



The Psychological Functioning in the COVID-19 Pandemic and Its Association With Psychological Flexibility and Broader Functioning in People With Chronic Pain

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Abstract: **Aims:** People with chronic pain may be particularly vulnerable to the impact of the pandemic COVID-19, and psychological flexibility may protect them. This study investigates psychological functioning in the context of COVID-19, including fear and avoidance in the context of COVID-19, specifically its association with daily functioning, and the role of psychological flexibility, among people with chronic pain. **Methods:** Responses from 555 adults with chronic pain were collected through a cross-sectional online survey and analyzed. **Results:** Eight out of 10 participants reported significant depression and nearly 9 out of 10 reported significant functional impairment. COVID-19-related fear and avoidance significantly correlated with pain, pain-related disability, depression, and work and social adjustment ($r = .18-.32$), as well as psychological flexibility processes, including pain acceptance, self-as-context, and committed action, $|r| = .13-.30$. COVID-19-related fear and avoidance and COVID-19-related interference were significant predictors of some measures of daily functioning beyond demographics and pain, $\beta = .09-.14$. However, these associations weakened when psychological flexibility processes were factored into the models, with fear of COVID-19 no longer being a significant predictor of pain-related disability or depression, and COVID-19 avoidance no longer a significant predictor of depression. **Conclusions:** The psychological functioning in the context of COVID-19 appears to be negatively associated with daily functioning in people with chronic pain, and is statistically significant in this regard. Psychological flexibility may have a role in these associations for people with chronic pain in the pandemic.

Perspective: This article demonstrates the psychological implication of COVID-19 and its association with broader emotional and daily functioning in people with chronic pain. It also demonstrates that Psychological flexibility may have a role in these associations for people with chronic pain in the pandemic.

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Introduction

We are facing an unprecedented global challenge in the COVID-19 pandemic.⁵⁰ Healthcare systems are overstretched. Extended and repeated lockdowns have been imposed in many countries. With the high infection and mortality rates, a parallel outbreak of fear and worry also emerges.^{2,31} The COVID-19 pandemic may exert a larger impact on people who already suffer health problems, such as those with chronic pain.

People with chronic pain may be particularly vulnerable to COVID-19 and the impact of the pandemic, due

to the burden of problems and insecure circumstances already present. Some of the emerging risk factors for adverse outcomes in the pandemic such as older age, comorbid chronic disease, overweight, lower socioeconomic status, limited access to healthcare, and smoking, are common among people with chronic pain, and are found to be associated with higher level of chronic pain burden.^{7,35,49} Due to the COVID-19 pandemic, healthcare delivery has changed to protect patients and staff from infection, and healthcare resources have been redistributed to acute needs. Treatments for health problems that many considered non-urgent, such as pain management, are inevitably disrupted.¹⁶ In addition, physical activity, which is an important pain management strategy, is significantly limited as a result of measures to control infection rate, such as quarantine, social distancing, and closure of fitness facilities.

With the high infection rate and mortality and other aspects of the aftermath of the pandemic, people naturally experience fear and worry. Fear of infection, alongside other factors such as frustration, anger, and other experiences, such as inadequate information, financial loss, and stigma have been identified as key adverse events experienced in prolonged quarantine.⁹ People with chronic pain appear prone to elevated levels of anxiety about their health.⁵⁴ If they experience themselves as particularly vulnerable in the pandemic, this may additionally contribute to elevated level of anxiety. Pain comorbid with anxiety has been shown to entail significant detrimental implication for health. For instance, people with chronic pain and anxiety disorder experience greater pain, worse psychological outcomes, and lower quality of life, compared to those without, and severity of anxiety disorder is strongly associated with the level of functional impairment in these people.²⁹ In one study of early influence of the pandemic on people with painful polyneuropathy,²⁶ more than half of the participants reported being more worried about their health than before the pandemic. In addition, about half of the participants experienced medical disadvantages and/or worsened mood due to the pandemic, and 28% reported worsened sleep due to the pandemic.

The Psychological Flexibility (PF) model appears relevant to the potential psychological impacts of the COVID-19 pandemic on people with chronic pain. The PF model and related treatments adopt a trans-diagnostic approach to health problems, in that they focus on functionally important, common factors or processes. These are processes that cut across types of disorders and also contribute to complex patterns of pathologic behavior patterns, such as the co-occurrence of pain and mental health problems including anxiety and depression, often demonstrated in people with chronic pain. PF refers to a set of skills to “recognize and adapt to various situational demands; shift mindsets or behavioral repertoires when these strategies compromise personal or social functioning; maintain balance among important life domains; and be aware, open, and committed to behaviors that are congruent with deeply held values”.²⁵ The PF model includes 6 practical

organizing terms: acceptance, cognitive defusion, present awareness, self-as-context, values, and committed action. These are often summarized as “open (including acceptance and cognitive defusion), aware (including present awareness and self-as-context), and active (including values and committed action)”.²⁰ Simply put, acceptance refers to the willingness to experience undesirable thoughts and feelings. Cognitive defusion involves contacting our thoughts in a way that can reduce their influence on our behaviors. Present awareness entails flexible awareness of ongoing events. Self-as-context entails an experience of taking a perspective, from which to observe one’s psychological experiences, a sense of separation from or containing psychological experiences. Values are ongoing purposes and qualities of our behavior that we want to reflect. Committed action is the ability to build and flexibly persist in actions guided by values. In the current study, we examined 3 processes, acceptance, self-as-context, and committed action, with each reflecting one of the 3 dimensions of PF (“open, aware, and active”), as they derive from brief and valid measures, and clearly reflect the key aspects of PF.

