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ORIGINAL RESEARCH

Fear of Movement Is Not Associated With Objective and Subjective Physical Activity Levels in Chronic Nonspecific Low Back Pain

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Abstract

Objectives: To assess the association of physical activity measures, derived with an accelerometer and a self-reported questionnaire, with fear of movement in patients with chronic nonspecific low back pain (LBP) and to investigate the association between disability and fear of movement in this population.

Design: Cross-sectional study.

Setting: Outpatient physical therapy university clinics.

Participants: Patients (N=119) presenting with nonspecific LBP of >3 months' duration.

Interventions: Not applicable.

Main Outcome Measures: Physical activity levels measured objectively with an accelerometer (ie, counts per minute, time spent in moderate-to-vigorous and light physical activity per day, number of steps per day, and number of 10-minute bouts of moderate-to-vigorous physical activity per day) and subjectively with a self-reported questionnaire (Baecke Physical Activity Questionnaire); fear of movement (Tampa Scale of Kinesiophobia); pain (11-point numerical rating scale); disability (Roland Morris Disability Questionnaire); and depression (Beck Depression Inventory). The associations were examined with correlational, univariate, and multivariable linear regression analyses.

Results: None of the objective physical activity measures were associated with fear of movement. The apparent association of self-reported physical activity levels with fear of movement (correlational analyses: $r=-.18$; $P<.05$; univariate regression analyses: $\beta=-.04$; 95% confidence interval [CI], −.07 to −.01; $P=.04$) was not confirmed in multivariable analyses. Fear of movement was consistently associated with disability in both correlational ($r=.42$; $P<.01$) and multivariable ($\beta=.21$; 95% CI, .11−.31; $P<.001$) analyses.

Conclusions: Our data support one aspect of the fear-avoidance model—that higher fear of movement is associated with more disability—but not the aspect of the model linking fear of movement with inactivity.

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In the chronic musculoskeletal pain field, pain-related cognitive and behavioral responses are thought to have a major role in the development and maintenance of chronic or persistent symptoms.[1,2] To better understand the theoretical relation between pain-related fear and disability, the fear-avoidance model has been proposed.[3] This is of importance to the nonspecific low back pain (LBP) field, where in most cases the pathoanatomical source of pain is unknown[4] and those with chronic symptoms have a poor prognosis.[5] The fear-avoidance model postulates that higher fear of movement is associated with the development of avoidance behavior, eventually leading to more disability and physical deconditioning (ie, likely due to inactivity or disuse).[6] The central concept is fear of pain, or the more specific fear that physical

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activity will cause (re)injury.[3] A widely used measure of fear of movement in clinical practice and research is the Tampa Scale of Kinesiophobia (TSK).[7]

Several studies have investigated the association between TSK scores and perceived disability measures in patients with chronic LBP. The findings from cross-sectional analyses show fair to moderate correlations between the TSK scores and disability measures, including Roland Morris Disability Questionnaire (RMDQ) ($r=.44-.59$),[8-11] Oswestry Disability Index ($r=.50$),[12] and Quebec Back Pain Disability Scale ($r=.30-.35$).[13,14] There is also evidence to suggest that this association persists even after controlling for important covariates such as age, sex, and body mass index (BMI).[12,15] Furthermore, fear of movement, measured by the TSK, has been shown to be an important predictor of chronicity in patients with LBP.[16-18]

Although there is evidence to support the association between fear of movement and disability, the relation between fear of movement and physical deconditioning in patients with chronic LBP is less clear. Previous studies[10,12,19] have found no association between TSK scores and measures of cardiorespiratory/aerobic fitness, such as walking endurance time[12] and predicted maximum oxygen consumption ($\dot{V}o_2max$) derived from a submaximal bicycle test.[10,19] In contrast, another study[20] found a significant negative association between fear of movement and self-reported physical activity levels. A possible explanation for the conflicting evidence is the use of self-reported measures or measures of cardiorespiratory/aerobic fitness to evaluate physical activity levels.

