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Acceptance and patient functioning in chronic pain: the mediating role of physical activity

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Abstract
Purpose Activity engagement, which refers to pursuing activities despite pain, is conceptually related to pain acceptance. A recent diary study suggested that pain acceptance precedes and directly influences physical activity, and thus, pain acceptance appears to be an important aspect of eliciting better functioning by allowing patients with chronic pain (PCPs) to participate in physical activity despite the pain. This retrospective, cross-sectional cohort study was conducted to investigate the mediating effect of physical activity on the association between pain acceptance and functioning and the association between physical activity level and functioning in PCPs.
Methods The study participants were 176 patients seeking treatment for chronic pain at a tertiary pain center in Korea. The Chronic Pain Acceptance Questionnaire, International Physical Activity Questionnaire-Short Form, and Short Form-36 were used to assess pain acceptance, physical activity, and patient functioning. The mediating effects of physical activity were tested using procedures described by Baron and Kenny. Also, three hierarchical multiple linear regression analyses were conducted to identify levels of physical activity that predict measures of patient functioning.
Results Physical activity partially mediated the association between pain acceptance and patient functioning except for pain intensity. Furthermore, walking and moderate activity were found to be associated with improvements in all areas of patient functioning except for pain intensity.
Conclusion To improve the functioning of PCPs, health professionals may need to help patients accept private experiences related to pain and plan activity pacing programs that focus on value-based activities.

Keywords Acceptance · Physical activity · Patient functioning · Chronic pain

Abbreviations

PCPs	Patients with chronic pain
ACT	Acceptance and commitment therapy
CPAQ	Chronic Pain Acceptance Questionnaire
IPAQ-SF	The International Physical Activity Questionnaire-Short Form
NRS	Numerical rating scale
SF-36	The Short Form-36

Introduction

Chronic pain usually refers to persistent and recurrent pain that lasts longer than 3–6 months [1]. Due to limited treatment effects and its unclear etiology, chronic pain remains a major challenge for patients and health professionals [2]. Accordingly, the main goal is to ease patient pain [3], and to achieve this end, patients frequently focus on controlling or avoiding private experiences (e.g., sensations, thoughts, and emotions associated with pain) [4, 5]. However, efforts to control such unwanted experiences often have the opposite effects and prevent patients achieving their goals [6]. Specifically, the more patients try to control pain or unwanted pain-related thoughts and emotions, the more they focus on pain and the more

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intrusive unwanted thoughts and emotions become [5, 7]. Failure to control such experiences leads to negative emotions, such as anxiety and depression, and feelings of helplessness and frustration, which in turn have adverse health-related consequences [8].

Recently, the acceptance of pain has gained increased emphasis, particularly when it is difficult to alter or alleviate the pain, and this emphasis has been found to be useful [9–11]. This approach stems from acceptance and commitment therapy (ACT), which emphasizes psychological flexibility [12]; defined as "the ability to contact the present moment more fully as a conscious human being and to change or persist in behavior when doing so serves a valued end" [13]. Psychological flexibility occurs as a result of six core processes: "acceptance," which refers to a willingness to experience private experience fully; "cognitive defusion," which refers to the recognition of thoughts without becoming involved in their content; "self-as-context," which refers to a stable and continuous sense of self that is independent from the content of one's experiences; "contact with the present moment," which refers to conscious awareness of present experiences; "values," which refers to what gives one's life meaning; and "committed action," which refers to taking actions in accord with one's values [13]. In the context of chronic pain, the acceptance of pain does not simply involve accepting pain passively. Rather, it is the pursuit of valuable life activities without controlling or avoiding the sensation of pain and its accompanying emotional and cognitive responses [10]. In accord with this conceptual framework, many studies have found that the acceptance of pain improves the physical and psychosocial functioning of patients with chronic pain (PCPs) [14]. Furthermore, in a prior study on the coping strategies of such patients [15], it was found acceptance-based coping is a better predictor of patient functioning than control-based coping.

PCPs frequently avoid daily activities and/or leisure activities [16]. Such disengagements make normal daily life difficult and deprives them of opportunities for obtaining positive reinforcement, which can lead to physical disability, depression, and social isolation [17]. Accordingly, activity engagement, which refers to pursuing activities despite pain, is conceptually related to pain acceptance [18] and has become an important goal in the management of chronic pain [19]. A recent diary study [6] found that pain acceptance predicts physical activity levels the next day, but does not predict pain intensity or positive or negative moods. This diary study was the first to investigate the temporal relationship between pain acceptance and physical activity, and its findings suggested pain acceptance precedes and directly influences physical activity. Given these findings, pain acceptance appears to importantly enhance functioning by allowing PCPs to participate in physical activity [6]. However, no research has been conducted on the associations between pain acceptance, physical activity, and the functioning of patients that suffer from chronic pain.