In a study investigating the impact of lockdowns on mental health in Italy,⁵¹ it was found that PF processes, including cognitive defusion, self-as-context, values, and committed action, moderated the impact of lockdown risk factors on COVID-19 peritraumatic distress (distress due to COVID-19 lockdown), general anxiety, and depression. Psychological inflexibility was also found to moderate the association between COVID-19 stressors and suicide risks among parents,¹³ as well as the association between social isolation and mental health in the general population.⁵⁹ There is also supporting evidence for the association between PF and anxiety disorders.⁶ A meta-analysis, aggregating across 63 studies, found a significant medium correlation between psychological (in)flexibility and anxiety symptoms.⁶ Systematic reviews of randomized controlled trials have also produced evidence supporting the effectiveness of PF-based interventions, namely Acceptance and Commitment Therapy (ACT), for the physical, psychological and daily functioning in people with chronic pain.^{19,23,58} These include evidence for the role of PF processes in relation treatment outcomes such as anxiety, depression and disability, in people with chronic pain.

The purpose of the current study was to investigate psychological functioning in the context of the COVID-19, and its association with broader daily functioning, and PF, among people with chronic pain. This includes 4 specific objectives:

- 1) To investigate COVID-19-related fear and avoidance, COVID-19 related interference, and broader daily functioning in the context of COVID-19 measured by depression, and work and social adjustment, in people with chronic pain.
- 2) To investigate if COVID-19-related fear and avoidance, alongside interference due to COVID-19, are

associated with pain-related disability, depression, and work and social adjustment.

- 3) To investigate if PF processes, including pain acceptance, self-as-context, and committed action, are associated with COVID-19-related fear and avoidance.
- 4) To investigate the relative associations of pain, COVID-19-related fear and avoidance, interference due to COVID-19, and PF processes, with pain-related disability, depression, and work and social adjustment.

Methods

Study Design and Procedure

The current study was a cross-sectional online survey of adults with chronic pain, using online survey tool Qualtrics. Ethical approval was obtained for this study (Middlesex University, Psychology Research Ethics Committee, 25/6/2020. Application Number: 14427). Informed consent was obtained from all participants.

Advertisement with the link for the online survey was distributed in widely accessible online social media, including Twitter and Facebook, as well as online platforms designed to support people with pain, such as Pain Support (<https://www.painsupport.co.uk>), Pain Concern (<http://painconcern.org.uk/how-we-help/forum/>), and Fibromyalgia Research UK (<https://www.facebook.com/FRUKgroup/>). Potential participants clicked on the link for the online survey to access information about the study, and provided informed consent, and participated if they wished to.

Sample Size

A priori estimation was used to determine the required sample size based upon several factors. Firstly, for multiple regression analyses, our estimate was based on similar studies.^{4,10} Modeling a regression equation with 12 predictors and an effect size,⁴⁷ of $f^2=0.15$ (medium effect), with power set at 0.80 was used. Based on these considerations a need for a sample size of at least 127 was suggested.

Participants

Adults with chronic pain were recruited for this survey of experiences of COVID-19. Initially 793 potential participants responded to the advertisements (clicked on the link for the survey and possibly viewed the Participant Information Sheet) between 2nd July and 24th July, 2020, among which, 97 did not proceed to complete the screening page. Among those who did proceed, 26 did not meet the inclusion criteria (aged 18 or above with chronic pain for 6 months or longer). Among the eligible potential participants, 657 provided informed consent. Among these participants, 102 did not provide data on any assessment variables. Finally, 555 participants who provided data on assessment variables were included in the analyses. Table 1 shows the

demographics and pain history of the participants. Notably, 11.5% of the participants were working part-time or unemployed due to the COVID-19.

Self-Report Measures

Participants completed a set of psychometrically validated assessment measures, including measures of COVID-19-related fear and avoidance, measures of psychological flexibility processes, and standard pain outcome measures. The following background information was collected through self-report questions: age, gender, ethnic group, work status, duration of chronic pain, pain locations and COVID-19 related interference.

COVID-19 related interference was measured by 4 independent items developed for the current study to provide an overview of the impact of the pandemic for people with chronic pain. Physical health, treatment for pain, exercise, and social activities were selected to represent the key domains, as these have been repeatedly identified as key domains that are affected for people with chronic pain in the pandemic.^{11,16,29} Participants were asked to rate the extent to which each of these domains was disrupted due to the COVID-19 pandemic, on a scale from 0 "Not disrupted at all" to 10 "Completely disrupted". Additionally, participants were asked to briefly describe how their treatment was interrupted. Principle component analysis including these 4 items yielded a one-factor structure with 46.3% variance explained. Each item loaded sufficiently onto the factor, factor loadings ranging from .62 to .76. These 4 items demonstrated acceptable internal consistency, Cronbach's $\alpha = .61$. In addition to the score of each item, a total score was calculated to reflect general interference from the COVID-19 pandemic.

Measures of COVID-19-Related Fear and Avoidance

Currently, the only validated measure available in this regard is the Fear of Coronavirus-19 Scale (FCV-19S). The FCV-19S consists of 7 questions related to fearful emotional reactions with regards to the pandemic. In addition, the avoidance subscale of the Impact of Event Scale was adapted to the COVID-19 context, to assess COVID-19-related avoidance. Participants were asked to rate each item, reflecting avoidance symptoms, in terms of frequency, regarding their experience with the COVID-19 pandemic.

