Abstract

Introduction. In past years, and mostly due to contextual psychological therapies, it has been argued that particular behavioral patterns may be useful in certain contexts, but not in others. The goal of this study has been to explore whether pain severity is indeed a contextual factor influencing the relationship between two controversial activity patterns, namely pacing and persistence, and functionality in people with fibromyalgia. **Methods.** Participants were 231 women diagnosed with fibromyalgia. A multivariate regression was conducted to explore the moderating role of pain severity in the relationship between activity patterns and outcomes (i.e. fibromyalgia impact and depressive symptoms). **Results.** Excessive persistence (interaction: t=-2.45, p=0.015) and pain-contingent persistence (interaction: t=-2.13, p=0.034) were more strongly associated with fibromyalgia impact when people experienced less severe pain. Pacing for pain reduction was only significantly related to depressive symptoms at very severe (M=10) pain levels (interaction: β=-0.18, t=-2.73). **Conclusions.** The results here reported suggest that the context in which behavior occurs is relevant when the utility of certain behavior patterns is considered. The clinical implications of this are clear, as it would justify adapting the recommendations given to patients according to their pain severity status.

Keywords: activity patterns; fibromyalgia; pain severity; moderation; contextual therapy.

Significance: This manuscript shows that some activity patterns (i.e., pacing to conserve energy for valued activities) might be advisable regardless of pain levels. Conversely, some patterns might be especially recommended (i.e., pain-reduction pacing) or inadvisable (i.e., excessive and pain-contingent persistence) depending on pain levels (i.e., severe and mild pain, respectively).

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Exploring the contextual role of pain severity as a moderator of the relationship between activity patterns and the physical and mental functioning of women with fibromyalgia

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Introduction

Experiencing chronic pain often leads to changes in the individual's ability to function physically. Three activity patterns are frequently observed in response to ongoing pain, namely avoidance, pacing, and persistence (Andrews et al., 2012). Avoidance is defined as an attempt to escape from activities that are anticipated to be unpleasant or pain-eliciting. Pacing is often viewed as a strategy aimed at regulating one's activity level by alternating action and rest to achieve an adaptive goal. Persistence, also known as endurance, refers to continuing with an activity until completed, despite pain (Cane et al., 2013; Luthi et al., 2018).

Traditionally, it has been believed that these activity patterns are inherently adaptive (i.e., pacing and persistence) or maladaptive (i.e., avoidance) (Molton et al., 2008; Nielson et al., 2001). While this has been shown to be true for avoidance (Andrews et al., 2012; Cane et al., 2013), in the recent years the intrinsically adaptive or maladaptive nature of the remaining activity patterns (i.e., pacing and persistence) has been questioned (Suso-Ribera et al., 2016). First, studies have shown that certain activities, such as limiting the time standing, laying down in bed when in pain, or going slow and steady despite the pain, correlate to both adaptive and maladaptive coping (Tan et al., 2011). Additionally, the nature of certain activity patterns appears to be inconsistent with the literature findings, showing that persistence and pacing have been unreliably associated with outcomes depending on how they are conceptualized (Hadzic et al., 2019; Kindermans et al., 2011; McCracken and Samuel, 2007; Racine et al., 2018). For example, persistence can be viewed as overdoing, which is often linked to an increase of pain and is considered to be a maladaptive coping strategy (Luthi et al., 2018). Alternatively, persistence can be understood as performing until an important task is completed. This can be more easily achieved, for instance, by means of different cognitive resources, such as coping self-statements, which in turn might lead to increased self-efficacy when completing the task (Esteve et al., 2016). Similarly, pacing can be viewed as reflexive and task-contingent (e.g., taking the necessary activity-rest steps to complete an important goal) and would therefore be adaptive. On the opposite side, pacing can be construed as a way of systematically avoiding activity when in discomfort, which would lead to poor outcomes (Andrews et al., 2012; Hasenbring et al., 2009; McCracken and Samuel, 2007; Molton et al., 2008).

The emergence of the flexibility model of pain, which states that the adaptive or maladaptive nature of activity patterns depends on the context in which the behavior occurs, has provided new insights into the relationship between cognitive-behavioral factors and outcomes, including activity patterns (McCracken et al., 2010). According to this model, psychological flexibility is a person's ability to persist or flexibly change a behavior in a given context of individual goals, psychological influences, and situational aspects (McCracken, 2013; McCracken et al., 2018).Therefore, this model argues that the context in which the behavior occurs plays a fundamental role in whether a given activity pattern is successful.

In the past, several attempts to provide a more consistent conceptualization of activity patterns have been made (Cane et al., 2016; Hadzic et al., 2019; Hasenbring et al., 2009). However, the Activity Pattern Profiles is probably the best example of a scale that combines the inclusion of all activity patterns and the context in which these behaviors occur (Esteve et al., 2016). This contextual approach has provided interesting insights that are consistent with the existing literature (Andrews et al., 2012). For example, in accordance with past research, both pain avoidance and especially overall activity avoidance have been associated with poor physical and psychological functioning. Persistence, on the other hand, has been linked to the perception that one can perform more daily activities regardless of the context. Interestingly, though, excessive persistence (i.e., overdoing) and pain-contingent persistence have been linked to poor affective status. In contrast, only task-consistent persistence has been related to both improved physical and mental health functioning. Finally, regarding pacing, both pacing to increase activity levels and pacing to conserve energy for valued activities, have been associated with positive physical and mental outcomes. On the other hand, pacing to reduce pain does not appear to correlate with the health status of patients with chronic pain (Esteve et al., 2016, 2017).

