Priori calculation of sample size required for correlation), based on effect sizes observed in our previous cross-sectional online survey study investigating the correlations between PF processes and functioning in people with chronic pain using a similar set of self-report measures [50]. Cohen's criteria [51] for effect sizes were applied: small r=.10, medium r=.20, large r=.50. In the study, we observed medium to large effect sizes for correlations between pain, PF processes and mood and daily functioning. A sample size of 84 participants was required to achieve 80% power to detect a medium effect size of d=.30.

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 significant nonlinear relation was found.

Following these preliminary analyses, in order to examine the possible confounding effect of the heterogeneity of GI diagnosis, one-way ANOVAs were conducted to examine the difference in outcome variables between participants with different GI conditions.GI conditions were grouped into three categories, including IBS, IBD and Other to facilitate the analyses. One-way ANOVAs were conducted to examine the difference in outcome variables between participants with different GI conditions (IBS, IBD, or Other). Next, Pearson correlations were conducted to examine the correlations between Pain, PF process variables, including pain acceptance (CPAQ-8), cognitive fusion (CFQ-7), and committed

action (CAQ-8), and outcome variables including GI symptoms (GSRS), GI-related anxiety

(VSI), pain-related interference (BPI), work and social adjustment (WSAS), and depression

(PHQ-9). Cohen's [51] thresholds for interpreting effect sizes were adopted: r=.10 is

considered as small effect size, r=.30 medium, r=.50 large.

Next, hierarchical multiple regressions were conducted to examine the role of each

PF process, independent from other PF processes, in relation to the outcome variables. In

these analyses, scores from measures of PF processes were independent variables and

scores from the measures of outcomes were dependent variables. For each hierarchical

regression model, demographic variables were simultaneously entered stepwise in the first

block, and pain intensity, investigated as a co-variate in the current study, was force entered

in the second block. In a recent comprehensive examination of the structure of the PF

model using confirmatory factor analyses in a large chronic pain sample, a general factor

reflecting openness (as reflected in acceptance measures) emerged explaining variance

across all measures of PF [52]. Therefore, pain acceptance was force entered in the third

block. As which PF processes would independently correlate with outcome variables was

exploratory, cognitive fusion and committed action were force entered simultaneously in

the last block.

Finally, another series of hierarchical multiple regressions were conducted to

examine the unique role of PF processes, independent from GSA, in relation to the outcome

variables. In these analyses, scores from measures of PF processes and VSI were

independent variables, and scores from measures of outcomes were dependent variables.

In each hierarchical regression model, demographic variables were simultaneously entered

stepwise in the first block, and pain intensity was force-entered in the second block, GSA the

third, and pain acceptance, cognitive fusion, and committed action were simultaneously force-entered in the last block.

3. Results

3.1 The association between GI conditions, pain, PF processes, and outcomes.

Participants with different GI conditions (IBS, IBD, or Other) did not show any difference in outcome variables including GI-related anxiety: $F(2, 75)= .04$, $p=.96$, pain-related interference, $F(2, 72)= .92$, $p=.40$, work and social adjustment, $F(2, 69)= .04$, $p=.96$, and depression, $F(2, 69)= .34$, $p=.72$. A marginally significant effect of GI condition was observed for GI symptom, $F(2, 80)= 3.95$, $p=.023$. However, post-hoc analyses did not show any difference in GI symptom between participants with different GI conditions.

Tables 2 shows the correlations between pain and PF process variables, and outcome variables. Higher levels of pain intensity significantly correlated with more severe GI symptoms and higher pain-related interference. However, pain intensity did not correlate with GI-related anxiety, work and social adjustment, or depression to a statistically significant extent.