Fear of Coronavirus-19 Scale (FCV-19S)

The FCV-19S is a 7-item self-report measure assessing the fear of COVID-19. The scale consists of 7 questions related to fearful emotional reactions with regards to the pandemic.² Participants are asked to respond on scale from 1 (strongly disagree) to 5 (strongly agree). The higher sum indicates the higher fear of Covid-19. The construct validity of the measure is supported by high correlations with anxiety and depression as evaluated by the Hospital Anxiety and Depression Scale⁴⁵ and the Perceived Vulnerability to Disease Scale.¹ In the

Table 1. The Demographics and Pain History of The Participants

VARIABLE	SUB-CATEGORY	N (%), MEAN (SD) OR MEDIAN (RANGE)
Gender	Women	479 (86.3%)
	Men	70 (12.6%)
	Other	6 (1.1%)
Age (y)		40 (SD=14)
Ethnicity	White	513 (92.4%)
	Mixed	21 (3.8%)
	Asian	11 (2.0%)
	Black	4 (0.7%)
	Other	6 (1.1%)
Work status	I am working/studying full-time.	195 (35.1%)
	I am working/studying part-time due to the Covid-19 pandemic.	24 (4.3%)
	I am working/studying part-time due to pain.	50 (9.0%)
	I am working/studying part-time due to other reasons.	20 (3.6%)
	I am a volunteer/carer/home maker.	23 (4.1%)
	I am temporarily unemployed due to the Covid-19 pandemic.	27 (4.9%)
	I am unemployed due to the Covid-19 pandemic.	13 (2.3%)
	I am unemployed due to pain.	146 (26.3%)
	I am unemployed for other reasons.	27 (4.9%)
Pain duration (Years)		30 (5.4%)
		8.0 (0.5-50)
Generalized pain		318 (57.3%)
Primary pain site	Lower back/spine	128 (23.1%)
	Lower limbs	86 (15.5%)
	Abdominal region	72 (13%)
	Upper shoulder or upper limbs	65 (11.7%)
	Pelvic region	48 (8.6%)
	Neck region	29 (5.2%)
	Head, face or mouth	28 (5.0%)
	Anal or genital region	17 (3.1%)
	Chest region	5 (0.9%)

current sample, the FCV-19S indicated good internal consistency, Cronbach's $\alpha = .91$.

The Impact of Event Scale (IES)

The IES is a 15-item broadly applicable self-report measure assessing total stress. It consists of subscales for intrusiveness and avoidance.²² Here the 8-item subscale was adapted to assess COVID-19-related avoidance. Responders are asked to rate each item regarding their experiences with the COVID-19 pandemic on a scale from 'Not at all' to 'Extremely'. The higher sum indicates more symptoms of avoidance to COVID-19. The IES has showed good reliability and validity²¹ as measured in people with Post Traumatic Stress Disorder.⁴² In the current sample, the IES indicated good internal consistency, Cronbach's $\alpha = .87$.

Measures of Pain and Daily Functioning

Pain Scale. Pain intensity was assessed through one validated question using a 0 (no pain) to 10 (worst possible pain) numerical rating. Participants were asked to rate their pain in the past week.^{24,65}

Pain Disability Index (PDI). The PDI is a 7-item widely used self-report measure assessing disability related to

pain.⁶² This questionnaire assesses perceived disability in 7 different areas: family/home responsibilities, recreation, social activity, occupation, sexual behavior, self-care and life-support activities. The scale is rated from 0 (no disability) to 10 (worst disability). The higher sum indicates worse perceived pain-related disability. The PDI has clear support on its validity and reliability in people with chronic pain.⁶¹ In the current sample, the PDI demonstrated good internal consistency, Cronbach's $\alpha = .88$.

Work and Social Adjustment Scale (WSAS). The WSAS is a 5-item reliable and validated self-report measure assessing impairment in work and social functioning.⁴⁸ WSAS items concerns home management, work, relationships and social and private leisure. Each item is using 0 (no impairment) to 8 (very severe impairment) numerical ratings. The validity of the WSAS is supported by strong associations with measures of psychiatric symptoms and strong effects in regard to treatment.⁴⁸ A summary score below 10 is associated with sub-clinical populations, 10-20 associated with significant functional impairment, such as the level associated with less severe clinical symptomatology, 20 and above associated with moderately severe or worse functional impairment, such as the level associated with moderately severe or worse psychopathology. In the current sample, the WSAS demonstrated good internal consistency, Cronbach's $\alpha = .90$.

Patient Health Questionnaire (PHQ-9). The PHQ-9 is a reliable and validated measure assessing depression severity. It consists of 10 items based on DSM-IV. The first 9 items reflect symptoms of depression and include a 0 (not at all) to 4 (nearly every day) numerical rating scale. The last item (10) measures the impact of depression and is rated from "not difficult at all" to "extremely difficult." This item was included as an additional variable because, within the PF model, the impact of depressive symptoms is considered as an important possible outcome in treatment. A higher summary score from the symptom items reflects higher levels of depression severity.³⁰ A summary score of 0-4 for the first 9 items indicates none to minimal depression, 5-9 mild depression, 10-14 moderate depression, 15-19 moderately severe depression, 20-27 severe depression. In the current sample, the PHQ-9 demonstrated good internal consistency, Cronbach's $\alpha = .89$.