As noted earlier, a strength of the Activity Pattern Profiles is that it considers situational factors (e.g., the existence of pain) and personal goals as contexts in which behavior happens. There is some evidence, however, that the relationship between the maladaptive cognitions that are associated with activity patterns and clinical outcomes may not be linear and might be contextually-determined (i.e., moderated), not only by the existence of pain but also by the amount of pain experienced by the individual (Suso-Ribera et al., 2017). In this sense, and similar to past research indicating the relatively inescapable and eruptive nature of pain (Blackburn-Munro, 2001; Ecclestone and Crombez, 1999), the study by Suso-Ribera et al. (2017) revealed that pain catastrophizing, which has been previously linked to overactivity (Andrews et al., 2014, 2015b), had a limited contribution to physical functioning when pain was very severe. This supports the hypothesis that, when pain is very severe, there might be less room for cognitive and behavioral efforts to impact well-being (i.e., the disability imposed by pain is relatively inevitable). In contrast, when pain is less intense, the behavioral options may be more poignant because pain is not as consuming. This is important as it can serve to create interventions which are more personalized.

Our goal is therefore to provide further evidence for this contextually-sensitive approach to chronic pain. We aim to achieve this by exploring whether the association between activity patterns and outcomes is influenced by a fundamental contextual factor in chronic pain (i.e. namely pain severity). We aim to do this following what is called a “functional”, as opposed to a “formal”, study of behavior (McCracken, 2013, 2017). Because controversy regarding the adaptive/maladaptive nature of activity patterns only exists for pacing and persistence, the avoidance component will not be included in the analyses.

Consistent with past research in catastrophizing (Suso-Ribera et al., 2017) and the relationship between catastrophizing and overactivity (Andrews et al., 2014, 2015b), we anticipate that the contribution of overdoing (i.e., excessive persistence) to physical status (i.e., fibromyalgia impact on functioning) will decrease as pain severity increases (e.g., patients will be physically disabled due to severe pain irrespective of their overdoing profile). This could be interpreted as indicating that, when pain is very intense, there is less room for cognitive and behavioral efforts to impact well-being (i.e., the disability imposed by pain is relatively inevitable). As opposed to that, when pain is less intense, it is possible that the behavioral options are more varied because pain does not impose so many limitations. It is unclear whether this line of reasoning also applies to mental health status. Based on the scarce literature in this regard (Suso-Ribera et al., 2017), however, we do not expect the relationship between overdoing and mental well-being to be moderated by pain severity. This can be, at least partly, explained by the fact that pain severity levels are more intensely associated with physical functioning compared to mental well-being (Costa et al., 2017; Karoly et al., 2008; Suso-Ribera et al., 2018).

In relation to pacing, its relationship with catastrophizing appears to be negative, but very weak (Hadzic et al., 2019; Karsdorp and Vlaeyen, 2009). Thus, the results of the moderation analyses are difficult to anticipate based on past research. However, pacing is most often conceptualized as a coping strategy that is implemented to enable individuals to participate in daily activities without exacerbating pain (Andrews et al., 2012, 2015b). Therefore and contrary to overdoing, it is possible that this strategy is most useful to reduce disability and distress when pain is more severe. In sum, we anticipate that pain severity will be a contextual factor (i.e., moderator) in the relationship between activity patterns and the physical disability and mental well-being of individuals with fibromyalgia. Particularly, we expect that the negative impact of overdoing on physical disability will be especially evident at milder levels of pain, while the benefits of pacing on health status will be revealed as pain increases.

Materials and Methods

Procedures and sample

Participants were recruited at different fibromyalgia associations in Spain. Once the study was circulated by mail at the different associations, in-person assessments were appointed with the women who replied confirming their willingness to participate in the study. Inclusion criteria included being a woman, having been diagnosed with fibromyalgia by a rheumatologist, and being over 18 years of age. Only women were included in the study for homogeneity and because the prevalence of fibromyalgia among men is very low (Wolfe et al., 2013).

In total, 231 women agreed to participate and signed the informed consent. The study and its procedures were approved by the Ethics Committee of the (blinded) University. The ethical principles for research with human participants were followed.

Measures

Demographic information. An *ad hoc* questionnaire was created to obtain information about the participants' age, marital status, educational level, and job status.

Pain severity. The Brief Pain Inventory item on usual pain intensity during the last week was used in the present study (Cleeland and Ryan, 1994). The numerical response scale has 11 points (ranging from 0 = "no pain at all" to 10 = "the worst pain you can imagine"). Because this consists of a single item, internal consistency reports are not provided. The validity of the Brief Pain Inventory as a measure of pain severity has been revealed in past research (Keller et al., 2004).