The present study was undertaken to examine whether physical activity mediates the association between pain acceptance and functioning of PCPs. Mediation has been described as a hypothesized causal chain whereby one variable influences a second variable (the mediator) and that this, in turn, influences a third variable [20]. Thus, we hypothesized a causal chain whereby pain acceptance influences physical activity and thereby enhances patient functioning. In addition, we examined the relationship between physical activity and patient functioning, and in particular, we sought to determine whether walking and moderate activities (e.g., carrying light loads, cycling at a regular pace) are associated with better patient functioning.

Methods

Study design and participants

One hundred and eighty-three patients seeking treatment for chronic pain at a tertiary pain center in Korea were enrolled in this retrospective, cross-sectional cohort study. All patients were adults (age $\geq$ 19) and had persistent or recurrent, non-cancer-related pain of at least 3 months duration. At the conclusion of the patients' appointment at the pain center, patients were invited to a private room where they were informed by a research assistant about the purposes and procedures of this study and asked to provide consent. Having done so, they completed the questionnaire packet and finally were debriefed. The study procedure was approved by the Institutional Review Board. However, the data of seven patients were eliminated because they either did not meet the 3-month pain duration criterion or withdrew from the study. Accordingly, the analysis was performed on 176 patients. Patient characteristics are summarized in Table 1.

Measures

The Chronic Pain Acceptance Questionnaire (CPAQ) [19] contains 20 items rated using a 7-point Likert scale (ranging from 0 (*never true*) to 6 (*always true*)). The CPAQ consists of two subscales (i.e., activity engagement and pain willingness) and is used to assess pain acceptance. As the "pain willingness" subscale contains negatively keyed items, we reversed their scores. Total possible scores ranged from 0 to 120, where higher scores indicated greater acceptance of pain. The Korean version of the CPAQ, which was used in the present study, has been shown to

Table 1 Characteristics of the study sample

Variable	Sample	$N = 176$
Sex (%)		
Men	42.6	75
Age (year)		
Mean (SD)	48.0 (13.5)	
Marital status (%)		
Married	73.9	130
Education level (%)		
≥High school	88.1	155
Employment status (%)		
Employed	31.8	56
Others (e.g., housewife)	47.7	84
Unemployed	21.6	38
Most significant pain site(s) (%)		
≥2 sites	41.5	73
Neck	4.5	8
Shoulder	5.1	9
Lower back	23.3	41
Hand	4.0	7
Leg	2.8	5
Foot	4.0	7
Others[a]	15.3	27
Pain duration (month)		
Median (range)	50.0 (3–600)	
Prescribed pain-related medication (%)	56.3	99
Pain-related surgery (%)		
Once or more than once	19.3	34

[a] Others includes head, face, upper back, chest, abdomen, arm, pelvis, knee, and the whole body

provide adequate reliability and validity estimates in a tertiary pain clinic sample [21].

The International Physical Activity Questionnaire-Short Form (IPAQ-SF) [22] is a 7-item scale that assesses physical activity. IPAQ-SF consists of four levels of activity, that is, vigorous activity, moderate activity, walking, and sitting. Scores for activity categories (except for sitting) were calculated by multiplying duration (minutes) per day by frequency per week and metabolic equivalent task (MET) intensity (8.0 for vigorous-intensity activity, 4.0 for moderate-intensity activity, and 3.3 for walking). Physical activity scores were calculated by summing the scores of the three activity categories. Higher scores indicate more physical activity. The Korean version of the IPAQ-SF has been shown to provide adequate reliability and validity estimates in a general population sample [23].

Pain intensity was calculated by averaging present pain and usual, lowest, and highest pain experienced during the previous week assessed using a numeric rating scale (NRS), where 0 represented *no pain* and 10 *worst pain imaginable*. The NRS has favorable psychometric properties and has been frequently used in pain research [24].

The Short Form-36 (SF-36) [25] is a 36-item scale that contains eight subscales, namely physical function, role limitations due to physical health problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional health problems, and mental health. Scores for each subscale range from 0 to 100, where a higher score indicates better functioning. These eight subscales can be grouped to produce two composite scales of physical and psychosocial health, and these scales were scored by summing the scores of the four subscales that compose these two composite scales [26]. The Korean version of the SF-36 has been shown to provide adequate reliability and validity estimates in a general sample [27].