Measures of Psychological Flexibility Processes

Chronic Pain Acceptance Questionnaire (CPAQ-8). The CPAQ-8 is a measure of acceptance of chronic pain. It encompasses participation in activities while experiencing pain and willingness to experience pain without efforts to either avoid or control it.^{40,41} CPAQ-8 is the short version of a 20-item questionnaire, and this short version is also fully validated.¹⁸ Items are rated on a scale from 0 (never true) to 6 (always true). A higher score reflects greater acceptance of pain. In the current sample, the CPAQ-8 demonstrated good internal consistency (Cronbach's $\alpha = .82$).

Self Experiences Questionnaire-8 (SEQ-8). The SEQ-15 is a 15-item self-report measure of self-as-context, within the PF model.⁶⁷ Self-as-context refers to the ability to take the perspective of being separate from, bigger than, and/or containing one's thoughts, feelings, and bodily sensations. Example items include, "Above all my experiences, there is a sense of myself who is noticing them". All items are rated on a 0 (never true) to 6 (always true) numerical scale. All items are positively keyed, and higher scores reflect higher self-as-context. SEQ-8 is the recently-developed short version of the measure, which is in-press (Yu, 2021).⁶⁸ The construct validity of the SEQ-8 has been supported in demonstrating strong associations with other PF processes including acceptance, committed action, and cognitive defusion, and with daily functioning and depression in individuals with chronic pain. In the current sample, the SEQ-8 demonstrated good internal consistency (Cronbach's $\alpha = .92$).

Committed Action Questionnaire (CAQ-8). The CAQ-8 is an 8-item measure of committed action.^{36,38} Committed action refers to the ability to build and carry on in patterns of behavior directed by goals and values, including when this includes uncomfortable experiences. Items are rated from 0 (never true) to 6 (always true). Four, out of the 8 items, are positively keyed and 4 negatively

keyed. Construct validity of the CAQ-8 is supported by demonstrated associations with measures of acceptance, and of physical, emotional and social functioning in people suffering from chronic pain.³⁸ In the current sample, the CAQ-8 demonstrated good internal consistency (Cronbach's $\alpha = .83$).

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, except for pain duration. Logarithmic transformation was used to transform pain duration data. No significant nonlinear relation was found. Following these preparatory analyses, descriptive statistics for the measures of COVID-19 related interference, COVID-19-related fear and avoidance, depression, and work and social adjustment were first calculated to psychological and broader functioning in the context of COVID-19.

Secondly, correlations of the measures of COVID-19-related fear and avoidance, including FCV-19S and IES, and measures of COVID-19-related interference, with measures of pain (pain intensity and pain duration) and broader daily functioning including, PDI, WSAS, and PHQ-9, were calculated to investigate the associations between the COVID-19 related fear and avoidance, COVID-19 related interference, and pain and daily functioning in people with chronic pain. People with and without generalized pain were compared on COVID-19-related fear and avoidance and COVID-19-related interference. Missing data were deleted pairwise. Cohen's¹² criteria for interpreting effect sizes were applied: small $r = .10$, medium $r = .20$, large $r = .50$.

Next, correlations of measures of PF processes, including CPAQ-8, SEQ-8, and CAQ-8, with measures of COVID-19-related fear and avoidance, including FCV-19S and IES, and measures of pain and broader daily functioning including PDI, WSAS, and PHQ, were calculated to examine the associations of PF with COVID-19-related fear and avoidance, pain and broader daily functioning in people with chronic pain. Missing data were deleted pairwise.

Lastly, A series of hierarchical regressions with demographics, pain (pain intensity, pain duration, have generalized pain or not), COVID-19 related interference, COVID-19-related fear and avoidance, and PF processes as independent variables, and pain-related disability, work and social adjustment, and depression as dependent variables, were conducted. These were to investigate the relative role of pain, the COVID-19-related variables, and PF processes in relation to broader daily functioning, as well as the role of PF in potentially counteracting these associations. For each model, demographic variables were force-entered in the first block, pain intensity, pain duration and generalized pain (having generalized pain or not) were forced-entered in the second block, COVID-19 related interference (total scores reflecting overall interference due to COVID-19)

and the COVID-19-related fear and avoidance were force-entered in the third block, and all 3 PF processes were forced-entered simultaneously in the last block. Missing data were deleted pairwise.

Results

Psychological and Broader Functioning, and Interference in the Context of COVID-19

Table 2 shows the descriptive statistics for COVID-19 related interference and COVID-19-related fear and avoidance. On average, social activities appeared to be the most severely disrupted aspect due to the COVID-19 pandemic, with an average score of 8.04 out of 10. In total, 78% of the participants (n = 437) reported their treatment for pain being disrupted to various extents (scored > 0 for interference with pain treatment due to COVID-19). Among these participants, 55.7% (n = 309) reported appointments for pain treatments, such as physiotherapy, operations and GP visits being delayed, cancelled, or unavailable, and 19.8% (n = 110) reported the availability of pain medication being disrupted. On average, participants scored 18.18 out of 35 for the fear of COVID-19, and 11.26 out of 32 for COVID-19 related avoidance.

Table 3 shows the descriptive statistics for depression and work and social functioning. In total 80% of the participants met the clinical threshold for depression, with 34% for severe depression. About 88% of the participants reported significant functional impairment, with 65.87% reporting moderately severe or worse functional impairment.