Fibromyalgia impact. The total score of the Spanish adaptation of the Fibromyalgia Impact Questionnaire-Revised (FIQ-R) was used to measure the impact of FM on functioning (Salgueiro et al., 2013). Items in the FIQ-R are answered on an 11-point numerical scale ranging from 0 to 10. Different anchors are used across items. Scores in the FIQ-R have a 0–100 range. Higher scores in the FIQ-R represent higher impact of FM on functioning. The internal consistency of the FIQ-R in the present study was excellent (α=.92). The validity of the FIQ-R as a measure of fibromyalgia impact (e.g., to detect patients differing in job status) has been supported in past research (Luciano et al., 2013).

Depressive symptoms. The 7 items that evaluate depressive symptoms in the Hospital Anxiety and Depression Survey were administered in this study (Herrero et al., 2003). In this questionnaire, response labels range from 0 = "Not at all" to 3 = "Nearly all the time". Thus, depressive symptoms scores range from 0 to 21. Higher scores indicate higher depressive symptoms. The internal consistency of the depressive symptoms scale in the present study was good (α=.69). The Hospital Anxiety and Depression Survey has obtained excellent validity reports in terms of evaluating symptom severity and detecting positive/negative cases (Bjelland et al., 2002).

Activity Patterns. The recently developed Activity Patterns Scale has 24 items grouped into 8 dimensions, each composed of 3 items: pain avoidance, activity avoidance, task-contingent persistence, excessive persistence, pain-contingent persistence, pacing to increase activity levels, pacing to conserve energy for valued activities, and pacing to reduce pain (Esteve et al., 2016). Only the pacing and the persistence scales were used in the study because avoidance has been consistently associated with poor outcomes in the literature. According to the Activity Patterns Scale, persistence can be excessive and rigid, contingent to a task, or contingent to pain severity. On the other hand, pacing can be implemented according to several personal goals, such as increasing activity level, conserving energy for valued activities, or reducing pain. Responses in the scale use a 5-point Likert scale ranging from 0 = "not at all" to 4 = "always". Similar to the scale development study, the internal consistency ratings were good for all subscales (α>.75), with the exception of excessive persistence (α=.64). Studies so far support the validity of the Activity Patterns Scale to measure different activity patterns in chronic pain settings (Esteve et al., 2016).

Data analysis

First, the bivariate associations between study variables (activity patterns, pain severity, FM impact on functioning, and depressive symptoms) were investigated. Next, a series of multivariate regressions were computed with the PROCESS macro (Hayes, 2017). In each regression, a combination of one independent variable (i.e., one activity pattern), the moderator (i.e., pain severity), and their interaction were entered to predict an outcome (i.e., FM impact on functioning or depressive symptoms). *Post hoc* analyses were computed when a significant moderation was found to obtain the conditional effects of the independent variables on outcomes at different levels of the moderator.

An alpha level of 0.05 was set for all analyses. Due to the exploratory nature of the study and because the effect sizes of moderations tend to be small, a more restrictive *p* value was not recommended as it might increase the risk of false negatives (Althouse, 2016; Écija et al., 2020).

All analyses were conducted with SPSS version 22 (IBM Corp., 2013).

Results

Demographic characteristics of the sample

Participants' ages ranged from 30 to 78 years (*M* = 56.91, *SD* = 8.9). Almost all participants were married (79.1%) at the time of assessment. Only 34.4% of the participants had completed secondary or higher education and only 12.2% were working at the time of assessment. See Table 1 for a more detailed description of sample characteristics.

Bivariate associations between study variables

The bivariate relationship between functioning, depressive symptoms, pain severity, and activity patterns is shown in Table 2.

Regarding activity patterns, only pacing for conserving energy for valued activities was significantly associated with improved outcomes (i.e., less severe depressive symptoms; r = -.21, p = .001). On the contrary, pacing for pain reduction correlated to greater FM impact on functioning (r = .14, p = .040) and pain severity (r = .16, p = .013). Pacing to increase activity correlated to more severe pain (r = .14, p = .041).

Regarding persistence, excessive persistence (r = .28, p = .001) and pain-contingent persistence (r = .14, p = .039) were associated with more FM impact on functioning. Excessive persistence (r = .24, p < .001) was also significantly related to more severe depressive symptoms and pain severity (r = .20, p = .002).

Multivariate associations and moderation analyses

The results of the multivariate hierarchical regression analyses predicting FM impact on functioning and depressive symptoms from activity patterns, pain severity, and their interaction are shown in Table 3. A main effect of pain severity was found on FM impact on functioning on all models (all $p < .001$), but contributed to depressive symptoms above and beyond activity patterns and their interaction in only five out of eight models tested.

The only activity pattern (negatively) associated with functioning when controlling for the contribution of pain severity and the interaction was excessive persistence ($\beta = 1.24$, $t = 3.14$, $p = .002$, 95% IC = 0.46, 2.02). Excessive persistence ($\beta = 0.40$, $t = 3.48$, $p < .001$, 95% IC = 0.17, 0.62) also contributed to more severe depressive symptoms, while the implementation of pacing for conserving energy for valued activities was associated with less severe depressive symptoms ($\beta = -0.35$, $t = -3.55$, $p < .001$, 95% IC = -0.54, -0.15).