Accelerometers are able to measure and record physical activity in real time, providing more objectivity regarding frequency, intensity, and duration of physical activity with minimal burden on patients.[21] This method overcomes the reporting bias or recall problems associated with subjective methods,[22] and compared to other objective methods (eg, $\dot{V}o_2max$), it allows the measurement of free-living physical activities during an extended period of time, in real-world rather than laboratory settings.[23] Nevertheless, to our knowledge, no previous study has used both subjective and objective physical activity measures to examine the association between fear of movement and physical activity levels in chronic LBP. Therefore, the aim of this study was to test the assumption that fear of movement is associated with physical activity levels, measured by objective and subjective methods, in people with chronic nonspecific LBP as well as the assumption that fear of movement is associated with disability in this population.

Methods

This was a 2-center cross-sectional study. This study was approved by the university ethics research committee (CAAE36332514.0.0000.5402).

List of abbreviations:

BMI	**body mass index**
CI	**confidence interval**
IQR	**interquartile range**
LBP	**low back pain**
MVPA	**moderate-to-vigorous physical activity**
RMDQ	**Roland Morris Disability Questionnaire**
TSK	**Tampa Scale of Kinesiophobia**
$\dot{V}o_2max$	**maximal oxygen consumption**

Participants

Patients with LBP were recruited through advertisements in the community, local press, and social media. Consecutive patients were assessed for eligibility at 2 outpatient physical therapy university clinics in Presidente Prudente, Brazil. Patients aged between 18 and 60 years with chronic nonspecific LBP were considered eligible for the study. *Chronic nonspecific LBP* was defined as pain and discomfort localized below the costal margin and above the inferior gluteal folds, with or without leg pain of at least 3 months' duration. To be eligible to enter the study, patients had to report moderate-intensity LBP and interference with function as measured by items 7 or 8 of the 36-Item Short Form Health Survey.[24] Patients presenting with known or suspected serious underlying condition (eg, tumors, fractures, and inflammatory diseases), nerve root compromise (ie, at least 2 of the following signs: weakness, reflex change, or sensation loss associated with the same spinal nerve), history of spinal surgery, cardiorespiratory illnesses, fibromyalgia, any other musculoskeletal condition that may affect activity and movement, pregnancy, illiteracy, or with insufficient understanding of the Portuguese language were excluded.

Procedures

Each participant attended the physical therapy clinic twice, ~1 week apart. All participants gave informed consent before data collection. A trained assessor administered the questionnaires during an interview. At the first session, demographic and anthropometric data, duration and severity of LBP, disability, fear of movement, and depression were collected. Participants were asked to wear an accelerometer during waking hours (except when showering, bathing, or swimming) for 7 days after the first session while maintaining their typical weekly schedule. Participants were also asked to record in a diary the times they took off the accelerometer and the reason for doing that to exclude these periods from the analyses. One week later, participants returned the accelerometer.

Data collection

The following information was collected at the first session:

Demographic and anthropometric data: age, BMI, highest education level, work status, and symptom duration.
Disability: The RMDQ consists of 24 items, with total score ranging from 0 (no disability) to 24 (maximum disability).[25,26]
Pain: The average pain intensity over the last 24 hours was measured with an 11-point numerical rating scale, where 0 denotes no pain and 10 denotes the worst pain imaginable.[27]
Fear of movement: The TSK is a 17-item self-report checklist used to measure fear of movement. Total score ranges from 17 to 68, with higher scores indicating greater fear of pain and the lowest score 17 indicating no or minimal fear of pain.[3,7,28] The TSK has shown to have acceptable reliability.[29]
Depression: The Beck Depression Inventory contains 21 items to measure depression symptoms, with scores ranging from 0 (low depression) to 63 (maximum depression).[30,31]
Subjective physical activity measure: The Baecke Habitual Physical Activity Questionnaire is a 16-item self-reported measure of habitual physical activity. Total score ranges from 3 to 15, with higher scores indicating higher physical activity level.[32,33] This questionnaire has been shown to have high test-retest reliability in general populations.[32]