The Associations of COVID-19-Related Fear and Avoidance and COVID-19 Related Interference, With Pain and Daily Functioning

Table 4 shows the correlations of COVID-19-related fear and avoidance and interference due to COVID-19, with pain intensity, pain duration, pain disability, mood and work and social functioning. COVID-19-related fear and avoidance significantly correlated with pain and all measures of daily functioning with small to medium effect sizes. Most aspects of COVID-19-related interference significantly correlated with pain and measures of daily functioning, except for COVID-19-related interference with social activity. Only fear of COVID-19 and COVID-19-related interference with physical health significantly correlated with pain duration.

People with generalized pain showed significant higher level of fear of COVID-19, $t(545.5) = -5.68, P < .001$, and significant higher level of covid-19-related avoidance, $t(527) = -4.02, P < .001$, compared with those without. People with generalized pain also reported more severe overall COVID-19 related interference, $t(551) = -3.19, P < .01$, which appeared to be mainly driven by COVID-19 related interference with physical health, $t(550) = -4.17, P < .001$, and regular exercises, $t(551) = -2.06, P < .05$.

The Associations Between PF Processes, and the Psychological Functioning in the Context of COVID-19

Table 5 shows the correlations of PF processes with COVID-19-related fear and avoidance, daily functioning

Table 2. The Descriptive Statistics for COVID-19-Related Interference and COVID-19-Related Fear and Avoidance

VARIABLE		SCORING RANGE	N	MEAN	SD
COVID-19-related interference	Physical health	0–10	554	5.05	3.27
	Pain treatment	0–10	554	5.08	3.63
	Regular exercises	0–10	555	4.98	3.60
	Social activities	0–10	555	8.04	2.76
	General interference (total score)	0–40	555	23.15	9.04
COVID-19-related fear and avoidance	Fear of COVID-19	7–35	555	18.18	7.42
	COVID-19-related avoidance	0–32	531	11.26	7.17

Table 3. The Descriptive Statistics for Depression and Work and Social Adjustment

VARIABLE	SCORING RANGE	N	MEAN	SD	MODERATE DEPRESSION (10–14)	MODERATELY SEVERE DEPRESSION (15–19)	SEVERE DEPRESSION (20–27)
Depression	0–27	500	15.75	6.75	21.8%	24.2%	34%
Work and social adjustment	0–40	504	24.38	10.37	Significant functional impairment (10–20) 22.62%	Moderately severe or worse impairment (>20) 65.87%	

Table 4. Correlations of COVID-19-Related Fear and Avoidance and Covid-19-Related Interference, with Pain and Daily Functioning

	<i>PAIN INTENSITY</i>	<i>PAIN DURATION</i>	<i>PAIN DISABILITY</i>	<i>WORK AND SOCIAL ADJUSTMENT</i>	<i>DEPRESSION</i>
Fear of COVID-19	.28***	.11*	.32***	.29***	.32***
COVID-19-related avoidance	.18***	.04	.26***	.25***	.27***
Interference with physical health	.28***	.09*	.34***	.32***	.32***
Interference with pain treatment	.23***	-.02	.27***	.23***	.19***
Interference with regular exercises	.13**	.06	.11*	.12**	.11*
Interference with social activities	.09*	.03	.10*	.06	.03
Overall interference (total score)	.27***	.06	.31***	.28***	.25***

Note. N = 499–551;

* $P < .05$,

** $P < .01$,

*** $P < .001$.

Table 5. Correlations of Psychological Flexibility With the Psychological Impact of the Covid-19 Pandemic and Pain Outcomes

<i>VARIABLE</i>	<i>FEAR OF COVID-19</i>	<i>COVID-19 RELATED AVOIDANCE</i>	<i>PAIN DISABILITY</i>	<i>WORK AND SOCIAL ADJUSTMENT</i>	<i>DEPRESSION</i>	<i>PAIN INTENSITY</i>
Pain acceptance	-.30***	-.23***	-.57***	-.61***	-.47***	-.34***
Self-as-context	-.15**	-.13**	-.21***	-.23***	-.42***	-.19***
Committed action	-.22***	-.22***	-.39***	-.42***	-.49***	-.24***

Note. N = 449–492;

** $P < .01$,

*** $P < .001$.

and pain. All 3 PF processes significantly correlated with COVID-19-related fear and avoidance with small to medium effect sizes, as well as all daily functioning and pain measures, with small to large effect sizes.

The Relative Associations of Pain, COVID-19-related Fear and avoidance, and PF Processes, with Daily Functioning

Table 6 shows the results from hierarchical regressions analyses with pain (pain intensity, pain duration, generalized pain), COVID-19 related variables (COVID-19 related interference, COVID-19 related fear and avoidance, and PF variables as independent variables, and measures of daily functioning as dependent variables. Pain intensity and generalized pain significantly predicted all 3 measures of daily functioning beyond demographics: $\beta = .40-.44$ for pain intensity, $\beta = .15-.28$ for generalized pain. However, pain duration did not appear to be associated with any of the dependent variables. COVID-19-related interference significantly predicted pain-related disability, $\beta = .14$, and work and social adjustment, $\beta = .10$, beyond pain, but it did not predict depression. Fear of COVID-19 significantly predicted pain disability $\beta = .09$, and depression, $\beta = .14$, beyond pain, but did not predict work and social adjustment. COVID-19-related avoidance significantly predicted depression beyond pain, $\beta = .11$, but did not predict pain disability or work and social adjustment. Overall, PF processes appeared to be strong predictors of dependent variables compared with COVID-19 related fear and

avoidance, with pain acceptance being the most prominent predictor. Furthermore, when PF process variables were entered into the models, the associations between COVID-19 related variables and all dependent variables weakened. In particular, fear of COVID-19 was no longer a significant predictor of pain disability and depression, and COVID-19-related avoidance was no longer a significant predictor of depression.

