Observational Studies

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Associations between psychological flexibility and daily functioning in endometriosis-related pain

https://doi.org/10.1515/sjpain-2022-0157
Received November 9, 2022; accepted September 13, 2023;
published online October 23, 2023

Abstract

Objectives: Processes of psychological flexibility (PF) are positively associated with health and wellbeing in several chronic pain disorders. However, these processes have not been investigated in endometriosis, a chronic pain disorder affecting 5–10 % of women worldwide. This study is a preliminary investigation of the associations between PF or psychological inflexibility (PI) and daily functioning in people with a primary diagnosis of endometriosis.

Methods: This study is based on a secondary analysis of survey data from Swedish-speaking adult participants with chronic pain recruited online. The current study included only those reporting a diagnosis of endometriosis and significant long-term pain. All participants completed the Multidimensional Psychological Flexibility Inventory (MPFI), a measure of PF and PI, as well as other measures of PF, and measures of pain and daily functioning. Correlation and multiple regression analyses were performed to examine relations of PF and PI with measures of pain and daily functioning.

Results: In general, PF facet scores from the MPFI did not correlate with pain interference but did correlate with depression, with the exception of acceptance. The overall facets of PI appeared to perform better as correlates and in regression. Established measures of PF performed in correlation and regression analyses generally as has been observed in other chronic pain populations, with significant positive associations.

Conclusions: In this preliminary analysis of PF and PI in participants with endometriosis-related pain, these processes appear relevant, especially in understanding depression, but results varied along with the measures used. Specifically, when employing the MPFI, the PI facets emerged as stronger correlates. The findings underscore the potential benefit of incorporating assessments of PF and PI as process variables in endometriosis-research, but also that careful consideration should be given when selecting instruments.

Keywords: endometriosis; psychological flexibility; psychological processes; acceptance and commitment therapy

Introduction

Endometriosis is a condition involving the occurrence of endometrial-like tissue outside of the uterus affecting approximately 10 % of all women globally, leaving more than 60 % with chronic pelvic pain [1–3]. Despite its prevalence, and calls for effective psychological treatment of endometriosis related pain, it has received little attention in psychological research [1, 4, 5]. We currently know little about the psychological processes playing a role in endometriosis, or which treatments are likely to be effective for this condition [1, 5–8].

Psychological flexibility (PF) is a general model of wellbeing and performance, consisting of six interrelated processes including; acceptance (acting with openness) cognitive defusion (seeing thoughts as just thoughts), present moment awareness (being present), self-as-context (the ability to separate what we experience and who we are), values (knowing and acting on what we choose as important in life), and committed action (the process of building wider persistent patterns of doing what we choose as important) [9, 10]. The model also includes six opposing processes that make up psychological inflexibility (PI), including experiential avoidance, cognitive fusion, lack of contact with the present moment, self as content, lack of contact with values, and inaction [9]. PF and PI are theoretically related and yet distinct.

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PF and PI appear to play an important role in health outcomes in chronic pain [11–14]. There are now over 25 randomized controlled clinical trials of treatments focused on enhancing PF in people with chronic pain and the evidence they yield is consistently supportive [15]. None of these studies focused on endometriosis.

In addition to the fact that there is limited knowledge related to psychological processes in endometriosis, it is a unique pain condition due to its association with the female reproductive system, and the relative neglect it receives in health care and research [1]. Further, there appears to be particular uncertainty surrounding how the patterns of pain experienced in endometriosis, including both cyclical and non-cyclical pain [16], may influence the role of core psychological processes.

Despite the large number of previous studies or PF and PI in chronic pain, it was not until recently that a measure including all twelve processes became available, the Multidimensional Psychological Flexibility and Inflexibility questionnaire (MPFI) [17], and now validated in a chronic pain population [18].

The primary aim in the present study is to investigate associations of PF and PI with pain interference, work and social adjustment, and depression. If there are significant associations, this will potentially provide a first indication that PF is a relevant set of processes that could be targeted in psychological treatments for endometriosis. The secondary aim is comparison across specific PF and PI processes, to see whether some of the processes appear to play a stronger role than others.