Objective physical activity measures: Objective measures of physical activity were collected by a triaxial accelerometer.[a] This accelerometer is a noninvasive, small, lightweight device (4.6×3.3×1.5cm, 19g) that is worn by the patient during waking hours for 7 consecutive days on the right hip. Acceleration data were sampled at 30Hz and analyzed at 60-s epochs. A complete data set for each patient was defined as having at least 10h/d of monitored wear during at least 5 days.[34,35] We defined *nonwear periods* as time intervals of at least 60 consecutive minutes of zero counts, with an activity interruption allowance of 0 to 100counts/min lasting a maximum of 2 consecutive minutes.[36] The physical activity measures derived from the accelerometer were (1) counts per minute; (2) time spent in light physical activity per day; (3) time spent in moderate-to-vigorous physical activity (MVPA) per day; (4) number of steps per day; and (5) number of 10-minute bouts of MVPA per day. Light physical activity was defined as values between 100 and 2019counts/min, and MVPA was defined as values greater than 2020counts/min.[34] The accelerometer variables were obtained from the vertical axis. Counts per minute were calculated by dividing the sum of activity counts of the vertical axis by the number of valid minutes.[34] *Bouts* were defined as ≥10 consecutive minutes above the relevant threshold, allowing interruptions of 1 or 2 minutes below the threshold.[34] Accelerometer data were analyzed with ActiLife 6 software.[a]

Data analysis

Descriptive analyses were conducted for the whole cohort and each subgroup defined by sex. Data were presented as frequency (proportion), mean ± SD, or median (interquartile range [IQR]) depending on the data distribution. The only exception was for physical activity measures, where we opted to report both mean ± SD and median (IQR) to allow comparisons with data from published studies. The associations were examined with correlational, univariate, and multivariable linear regression analyses.

For correlational analyses, we calculated the correlation of physical activity measures with fear of movement, pain, and disability as well as the correlation of fear of movement with pain and disability. Bivariate correlations were evaluated with the Pearson correlation coefficient, when both variables analyzed were normally distributed, and with the Spearman rank correlation coefficient, if at least 1 of the variables showed nonnormal distribution. The magnitude of association was interpreted as little or no (from .00 to .25), fair (from .25 to .50), moderate to good (from .50 to .75), and good to excellent (>.75) relations.[37]

For multivariable linear regression analyses, we conducted separate analyses with a backward elimination approach to investigate the association between each measure of physical activity or disability (ie, dependent variable) and fear of movement (ie, independent variable). The other variables, grouped as personal (age, sex, BMI, symptoms duration, work status, education level) and emotional (depression) factors, were selected a priori as potential covariates. A log transformation was applied to nonnormally distributed variables. If after log transformation the variable was still considered nonnormal, we opted to not include the variable in multivariable regression models.

In the first step, we built separate univariate linear regressions for each variable to identify candidates for the multivariable model. Variables considered to be associated with the dependent variable ($P \leq .25$) were selected for the base model. At this stage, if there were physical activity measures not associated ($P > .25$) with the TSK, these measures were not evaluated further in multivariable analyses. We also explored whether the interaction between the TSK and age,