Three moderation effects of pain severity were revealed: one in the relationship between excessive persistence and FM impact on functioning ($\beta = -0.52$, $t = -2.45$, $p = .015$, 95% IC = -0.94, -0.10), another in the relationship between pain-contingent persistence and FM impact on functioning ($\beta = -0.53$, $t = -2.13$, $p = .034$, 95% IC = -1.03, -0.04), and a final one in the relationship between pacing for pain reduction and depressive symptoms ($\beta = -0.18$, $t = -2.73$, $p = .015$, 95% IC = -0.94, -0.10). As noted in Tables 4 to 6 and Figures 1 to 3, the analyses of conditional effects indicated that the strength of the relationship between FM impact on functioning and the two persistence patterns (excessive and pain-contingent persistence) decreased notably as pain severity increased. In particular, the association with excessive persistence was no longer significant at very severe pain levels (M=10) and that with pain-contingent persistence was only significant at moderate levels of pain (M=6). Regarding pacing for pain reduction, the opposite pattern was found. Specifically, this activity pattern was only significantly related to depressive levels when pain severity levels were at their highest (M=10).

Discussion

In recent years, a call for contextually-sensitive approaches to behavioral determinants of functioning in chronic pain has been made (Yu et al., 2020). The development of the Activity Patterns Scale has been a first step in this direction (Esteve et al., 2016). However, as noted in the present investigation, situational determinants, such as pain severity should be additional elements to be considered when exploring the impact of activity patterns on functioning of individuals with chronic pain. These findings are consistent with the psychological flexibility model assumption that behavior has to be studied in a context of personal goals, taking into account the influence of psychological determinants, and situational conditions (McCracken, 2013). Specifically, the results reported here support the idea that pain severity levels should be considered when making recommendations about certain activity patterns (i.e., excessive and pain-contingent persistence and pacing for pain reduction).

Past literature has revealed contradictory findings in relation to persistence (Kindermans et al., 2011; McCracken and Samuel, 2007; Racine et al., 2018). According to the psychological flexibility model, when conceptualized as overdoing in an inflexible, impulsive, and rigid manner, persistence (i.e., excessive persistence) should be maladaptive (McCracken et al., 2010). The literature has indeed supported the idea that excessive persistence, which is reflected by items such as "I have tried to do too much and felt even worse as a result" and "I find myself rushing to get everything done before I crash", are associated with poor affective states when performed frequently (Benaim et al., 2017; Cane et al., 2013; Esteve et al., 2016, 2017), which has been replicated in the present study (i.e., depressive symptoms). In contrast to mental well-being, the study of the frequency of overactive behavior has yielded complex associations with physical outcomes. Specifically, while excessive persistence has been linked to the perception that one can perform an increased number of tasks, its association with physical impairment has been weak (Esteve et al., 2016, 2017). According to the psychological flexibility model, because excessive persistence would be the most rigid form of persistence behavior, we would expect that the use of this inflexible form of behavior to be associated with poor outcomes. Our results are consistent with the idea that patients with fibromyalgia perceive that they are more impacted by the disease when implementing excessive persistence as a coping strategy, which is consistent with the literature (Andrews et al., 2012).

Another important finding in relation to excessive persistence, and one of the contributions of the present study, is the finding that excessive persistence might be particularly deleterious for FM impact on functioning at milder levels of pain severity (i.e., when pain levels are less interfering and therefore there is more room for behavior to affect outcomes). The relationship between depression and excessive persistence has not been found to be moderated by pain severity, which suggests that excessive persistence might be maladaptive for depression irrespective of pain severity levels. These results are consistent with our hypotheses and a previous study, in which pain severity moderated the relationship between maladaptive cognitions that are linked to overactivity behaviour (i.e., pain catastrophizing; Andrews et al., 2014, 2015) and physical, but not mental, health status (Suso-Ribera et al., 2017). These results partially support the need for a contextual approach to behavior (i.e., in the case of FM impact on functioning but not on mental distress), as argued in the psychological flexibility model of pain (Mccracken and Morley, 2014). Particularly, the results point to the experienced pain severity as an important factor that should be considered in current models of functioning despite pain, as noted in past research with the fear-avoidance model of pain (Leeuw et al., 2007).

The potential consequences of these findings for clinical practice should be highlighted. Specifically, and consistently with past research in pain catastrophizing (Suso-Ribera et al., 2017), we suggest that treatments to reduce the impact of excessive persistence (i.e., overdoing) on physical disability should be offered in a timely manner (i.e., early before a progression to severe levels of pain occurs). In fact, there is evidence indicating that those who usually implement overactivity patterns tend to increasingly adhere to avoidant behaviors overtime, which results in increased pain and disability levels (Andrews et al., 2015b, 2015a). Therefore, based on our findings and past evidence on the maladaptive role of activity avoidance on outcomes (Meulders, 2019), efforts should be directed towards facilitating evidence-based treatments to stop the progression to severe pain and disability levels.