It is predicted that PF and PI processes will account for significant variance in outcome variables after controlling for background variables, number of pain days per month, and pain intensity. Since this is a preliminary investigation in endometriosis, no predictions are made regarding comparisons between facets of PF/PI. A final aim is to compare established measures of PF with the newer MPFI, to indicate which approach might be more useful for assessment of PF and PI in people with endometriosis.

Methods

Data collection

The sample consisted of adults aged 18 or older with persistent endometriosis related pain for the past three months or more. People having another pain condition in addition to endometriosis were included. Participants were recruited via social media and gave their consent to participate. Details of the data collection procedure are described in more detail elsewhere [18].

Measures

All participants provided demographic information, including gender, work status, and details about their pain condition(s). Following this, participants filled out four measures of psychological flexibility: the MPFI [17] measuring all facets of both PF and PI, the Chronic Pain Acceptance Questionnaire – 8 item version (CPAQ-8) [19] measuring pain acceptance, the Committed Action Questionnaire – 8 item version (CAQ-8) [20] measuring committed action, and the acting with awareness subscale from the Five Facet Mindfulness Questionnaire (AAS) [21] measuring contact with the present moment. Lastly, participants filled out questionnaires assessing daily functioning: the Brief Pain Inventory (BPI) [22] including items on pain interference and pain intensity, the Work and Social Adjustment Scale (WSAS) [23] assessing impairment in work and social adjustment, and the Patient Health Questionnaire – 9 (PHQ-9) [24] assessing depression. All measures are established and well-validated. Further details regarding methods can be found in our previous report [18].

Statistical analyses

Statistics for skewness and kurtosis, and Q-Q plots were used to examine the normality of each variable, and scatter plots were used to assess underlying shape and linearity for each correlation. The data were also checked for potential outliers, defined as scores more than three standard deviations from the mean. No outliers were detected. All variable distributions were deemed adequate to perform parametric tests.

The next step was to conduct Pearson's correlation analyses to examine the associations between pain, PF and PI, and outcome variables. The strength of the correlation was interpreted using Cohen's criteria: weak r=0.10, moderate r=0.30, and strong r=0.50 [25].

As preparation for hierarchical multiple regression (HMR) analyses, it was verified that there was homoscedasticity and linearity between all process and outcome variables, as assessed by visual inspection of a plot of studentized residuals vs. unstandardized predicted values. The data were also examined for multicollinearity and none was found. No tolerance values were less than 0.1 and no VIF exceeded 10 [26].

We conducted HMRs to statistically control for the role of covariates in relation to outcome variables, and to determine unique contributions of primary variables of interest, including measures of PF and PI. Background variables were included if they significantly correlated with the dependent variable ($r \geq 0.20$, $p < 0.05$).

Results

Sample characteristics

The sample in this study had a mean age of 36.4 years (SD=10.1) (see Table 1). Most participants had a college or university degree (61.1 %), were employed full-time (46.9 %), indicated that their economic status was either good (41.6 %) or very good (15.0 %), and a majority were in a relationship (71.7 %). Most participants described their family origin as

Swedish (91.2 %) or from another Scandinavian country (9.7 %). The number of individuals identifying as belonging to a minority group was 14 (12.4 %).

The average number of days of pain per month in the sample was 23.8 days (SD=7.6), and a large proportion of the sample (45.1 %) indicated that they experienced pain every day. Further, only 15 individuals (13.3 %) experienced pain less than 15 days a month. While the abdomen, pelvic region and lower back/spine were the most common pain areas, a large proportion of the sample also reported widespread pain (32.1 %).

Regarding treatment, almost half of the sample had a prescription for an opioid (48.7 %) and health care visits due to pain in the last six months were on average 6.30 (SD=11.7).

Table 1: Sample characteristics.