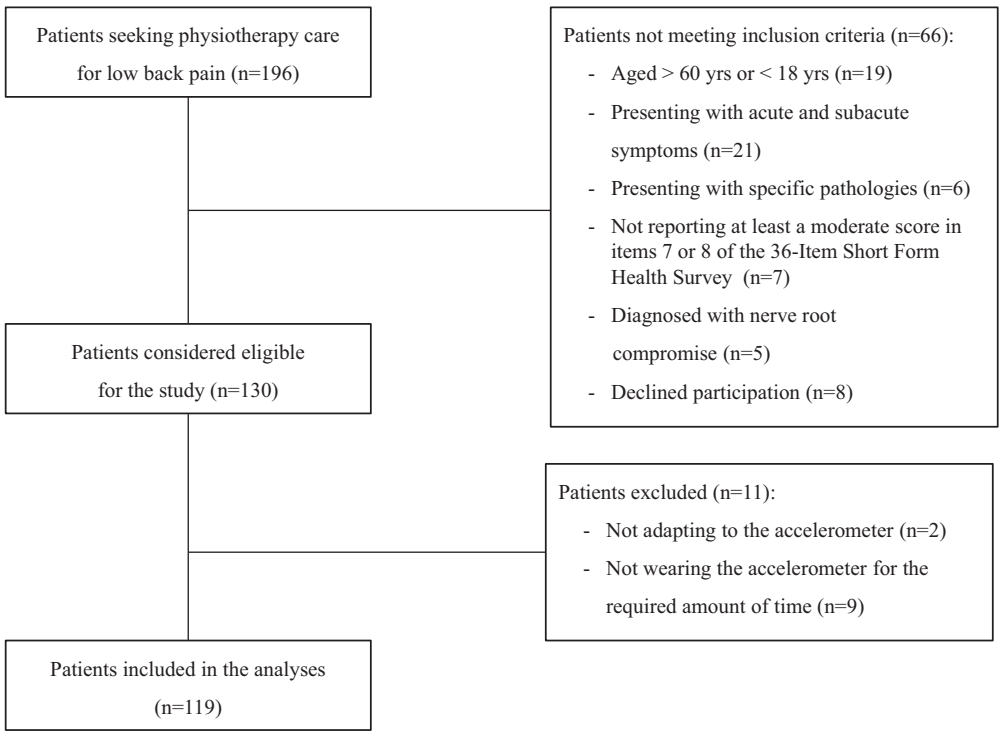

Fig 1 Flow diagram of participants in the study.

Table 1 Demographic and clinical characteristics of 119 patients and separate data for men and women

Characteristic	Sample (n=119)	Women (n=82)	Men (n=37)
Age (y)	39.1±11.2	38.6±11.2	40.0±11.3
BMI (kg/m^2)	27.1±7.0	27.0±7.0	27.5±7.0
Symptoms duration (mo)	12 (6.0–48.0)	12.0 (6.0–43.5)	24.0 (10.0–60.0)
Work status			
Employed full-time	24 (20.2)	20 (24.4)	4 (10.8)
Employed part-time	49 (41.2)	28 (34.1)	21 (56.7)
Unemployed	46 (38.7)	34 (41.5)	12 (32.4)
Education			
No education beyond primary school*	23 (19.3)	13 (15.8)	10 (27.0)
No education beyond secondary school†	42 (35.3)	28 (34.1)	14 (37.8)
Tertiary education incomplete	24 (20.2)	17 (20.7)	7 (18.9)
Tertiary education complete	30 (25.2)	24 (29.2)	6 (16.2)
Fear of movement (TSK, 17–68)	41.0±9.0	40.5±6.3	43.9±8.4
Depression (BDI, 0–63)	11.5±7.6	12.1±7.8	10.1±6.9
Disability (RMDQ, 0–24)	12.2±4.6	12.0±4.6	13.0±5.5
Pain (NRS, 0–10)	6.7±1.7	6.7±1.7	6.5±1.6
Self-reported physical activity levels (BPAQ, 3–15)	6.7±1.3	6.9±1.3	6.4±1.4
Accelerometer data‡			
Time spent in MVPA per day	21.7±16.2	22.8±17.2	19.1±13.4
	17.3 (10.2–30.5)	18.1 (10.1–31.4)	15.8 (10.9–23.0)
Counts per minute	296.1±111.6	296.7±111.7	291.6±113.0
	272.4 (219.1–342.5)	271.1 (227.7–343.8)	283.7 (208.4–353.4)
Number of bouts per day	9.9±9.5	11.0±8.8	7.7±11.0
	11.5 (0.0–14.0)	12.0 (0.0–14.5)	0.0 (0.0–12.5)
Number of steps per day	6843.7±2543.9	6913.3±2413.6	6689.3±2840.8
	6428.0 (5183.5–8137.0)	6441.6 (5374.4–8178.9)	6395.5 (4933.0–7791.4)
Time spent in light physical activity per day	333.4±89.5	331.7±82.9	337.0±102.7
	334.0 (272.5–389.2)	342.6 (271.2–388.3)	317.8 (272.6–399.1)