Higher pain acceptance significantly correlated with less severe GI symptoms, lower level of GI-specific anxiety, pain interference, and depression, as well as better work and social adjustment, with small to large effect sizes, $|r|=.25$ to $.68$. Higher level of cognitive fusion significantly correlated with higher level of GI-specific anxiety, pain interference and depression, and worse work and social adjustment, $|r|=.35$ to $.60$, but not GI symptoms. Committed action significantly moderately correlated with depression and daily functioning, $|r|=.36$ to $.44$, in the expected directions, but not GI-symptoms or GI-related anxiety.

[Table 2 about here]

3.2 The relative role of each PF process variable in relation to outcome variables

Table 3 shows the results from regression analyses. Pain was significantly associated with GI symptoms (β=.43, p<.001) and pain-related interference (β=.34, p<.001), but not any other outcome variables. After controlling for pain, pain acceptance was still significantly associated with all outcome variables (β=-.28, p<.05 for GI symptoms, β=-.56, p<.001 for pain-related interference, β=-.52, p<.001 for work and social adjustment), except for depression (β=-.11, ns). After controlling for pain and pain acceptance, only cognitive fusion explained significant incremental variance in the models, committed action did not. Cognitive fusion was significantly associated with depression (β=.43, p<.001), but none of the other outcome variables.

[Table 3 about here]

3.3 The role of each PF process variable versus GSA

Table 4 shows the results from regression analyses including GSA as an independent variable. GSA was significantly associated with all outcome variables. While the variance explained by pain intensity and GSA partitioned out, pain acceptance was still significantly associated with pain-related interference (β=.-.37, p<.01), and work and social adjustment (β=.-.39, p<.01), but not GI symptom or depression. However, after the variance explained by pain and GSA partitioned out, cognitive fusion (β=.-.32, p<.001) and committed action (β=.-.26, p<.01) were still significantly associated with depression.

[Table 4 about here]

4. Discussion

The current study preliminarily examines the association between PF processes and aspects of daily functioning in people with CAP. As hypothesized, PF processes including

pain acceptance, cognitive fusion, and committed actions were significantly associated with GI symptoms, anxiety, mood and daily functioning.

To our knowledge, this is the first study directly investigating PF processes in people with CAP across GI diagnoses. On the positive side, these findings are in line with evidence from previous studies supporting the associations between PF processes and aspects of daily functioning in GI conditions [28, 29, 30, 53]. Previous studies of ACT for IBS [29, 30] showed significant improvement in acceptance after the treatment, maintained at follow-up. In the RCT of ACT for IBD [28], it was observed that the reduction in stress was associated with the improvement in PF. Cognitive fusion has also been observed to predict depressive mood in people with IBD in a longitudinal study [53]. The results from the current study were also consistent with findings in chronic pain [54,55,56]. In outcome studies of ACT for chronic pain [54,56,57], change in pain acceptance was found correlated with improvements in anxiety, depression, and physical and psychological disability with small to large effect sizes ($|r|=.18$ to $.66$). Correlations between pain acceptance and mood and functioning were also observed in cross-sectional studies in people with chronic pain [50,58]. Cognitive fusion was found correlated with depression, $r=.51$, and patient functioning, $|r|=.16$ to $.39$, in a cross-sectional study in chronic pain [58]. Change in value-based action was found to significantly correlate with changes in anxiety, depression, physical and psychological disability with small to medium effect sizes, $|r|=.17$ to $.44$ [56]. Additionally, Psychological inflexibility has been identified as mediator of improvements in pain-related disability, depression and anxiety in ACT for chronic pain [55, 59].

After pain and pain acceptance were adjusted for in the regression analyses, only cognitive fusion, and not committed action, was associated with outcomes. These results are perhaps not entirely unexpected. PF processes are theoretically defined as inter-related.

In particular, "openness", reflecting acceptance, has been identified as a general factor underlying several PF processes [52]. Therefore, partitioning out the shared variance of pain acceptance and other PF processes can limit the ability of these processes to emerge as independent predictors of outcomes.