	Mean, SD or n, %
Age	36.37 (10.06)
Gender (women)	112 (99.1 %)
Identify as part of a minority group	14 (12.4 %)
Education (highest completed)	
Elementary	7 (6.2 %)
Secondary	32 (28.3 %
College/university	69 (61.1 %)
Vocational/other	5 (4.4 %)
Work status	
Employed (full-time)	53 (46.9 %)
Employed (part-time)	10 (8.8 %)
Self-employed	8 (7.1 %)
Job seeking	5 (4.4 %)
Sick leave	13 (11.5 %)
Other (retired, student, etc.)	24 (21.3 %)
Economic status	
Very good	17 (15.0 %)
Good	47 (41.6 %)
Sufficient	31 (27.4 %)
Bad	13 (11.5 %)
Very bad	5 (4.4 %)
Relationship status (married/in a relationship)	81 (71.7 %)
Days in pain per month	23.82 (7.63)
Generalized pain	36 (32.1 %)
Pain sites (most frequent)	
Abdomen	98 (86.7 %)
Pelvic region	96 (85.0 %)
Lower back/spine	58 (51.3 %)
Anal-or genital region	57 (50.4 %)
Prescribed opioids	55 (48.7 %)
Healthcare visits due to pain (6 months)	6.29 (11.73)
PHQ-9 (≥8 points)	87 (87.0 %)
Received psychological treatment	86 (76.1 %)
Pain	43 (38.1 %)
Mental health condition	67 (59.3 %)
Other	13 (11.5 %)

N=100–113. Pain sites were not mutually exclusive. PHQ-9, Patient Health Questionnaire – 9.

The number of individuals having received psychological treatment due to their pain, was 43 (38.1 %).

Correlations between PF, PI and demographic variables

The relations between the main demographic variables and the main process and outcome variables were examined. In general, being older, having a partner, and having a university or college degree meant having higher scores on some of the PF facets and lower scores on some of the PI facets. Having a good financial situation was related to higher scores on one PF facet, whereas having a job was related both to having higher scores on one PF facet and lower scores on another PF facet.

Specifically, age had a significant positive correlation to three facets of PF; present moment awareness ($r=0.23$, $p<0.05$), self-as-context ($r=0.20$, $p<0.05$), and defusion ($r=0.22$, $p<0.05$), and also significant negative correlations to the three corresponding PI facets, lack of contact with the present moment ($r=-0.25$, $p<0.05$), self-as-content ($r=-0.31$, $p<0.01$), and fusion ($r=-0.24$, $p<0.05$). Having a partner correlated with higher scores in the PF facet values ($r=0.25$, $p<0.01$), and similarly had a negative correlation to the PI counterpart lack of contact with values ($r=-0.27$, $p<0.01$).

Having a job (full-time, part-time or self-employed or being a student) had a negative correlation to defusion ($r=-0.27$, $p<0.01$) and having a university/college degree meant lower scores of the PI facets avoidance ($r=-0.24$, $p<0.05$) and lack of present moment awareness ($r=-0.24$, $p<0.05$), but also lower scores on the global PI dimension ($r=-0.20$, $p<0.05$). Having a higher education was correlated with higher scores of pain acceptance from the CPAQ-8 ($r=0.38$, $p<0.001$), as were having a job ($r=0.22$, $p<0.05$), and a better financial situation ($r=0.25$, $p<0.05$). The number of days of pain in an average month was positively correlated with pain interference ($r=0.39$, $p<0.001$), WSAS ($r=0.28$, $p<0.01$), and PHQ-9 ($r=0.21$, $p<0.05$), meaning that participants with a higher number of days with pain per month also had a higher degree of pain interference in their daily life, higher levels of disability in their work and social life, and a higher degree of depressive symptoms.

Correlations between PF, PI and outcome variables

Correlations between PF and PI variables with the outcome variables pain interference, work and social adjustment, and depression, were examined (see Table 2).

Table 2: Descriptives and correlation analyses.