NOTE. Values are mean ± SD, median (IQR), or n (%).
Abbreviations: BDI, Beck Depression Inventory; BPAQ, Baecke Habitual Physical Activity Questionnaire; NRS, numerical rating scale.
* In Brazil, primary schools provide education from the age of 5 to 11.
† In Brazil, secondary schools provide education from the age of 12 to 17.
‡ For accelerometer data, mean ± SD and median (IQR) values are reported to allow comparison with data from the literature.

between the TSK and sex, between education level and sex, or between work status and sex affected the results of multivariable models. Statistical assumptions underlying linear regression models were met for all analyses presented, because the residuals showed no indication of nonnormal distribution, heteroscedasticity, and nonlinearity. In addition, there was no indication of multicollinearity because continuous variables were not highly correlated ($r<0.6$) and the variance inflation factor values were not >2.0 in all steps. All statistics were performed using SPSS version 20.0,[b] with a P value of .05 set as a criterion for the final multivariable model.

Results

A total of 196 patients were assessed for eligibility between September 1, 2014, and October 15, 2015. Sixty-six (34%) patients were excluded for not meeting the inclusion criteria and 11 (6%) patients for not adapting to or not correctly wearing the accelerometer for the required amount of time. A final sample including 119 participants with chronic nonspecific LBP was included in the study (fig 1). Our sample was predominantly women (69%), with a mean age of 40±19 years with a median symptom duration of 12 months (IQR, 6–48mo). The detailed characteristics of the whole sample and men/women are listed in table 1.

Correlational analyses

Correlation coefficients are presented in table 2. The objective physical activity measures showed no association with fear of movement, pain, and disability. Even when the association was statistically significant, the magnitude of association was interpreted as having, at best, little relation ($r<.25$). Similarly, although the self-reported measure of physical activity levels showed a significant negative association with fear of movement, disability, and pain, the relation varied from little to fair. Disability showed a fair positive association with fear of movement and pain.

Multivariable linear regression analyses

Because of nonnormal distribution, symptom duration, Time spent in MVPA, and number of steps were log-transformed before inclusion in the multivariable analyses. Number of bouts even after log transformation remained not normally distributed, so this variable was not further investigated in multivariable analyses. The results of univariate analyses are presented in table 3. Counts, number of steps, and time spent in light physical activity were not associated with the TSK and not further investigated in multivariable analyses. Age, BMI, sex, depression, disability, pain, and work status were associated ($P\leq.25$) with the Baecke Habitual

Table 2 Correlation coefficients for the association of fear of movement with PA measures, pain, and disability and for the association of PA measures with pain and disability

Variable	Fear of Movement (TSK)	Disability (RMDQ)	Pain (NRS)
Disability (RMDQ)	.42*	NA	.45*
Pain (NRS)	.17	.45*	NA
Self-reported PA (BPAQ)	−.18†	−.28*	−.23†
Accelerometer data			
Time spent in MVPA per day‡	−.13	−.20†	−.08
Time spent in LPA per day	.09	−.01	−.04
Counts per minute	−.02	−.06	−.05
Number of bouts per day‡	−.17	−.22†	−.01
Number of steps per day‡	−.15	.01	−.06

NOTE. Disability showed significant fair (from .25 to .50) positive association with fear of movement and pain and significant fair negative association with self-reported PA. Correlation coefficients presented were calculated using the Pearson correlation method unless otherwise indicated.

Abbreviations: BPAQ, Baecke Habitual Physical Activity Questionnaire; LPA, light physical activity; NA, not applicable; NRS, numerical rating scale; PA, physical activity.

* Correlation is significant at the .01 level (2-tailed).

† Correlation is significant at the .05 level (2-tailed).

‡ Because of nonnormal distribution, correlation coefficients for the specific variable were calculated using the Spearman rank correlation method.

Physical Activity Questionnaire, whereas BMI and disability were associated with time spent in MVPA. Variables showing association with dependent variables (ie, Baecke Habitual Physical Activity Questionnaire, time spent in MVPA, and disability) were considered as potential covariates for the multivariable models. None of the interaction terms were found to improve the model.

