

# Illness Perceptions Explain the Variance in Functional Disability, but Not Habitual Physical Activity, in Patients With Chronic Low Back Pain: A Cross-Sectional Study

Citation for published version (APA):

Leysen, M., Nijs, J., Van Wilgen, C. P., Struyf, F., Meeus, M., Fransen, E., Demoulin, C., Smeets, R. J. E. M., & Roussel, N. A. (2018). Illness Perceptions Explain the Variance in Functional Disability, but Not Habitual Physical Activity, in Patients With Chronic Low Back Pain: A Cross-Sectional Study. *Pain Practice*, 18(4), 523-531. <https://doi.org/10.1111/papr.12642>

## Document status and date:

Published: 01/04/2018

## DOI:

[10.1111/papr.12642](https://doi.org/10.1111/papr.12642)

## Document Version:

Publisher's PDF, also known as Version of record

## Document license:

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## ORIGINAL ARTICLE

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# Illness Perceptions Explain the Variance in Functional Disability, but Not Habitual Physical Activity, in Patients With Chronic Low Back Pain: A Cross-Sectional Study

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### ■ Abstract

**Introduction:** Although the importance of psychosocial factors has been highlighted in many studies in patients with chronic low back pain (CLBP), there is a lack of research

examining the role of illness perceptions in explaining functional disability and physical activity in patients with CLBP.

**Aim:** The aim of the study was to explore the value of illness perceptions in explaining functional disability and physical activity in patients with CLBP.

**Methods:** Eighty-four participants with CLBP (of > 3 months' duration) completed a battery of questionnaires investigating psychosocial factors (Pain Catastrophizing Scale [PCS], Illness Perceptions Questionnaire Revised [IPQ-R], and 36-Item Short Form mental health scale [SF-36\_MH]) and perceived pain intensity (visual analog scale [VAS]), as well as the Oswestry Disability Index (ODI) and Baecke questionnaire. The latter 2 were entered separately as dependent variables in a regression analysis.

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Submitted: June 6, 2017; Revised August 18, 2017;

Revision accepted: September 8, 2017

DOI: 10.1111/papr.12642

**Results:** The combined variables (VAS, PCS, SF-36\_MH, IPQ-R) accounted for 62% of the variance in functional disability (ODI). Adding the results of the IPQ-R to the scores of the other 3 variables (VAS, PCS, SF-36\_MH) significantly increased the explained variance of ODI scores in CLBP patients, yielding 18% additional information ( $P < 0.01$ ). Only 5% of the variance in the Baecke questionnaire was explained by combining the 4 variables. None of the single variables alone made a significant contribution to  $R^2$ .

**Conclusions:** Illness perceptions are an important factor for explaining functional disability, but not for explaining habitual physical activity in CLBP patients. ■

**Key Words:** illness perceptions, beliefs, physical activity, chronic low back pain, disability, psychosocial factors

## INTRODUCTION

Chronic low back pain (CLBP) represents a major health problem and an economic burden for society, considering that 70% to 85% of all people have low back pain (LBP) at some time in their lives, and in 4% to 20% of them it develops into a chronic condition.<sup>1,2</sup> Most treatments only have limited and/or short-term effects,<sup>3</sup> since the contributing factors for CLBP remain poorly understood.

Several guidelines emphasize the role of psychological, cognitive, and social factors in CLBP.<sup>4,5</sup> Pain catastrophizing,<sup>6–10</sup> fear avoidance and kinesiophobia,<sup>6,11–13</sup> and depression<sup>6,14</sup> have been studied extensively in LBP patients and are related to the prognosis. One of the theories combining these biopsychosocial factors is Leventhal's Common Sense Model.<sup>15</sup> According to this model, patients develop cognitions and emotions about their illness based on former experiences, interpretation of symptoms, and provided information, called illness perceptions. Besides psychosocial factors such as kinesiophobia and pain catastrophizing, patients' attitudes and beliefs about pain have been identified as key perpetuating factors for pain and associated disability.<sup>16,17</sup>