Scale	n of items	M, SD	Pain interference	WSAS	PHQ-9
1. MPFI global psychological flexibility	30	3.62 (0.79)	0.06	0.06	−0.28[b]
1a. Acceptance	5	3.29 (0.91)	0.17	0.12	−0.11
1b. Present moment awareness	5	3.71 (0.94)	0.17	0.23[a]	−0.05
1c. Self-as-context	5	3.78 (1.12)	−0.01	0.01	−0.27[b]
1d. Defusion	5	2.99 (1.02)	0.07	−0.01	−0.29[b]
1e. Values	5	4.10 (1.00)	−0.04	0.02	−0.29[b]
1f. Committed action	5	3.87 (1.03)	−0.07	−0.08	−0.26[b]
2. MPFI global psychological inflexibility	30	3.10 (0.83)	0.16	0.21[a]	0.64[c]
2a. Experiential avoidance	5	3.53 (1.09)	0.01	0.19	0.22[a]
2b. Lack of contact with present moment	5	2.97 (0.97)	−0.01	0.09	0.31[b]
2c. Self-as-content	5	2.70 (1.39)	0.19	0.13	0.64[c]
2d. Fusion	5	3.45 (1.19)	0.10	0.08	0.62[c]
2e. Lack of contact with values	5	3.11 (1.00)	0.18	0.20[a]	0.48[c]
2f. Inaction	5	2.84 (1.19)	0.21[a]	0.23[a]	0.48[c]
3. CPAQ-8	8	28.13 (6.95)	−0.53[c]	−0.63[c]	−0.36[c]
4. FFMQ – AAS	8	25.85 (8.01)	−0.03	−0.11	−0.29[b]
5. CAQ-8	8	39.65 (5.39)	−0.26[b]	−0.35[c]	−0.50[c]
6. Catastrophizing	6	18.96 (8.42)	0.40[c]	0.38[c]	0.57[c]
7. Pain intensity	1	5.81 (1.69)	0.61[c]	0.54[c]	0.19

N=100–113. CPAQ-8, Chronic Pain Acceptance Questionnaire – 8; FFMQ – AAS, Five Facet Mindfulness Scale – Acting with Awareness Subscale; CAQ-8, Committed Action Questionnaire – 8; PHQ-9, Patient Health Questionnaire – 9; WSAS, Work and Social Adjustment Scale; Pain intensity, average pain intensity during last week assessed with a 0–10 numerical scale. [a]p<0.05, [b]p<0.01, [c]p<0.001.

No significant correlations were found between the global flexibility, as measured by the MPFI global PF dimension, nor any of the underlying facets, with pain interference. Further, only present moment awareness showed a significant correlation with work and social adjustment in a theoretically unexpected direction. However, higher levels of global flexibility had a significant association with lower levels of depression. When looking at the separate facets of flexibility, this pattern was also found for self-as-context, defusion, values, and committed action. Unexpectedly, there was no significant correlation between depression and acceptance, nor between depression and present moment awareness.

No significant correlation was found between pain interference and the global inflexibility dimension. In terms of facets, inaction was the only individual facet that had a significant correlation with pain interference. The global inflexibility dimension showed significant correlations to both WSAS and PHQ-9 in the expected direction. For work and social adjustment, two of the individual facets of PI exhibited small but significant correlations, including lack of contact with values (r=0.20, p=0.05) and inaction (r=0.23, p=0.05). All the individual facets of inflexibility showed significant correlations with depression, ranging from weak to strong relationships (r=0.22–0.64).

Additional correlation analyses examined the performance of the established measures of PF. The CPAQ-8 measuring pain acceptance, had significant moderate to strong correlations (r=−0.36 to −0.63) with all outcome variables. Thus, showing a different pattern as compared to the MPFI acceptance facet. The AAS only correlated with depression, with a moderate association (r=−0.29), showing a similar pattern when comparing to 'lack of contact with present moment' (r=0.31) as assessed with the MPFI. The CAQ-8 displayed significant correlations with all outcome variables, ranging from weak to strong (r=−0.26 to −0.50), which is partly comparable with the inaction facet from the MPFI, but better than the committed action facet. Further, higher levels of average pain during the last week significantly correlated with both pain interference and work and social adjustment, but not with depression (see Table 2).