A similar finding was revealed regarding pain-contingent persistence ("When my pain decreases I try to be as active as possible"), a more contextually-sensitive activity pattern, for which our results also indicated that its potentially harmful influence on disease impact on functioning might be at its highest when pain levels are milder (i.e., moderate pain severity). In contrast to excessive persistence, pain-contingent persistence has not been consistently or strongly associated with lower mood in previous research (Esteve et al., 2016, 2017). This is consistent with the idea, from the psychological flexibility model, that the impact and utility of behaviors is contextually-determined (Scott and McCracken, 2015).

The most promising persistence-related activity pattern has been task-contingent persistence ("Once I start an activity I keep going until it is done"). Similar to pain-contingent persistence, task-contingent persistence includes a contextual approach to behavior analysis (i.e., the existence of a task). In contrast to pain-contingent persistence, task-contingent persistence has been linked not only to reduced FM impact on functioning, but also to more positive affective states (Esteve et al., 2016, 2017; Kindermans et al., 2011). The previous would support persisting when an individual is conducting a task. Our findings, however, are not consistent with this idea (the associations with FM impact on functioning and depressive symptoms were not significant). There might be several reasons to explain this discrepancy. First, the selection of measures across studies (e.g., positive and negative affect have been explored in past research and depressive symptoms were investigated here). However, an important difference between studies is regarding the population of study, which has been musculoskeletal pain of various etiologies in past research while this study has exclusively focused on fibromyalgia. Past research has shown that individuals with fibromyalgia report stronger pain severity, higher consumption of pain medication, and more disability than individuals with other musculoskeletal problems (Mellegård et al., 2001). The literature has also shown that the associations between activity patterns and outcomes may differ when comparing fibromyalgia patients and other pain conditions, in the sense that overactivity might be more detrimental for patients with fibromyalgia (Andrews et al., 2012). Thus, it is possible that the effectiveness of behavioral strategies differs across pain populations, which again would support the need for a contextual approach to the analysis of activity patterns in chronic pain.

Regarding pacing, this activity pattern has been traditionally viewed as an adaptive way of dealing with the limitations associated with experiencing chronic pain. However, its arguably adaptive nature has not been systematically replicated across research (Kindermans et al., 2011; McCracken and Samuel, 2007; Racine et al., 2018). Again, in an attempt to explore whether a more contextually-sensitive approach to behavior yielded more consistent findings, the Activity Patterns Scale included goals and the existence of pain in the conceptualization of pacing. Consistent with past research (Esteve et al., 2016, 2017), our results indicated that pacing for conserving energy for valued activities ("I do things more slowly and so I can save energy to do other things that matter to me") is associated with improved mood (i.e., reduced depressive symptoms). Also, in line with existing findings, the relationship between the remaining forms of pacing, that is pacing for increasing activity ("I do things more slowly so that I can do a lot more things") and pacing for pain reduction ("I usually take several breaks so that it hurts less"), and mental health status is insignificant. In relation to FM impact on functioning, the role of pacing (as conceptualized within this contextual approach) is less clear. Specifically, pacing for increasing activity and for conserving energy for valued activities have been sometimes associated with improved functioning (Esteve et al., 2016), but not consistently (Esteve et al., 2017), and their association with functional impairment appears to be very weak (Esteve et al., 2016, 2017). Our results are consistent with the latter findings in suggesting that none of these forms of pacing are unequivocally and strongly associated with improved functioning. This has been attributed to the fact that pacing can be partly conducted as a form of avoidance (McCracken and Samuel, 2007). This might help understand the difficulties in finding a consistent and positive influence of pacing on functioning.

Contrary to the literature on avoidance, the use of pacing, and particularly pacing for conserving energy for valued activities, has been linked with improved mental well-being. This suggests that this form of pacing might be one recommendable practice to be included as a coping tool for people experiencing chronic pain, and again supports this contextual approach to the study of behavioral patterns. In line with this idea, a non-avoidant pacing scale has been recently developed and has been negatively associated with avoidance and positively related to mental health (Hadzic et al., 2019). Some of the included items, such as "When my pain flares up and is much worse than usual, I reduce my activity levels rather than stopping entirely" are indeed consistent with this idea of reducing but not stopping activity to continue with an important activity. This is also reflected in the pacing to conserve energy for valued activities scale ("I do things more slowly and so I can save energy to do other things that matter to me"). These findings are encouraging as they shed light into ways in which pacing can be construed as an adaptive coping strategy in the presence of chronic pain.

Finally, our analyses indicated that pacing for pain reduction might be an adaptive activity pattern, mostly at high levels of pain severity (M = 10). Again, this is consistent with the idea that the context in which behavior is implemented needs to be taken into consideration in chronic pain settings. While the following explanation for the findings is only tentative at this stage, it is possible that patients experiencing very severe pain need this fragmentation of activities and the combination of activity and rest periods to be able to care for their mental health status. While further causal inferences cannot be drawn from the aforementioned results, these findings seem to suggest that there is a need for a contextual approach to the study of pacing behavior in chronic pain (Mccracken and Morley, 2014). The above suggests that the relationship between coping, pain severity, and outcomes might be, in some cases, more complex (i.e., not necessarily linear) than previously considered.