Data analysis

The software G power, version 3.1.9.2 [28], was used to determine the sample size needed for this study. Sample size was calculated based on the assumption of an expected effect size of .15. For a desired statistical power of 95 % at a two-tailed significance level of 5 %, and assuming the inclusion of 9 predictors in the linear regression analysis, the minimum sample size was 166 patients. Thus, to account for losses, we recruited 183 patients.

The SPSS 18.0 for Windows was used for the analysis. Bivariate Pearson correlations were calculated to examine relationships between study variables. Baron and Kenny's procedures were used to examine the mediating effect of physical activity [29]. To establish mediation, the following conditions should be met: (1) The predictor variable must be significantly related to the outcome variable, (2) the predictor variable must be significantly related to the mediator variable, (3) the mediator variable must be significantly related to the outcome variable when the predictor variable is added, and (4) the relationship between the predictor and outcome variable must become non-significant (full mediation) or significant but relatively weak (partial mediation) when the mediator is added [29]. A graphic representation of the mediation model is presented in Fig. 1. During Step 1, simple linear regression analysis was conducted to confirm a relationship between the predictor variable (i.e., pain acceptance) and each outcome variable (i.e., pain intensity, physical functioning, psychosocial functioning). In Step 2, simple linear regression analysis was conducted to confirm a relationship between the predictor variable and the mediator variable (i.e., physical activity). In Step 3, multiple linear regression analysis was used to confirm relationships between the mediator variable and each outcome variable after controlling for the predictor variable. Finally, to examine full vs. partial mediation, we conducted multiple linear regression analysis to confirm relationships between the predictor variable and the three outcome variables, after controlling for the mediator variable. The Sobel test [30] was used to determine the indirect effects of the mediator variable on the association between the predictor variable and outcome variable(s). Finally, to determine which levels of physical activity predict measures of patient functioning, after controlling for demographic variables, pain intensity, and pain acceptance, we conducted three hierarchical multiple linear regression analyses.

Results

Preliminary analyses

Table 2 presents descriptive statistics of the study variables, and Table 3 shows bivariate Pearson correlations among the study variables. Pain acceptance was found to be significantly and positively associated with physical activity, $r = .52$, $p < .001$, and pain acceptance and physical activity were significantly and positively associated with physical and psychosocial functioning, range of r values from .38 to .68, all p values <.001. Pain acceptance was significantly and negatively associated with pain intensity, $r = -.38$, $p < .001$. However, no significant relationship was found between physical activity and pain intensity, $r = -.16$, $p =$ n.s.

Mediatory and indirect effects

The mediating effect of physical activity was examined using procedures described by Baron and Kenny [29]. Five key assumptions (i.e., linearity, independence, homoscedasticity, no or little multicollinearity, and normality) of linear regression were fulfilled. First, we regressed each outcome variable on pain acceptance. Pain acceptance significantly predicted all outcome variables, $\beta = -.38$, $p < .001$ for pain intensity, $\beta = .68$, $p < .001$ for physical functioning, and $\beta = .68$, $p < .001$ for psychosocial functioning. Second, we regressed physical activity on pain acceptance and found pain acceptance significantly predicted physical activity, $\beta = .52, p < .001$. Third, we regressed each outcome variable on physical activity after controlling for pain acceptance. Physical activity significantly predicted physical functioning, $\beta = .28$, $p < .001$ and psychosocial functioning, $\beta = .36$, $p < .001$, but not pain intensity, $\beta = -.13$, $p =$ n.s. Finally, to determine whether physical activity had a full or partial mediatory effect, we regressed each outcome variable on pain acceptance after controlling for physical activity. The relationship between pain acceptance and all of the outcome variables decreased in strength after controlling for physical activity, but remained significant, $\beta = -.32$, $p < .001$ for pain intensity, $\beta = .53$, $p < .001$ for physical functioning, and $\beta = .49$, $p < .001$ for psychosocial functioning. We then evaluated the indirect effects of physical activity on the relationships between pain acceptance and physical and psychosocial functioning. The Sobel test confirmed that both indirect effects were significant for physical functioning, $Z = 2.89$, $p < .01$ and psychosocial functioning, $Z = 4.16$, $p < .001$. These findings indicated that physical activity partially mediated the relationships between pain acceptance and physical and psychosocial functioning. These analyses are summarized in Table 3 and Fig. 2.