Unexpectedly, pain acceptance did not emerge as an independent predictor of depression. While it has been observed in a previous study that pain acceptance did not predict depression independent of pain intensity [54], pain acceptance emerged as an independent predictor of depression in several other studies of ACT for chronic pain [44,50,60], even when competing with other PF processes. It is plausible that other GI symptoms, but not pain, are the primary concern among some people with CAP, and the struggle with pain did not have as big an impact on mood as among people with musculoskeletal painful conditions. In the current sample, fifteen GI conditions with a variety of GI symptoms were reported. In fact, in our data, GI symptoms showed significant moderate correlation with depression, $r=.38$, $p<.001$, while pain showed no association with depression, $r=.004$, ns. Perhaps a measure of acceptance that is specific to GI conditions can access a more relevant form of acceptance in people with CAP, such as the acceptance measure adapted for IBS population [61]. Future studies developing a measure of acceptance specific to this population, is needed to further understand the role of acceptance in relation to functioning and wellbeing in people with CAP.

After adjusting for pain and pain acceptance in the regression analyses, cognitive fusion still accounted for 21% significant increment in the variance in depression. Again, this finding echoes with the finding from a longitudinal study, where cognitive fusion was found predictive of depressive mood in people with IBD [53]. This finding also appears in line with previous research, where significant positive association between rumination and

depression [62,63,64,65], as well as negative association between cognitive fusion and decentring (a process like cognitive defusion) and depression have been observed [58,62,66,67]. These results appear to suggest that while staying "entangled" within one's thoughts may contribute to depression, being aware of thoughts as thoughts can potentially help. Further mediation studies are in need to determine the effect of cognitive fusion on depression.

Again, after adjusting for pain and pain acceptance in the regression analyses, cognitive fusion still significantly accounted for 4% incremental variance in the model with anxiety as dependent variable. Similarly, moderate correlation between cognitive fusion and anxiety was observed in other studies [47,66, 67]. These findings together suggest techniques within ACT that facilitate acceptance and cognitive defusion, could perhaps help with anxiety and related problems.

When contrasting these PF processes with GSA, GSA emerged as a significant predictor of all outcome variables, and the only significant predictor of GI symptom. The unique role of GSA in GI symptom is not unexpected, as GSA specifically measures GI symptom-related anxiety, while PF processes do not focus on specific symptoms, but the underlying processes in the ways they exert their distressing and disabling effect on functioning. Nevertheless, fears and worries about GI symptoms and its related experiences clearly have an important role in mood and functioning in people with CAP. It is notable perhaps that pain acceptance was the most prominent predictor of pain-related interference and work and social adjustment. And cognitive fusion and committed action were significantly and uniquely associated with depression. Pain acceptance and cognitive fusion are perhaps the PF processes that have the strongest theoretical overlapping with GSA. Pain acceptance involves allowing pain-related experiences, such as pain, fear, worries,

without needing to particularly look out for them or avoid them. Cognitive fusion entails an

attachment or "being entangled in" one's thoughts and feelings, including worries and fear

– it is similar to processes of belief and worry. While these processes seem to overlap with

GSA, they also appear to include unique components beyond one's fear of GI symptoms and

one's anxious response to these. It is difficult to definitively delineate the unique role of

each of these investigated processes in relation to each outcome, due to the cross-sectional

design of the study, the limitations of the measures used, and essential overlaps. More

studies with experimental designs may further illuminate the unique role of these

processes. We suggest that some eventual integration of the processes around PF and GSA

seems possible.

As a preliminary Internet-delivered investigation, the current study naturally has

limitations. First of all, participants were selectively recruited online through social media.