Hierarchical multiple regression analyses

Table 3 displays the results from the HMR analyses conducted with pain interference, work and social adjustment, and depression as outcome variables. PF and PI processes were used as predictor variables measured by either the MPFI or CPAQ-8, CAQ-8 and AAS. Background variables were included in the equations if they had a significant correlation with the outcome variable.

All PF facets as measured by the MPFI (model 1) were added simultaneously to the analyses in the fourth step. For

Table 3: Hierarchical multiple regression analyses.

Step	Predictor variables	Pain interference				Work and social adjustment				Depression		
		R^2	ΔR^2	β		R^2	ΔR^2	β		R^2	ΔR^2	β
MPFI												
Model 1: PF facets												
1	Work status	0.094	0.094[b]	−0.120	1	Financial situation	0.050	0.050[a]	−0.282[b]	1	Age			−0.225[a]
	Financial situation			−0.173[a]	2	Pain intensity	0.349	0.299[c]	0.508[c]		Education			−0.141
2	Pain intensity	0.433	0.338[c]	0.531[c]	3	Days of pain per month	0.358	0.009	0.111	2	Pain intensity	0.137	0.021	0.101
3	Days of pain per month	0.457	0.024[a]	0.198[a]	4	Acceptance	0.453	0.095[a]	−0.031	3	Days of pain per month	0.193	0.056[a]	0.324[b]
4	Acceptance	0.504	0.047	0.069		PMA			0.295[b]	4	Acceptance	0.330	0.137[a]	0.056
	PMA			0.143		Self as context			−0.116		PMA			0.072
	Self as context			−0.213		Defusion			−0.180		Self as context			−0.072
	Defusion			−0.049		Values			0.194		Defusion			−0.246
	Values			0.014		Committed action			−0.183		Values			−0.268
	Committed action			0.47							Committed action			0.090
Model 2: PI facets														
3	Experiential avoidance	0.519	0.062	−0.083	3	Experiential avoidance	0.434	0.076	0.169	3	Experiential avoidance	0.603	0.409[c]	−0.095
	Lack of PMA			−0.042		Lack of PMA			0.009		Lack of PMA			0.085
	Self as content			0.075		Self as content			−0.080		Self as content			0.336[b]
	Fusion			0.139		Fusion			0.024		Fusion			0.365[b]
	Lack of values			0.055		Lack of values			0.119		Lack of values			0.145
	Inaction			0.064		Inaction			0.118		Inaction			−0.089
Model 3: CPAQ-8, CAQ-8, FFMQ-AAS														
1	Work status	0.094	0.094[b]	−0.111	1	Financial situation	0.050	0.050[a]	−0.225[b]	1	Age	0.116	0.116[b]	−0.142
	Financial situation			−0.154	2	Pain intensity	0.349	0.299[c]	0.424[c]		Education			−0.081
2	Pain intensity	0.433	0.338[c]	0.481[c]	3	Days of pain per month	0.358	0.009	0.063	2	Pain intensity	0.137	0.021	0.063
3	Days of pain per month	0.457	0.024[a]	0.167	4	CPAQ-8	0.590	0.232[c]	−0.490[c]	3	Days of pain per month	0.193	0.056[a]	0.210[a]
4	CPAQ-8	0.567	0.111[c]	−0.379[c]		CAQ-8			−0.010	4	CPAQ-8	0.367	0.174[c]	−0.039
	CAQ-8			0.024		FFMQ-AAS			−0.059		CAQ-8			−0.362[c]
	FFMQ-AAS			−0.021							FFMQ-AAS			−0.098

Generalized pain did not explain significantly incremental variance in any of the models. Generalized pain is thus not reported in the table. R^2, R square; ΔR^2, R square change; β, Standardized regression coefficient in final equation. Background variables were included based upon if a significant relationship to the dependent variable existed (r>0.20, p<0.05). [a]p<0.05, [b]p<0.01, [c]p<0.001.

pain interference, the variance added by the PF facets was 4.7 %, increasing the total explained variance to 50.4 %, although this change was not statistically significant. For work and social adjustment, the variance added by the PF facets was 9.5 %, significantly increasing the total explained variance to 45.3 %. For depression, the variance added by the PF facets was 13.7 %, significantly increasing the total explained variance to 33.0 %.