Discussion

The aim of the study was to investigate psychological functioning in the context of COVID-19, and its association with broader daily functioning, and PF in people with chronic pain. In the current study, the COVID-19 pandemic appears associated with significant interference in people with chronic pain. These are demonstrated in high levels of reported interference in separate domains of functioning specifically related to COVID-19, and with significant COVID-19-related fear and avoidance, depression, and impaired general daily functioning. Higher levels of COVID-19-related fear and avoidance were associated with more pain and worse daily functioning to a statistically significant degree. PF processes, including pain acceptance, self-as-context, and committed action were also associated with COVID-19-related fear and avoidance, again, to a statistically significant degree. In addition, PF appeared to buffer the impact of the COVID-19 pandemic on daily functioning. To our knowledge, this is the first quantitative study investigating PF in people with chronic pain in the

Table 6. Hierarchical Regressions With Pain, the Impact of the COVID-19 Pandemic, and PF Variables as Independent Variables, and Measures of Daily Functioning as Dependent Variables

MODEL	BLOCK	PREDICTOR	F CHANGE	DF	ADJUSTED R ²	Δ R ²	β
Pain disability							
A	1	Age	16.06***	(3, 443)	.09	.10	.29***
		Gender					.12**
B	1	Age	62.86***	(3, 440)	.36	.27	.09*
	2	Pain intensity					.43***
		Pain duration					-.07
		Generalized pain					.26***
C	1	Age	10.25***	(3, 437)	.40	.04	.10*
	2	Pain intensity					.36***
		Pain duration					-.07
		Generalized pain					.24***
	3	COVID-19 related interference					.14***
		Fear of COVID-19					.09*
		COVID-19 avoidance					.05
D	1	Age	45.74***	(3, 434)	.54	.14	.15***
	2	Pain intensity					.24***
		Pain duration					-.03
		Generalized pain					.19***
	3	Covid-19 related interference					.13***
		Fear of Covid-19					.02
		COVID-19 avoidance					.01
	4	Pain acceptance					-.38***
		Self-as-context					.04
		Committed action					-.09*
Work and social adjustment							
A	1	Age	17.24***	(3, 443)	.10	.11	.32***
B	1	Age	73.48***	(3, 440)	.40	.30	.10*
	2	Pain intensity					.44***
		Pain duration					-.02
		Generalized pain					.28***
C	1	Age	6.59***	(3, 437)	.42	.03	.11**
	2	Pain intensity					.39***
		Pain duration					-.02
		Generalized pain					.26***
	3	COVID-19 related interference					.10**
		Fear of Covid-19					.05
		COVID-19 avoidance					.08
D	1	Age	67.07***	(3, 434)	.60	.18	.16***
	2	Pain intensity					.26***
		Pain duration					.03
		Generalized pain					.21***
	3	COVID-19 related interference					.09*
		Fear of Covid-19					-.03
		COVID-19 avoidance					.03
	4	Pain acceptance					-.43***
		Self-as-context					.02
		Committed action					-.09*
Depression							
A	1	Age	34.27***	(3, 440)	.19	.19	-.11*
		Pain intensity					.40***
		Pain duration					-.03
		Generalized pain					.15**
B	1	Age	11.06***	(3, 437)	.24	.06	-.11*
		Pain intensity					.34***
		Pain duration					-.04
		Generalized pain					.12*
	2	COVID-19 related interference					.07
		Fear of COVID-19					.14**
		COVID-19 avoidance					.11*
C	1	Pain intensity	43.52***	(3, 434)	.41	.17	.21***

(continued on next page)

Table 6. Continued

MODEL	BLOCK	PREDICTOR	F CHANGE	DF	ADJUSTED R ²	Δ R ²	β
		Pain duration					-.01
		Generalized pain					.05
	2	COVID-19 related interference					.06
		Fear of Covid-19					.08
		COVID-19 avoidance					.06
	3	Pain acceptance					-.20***
		Self-as-context					-.20***
		Committed action					-.19***

Note.

* $P < .05$,

** $P < .01$,

*** $P < .001$. Demographic variables that did not significantly explain incremental variance in the models was not reported in the table.

context of COVID-19. This is also the second quantitative study investigating the psychological functioning of in people with chronic pain in the pandemic. One quantitative study investigated early influence of the pandemic in Germany,²⁶ where patients with painful polyneuropathy were assessed 2 weeks after COVID-related regulations came into effect, while current study collected data from people with chronic pain in the community, about 3 to 4 months into the pandemic. In one mixed methods study in people with chronic pain,³⁴ correlations between measures of mental health collected (several weeks to several years) prior to the pandemic, and one PF process (pain acceptance) measured during the pandemic, were reported. The retrospective nature of this investigation limited its implication for the psychological impact of COVID-19 or its association with PF during the pandemic.