The results of multivariable regression analyses with Baecke Habitual Physical Activity Questionnaire, time spent in MVPA, and disability as dependent variables, TSK as the independent variable, and all potential covariates are presented in table 4. The base model represents the starting model, and the final model is the model after elimination of all nonsignificant variables. The results show that none of the physical activity measures (ie, Baecke Habitual Physical Activity Questionnaire and time spent in MVPA) investigated in multivariable analyses were associated with the TSK after controlling for potential covariates. The final model for the Baecke Habitual Physical Activity Questionnaire including disability, BMI, and age explained 14% of the total variance. For time spent in MVPA, none of the variables included in the base model were significant in the final model. In the multivariable model for disability, fear of movement remained significant in the final model after controlling for covariates. The final model, including age, BMI, numerical rating scale, TSK, Baecke Habitual Physical Activity Questionnaire, and work status, explained 44% of the total variance in disability.

Discussion

Our findings showed that objective physical activity measures are not associated with fear of movement in people with chronic nonspecific LBP. Our results also revealed that the apparent association between self-reported physical activity and fear of movement was not confirmed in multivariable analyses. Not surprisingly, disability was found to be associated with fear of movement even after controlling for potential confounders. Our data support the part of the fear-avoidance model stating that higher fear of movement leads to more disability. However, our analysis challenges the part of the model suggesting that fear of movement is associated with inactivity.

Three previous studies[10,12,19] conducting univariate or multivariate regression analyses found no association between fear of movement and objective measures of aerobic fitness (ie, $\dot{V}o_2max$ and walking endurance). Our study using accelerometers that allow the objective measurement of free-living physical activities showed somewhat similar findings, suggesting that patients who report high fear of movement do not necessarily have low objective physical activity levels. In contrast, a previous study[20] found a negative association between fear of movement and self-reported physical activity after controlling for age. In the present study, our findings suggest little relation between self-reported physical activity and fear of movement. This apparent association, however, was not confirmed in multivariable analyses. To our knowledge, this is the first study to explore whether the association between fear of movement and physical activity levels vary depending on the assessment method. Our findings suggest that regardless of the physical activity assessment method, patients reporting higher fear of movement did not show lower levels of physical activity.

Although our findings support the association between disability and fear of movement, we could not confirm the fear-avoidance model's assumption that high levels of fear of movement are associated with lower physical activity levels in people with chronic LBP. Although the fear-avoidance model implies that fear of movement is associated with both disability and physical activity levels, important conceptual differences exist between the two. Perceived disability is often measured by questionnaires that cover a range of spine-related functions (eg, twisting, bending over, and sitting) likely to be affected by LBP, whereas subjective and objective physical activity assessment methods provide a global measure of the patient's level of physical activity. Therefore, one interpretation is that patients having higher fear of movement would avoid spine-related functions, such as those tasks described in the RMDQ, but would remain physically active during their daily routine. It is still debatable in the LBP field whether chronic pain leads to inactivity.[38,39] Interestingly, the male participants in our sample (292counts/min; 95% confidence interval [CI], 255−327counts/min) were considered less active than the American adult population[40] (377counts/min; 95% CI, 363−391counts/min), whereas the female participants' physical activity levels (297counts/min; 95% CI, 273−321counts/min) in our sample did not differ from those of the American population[40] (298counts/min; 95% CI, 289−307counts/min). A potential factor that can make it difficult to compare studies is the actual physical activity level of the sample. A recent study[41] from a related chronic pain field showed that having knee osteoarthritis is associated with a varying degree of physical activity patterns in different countries. If these data apply to the LBP field, it may explain why there is not a clear pattern in previous studies.

Recently, criticisms of the fear-avoidance model have emerged. Wideman et al[42] argued that the proposed cyclical pathway in the fear-avoidance model might be too simplistic to understand how its components interact with each other. Recent

Table 3 Univariate regression analyses for the identification of candidate variables for multivariable regression models