In model number two, the PI facets of the MPFI were used. For pain interference, the variance added by the MPFI PI facets was 6.2 %, increasing the total explained variance to 51.9 %, although this change was not statistically significant. For work and social adjustment, the variance added by the PI facets was 7.6 %, increasing the total explained variance to 43.4 %, but again, this change was not statistically significant. For depression, the variance added by the PI facets was 40.9 %, significantly increasing the total explained variance to 60.3 %.

When using CPAQ-8, CAQ-8 and AAS, rather than the MPFI, as predictors (model 3), and after controlling for background variables and pain intensity, the variance added by these variables was 11.1 % for pain interference, 23.3 % for work and social adjustment, and 17.4 % for depression, respectively, significant in each case. The total explained variance in each of the variables were relatively higher than those achieved employing the MPFI for pain interference (R^2=0.57) and work and social adjustment (R^2=0.59) but not for depression (R^2=0.37).

Discussion

The PF model includes a set of processes that has shown promise in understanding outcomes of psychological treatment in a wide range of chronic pain conditions [13, 15]. However, it appears that it has not been investigated in individuals with a primary diagnosis of endometriosis, a condition that is unique in several respects from the larger range of musculoskeletal pain conditions. In this preliminary study of PF and PI in participants with endometriosis we aimed to examine relations of these variable sets with aspects of pain and daily functioning. Because the MPFI is recently developed and rarely used in the context of chronic pain, we also included established measures of PF that are frequently used in studies of chronic pain.

Exploring the associations between facets of PF and PI and daily functioning in participants with persistent endometriosis pain, we found varying results depending on the measure used. Contrary to our predictions, none of the PF facets from the MPFI demonstrated significant correlations with pain interference or with work and social adjustment. On the other hand, self-as-context, defusion, values, and committed action had weak to moderate associations, in the expected direction, with depression.

When using the PI facets from the MPFI, only inaction was positively associated with pain interference. Further, only inaction and lack of contact with values showed a significant association with work and social adjustment. However, all facets of PI showed weak to strong associations with depression, consistent with our predictions. All these significant findings were in the expected direction.

Consistent with our expectations, the CPAQ-8, an established instrument assessing pain-related acceptance, had weak to strong associations with all outcome variables, unlike the acceptance and experiential avoidance facets of the MPFI. A measure of committed action, the CAQ-8, showed weak to strong correlations with all outcome variables which is comparable with inaction as measured by the MPFI. Contrary to our expectations, the AAS that aims to assess present moment awareness only had a significant association with depression.

In the regression equations controlling for background variables, pain intensity, and days in pain per month, the addition of PF and PI regardless of measure led to an increase in explained variance in six out of nine analyses. The inclusion of the PI facets of the MPFI did not lead to a significant increase of explained variance in pain interference or work and social adjustment which is unexpected. However, both PF and PI facets did so when depression was the dependent variable, as did PF in the case of work and social adjustment, as expected. Further, the established measures of PF did contribute significantly in analyses of all three outcomes. When comparing the established measures and the MPFI in predictions of depression, the PI scale of the MPFI appeared to perform better in variance explained. Once again, unexpectedly, a closer inspection of the individual facets showed that the significant associations found in the correlational analyses were not always preserved when controlling for background variables, pain intensity, and days of pain per month. When using PF facets from the MPFI as predictor variables, no significant betas emerged when pain interference was the dependent variable. One significant beta coefficient, for present moment awareness, was found for work and social adjustment but this was in a theoretically unexpected direction. For depression, no facet emerged with a significant beta. Thus, showing patterns not predicted.

PI facets show a similar story as for PF, not all associations to the outcome variables were kept when controlling for background variables and pain intensity. No facet achieved a significant beta in the equation for pain interference, nor work and social adjustment. For depression, betas for self-as-content and fusion both were significant. In contrast, results from the CPAQ-8 showed significant associations to pain interference and work and social adjustment even after controlling for background variables and pain intensity. The CAQ-8 was the only one among the established measures with a significant beta in the equation for depression.