This allows little control over the process of recruitment and no ability to verify either

diagnosis or other participant responses. However, in the current study, participants with or

without diagnosis did not differ in any outcome and most PF processes. Although an

underpowered comparison, this suggests the impact of the lack of strict screening, due to

the nature of the recruitment, might not have a significant impact on the results in the

current study. Another limitation is that, as inclusion was based on the presence of CAP but

not GI-related diagnosis, the resulting heterogeneity in this sample can confuse the

generalisability of the results. However, in the current study, participants with different

diagnoses did not differ in any outcome. Perhaps, the theoretical mechanisms, namely the

PF processes, apply to CAP across various GI conditions. If this is the case, relevant

treatments such as ACT, may hold the potential to address the CAP problems observed

across GI conditions. Further studies are warranted to examine the applicability of these

mechanisms in CAP and the potential for applying relevant treatments in CAP across GI

conditions. Further, the cross-sectional design of the study limits its ability to determine the

directions of the relations between PF processes and outcomes. Longitudinal studies with

experimental design are needed to understand the potential benefits of PF processes on

functioning in people with CAP. Finally, the sample size of the current study was only

sufficient to detect a medium-size effect, which limits the power of the study to detect

some potential relationships between PF processes and outcomes, and possibly the

reliability of the findings. Studies with larger samples sizes in other languages (or cultures)

and other study settings (e.g. clinical services) are needed to produce reliable and

generalisable evidence.

In summary, this preliminary investigation shows the associations between PF

processes and daily general, social, and emotional functioning in people with CAP. It clarifies

relations between three PF facets and outcomes in CAP. The role of acceptance is

highlighted, some role for cognitive defusion is shown, but a unique role for committed

action is not shown. More comprehensive investigation of PF processes, or investigation of

other PF processes, using different measures is suggested. Longitudinal studies with

experimental design will be needed to examine the effectiveness of ACT for CAP

management, and to understand the causal relations between PF processes and functioning

and wellbeing in people with CAP. Nevertheless, ACT may provide benefits for people with

CAP.

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Table 1 Demographics of the participants.

		Mean (SD) or *n* (%)
Gender	Female	64 (72.7%)
	Male	22 (25.0%)
Age (years)		42.97 (14.94)
Ethnicity	White	76 (86.4%)
	Black	4 (4.5%)
	Asian	3 (3.4%)
	Mixed	4 (4.5)
	Other	1 (1.1%)
Years of Education		15.77 (3.18)
Work status	Employed full time	31 (35.2%)
	Employed part time due to pain	11 (12.5%)
	Employed part time by other reasons	8 (9.1%)
	Unpaid volunteer	1 (1.1%)
	Carer	1 (1.1%)
	Homemaker	1 (1.1%)
	Unemployed because of pain	14 (15.9%)
	Unemployed for other reasons	5 (5.7%)
	Full time student/trainee	4 (4.5%)
	Part time student/trainee	2 (2.2%)
	Retired	10 (11.4%)
Pain duration (years)		12.06 (12.56)
Diagnosed with gastrointestinal conditions	Yes	82 (93.2%)
	No	6 (6.8%)
Self-reported gastrointestinal conditions	Irritable Bowel Syndrome	53 (53.0%)
	Inflammatory Bowel Disease	30 (30.0%)
	Diverticulitis	3 (3.0%)
	Colitis	2 (2.0%)
	Gastroesophageal Reflux Disease	2 (2.0%)
	Acid Reflux	1 (1.0%)
	Functional Pain	1 (1.0%)
	Functional Dyspepsia	1 (1.0%)
	Gastroenteritis	1 (1.0%)
	Ileostomy	1 (1.0%)
	Megacolon	1 (1.0%)
	Oesophagitis	1 (1.0%)
	Proctitis	1 (1.0%)
	Stomach Ulcer	1 (1.0%)
	Small intestinal bacterial overgrowth	1 (1.0%)

Table 2 Correlations between pain and PF process variables, and outcome variables.

	GI symptoms	Pain interference	Work and social adjustment	Depression
Pain	.44***	.37**	0.13	0.00
Pain acceptance	-.25*	-.68***	-.67***	-.46***
Cognitive fusion	0.05	.37**	.35**	.60***
Committed action	0.06	-.36**	-.40***	-.44***

Note. *p<.05 **p<.01 ***p<.001. Sample size for each correlation ranges from 74 to 88.