In a prospective study, Foster et al.<sup>18</sup> stressed the importance of assessing illness perceptions in patients with LBP in primary care. Patients with LBP who expect their problem to last a long time, who perceive severe consequences of their back pain, or who have a lower sense of controllability of their back problem are more likely to have a poor clinical outcome 6 months after consultation.<sup>18</sup> Furthermore, in nonspecific LBP patients, negative illness perceptions were better predictors of disability at 6 months than fear avoidance, catastrophizing, or depression.<sup>6</sup> To measure these cognitive and emotional perceptions, the Illness Perception Questionnaire-Revised

(IPQ-R) was developed.<sup>19</sup> However, the complex interactions between contributing constructs and the specific value of every construct remain unclear.

Moreover, since clinical guidelines for LBP recommend increases in habitual physical activity levels as a therapy goal apart from just pain relief, an active coping strategy is encouraged, as is the early resumption of activities, even when still experiencing pain.<sup>20–23</sup> However, studies examining whether illness perceptions are associated with habitual physical activity levels in LBP patients are essentially lacking.

Likewise, to the best of our knowledge we are unaware of studies examining the specific role of illness perceptions in explaining disability in patients with CLBP, especially combined with other psychosocial influencing factors.

For the reasons outlined above, the present study aims to explore the added value of illness perceptions in explaining functional disability and habitual physical activity in patients with CLBP. It is hypothesized that illness perceptions contribute significantly to explaining the variance in disability and habitual physical activity in patients with CLBP, independent from established psychological correlates of CLBP disability, such as fear of movement, depression, and pain catastrophizing. The recent development of the IPQ-R may contribute to the unravelling of the complex interactions of all these contributing factors.

## METHODS

### Participants

Eighty-four participants with CLBP were recruited in private practices as well as in outpatient rehabilitation settings. The variety in settings for recruiting patients was chosen to increase the external validity of the study findings. The following inclusion criteria were applied: a diagnosis of nonspecific CLBP (of > 3 months' duration) made by a physician, referral by a physician for physiotherapy, and having Dutch as a native language, since all questionnaires were in Dutch, as in previous research.<sup>24</sup> Patients with specific pathologies, trauma, or pregnancy were excluded. No criteria were defined regarding the stage of treatment or the content of any previous treatment, again to maintain the variety in patients to adequately reflect a nonspecific CLBP population.

### Study Design

Prior to study participation, all subjects received written and oral information addressing the nature of the study,

and written informed consent was obtained. The study protocol was approved by the local ethical committee of University Hospital of Brussels. Patients were asked to complete a battery of questionnaires, including several validated questionnaires and a general questionnaire, assessing demographic characteristics, current pain intensity (by means of a visual analog scale [VAS]), and medical history of LBP. The procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 2013.<sup>25</sup>

**Outcome Variables**

**Oswestry Disability Index.** The Oswestry Disability Index (ODI) attempts to quantify the functional disability in patients with LBP. Ten dimensions of daily functioning are measured: pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sexual life, social life, and travelling. For all 10 items, patients select a score ranging from 0 (no limitation) to 5 (great disability). The overall score (maximum of 50) is doubled to obtain a percentage of functional disability. The Dutch version has good psychometric properties.<sup>26</sup>

**Baecke Questionnaire.** The Baecke questionnaire includes 16 questions, most with a 5-category response possibility, to measure a person’s habitual physical activity, comprising 3 dimensions: work activities (8 questions), sports activities (4 questions), and leisure activities (4 questions), with higher scores indicating more physical activity.<sup>27</sup> Reliability and validity of the Dutch version were tested, as well as the reliability and validity when used for LBP patients.<sup>27–30</sup>