It is important to note that our hypotheses regarding the moderation of pain severity in the relationship between activity patterns and outcomes were only partially supported. In some cases, this might be explained by the weak associations between some activity patterns (e.g., pacing to increase activity and task-contingent persistence) and outcomes, which suggests a negligible relationship between variables irrespective of the context. In some other cases, activity patterns were associated with outcomes (e.g., pacing for conserving energy and excessive persistence in the relationship with depression) but no moderation occurred. Several explanations might exist for this, including the possibility that the relationship between variables is not contextually determined, or that they are contextually determined by factors other than pain severity. This opens new avenues of research into chronic pain.

This study certainly has some limitations. First, because this is not an experimental study, the associations should be interpreted according to its observational nature. Next, it is important to consider that the sample was composed of FM patients only. As noted earlier, important differences have been revealed between this population and other populations with chronic pain, which does not guarantee the generalizability of the findings to other musculoskeletal and non-musculoskeletal pain populations. Thus, we encourage researchers to replicate these findings and other analyses using a contextual approach to care in different pain populations. Another limitation refers to the cross-sectional nature of the data. While this is a design frequently used in similar past research, it is also true that pain severity and behavior can change across and within days, which makes longitudinal studies more recommendable (Andrews et al., 2018; Luthi et al., 2018). As noted in past research, ecological momentary assessment using technology (e.g., apps and wearable devices) is a feasible and effective way of doing this (Colombo et al., 2020). We expect that the present study findings might encourage new research in this direction. Additionally, it is important to consider that the internal consistency of the excessive persistence scale in the present and past research has been low (Esteve et al., 2016). This should encourage a reformulation of the corresponding items in the scale in future research. Finally, it should be noted that alpha levels were not corrected due to the exploratory nature of the study and because interaction effects tend to be small. Therefore, the magnitude of the presented findings should be interpreted accordingly.

While acknowledging some study shortcomings, the present study's findings also have important clinical implications in the field of personalized behavioral treatments for patients with chronic pain (Vlaeyen and Crombez, 2020). In this sense, what our moderation findings suggest is that slightly different recommendations should be provided regarding activity patterns according to the pain status of individuals. Specifically, while certain behaviors might be adaptive (e.g., pacing for conserving energy for valued activities) irrespective of pain levels, other activity patterns might be especially inadvisable at milder levels of pain (e.g., excessive persistence and pain-contingent persistence) or recommendable only when pain is very severe (e.g., pacing for pain reduction). These findings could serve to make interventions more efficient. For example, recommendations on activity patterns could be made according to the patient's pain status to maximize the effectiveness of such behavior on outcomes (especially FM impact on functioning). Furthermore, in some cases (i.e., when trying to reduce FM impact on functioning) an effort to reduce pain severity before implementing changes in certain activity patterns (i.e., a reduction in excessive persistence) might be preferable. Other times (i.e., when attempting to improve mental well-being), changes in activity patterns might be equally effective, irrespective of initial levels of pain. Therefore, in the latter scenario a reduction in pain severity and changes in activity patterns could both be implemented.

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Table 1. Demographic characteristics of the sample

Variable	Frequency (%)
Marital status	
Married/in a relationship	182 (79.1)
Single	12 (5.2)
Divorced/separated	20 (8.7)
Widowed	16 (7.0)
Educational level	
Primary or less	152 (64.7)
Secondary	61 (26.8)
University	15 (6.6)
Job status	
Active worker	28 (12.2)
Retired	74 (32.3)
Sick leave	23 (10.0)
Homemaker	76 (33.2)
Unemployed	28 (12.2)

Table 2. Bivariate associations between functioning, depressive symptoms, pain severity, and activity patterns

	2		3		4		5		6		7		8		9	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
1. FIQ total	.51	<.001	.51	<.001	-.07	.277	.28	<.001	.14	.039	.09	.192	-.05	.456	.14	.040
2. Depressive symptoms			.14	.035	-.04	.554	.24	<.001	.03	.624	-.04	.546	-.21	.001	-.02	.787
3. Pain Severity					.04	.591	.20	.002	.09	.190	.14	.041	.10	.128	.16	.013
4. Task-contingent persistence							.37	<.001	.27	<.001	-.23	<.001	-.25	<.001	-.37	<.001
5. Excessive persistence									.45	<.001	.04	.506	-.03	.704	-.03	.605
6. Pain-contingent persistence											.16	.014	.15	.020	.06	.365
7. Pacing increase activity													.80	<.001	.76	<.001
8. Pacing conserving energy															.75	<.001
9. Pacing pain reduction																

Table 3. Multivariate hierarchical regression analyses predicting FM impact on functioning and depressive symptoms from activity patterns, pain severity, and their interaction.