The extent of COVID-19-related fear and avoidance in people with chronic pain appeared comparable with levels reported in the general population, where an average score of 15.59 to 27.39 were reported for the fear of COVID-19 assessed with the same measure as the current study.^{2,5,56,66} The prevalence of depression found here, 80%, appears clearly higher than the level reported outside the context of the pandemic. Prevalence of depression in people with chronic pain in the community is reported at round 20% in several large-scale survey studies.^{8,14,44,64} It also appeared significantly higher than the prevalence of depression in the general population during the COVID-19 pandemic. The prevalence of moderate to severe depression (defined as PHQ-9 summary scores ≥ 10) was reported to be 21.2% in Italy,⁵¹ 30% in Sweden,³⁷ and 37% in the UK,¹⁵ as compared to 80% in the current study. The prevalence of depression found here also appeared higher than, that of chronic pain patients attending pain clinics, a group known to report high levels of depression as compared to community samples. In one study in the UK, 60.8% of patients attending a pain clinic met criteria for probable depression, including 55.1% who met the threshold for moderate to severe depression (defined as PHQ-9 summary scores range 15–27).⁵³

In an unplanned analysis, it was shown that about 43% of the participants had suicidal thoughts in the 2 weeks prior to assessment, with 23.8% having suicidal

thoughts several days, 8.6% more than half the days, and 10.5% nearly every day. This prevalence appears comparable to the prevalence among chronic pain patients attending pain clinics outside of the pandemic context. In a survey of 1512 chronic pain patients seeking treatment, about 32% reported some form of recent suicidal ideation.¹⁷ In a study of a multidisciplinary chronic pain program in the UK, 45.7% patients had suicidal thoughts of some frequency, with 22% having suicidal thoughts several days, 10.4% more than half the days, and 13.3% nearly every day.³⁹ This is consistent with other studies where about 35% of the chronic patients attending a multidisciplinary pain treatment were reported to have "suicidal ideation".²⁸ Overall, people with chronic pain surveyed here appeared to demonstrate higher levels of depression than those commonly reported in previous studies in the community, and even higher than those found in specialty treatment samples.

In order to control the spread of the virus, lockdowns were imposed, and extended over several weeks, in many countries. This restriction in movements and activities and social isolation could have had significant psychological implications.^{9,51} In the current study, interference to one extent or another, was reported in domains of physical health, treatment for pain, exercise, and social activities. Furthermore, people with chronic pain also appeared significantly affected by the downstream consequences of lockdown measures, such as job loss. In the current study, 11.5% of all participants were working/studying part-time or unemployed due to COVID-19. This may seem to be a lower percentage than expected. However, it should be noted that as employment/study is commonly affected by pain even outside of the pandemic. Only 35.1% of the participants were employed/studying full time, which means that in the subsample of actual or potential workers, 25% of the participants' employment/working status were affected due to COVID-19. For people with chronic pain, the interference with treatment for pain in particular, appeared to be significantly associated with interference with functioning. In the current study, the majority of the participants (78%) reported their treatments for pain being delayed, cancelled, or unavailable due to the pandemic. Such severe disruption to treatment could have

detrimental impact on the health and wellbeing of people with chronic pain. A systematic review of the effect of waiting for chronic pain treatment,³³ it was identified that patients experienced a significant deterioration in health-related quality of life and psychological well-being during the 6-month wait for treatment. Remote assessment and treatment, such as via telephone, or the internet, have been suggested to address restricted access to services during and beyond the pandemic.¹⁶

In our data, COVID-19-related fear and avoidance were significantly associated with pain, anxiety, depression, and daily functioning. This finding is consistent with earlier studies where fear of COVID-19 was found to be correlated with depression and anxiety in the general population.^{2,3,60} Due to the cross-sectional nature of the study, it is not possible to infer the direction of the relation between COVID-19-related fear and avoidance and functioning. It is possible that fear and avoidance of COVID-19 have resulted in restricted mobility, disengagement, and ultimately to a pattern of reduced overall functioning. It is also possible that people with more disabling pain and more impaired functioning felt more vulnerable to COVID-19, which led to COVID-19-related fear and avoidance. Perhaps these processes operate in a bi-directional vicious circle. Longitudinal studies are needed to understand the consequence of the COVID-19 pandemic for people with chronic pain, including the unique role of different stressors. Nevertheless, it is clear in the present results that COVID-19 is associated with significant psychological impact in people with chronic pain, which is associated with diminished emotional and general daily functioning. We examined fear of COVID-19 as one construct using the Fear of Coronavirus-19 Scale. However, it would also be valuable to identify more detailed elements of the fear of COVID-19 and the context of these, such as fear caused by media reports, or change to employment status and financial security, which in turn, can inform measures to reduce the psychological impact of the pandemic.

Unsurprisingly, pain emerged as the strongest predictor of depression and the second strongest predictor of pain disability and daily functioning. Generalized pain also emerged as a strong predictor of these broader aspects of daily functioning. Often being considered as non-urgent, the treatment for pain is significantly disrupted. As seen in our data, the interference with treatment showed a stronger association with pain, compared with other aspects of the interference due to COVID-19. In other words, the interference with pain treatment may have a specific detrimental effect on the broader functioning in people with chronic pain. Both measures of fear and avoidance in the context of COVID-19 also emerged as significant predictors of these broader aspects of daily functioning, including pain disability, beyond the role of pain itself. We do not know if fear and avoidance impact on pain-related interference through exacerbating pain or other mechanisms, due to the cross-sectional nature of the study. Nevertheless, it seems possible or even likely that the psychological impact of the pandemic has a specific detrimental impact on people with chronic pain.