Table 3 F change, degree of freedom, R square, R square change, and β for the regression

models, with pain and PF process variables as independent variables and outcome variables

as dependent variables.

Block	Predictor	F change	df	R^2	ΔR^2	β
<u>GI symptoms</u>						
1	Pain	16.33***	(1, 67)	.18	.20	0.43***
2	Pain acceptance	3.71	(1, 66)	.22	.04	-0.28*
3	Cognitive fusion	2.06	(2, 64)	.24	.05	0.12
	Committed Action					0.25
<u>Pain-related interference</u>						
1	Pain	12.43**	(1, 66)	.22	.14	0.34***
2	Pain acceptance	43.19***	(1, 65)	.52	.30	-0.56***
3	Cognitive fusion	2.29	(2, 63)	.54	.03	0.20
	Committed Action					0.61
<u>Work and social adjustment</u>						
1	Pain	1.56	(1, 66)	.16	.02	0.08
2	Pain acceptance	34.93	(1, 65)	.45	.28	-0.52***
3	Cognitive fusion	0.95	(2, 63)	.45	.02	0.05
	Committed Action					-0.12
<u>Depression</u>						
1	Pain	0.03	(1, 66)	.14	.00	0.07
2	Pain acceptance	9.18	(1, 65)	.25	.11	-0.11
3	Cognitive fusion	12.19	(2, 63)	.46	.21	0.43***
	Committed Action					-0.19

Note. *p<.05 **p<.01 ***p<.001. None of the demographic variables explained significantly

incremental variance in any of the models. Therefore, demographic variables were not

reported in the table. The numbers of blocks indicate the order of the blocks in the final

hierarchical regression model. Pain was entered in the first block, pain acceptance the

second, and cognitive fusion and committed action were entered simultaneously into the

third block.

Table 4 F change, degree of freedom, R square, R square change, and β for the regression models, with pain, GI-specific anxiety and PF process variables as independent variables and outcome variables as dependent variables.

Block	Predictor	F change	df	R^2	ΔR^2	β
GI symptoms						
1	Pain	16.33***	(1,67)	0.18	0.20	0.43***
2	GI-specific anxiety	10.92**	(1,66)	0.29	0.11	-0.29*
3	Pain acceptance	0.96	(3,63)	0.29	0.03	-0.13
	Cognitive fusion					0.05
	Committed Action					0.21
Pain-related interference						
1	Pain	12.43**	(1,66)	0.22	0.14	0.33***
2	GI-specific anxiety	37.78***	(1,65)	0.50	0.28	-0.33**
3	Pain acceptance	7.09***	(3,62)	0.61	0.12	-0.37**
	Cognitive fusion					0.11
	Committed Action					-0.06
Work and social adjustment						
1	Pain	1.61	(1,66)	0.16	0.02	0.08
2	GI-specific anxiety	18.39***	(1,65)	0.34	0.18	-0.23*
3	Pain acceptance	6.67**	(3,62)	0.48	0.15	-0.39**
	Cognitive fusion					-0.02
	Committed Action					-0.16
Depression						
1	Pain	0.03	(1,66)	0.11	0.00	0.07
2	GI-specific anxiety	25.50***	(1,65)	0.35	0.24	-0.40***
3	Pain acceptance	8.31***	(3,62)	0.52	0.18	0.12
	Cognitive fusion					0.32**
	Committed Action					-0.26*

Note. *p<.05 **p<.01 ***p<.001. None of the demographic variables explained significantly incremental variance in any of the models. Therefore, demographic variables were not reported in the table. The numbers of blocks indicate the order of the blocks in the final hierarchical regression model. Pain was entered in the first block, Gi-specific anxiety the second block, pain acceptance, cognitive fusion and committed action were entered simultaneously into the last block.