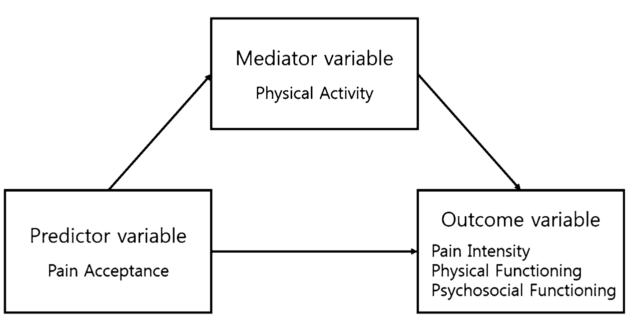

Fig. 1 Graphic representation of the mediation model

Physical activity levels and patient functioning

Three hierarchical multiple linear regressions were further conducted to identify levels of physical activity that predict measures of patient functioning. In each equation, demographic variables (i.e., sex, age, education, pain duration) were controlled initially, pain intensity (not controlled when used as an outcome variable) next, and then the three levels (i.e., vigorous, moderate, and walking) of physical activity were entered in the final step. The five key assumptions (i.e., linearity, independence, homoscedasticity, no or little multicollinearity, and normality) of linear regression were fulfilled. As shown in Table 4, 4.0 % of the variance in pain intensity was accounted for by the demographic variables in the first step, which was not significant ($\Delta R^2 = .04$, $p =$ n.s.). An additional 15.0 % of the variance in pain intensity was explained by the addition of pain acceptance in the second step, which was significant ($\Delta R^2 = .15$, $p < .001$). The additional variance accounted for by adding physical activity in the third step was 3.0 %, which was not significant ($\Delta R^2 = .03$, $p =$ n.s.). In the final regression model, pain acceptance was the only significant predictor ($\beta = -.35, p < .01$).

Ten percent of the variance in physical functioning was accounted for by demographic variables in the first step, which was significant ($\Delta R^2 = .10$, $p < .01$). An additional

Table 2 Descriptive information on pain acceptance, physical activity, and measures of patient functioning

Measure (score)	Mean (SD)	Observed range of scores
CPAQ	43.62 (16.79)	2–92
IPAQ-SF		
Physical activity—vigorous[a]	220.83 (722.48)	0–6720
Physical activity—moderate[a]	167.33 (393.36)	0–3360
Physical activity—walking[a]	510.70 (573.36)	0–2772
Physical activity—total	824.12 (1270.10)	0–12,852
Pain intensity	5.22 (2.29)	0–10
SF-36		
Physical functioning	42.03 (20.01)	8–89
Psychosocial functioning	48.24 (22.87)	0–94

CPAQ The Chronic Pain Acceptance Questionnaire, *IPAQ-SF* The International Physical Activity Questionnaire-Short Form, *SF-36* The Short Form-36

[a] The duration (minutes) per day × frequency per week × metabolic equivalent task intensity (8.0 for vigorous-intensity activity, 4.0 for moderate-intensity activity, and 3.3 for walking)

Table 3 Correlations among pain acceptance, physical activity, and outcome variables

Study variable	1	2	3	4	5
1. Pain acceptance	1.00				
2. Physical activity	.52***	1.00			
3. Pain intensity	−.38***	−.16	1.00		
4. Physical functioning	.68***	.38***	−.57***	1.00	
5. Psychosocial functioning	.68***	.42***	−.51***	.80***	1.00