	FIQ-tot				Depression			
	β	*t*	95% CI	R^2	*β*	*t*	95% CI	R^2
Model 1				.27				.02
Task-contingent persistence	-0.59	-1.56	-1.33, 0.15		-0.09	-0.86	-0.31, 0.12	
Pain severity	5.27	8.98[c]	4.11, 6.42		0.37	2.15[a]	0.03, 0.70	
Pain intensity x Task-contingent persistence	-0.33	-1.41	-0.78, 0.13		-0.03	-0.42	-0.16, 0.10	
Model 2				.31				.09
Excessive persistence	1.24	3.14[a]	0.46, 2.02		0.40	3.48[c]	0.17, 0.62	
Pain severity	4.54	7.62[c]	3.36, 5.71		0.17	1.02	-0.16, 0.51	
Pain intensity x Excessive persistence	-0.52	-2.45[a]	-0.94, -0.10		-0.11	-1.78	-0.23, 0.01	
Model 3				.28				.02
Pain-contingent persistence	0.55	1.37	-0.24, 1.34		0.04	0.34	-0.19, 0.27	
Pain severity	5.09	8.69[c]	3.94, 6.25		0.34	2.04[a]	0.01, 0.69	
Pain intensity x Pain-contingent persistence	-0.53	-2.13[a]	-1.03, -0.04		-0.05	-0.68	-0.19, 0.09	
Model 4				.27				.04
Pacing increase activity	0.11	0.32	-0.58, 0.81		-0.10	-0.97	-0.30, 0.10	
Pain severity	5.10	8.51[c]	3.92, 6.28		0.35	2.03[a]	0.01, 0.69	
Pain intensity x Pacing increase activity	-0.33	-1.50	-0.77, 0.11		-0.11	-1.71	-0.24, 0.02	
Model 5				.27				.07

Pacing for conserving energy	-0.66	-1.89	-1.34, 0.03		-0.35	-3.55[c]	-0.54, -.015	
Pain severity	5.34	9.05[c]	4.18, 6.50		0.42	2.52[a]	0.09, 0.75	
Pain intensity x Pain conserving energy	0.18	0.82	-0.25, 0.62		0.02	0.25	-0.11, 0.14	
Model 6				.27				.05
Pacing pain reduction	0.28	0.78	-0.43, 0.99		-0.07	-0.68	-0.28, 0.13	
Pain severity	5.10	8.54[c]	3.92, 6.28		0.35	2.06[a]	0.02, 0.69	
Pain intensity x Pacing pain reduction	-0.34	-1.46	-0.79, 0.12		-0.18	-2.73[b]	-0.31, -0.05	

Note. Beta values are standardized. Reported R^2 is adjusted. Beta values are from the final regression equation. Pain severity and pain activity patterns were centered. [a]$p < .05$; [b]$p < .01$; [c]$p < .001$

Table 4. Conditional effects of excessive persistence on FM impact on functioning at different levels of pain severity

Pain severity	*β*	*t*	95% CI
6	2.12	4.10[c]	1.10, 3.14
8	1.08	2.66[b]	0.28, 1.88
10	0.04	0.05	-1.25, 1.32

[a]$p < .05$; [b]$p < .01$; [c]$p < .001$

Table 5. Conditional effects of pain-contingent persistence on FM impact on functioning at different levels of pain severity

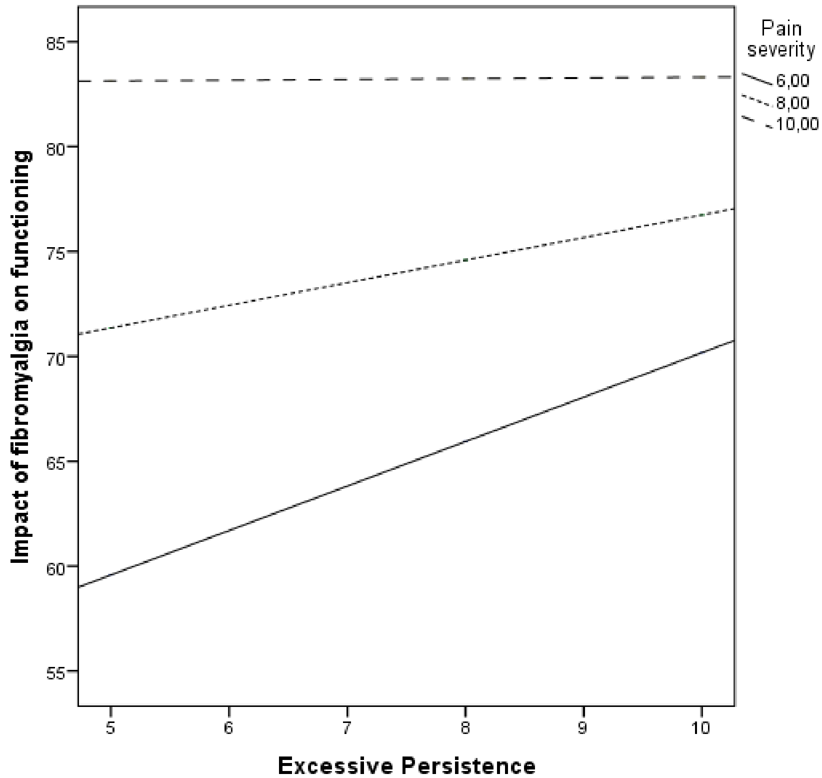
Pain severity	*β*	*t*	95% CI
6	1.46	2.62[b]	0.36, 2.55
8	0.38	0.93	-0.43, 1.21
10	-0.68	-0.93	-2.13, 0.77