It was observed that after PF processes were factored into the regression models, the associations of pain and COVID-19-related variables weakened. These findings may mean that while pain and COVID-19-related interference, fear and avoidance were statistically significantly associated with broader aspects of daily functioning in people with chronic pain, PF appears to weaken this association. Pain comorbid with anxiety, a closely allied variable with fear and avoidance, has been shown to have significant detrimental implication for health²⁹. PF may have the potential to protect people with chronic pain from this specific impact of the COVID-19 pandemic. These findings are in line with several cross-sectional studies on the impact of COVID-19. In a study in Italy,⁵¹ PF processes including cognitive defusion, self-as-context, values and committed action were found to moderate the relations between lockdown risk factors and mental health. It was also observed that psychological inflexibility moderated the association between COVID-19 stressors and suicide risks,¹³ and the association between social isolation and mental health.⁵⁹ Further longitudinal studies including moderation and mediation analysis are needed to understand the PF as a potential mechanism for reducing the impact of the pandemic on people with chronic pain.

These findings appear to suggest that COVID-19 may have a weaker association with functioning in people with higher level of PF. It is possible and theoretically consistent that people who are more willing to experience unwanted thoughts and feelings, and more committed to actions guided by their goals, will experience less COVID-19-related fear and avoidance, or less impact on their functioning from these. Under the circumstances of reduced access to treatments, interventions that are designed to foster PF, and can be flexibly delivered online, such as internet-based ACT^{27,32,57} could potentially help address the psychological impact of COVID-19, and its potential implications for functioning and wellbeing in people with chronic pain. ACT is designed to be flexibly applied. ACT-oriented interventions can be delivered in various formats and in lengths varying from one or a few sessions to many, and from minutes to many hours or days. Studies that include an experimental design are needed to understand the potential utility of such interventions that design to foster PF in the context of the pandemic.

On the negative side, while self-as-context was statistically significantly associated with daily functioning, its association with COVID-19-related fear and avoidance were weak in the current study. This result differs from the results in another study examining PF processes in the context of COVID-19, where self-as-context was identified as a significant moderator of the impact of lockdowns on general anxiety.⁵¹ Self-as-context refers to the ability to take a separate perspective on one's thoughts and feelings, as if one is above or containing one's thoughts and feelings. We used Self Experiences Questionnaire to measure this process, which specifically tapped into the "transcendent" experience of self, while the study of PF in lockdowns used the Multidimensional Psychological Flexibility Inventory to measure self-as-context,⁵¹ which rather assesses a broader perspective on life

events. Differences between these assessment tools may explain the disparity in findings. It is also possible that this PF process is not directly relevant to fear and avoidance specific to COVID-19, but rather has immediate implication for general emotional and daily functioning. Indeed, the lockdowns imposed during the pandemic have led to people having to abruptly adapt or change their roles.⁵² This can exacerbate the disruption to sense of self often experienced by people with chronic pain⁶³ due to the lasting separation from normal roles⁴³, which in turn can lead to diminished emotional and social functioning and wellbeing.^{46,55}

As an internet-delivered survey study, this study naturally has its limitations. First and foremost, the cross-sectional design of the study limited our ability to infer any directional relations between the psychological impact of COVID-19, PF, and emotional and daily functioning. Studies with longitudinal and experimental design are needed to further understand the role of PF in relation to the psychological impact of COVID-19 and functioning. Longitudinal studies comparing physical, emotional and daily functioning before and after the pandemic are also needed to further understand the impact of the pandemic. Secondly, participants were recruited online via social media, which limited our ability to verify participants' eligibility and other responses. However, at the beginning of the survey, potential participants were asked if they were aged 18 and above, and if they have had chronic pain for 6 months or longer. Those who answered "No" to either of the questions were automatically excluded from further participation. On a related note, for the anonymity of participants and the sensitivity of the topic, no information on geographical location, IP address, or any COVID-19 related diagnosis were collected, which can have implications for variability regarding the impact of COVID-19. In an effort to limit the influence of this variability, information on self-assessed interference with physical health, treatment, social activities, and regular exercises due to COVID-19 were collected and controlled for in the regression analyses. As participants would have browsed on the Internet to encounter the advertisement for the study, and completed the survey on a computer or smart phone. We do not expect any participants to be having severe COVID-19 symptoms as

they participated. The lack of information on participants' geographical location also limited our ability to infer the representativeness of the sample.

Additionally, only 3 PF processes were assessed in order to limit responders' burden. These 3 processes were selected as they clearly reflect key processes of the PF model, and the measures for these processes were brief and well-validated in chronic pain. Studies that include other PF processes are needed to fully understand the role of PF in relation to the impact of the pandemic. Furthermore, we only assessed pain intensity, pain duration, and pain sites, again, in an effort to reduce participant burden. A more comprehensive assessment of pain, including the emotional aspect of pain would contribute valuable information for our understanding of the experience of people with chronic pain in the pandemic. Finally, we primarily examined COVID-19-related fear and avoidance as psychological functioning in the context of the pandemic, as these appear to be uniquely relevant factors for people with chronic pain with reliable and valid measures specific to the COVID-19 context available for assessment. Some other psychological factors, such as frustration and anger may also have significant implication for health and wellbeing. Further studies on these psychological factors would contribute valuable knowledge to the understanding of the psychological impact of the pandemic.

Conclusions

COVID-19 appears to be significantly associated with the psychological functioning in people with chronic pain. These in turn are associated with broader aspects of emotional and daily functioning in people with chronic pain. In this context PF may represent a counteracting set of influences. PF-based treatment, that can be flexibly delivered, such as Internet-based ACT, may offer a way to address the psychological impact of COVID-19 and its potential implication for the health and wellbeing in people with chronic pain. Further studies that include PF processes, and include longitudinal and experimental designs, are needed to better understand the role of PF in the current pandemic and other crises like it in the future.

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