**Illness Perception Questionnaire-Revised.** The IPQ-R is a questionnaire with good short- and long-term retest reliability and known group and predictive validity in a study population consisting of patients with a variety of diseases and especially with musculoskeletal pain.<sup>19,31</sup> The IPQ-R-LBP measures 9 dimensions of illness perceptions and consists of 3 domains. It is recommended that the causal and identity domains be modified in order to suit particular illnesses, cultural settings, or populations.<sup>19</sup> The Dutch version of the IPQ-R, obtained from the official website (<http://www.uib.no/ipq/>), was adapted for this study after consensus was obtained from experts in the treatment of patients with LBP. Three symptoms were added to the first domain (energy surplus, weight gain, and swelling); thus, the illness identity domain contains a total of 17

symptoms. The second domain, the beliefs domain, covers 7 dimensions with 38 questions: acute/chronic timeline, cyclical timeline, consequences, controllability, curability, emotional representations, and illness coherence. The third domain lists possible causes to which individuals attribute their condition. Eight causes were added: overuse, hormonal changes, blood flow, psychological trauma, muscle disorder, sleeping disorders, changes in neural system, and unknown. In the last question of the IPQ-R, patients are asked to describe the 3 most important causes for their illness. Patients rate their level of agreement for all the items of the IPQ-R on a 5-point Likert scale, ranging from “strongly disagree” to “strongly agree.” The minimum and maximum possible scores are presented in Table 1.

**Pain Catastrophizing Scale.** The Pain Catastrophizing Scale (PCS) is a 13-item questionnaire to objectify the patient’s catastrophizing and consists of 3 factors: rumination (4 items), magnification (3 items), and helplessness (6 items). A 5-point Likert scale is used to indicate whether or not patients experience a particular thought. The Dutch version of this questionnaire was used.<sup>32</sup> Factor structure is stable, and internal consistency, test-retest reliability, and concurrent validity is good, as tested for the Dutch version<sup>33,34</sup> and the original version.<sup>35,36</sup>

**Table 1. Patient Characteristics and Questionnaire Outcomes (N = 84)**

Variable		%
Gender	Male	39
Variable	Possible Range	Mean ± SD
Age	Age (years)	47 ± 15
SF-36	Mental health (%)	72 ± 16
ODI	Total score (%)	22 ± 14
Baecke questionnaire	Total score	8.4 ± 1.4
PCS	Total score	16.8 ± 10.4
IPQ-R	Timeline	21.6 ± 5.3
	Consequences	16.5 ± 5.0
	Personal control	21.0 ± 4.1
	Treatment control	18.9 ± 3.2
	Coherence	19.2 ± 4.4
	Cyclical timeline	13.4 ± 3.5
	Emotional response	14.2 ± 4.6
	Duration of symptoms (months)	94 ± 111
	VAS current pain intensity (%)	31.6 ± 20.3

SF-36, 36-Item Short Form Health Survey; ODI, Oswestry Disability Index; PCS, Pain Catastrophizing Scale; IPQ-R, Illness Perception Questionnaire Revised; LBP, low back pain; VAS, visual analog scale.

**36-Item Short Form Health Survey.** The 36-item Short Form Health Survey (SF-36) is a multidimensional generic questionnaire assessing quality of life, which consists of 8 dimensions: physical functioning (10 items), role constraint caused by physical health problems (4 items), bodily pain (2 items), general health (5 items), vitality (4 items), social functioning (2 items), role constraint caused by emotional problems (3 items), and mental health (5 items).<sup>37</sup> One item asks the patient to assess change in health status. For each dimension, the scores are summed (raw scale score) and transformed to a percentage (transformed scale), with higher scores reflecting a better health condition.<sup>38</sup> For the purpose of this study, only the mental health transformed scale (SF-36\_MH) will be used, which consists of 5 questions. Reliability and validity of the Dutch version were satisfactory.<sup>39,40</sup>

### Statistical Analysis

Statistical analysis was performed with Statistical Package for Social Sciences (SPSS) version 24.0 (IBM Corp., Armonk, NY, U.S.A.). Linear regression analysis was used to identify any relationship between the ODI or Baecke questionnaire on the one hand and the scores from the SF-36 mental health scale, PCS, VAS for current pain and IPQ-R on the other hand. The scores obtained from the ODI or Baecke questionnaire were entered separately as dependent variables. Scores obtained from the other questionnaires were entered as independent variables.