*** $p < .001$

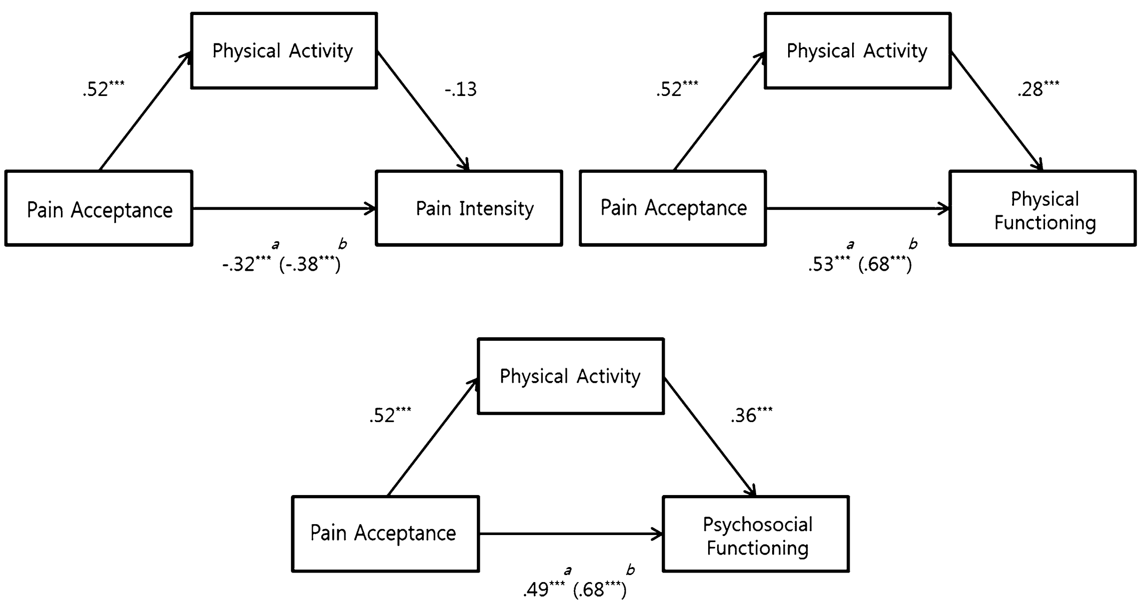

Fig. 2 Standardized coefficients (beta) derived from using linear regression testing for the mediating effect of physical activity. [a]Regressing the outcome variable on both the predictor variable and the mediator variable, [b]Regressing the outcomes variable on the predictor variable. ***$p < .001$

43.0 % of the variance in physical functioning was explained by adding pain intensity in the second step, which was significant ($\Delta R^2 = .43$, $p < .001$). An additional 17.0 % of the variance in physical functioning was explained by adding pain acceptance in the third step, which was significant ($\Delta R^2 = .17$, $p < .001$). The

Table 4 Results of hierarchical multiple linear regression analyses predicting outcome variables from the three levels of physical activity

Step	Predictor	β (Final)	ΔR^2	Total R^2
Pain intensity				
1.	Age	.10	–	
	Sex[a]	−.09		
	Education	−.08		
	Pain duration	.03	.04	
2.	Pain acceptance	−.35**	.15***	
3.	Physical activity—Vigorous	−.11		
	Physical activity—Moderate	−.10		
	Physical activity—Walking	−.08	.03	.22**
Physical functioning				
1.	Age	−.08		
	Sex[a]	−.16**		
	Education	.07		
	Pain duration	−.09	.10**	
2.	Pain intensity	−.45***	.43***	
3.	Pain acceptance	.41***	.17***	
4.	Physical activity—vigorous	.08		
	Physical activity—moderate	.13*		
	Physical activity—walking	.09	.03*	.73***
Psychosocial functioning				
1.	Age	.07		
	Sex[a]	−.02		
	Education	.11		
	Pain duration	−.07	.14**	
2.	Pain intensity	−.27***	.25***	
3.	Pain acceptance	.36***	.16***	
4.	Physical activity—vigorous	.08		
	Physical activity—moderate	.21**		
	Physical activity—walking	.17*	.07**	.62***

IPAQ-SF The International Physical Activity Questionnaire-Short Form

* $p < .05$; ** $p < .01$; *** $p < .001$

[a] Men coded 0, women coded 1

additional variance accounted for by adding physical activity in the fourth step was 3.0 %, which was significant ($\Delta R^2 = .03$, $p < .05$). In the final regression model, four individual variables were significant predictors, sex (β = -.16, $p < .01$), pain intensity ($\beta = -.45$, $p < .001$), pain acceptance ($\beta = .41$, $p < .001$), and moderate activity ($\beta = .13$, $p < .05$).

Fourteen percent of the variance in psychosocial functioning was accounted for by demographic variables in the first step, which was significant ($\Delta R^2 = .14$, $p < .01$). An additional 25.0 % of the variance in psychosocial functioning was explained by the addition of pain intensity in the second step, which was significant ($\Delta R^2 = .25$, $p < .001$). An additional 16.0 % of the variance in psychosocial functioning was explained by the addition of pain acceptance in the third step, which was significant ($\Delta R^2 = .16$, $p < .001$). The additional variance accounted for by adding physical activity in the fourth step was 7.0 %, which was significant ($\Delta R^2 = .07$, $p < .01$). In the final regression model, four individual variables were significant predictors, pain intensity ($\beta = -.27$, $p < .001$), pain acceptance ($\beta = .36$, $p < .001$), moderate activity ($\beta = .21$, $p < .01$), and walking ($\beta = .17$, $p < .05$).

Discussion

In the present study, we investigated whether physical activity mediates the association between pain acceptance and functioning in PCPs. The study was based on a previous study [6], in which it was suggested pain acceptance can play an important role in eliciting better functioning of PCPs by allowing them to participate in activities in the presence of pain. In addition, we investigated the effect of physical activity level on patient functioning. Our results showed that physical activity partially mediates the association between pain acceptance and patient functioning except for pain intensity. Furthermore, walking and moderate physical activity were found to be associated with improvements in all areas of patient functioning except for pain intensity.