[a]$p < .05$; [b]$p < .01$; [c]$p < .001$

Table 6. Conditional effects of pacing for pain reduction on depressive symptoms at different levels of pain severity

Pain severity	*β*	*t*	95% CI
6	0.23	1.60	-0.05, 0.52
8	-0.13	-1.19	-0.34, 0.08
10	-0.48	-2.56[a]	-0.86, -0.11

[a]$p < .05$; [b]$p < .01$; [c]$p < .001$



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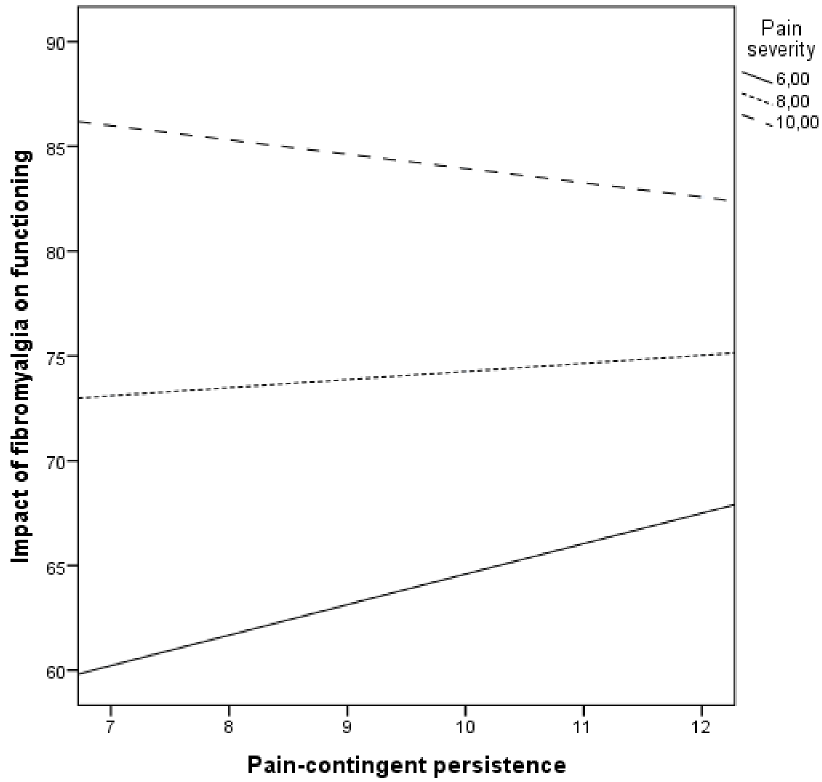

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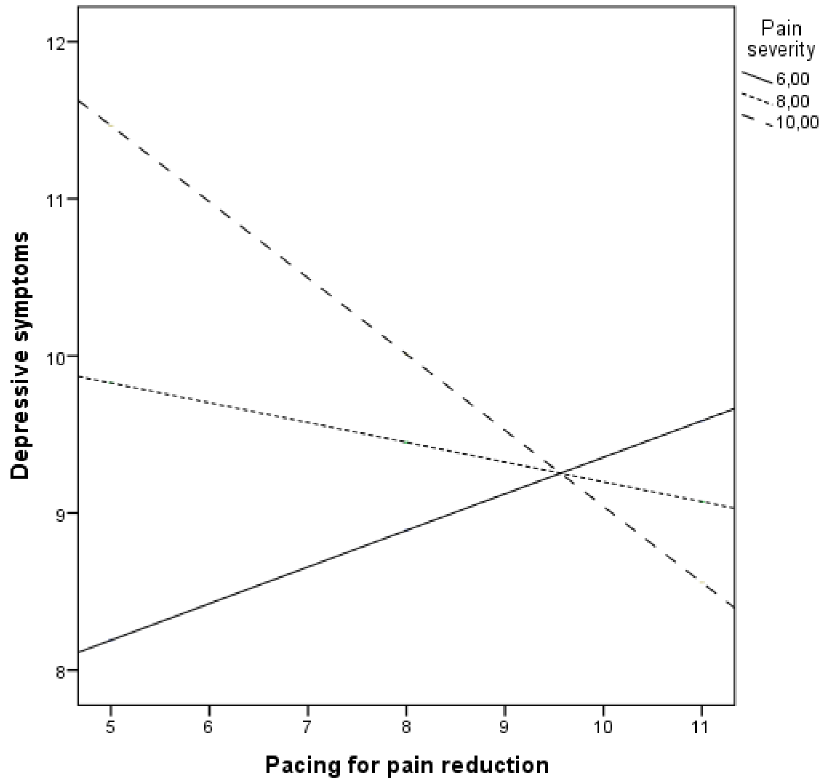

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