To analyze which subset of variables was most informative on the ODI or Baecke questionnaire, stepwise backward linear regression analysis was performed starting with a full model containing all scores. The resulting model is the only model that includes statistically significant predictors on the ODI or Baecke questionnaire, respectively. The  $R^2$  describes the variance in the outcome (ODI or Baecke questionnaire) attributable to the variance in the questionnaire scores.

Multicollinearity was calculated by variance inflation factors (VIFs). The general rule of thumb is that VIFs exceeding 10 are signs of serious multicollinearity problems, but some suggest that even VIFs of 6 or 7 are signs of serious multicollinearity.<sup>41</sup>

To quantify the relative importance of one particular variable in the presence of other variables in the regression model, the partial  $R^2$  values were recorded. For such analyses, subsets of variables were entered into the regression model in different sequences (blocks).

## RESULTS

### Patient Characteristics and Questionnaire Outcomes

Eighty-four patients with nonspecific CLBP were recruited (see Table 1). The scores on the beliefs domain of the IPQ-R are presented in Table 2.

### Regression Analysis

**Low Back Pain Disability as a Dependent Variable.** Overall, the scores of the ODI were relatively low, with a mean score of 22% ( $\pm 14\%$ ) (see Table 1). Linear regression analyses showed that 62% of the variance in ODI is explained by the 4 combined variables (Table 3). Stepwise backward linear regression was used to determine the subset of variables that most accurately predicted the variance in scores obtained from the ODI using the lowest number of variables. Table 3 shows the resulting model in terms of  $R^2$  and adjusted  $R^2$ . Model 4 provided the highest explained variance for the lowest number of variables ( $R^2 = 0.62$ , adjusted  $R^2 = 0.58$ ). The VIFs were all less than 2.81 (tolerance  $> 0.35$ ) in the first model. In the final model, all VIFs were less than 2.40 (tolerance  $> 0.41$ ).

Subsets of scores were combined to determine if they provided additional information. With PCS, current VAS, and SF-36 mental health scale scores entered in the first block of the regression model, adding the IPQ-R results in the second block yielded 18% ( $P < 0.01$ ) additional information on the ODI not covered by the other 3 variables (Table 4). Conversely, if the IPQ-R results were incorporated in the first block, only the addition of the SF-36 mental health scale results increased the explained variance of the ODI, albeit to a lesser extent (4% with  $P < 0.05$ , Table 4). Neither the addition of the current VAS score nor the addition of the PCS score provided additional information on the variance of ODI.

**Habitual Physical Activity Level as a Dependent Variable.** The mean score of the Baecke questionnaire for habitual physical activity is presented in Table 1.

A maximal  $R^2$  of 0.074 was reached when all variables were entered together into the linear regression model (Table 5). None of the variables explained a significant amount of the variance ( $R^2$  change) in the level of habitual physical activity of the CLBP patients