In the present study, physical activity partially mediated the association between pain acceptance and physical and psychosocial functioning in PCPs. This result suggests that the acceptance of pain enhances physical activity, which, in turn, improves functioning among PCPs. This finding is in line with ACT [31], which aims to increase psychological flexibility by focusing on the present moment and maintaining or changing behavior in the direction of one's identified values [13]. Of the six core processes of psychological flexibility, acceptance refers to the view that all experiences are precious and valuable based on accepting private experience as is, and allowing energy used for avoidance, to be directed toward accomplishing one's personal goals [32]. Furthermore, taking an action toward achieving one's value-based goal(s) while weakening psychological barriers through the acceptance of private experience is the core goal of ACT [33]. Therefore, if PCPs accept their experiences, they become unwilling to make unproductive efforts (e.g., excessive rest, avoiding outdoor activities) to alleviate pain, and act according to their value-based goals. The more developed this behavior is, the more it elicits psychological flexibility and positively effects functioning.

The study shows physical functioning was predicted by "moderate" activity and psychosocial functioning by "walking" and "moderate" activity. This implies that "walking" and "moderate" activity rather than "vigorous" activity lead to better functioning among PCPs. These results support those of several previous studies [6, 14, 34] and are in line with the nature of activity pacing, one of the behavioral strategies used in chronic pain management [35]. Activity pacing refers to either partially completing work or regulating work speed by taking breaks or slowing down [35]. Many PCPs avoid physical or social activity that elicits pain in daily life, or they endure pain until the activity is finished [36, 37]. Both of these inefficient activity patterns can result in disability by damaging a patient's physical capacities [38]. Given this, activity pacing helps PCPs to regulate activities according to patients' conditions [39].

On the other hand, physical activity was not found to mediate the effect of pain acceptance on pain intensity, and physical activity did not predict pain intensity. These observations may have been obtained because more than half of the study participants were patients with lower back pain (50.3 % = lower back only 23.2 % + multiple pain sites including lower back 27.1 %). They have various problems associated with work posture, sitting or standing up, lifting heavy loads, and performing twisting or crouching movements [40]. Furthermore, the IPAQ-SF used in the present study to measure physical activity levels (e.g., carrying heavy loads, riding a bicycle at normal speed) was largely composed of activities eliciting pain in patients with lower back pain. Accordingly, the study participants were more likely to report comparable pain intensities at different physical activity levels.

The results of the present study have clinical implications for treatment strategies targeting chronic pain. From an ACT perspective, treatment is designed to promote acceptance of one's private experiences and participation in activities to accomplish one's value-based goals. Health professionals may need to consider assisting patients to use mindfulness, which enables them to become aware of and accept sensations, thoughts, and emotions associated with pain, in the present moment. In addition, value-based behavioral change strategies that encourages patients to identify their values (e.g., to become a good friend) and choose actions in accord with these values (e.g., meeting up with friends despite pain) could be adopted. [33]. Traditionally, activity pacing has been used to improve inefficient activity patterns in PCPs, but its reported effects on patient functioning are less than consistent [35, 39, 41]. On the other hand, commitment to action (taking action in accord with one's values) has been found to have a consistent positive effect on the functioning of PCPs [39, 42]. Interestingly, this difference appears to be due to having and not having personal goals. Specifically, unlike committed action based on value-based goals [12], activity pacing does not consider goals [41, 43]. Furthermore, recent studies have confirmed that committed action is a more powerful predictor of the functioning of PCPs than activity pacing [44]. Given these findings, health professionals could help to improve the functioning of PCPs by planning activity pacing programs based on value-directed activities.

The limitations of the present study are as follows. First, the IPAQ-SF used to assess activities assesses physical activity levels, which are not necessarily reflective of patients' values. Thus, the results of the present study need to be confirmed by further study using a questionnaire that can assess the value-based activities of PCPs, such as the Committed Action Questionnaire [45]. Second, we adopted a retrospective, cross-sectional cohort design and used correlation analysis, and thus, the study could not provide clear evidence of causal relationships. Third, the study participants were heterogeneous in terms of pain complaints and were recruited at a tertiary pain center, and thus, the generalizabilities of our findings are limited. We suggest for future research, a longitudinal design and experimental and treatment studies are needed to address these limitations and that the sample be expanded by recruiting participants from primary care clinics or the community, and stratified by recruiting patients with specific pain conditions.