Taken together, the results at the level of individual facets are worth noting since some of the facets showing the strongest associations to the outcome variables, such as self-as-context and committed action, have not been commonly assessed in chronic pain [27, 28]. This provides further motivation to continue to investigate the influence of all facets of PF or PI in relation to daily functioning. Perhaps interpretation of the regression coefficients requires some caution, however, as the MPFI facets are significantly intercorrelated and including all facets in one model can shrink unique contributions.

To summarize, multiple PF and PI facets of the MPFI correlate to depression, including facets previously not commonly assessed, while some PI facets of the MPFI correlate to pain interference and work and social adjustment. All three outcomes correlate to PF when measures by the more established measures of CPAQ-8 and CAQ-8. When controlling for background variables, both PF and PI facets of the MPFI add to explained variance in outcomes when it comes to depression while only PF adds to the explained variance using work and social adjustment as an outcome. The established measures add to explained variance in all outcomes.

The difference in correlations between the MPFI and established measures of PF are somewhat surprising. This is particularly so because the items in the MPFI are taken from established measures of PF and PI [17]. One potential explanation is that CPAQ-8 is specifically a measure of pain acceptance and developed specifically for a chronic pain population [19]. Some researchers find that the CPAQ-8 includes some items that might reflect aspects of daily functioning, meaning it is contaminated with outcome content [29] although this view is not necessarily widely agreed upon [30]. Further, other studies using the MPFI in pain populations and in a general population report somewhat similar patterns, particularly with respect to acceptance and experiential avoidance facets [31, 32]. Thus, it is unlikely that the current differences between the MPFI facets and the more established PF measures are due to the endometriosis population in particular. However, with the established measures demonstrating significant correlations between PF and pain related outcomes, PF and PI appear relevant to further investigate in endometriosis. The difference in results between the measures also highlights the importance of the careful consideration of what measures to use, for whom and when. For example, even though the established measures of PF did perform better in several aspects, it should be noted that the use of separate single-facet measures will ultimately result in somewhat confounded comparisons between facets. There remains a need for continued development of measures, for more precise measures capturing all facets of PF and PI. Even if the MPFI provides this, the patterns emerging in the current study also highlights the importance of further improvements in the assessment of PF and PI.

This is a preliminary study of PF and PI in individuals with a primary diagnosis of endometriosis and several limitations should be noted. Firstly, this was a secondary analysis of a larger sample including several different chronic pain diagnoses and the sample size for endometriosis is relatively small. This will in turn influence power and potential reliability, and results should thus be interpreted with caution. Secondly, cross-sectional studies do not allow appreciation of processes over time within people, nor determination of cause and effect, and are inherently non-idiographic [33]. Further research should also aim to assess PF and PI in people over time to account for the degree of temporal change of these variables.

To conclude, PF and PI appear relevant in endometriosis, especially for identifying potential processes involved in depression in people with endometriosis. In addition, a difference is observed in the role of PF and PI in relation to outcome variables depending on which set of measures that are used as predictors. When the MPFI is considered, the PI facets seem to perform as better correlates. Overall, this preliminary investigation of PF and PI in patients with endometriosis related pain shows the potential utility of including assessments of PF and PI as process variables. The current study also highlights the importance of assessing facets of PF and PI not commonly accounted for in research on chronic pain, for example self-as-context/self-as-content and committed action/inaction. Finally, measures of the flexibility and inflexibility facets included here show opportunities for improvement, perhaps more so the flexibility facets.

Research ethics: This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Swedish Ethical Review Authority (approval no. 2021-02656).
Informed consent: Informed consent was obtained from all individuals included in this study.
Author contributions: The authors have accepted responsibility for the entire content of this manuscript and approved its submission.
Competing interests: The authors state no conflict of interest.
Research funding: None declared.
Data availability: The raw data can be obtained on request from the corresponding author.

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