**Table 2. Beliefs Domain of IPQ-R in Patients with CLBP (N = 84)**

	Median	Mean
<b>Timeline Acute/Chronic (0–30)</b>	23	21.5
1 <i>My complaint will last a short time</i>	4	3.6
2 My complaint is likely to be permanent rather than temporary	4	3.7
3 My complaint will last for a long time	4	3.9
4 <i>My complaint will pass quickly</i>	4	4.0
5 I expect to have my complaint for the rest of my life	4	3.7
18 <i>My complaint will improve in time</i>	3	3.0
<b>Timeline Cyclical (0–20)</b>	14	13.1
32 I go through cycles in which my complaint gets worse and better	4	3.4
29 The symptoms of my complaint change a great deal from day to day	4	3.3
30 The symptoms of my complaint come and go	3	3.1
31 My complaint is unpredictable	4	3.6
<b>Consequences (0–30)</b>	17	16.3
6 My complaint is a serious condition	4	3.5
7 My complaint has major consequences in my life	3	3.1
8 <i>My complaint does not have much effect on my life</i>	4	3.3
9 My complaint strongly affects the way others see me	2	2.2
10 My complaint has serious financial consequences	2	2.3
11 My complaint causes difficulties for those who are close to me	2	2.3
<b>Personal Control (0–30)</b>	22	21.2
12 There is a lot which I can do to control my symptoms	4	3.8
13 What I do can determine whether my complaint gets better or worse	4	3.6
14 The course of my complaint depends on me	3	3.0
15 <i>Nothing I do will affect my complaint</i>	4	3.6
16 I have the power to influence my complaint	4	3.5
17 <i>My actions will have no effect on the outcome of my complaint</i>	4	3.7
<b>Treatment Control (0–25)</b>	19	18.7
19 <i>There is very little that can be done to improve my complaint</i>	4	3.4
20 Treatment will be effective in curing my complaint	4	4.0
21 Negative effects of my complaint can be prevented by my treatment	4	3.8
22 Treatment can control my complaint	4	3.8
23 <i>There is nothing which can help my complaint</i>	4	3.9
<b>Illness Coherence (0–25)</b>	20	19.1
24 <i>The symptoms of my complaint are puzzling to me</i>	4	3.8
25 <i>My complaint is a mystery to me</i>	4	3.9
27 <i>I don't understand my complaint</i>	4	3.7
28 I have a clear picture or understanding of my complaint	4	4.1
26 I clearly understand my complaint	4	3.9
<b>Emotional Representations (0–30)</b>	14	13.8
33 I get depressed when I think about my complaint	2	2.2
34 When I think about my complaint I get upset	2	2.1
35 My complaint makes me feel angry	2	2.2
36 <i>My complaint does not worry me</i>	4	3.3
37 Having this complaint makes me feel anxious	2	2.2
38 My complaint makes me feel afraid	2	2.1

Italic script denotes items reverse scored to calculate the total score. IPQ-R, Illness Perception Questionnaire Revised; CLBP, chronic low back pain.

studied here (data not shown). Stepwise backward model building, starting from a model containing all variables, showed the highest adjusted  $R^2$  (0.037), for

model 8. The final model showed an  $R^2$  of 0.049 (Table 5).

## DISCUSSION

The results of the present study indicate that disability appears closely related to illness perceptions in patients with CLBP. Indeed, in this cross-sectional study, illness perceptions (measured by the IPQ-R) partially explained the variance in ODI scores in a sample of CLBP patients, confirming our a priori hypothesis. Illness perceptions significantly increased the explained variance in functional limitation by 18% when the PCS, current VAS, and SF-36\_MH scores were also entered. However, contrary to our other hypothesis, illness perceptions combined with pain catastrophizing, perceived pain intensity, and mental health state explained little variance in the level of habitual physical activities (measured by the Baecke questionnaire) of patients with CLBP ( $R^2 = 0.074$ ). These data show the importance of monitoring a person's illness perceptions, as they are closely related to the current disability level of the CLBP patient.

Compared to previous studies, the CLBP patients studied here had a high score on illness coherence and a low score on emotional response.<sup>18,42</sup> All other scores of the IPQ-R were similar, with our sample having a slightly lower score on consequences and a higher score on personal and treatment control, which suggest somewhat better illness perceptions. These differences can be due to slightly different inclusion criteria, such as the presence of activity limitation<sup>42</sup> and recruitment within physiotherapy practices. The mean ODI score and mean PCS score in this sample were relatively low (mean ODI = 22%, mean PCS = 16.8). The level of habitual physical activity was comparable with that reported in another study on CLBP patients.<sup>43</sup> Lower levels of physical activity might be linked to CLBP. Therefore, the external validity of this study might not be guaranteed in patients with very high levels of physical activity.