Despite these limitations, this study represents a first attempt to examine associations between pain acceptance, physical activity, and the functioning of patients that suffer from chronic pain. Our findings suggest pain acceptance improves patient functioning by increasing physical activity and that walking and moderate activities may be critical. Furthermore, we hope they will aid the development of ACT-based intervention strategies aimed at improving functioning of PCPs.

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Compliance with ethical standards

Conflict of interest Saetbyeol Jeong and Sungkun Cho declare that they have no conflict of interest.

Human or animal rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Merskey, H., & Bogduk, N. (1994). *Classification of chronic pain* (2nd ed., p. 1). Seattle: IASP Press.
2. Singh, M. K., Patel, J., & Gallagher, R. M. (2005). Chronic pain syndrome. *Physical Medicine and Rehabilitation*. http://emedicine.medscape.com/article/310834-overview.
3. Kim, Y. S. (2011). Spinal cord stimulation for control of chronic pain. *Hanyang Medical Reviews, 31*(2), 85–89.
4. Turk, D. C., & Okifuji, A. (2002). Psychological factors in chronic pain: Evolution and revolution. *Journal of Consulting and Clinical Psychology, 70*(3), 678.
5. Sullivan, M. J., Rouse, D., Bishop, S., & Johnston, S. (1997). Thought suppression, catastrophizing, and pain. *Cognitive Therapy and Research, 21*(5), 555–568.
6. Cho, S., McCracken, L. M., Heiby, E. M., Moon, D. E., & Lee, J. H. (2013). Pain acceptance-based coping in complex regional pain syndrome Type I: Daily relations with pain intensity, activity, and mood. *Journal of Behavioral Medicine, 36*(5), 531–538.
7. Petrie, K. J., Booth, R. J., & Pennebaker, J. W. (1998). The immunological effects of thought suppression. *Journal of Personality and Social Psychology, 75*(5), 1264.
8. McCracken, L. M. (2005). Social context and acceptance of chronic pain: The role of solicitous and punishing responses. *Pain, 113*(1), 155–159.
9. Viane, I., Crombez, G., Eccleston, C., Poppe, C., Devulder, J., Van Houdenhove, B., et al. (2003). Acceptance of pain is an independent predictor of mental well-being in patients with chronic pain: Empirical evidence and reappraisal. *Pain, 106*(1), 65–72.
10. McCracken, L. M., Carson, J. W., Eccleston, C., & Keefe, F. J. (2004). Acceptance and change in the context of chronic pain. *Pain, 109*(1), 4–7.
11. McCracken, L. M., & Vowles, K. E. (2006). Acceptance of chronic pain. *Current Pain and Headache Reports, 10*(2), 90–94.
12. Hayes, S. C. (2004). Acceptance and Commitment Therapy and the new behavior therapies: Mindfulness, acceptance and relationship. In S. C. Hayes, V. M. Follette, & M. Linehan (Eds.), *Mindfulness and acceptance: Expanding the cognitive behavioral tradition* (pp. 1–29). New York:Guilford.
13. Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour Research and Therapy, 44*(1), 1–25.
14. Reneman, M. F., Dijkstra, A., Geertzen, J. H., & Dijkstra, P. U. (2010). Psychometric properties of chronic pain acceptance questionnaires: A systematic review. *European Journal of Pain, 14*(5), 457–465.
15. McCracken, L. M., Vowles, K. E., & Gauntlett-Gilbert, J. (2007). A prospective investigation of acceptance and control-oriented coping with chronic pain. *Journal of Behavioral Medicine, 30*(4), 339–349.
16. Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. *European Journal of Pain, 10*(4), 287.
17. Van Damme, S., Crombez, G., & Eccleston, C. (2004). Disengagement from pain: The role of catastrophic thinking about pain. *Pain, 107*(1), 70–76.
18. McCracken, L. M., Vowles, K. E., & Eccleston, C. (2004). Acceptance of chronic pain: Component analysis and a revised assessment method. *Pain, 107*(1), 159–166.
19. Habib, S., Morrissey, S., & Helmes, E. (2005). Preparing for pain management: A pilot study to enhance engagement. *Journal of Pain, 6*(1), 48–54.
20. Biesanz, J. C., Falk, C. F., & Savalei, V. (2010). Assessing mediational models: Testing and interval estimation for indirect effects. *Multivariate Behavioral Research, 45*(4), 661–701.
21. Cho, S., Heiby, E. M., McCracken, L. M., Moon, D. E., & Lee, J. H. (2012). Psychometric properties of a Korean version of the Chronic Pain Acceptance Questionnaire in chronic pain patients. *Quality of Life Research, 21*(6), 1059–1064.
22. Sjøstrom, M., Ekelund, U., Poortvliet, E., Hurting-Wennlof, A., & Yngve, A. (2000). Assessment of physical activity using IPAQ (version 4) and activity monitors (CSA). *Measurement in Physical Education and Exercise Science, 4*, 263–264.
23. Oh, J. Y., Yang, Y. J., Kim, B. S., & Kang, J. H. (2007). Validity and reliability of Korean version of International Physical Activity Questionnaire (IPAQ) short form. *Journal of the Korean Academy of Family Medicine, 28*(7), 532–541.
24. Jensen M. P., & Karoly P. (2011). Self-report scales and procedures for assessing pain in adults. In: Turk D. C, Melzack R (Eds), *Handbook of pain assessment* (pp. 19–41). 3rd Edn. New York, NY: Guilford Press.
25. Ware, J. E., Jr., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical Care, 30*, 473–483.
26. Hays, R. D., Sherbourne, C. D., & Mazel, R. M. (1993). The rand 36-item health survey 1.0. *Health Economics, 2*(3), 217–227.
27. Koh, S. B., Chang, S. J., Kang, M. G., Cha, B. S., & Park, J. K. (1997). Reliability and validity on measurement instrument for health status assessment in occupational workers. *Korean Journal of Preventive Medicine, 30*(2), 251–266.
28. Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160.
29. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173.
30. Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhart (Ed.), *Sociological Mhodology* (pp 290–312). San Francisco: Jossey-Bass.
31. Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford Press.
32. Yun, H. K. (2005). The therapeutic mechanisms of on-maeum counseling. *Korean Journal Counseling Psychotherapy, 17*(1), 1–13.
33. Moon, H. M. (2006). Development and validation of the program for facilitation of psychological acceptance based on Acceptance and Commitment Therapy model. *Unpublished doctoral dissertation*.
34. Parkinson, W. L., Krames, L., Kumbhare, D., D'Arcy, B., Gromkowska, G., & Balsor, B. (2006). Use of pedometers in chronic pain: Associations with self-reported coping measures. *Archives of Physical Medicine and Rehabilitation, 87*(11), e39.
35. Nielson, W. R., Jensen, M. P., & Hill, M. L. (2001). An activity pacing scale for the chronic pain coping inventory: Development in a sample of patients with fibromyalgia syndrome. *Pain, 89*(2), 111–115.
36. Hasenbring, M. I., & Verbunt, J. A. (2010). Fear-avoidance and endurance-related responses to pain: New models of behavior and their consequences for clinical practice. *Clinical Journal of Pain, 26*(9), 747–753.
37. Vlaeyen, J. W., & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain, 85*(3), 317–332.
38. Birkholtz, M., Aylwin, L., & Harman, R. M. (2004). Activity pacing in chronic pain management: One aim, but which method?