### Low Back Pain Disability as a Dependent Variable

The scores obtained with the ODI were set as a dependent variable, because the ODI is used to quantify the functional disability in patients with LBP.<sup>44</sup>

Both regression analyses confirm that illness perceptions contribute substantially to explaining disability in CLBP patients. This finding supports the clinical importance of illness perceptions in patients with CLBP. Foster

**Table 3. Stepwise Backward Regression Analysis for ODI (%) in Patients with CLBP (N = 84)**

Model	Variables	R <sup>2</sup>	Adjusted R <sup>2</sup>	Constant	Unstandardized B	Tolerance	VIF			
1	Current VAS	Total	0.62	0.56	51.454	0.118	0.82			
	SF-36	Mental health						-0.216	0.55	1.81
	PCS	Total						0.239	0.57	1.74
	IPQ-R	Timeline						-0.130	0.53	1.87
		Consequences						1.300	0.39	2.60
		Personal control						-0.980	0.42	2.38
		Treatment control						0.007	0.36	2.80
		Coherence						0.014	0.69	1.46
		Cyclical timeline						-0.886	0.72	1.38
		Emotional representation						-0.627	0.43	2.34
4	Current VAS	Total	0.62	0.58	49.283	0.119	0.84			
	SF-36	Mental health						-0.218	0.71	1.42
	PCS	Total						0.250	0.59	1.70
	IPQ-R	Consequences						1.247	0.42	2.39
		Personal control						-0.922	0.77	1.29
		Cyclical timeline						-0.640	0.86	1.17
		Emotional representation						-0.640	0.43	2.31

ODI, Oswestry Disability Index; CLBP, chronic low back pain; VIF, variance inflation factor; VAS, visual analog scale for pain intensity; SF-36, 36-Item Short Form Health Survey; PCS, Pain Catastrophizing Scale; IPQ-R, Illness Perception Questionnaire Revised.

**Table 4. Summary of Linear Regression Analysis for Explaining the Variances in Scores Obtained from the ODI (%) in Patients with CLBP (N = 84)**

Variables Entered		R <sup>2</sup> change	R <sup>2</sup>	Adjusted R <sup>2</sup>
Block 1	Block 2			
Current VAS SF-36_MH PCS			0.44	
	IPQ-R	0.18**	0.62 0.60	0.56
SF-36_MH PCS IPQ-R			0.62 0.59	0.56
	Current VAS	0.02 NS	0.62 0.60	0.56
Current VAS PCS IPQ-R			0.62 0.60	0.56
	SF-36_MH	0.04*	0.62 0.60	0.56
Current VAS SF-36_MH IPQ-R			0.62 0.60	0.56
	PCS	0.02 NS	0.62 0.60	0.56

R<sup>2</sup> change: Variance is explained by the variable in the current block, and not yet explained by the variables in the previous block.  
ODI, Oswestry Disability Index; CLBP, chronic low back pain; VAS, visual analog scale for pain intensity; SF-36\_MH, 36-Item Short Form (transformed) mental health scale; PCS, Pain Catastrophizing Scale; IPQ-R, Illness Perception Questionnaire Revised; NS, not significant.  
Significance of R<sup>2</sup> change: \* < 0.05; \*\* < 0.01.

et al. claimed that illness beliefs are better predictors of disability than catastrophizing, although the latter is thought to be involved in delayed recovery too.<sup>10,16,18</sup> The results of the present study are in line with these results.

### Habitual Physical Activity Level as a Dependent Variable

Only 7% of the variance of habitual physical activity in patients with CLBP was explained by all 4 variables

combined. The most important variable in explaining the variance in habitual physical activity levels in patients with CLBP was the “personal control” scale of the IPQ-R, which accounts for 5% of the explained variance in habitual physical activity.