Part one: Introduction and literature review. *The British Journal of Occupational Therapy, 67*(10), 447–452.
39. McCracken, L. M. (2013). Committed action: An application of the psychological flexibility model to activity patterns in chronic pain. *Journal of Pain, 14*(8), 828–835.
40. Cavanaugh, J. M., & Weinstein, J. N. (1994). Low back pain epidemiology, anatomy and neurophysiology. In P. D. Wall & R. Melzack (Eds.), *Textbook of pain*. New York, NY: Livingstone.
41. Kindermans, H. P., Roelofs, J., Goossens, M. E., Huijnen, I. P., Verbunt, J. A., & Vlaeyen, J. W. (2011). Activity patterns in chronic pain: Underlying dimensions and associations with disability and depressed mood. *The Journal of Pain, 12*(10), 1049–1058.
42. Trompetter, H. R., Ten Klooster, P. M., Schreurs, K. M., Fledderus, M., Westerhof, G. J., & Bohlmeijer, E. T. (2013). Measuring values and committed action with the Engaged Living Scale (ELS): Psychometric evaluation in a nonclinical sample and a chronic pain sample. *Psychological Assessment, 25*(4), 1235.
43. Antcliff, D., Keeley, P., Campbell, M., Oldham, J., & Woby, S. (2013). The development of an activity pacing questionnaire for chronic pain and/or fatigue: A Delphi technique. *Physiotherapy, 99*(3), 241–246.
44. Park, Y., Kim, D., & Cho, S. (2015). The relative utility of pacing and committed action for predicting adjustment to chronic pain. *Journal of Pain, 4*(16), S104.
45. McCracken, L. M. (2013). Committed action: An application of the psychological flexibility model to activity patterns in chronic pain. *The Journal of Pain, 14*(8), 828–835.