The very low overall explained variance indicates that other factors contributing to self-reported habitual physical activity levels in patients with CLBP are missing. We focused on psychosocial factors, whereas physical factors, environmental factors, work-related factors, and even financial factors can play an important role in the amount of physical activity in sports and leisure time. Another possibility of the low explained variance may be that we did not add a time constraint to the Baecke questionnaire. People might experience difficulties recalling certain activities when no period of time is indicated. The Baecke questionnaire is a self-administered questionnaire for habitual activity; therefore, it is not a direct measurement, but is subjective and subject to difficulties of recall. Many questionnaires add a time constraint to the questions, such as “past week physical activity” or “usual week physical activity over the past 12 months.” This may prevent difficulties in recalling the activities and perhaps also socially favorable answers.

Further research should focus on the role of illness perceptions in habitual physical activity in CLBP patients, because from this study, we see that personal control is the most relevant factor of all perceptions. This makes sense, given the active coping strategy promoted by the clinical guidelines for LBP<sup>22,23</sup> and given the importance of self-efficacy beliefs in lifestyle

**Table 5. Stepwise Backward Regression Analysis for the Baecke Questionnaire in Patients with CLBP (N = 84)**

Model	Variables	R <sup>2</sup>	Adjusted R <sup>2</sup>	Constant	Unstandardized B	Tolerance	VIF	
1	Current VAS SF-36 PCS IPQ-R	Total	0.074	-0.075	6.336	-0.004	0.822	1.216
		Mental health				0.008	0.554	1.806
		Total				0.007	0.583	1.716
		Timeline				0.004	0.534	1.872
		Consequences				-0.004	0.391	2.560
		Personal control				0.080	0.423	2.363
		Treatment control				-0.005	0.358	2.797
		Coherence				-0.023	0.685	1.460
		Cyclical timeline				-0.022	0.719	1.391
		Emotional representation				0.040	0.429	2.332
9	IPQ-R	Emotional representation	0.063	0.037	6.085	0.035	0.969	1.032
		Personal control				0.085	0.969	1.032
10	IPQ-R	Personal control	0.049	0.036	6.728	0.078	1.000	1.000

CLBP, chronic low back pain; VAS, visual analog scale of pain intensity; SF-36, 36-Item Short Form Health Survey (mental health [transformed] scale); PCS, Pain Catastrophizing Scale; IPQ-R, Illness Perception Questionnaire Revised.

change. Moreover, cognitive treatment of illness perceptions significantly improved patient-relevant activity (Patient-Specific Condition questionnaire) in a CLBP group.<sup>42</sup>

### STUDY LIMITATIONS

The results of this study should be seen in the light of its methodological limitations. We relied on self-report for assessing functional disability and habitual physical activity levels, while accelerometers are available for real-time assessment of physical activity levels in humans.<sup>45</sup> Further research can include more biopsychosocial variables or different questionnaires to evaluate a broader range of possible predictors. The present results should also be tested against outcome variables that do not involve self-report to obtain a more direct estimation of a person's functional limitation of behavior. Furthermore, in this analysis we assumed linear associations.

As outlined above, the patients included in the present study show relatively low ODI and PCS scores. Further research should clarify if and how a wider variation in these scores might influence the outcome.

In conclusion, the present study aimed at unravelling (part of) the black box, including the concept of illness perceptions, that influences habitual physical activity and functional disability of CLBP patients. It can provide practitioners with an idea of which questionnaires and thus constructs play an important role in the present state of their patients and reveal important factors for treatment.

The results indicate that functional disability is closely related to illness perceptions in patients with CLBP, providing evidence for the importance of

monitoring a patient's illness perceptions in primary care. Monitoring is essential in a treatment program. However, in the present study, illness perceptions failed to explain the variance in physical activity levels in CLBP patients. Given the limitations of this study, however, further research should clarify the role of illness perceptions in habitual physical activity.

### ACKNOWLEDGEMENTS

The study was funded by the research council of Artesis University College, Antwerp, Belgium. Informed consent of all subjects was obtained. The study protocol was approved by the local ethical committee of University Hospital of Brussels, and the procedures followed were in accordance with the Helsinki Declaration of 1975, as revised in 2013.

### CONFLICT OF INTEREST

The authors report no conflicts of interest. All authors satisfy all three authorship criteria.

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