	Self-Reported PA (BPAQ)		Time spent in MVPA per Day*		Counts per Minute		Number of Steps per Day*		Time Spent in LPA per Day		Disability (RMDQ)	
Variable	β (95% CI)	*P*	β (95% CI)	*P*	β (95% CI)	*P*	β (95% CI)	*P*	β (95% CI)	*P*	β (95% CI)	*P*
Fear of movement (TSK)	−0.04 (−0.07 to −0.01)	.04	−0.01 (−0.02 to 0.00)	.14	−0.30 (−3.16 to 2.56)	.84	−0.00 (−0.01 to 0.00)	.64	1.18 (−1.10 to 3.46)	.31	0.27 (0.17 to 0.38)	<.001
Disability (RMDQ)	−0.08 (−0.13 to −0.03)	.00	−0.01 (−0.03 to 0.00)	.09	−0.00 (−0.01 to 0.01)	.51	−5.86 (−11.07 to −0.65)	.03	0.00 (−0.01 to 0.01)	.95	NA	NA
Age	0.01 (−0.01 to 0.03)	.24	0.00 (−0.01 to 0.00)	.38	NA		NA		NA		0.12 (0.05 to 0.19)	.002
BMI	0.03 (−0.00 to 0.07)	.09	−0.01 (−0.02 to 0.01)	.25	NA		NA		NA		0.10 (−0.03 to 0.22)	.12
Sex†	0.50 (−0.02 to 1.01)	.06	0.07 (−0.09 to 0.24)	.38	NA		NA		NA		−0.83 (−2.66 to 1.01)	.37
Symptoms duration*	0.22 (−0.23 to 0.67)	.34	0.06 (−0.08 to 0.20)	.38	NA		NA		NA		−0.20 (−1.78 to 1.38)	.80
Depression (BDI)	−0.02 (−0.05 to 0.01)	.25	0.00 (−0.01 to 0.01)	.99	NA		NA		NA		0.85 (−0.03 to 0.20)	.14
Pain (NRS, 0—10)	−0.18 (−0.32 to −0.04)	.01	−0.02 (−0.06 to 0.03)	.43	NA		NA		NA		1.25 (0.79 to 1.70)	<.001
Education†												
No education beyond primary school	0.02 (−0.54 to 0.94)	.59	−0.01 (−0.24 to 0.22)	.94	NA		NA		NA		0.79 (−1.77 to 3.36)	.54
No education beyond secondary school	0.19 (−0.45 to 0.82)	.56	−0.03 (−0.23 to 0.17)	.78	NA		NA		NA		−0.62 (−2.84 to 1.59)	.58
Tertiary education incomplete	−0.17 (−0.89 to 0.56)	.65	0.07 (−0.16 to 0.30)	.55	NA		NA		NA		−1.31 (−3.84 to 1.23)	.31
Work status†												
Employed part-time	0.84 (0.19 to 1.49)	.01	0.09 (−1.21 to 0.29)	.41	NA		NA		NA		−2.27 (−4.56 to 0.02)	.05
Employed full-time	0.52 (0.01 to 1.07)	.04	−0.00 (−0.17 to 0.17)	.99	NA		NA		NA		−1.93 (−3.80 to −0.06)	.04

NOTE. Self-reported physical activity and time spent in MVPA were associated ($P<.25$) with fear of movement and selected as dependent variables for the multivariable regression models. Disability was associated with fear of movement, self-reported physical activity, number of steps, and time spent in MVPA. Other variables associated ($P<.25$) with dependent variables were selected as covariates.
Abbreviations: β, unstandardized B coefficient; BDI, Beck Depression Inventory; BPAQ, Baecke Habitual Physical Activity Questionnaire; LPA, light physical activity; NA, not applicable; NRS, numerical rating scale.

* Variable log-transformed.

† Reference categories for sex, education, and work status are male, tertiary education complete, and unemployed, respectively.

Table 4 Summary of 3 multivariable regression analyses with self-reported PA, time spent in MVPA, and disability as dependent variables, fear of movement as the independent variable of interest, and all potential covariates

Model Steps	Independent Variable or Covariates	F	R^2 (Adjusted R^2)	β (95% CI)	*P*
Dependent variable: Self-reported PA (BPAQ)					
Base model	(Constant)	3.61	23% (17%)		.001
	Age			0.02 (0.00 to 0.04)	.02
	Sex			0.48 (−0.035 to 0.99)	.07
	BMI			0.03 (−0.00 to 0.07)	.06
	Depression (BDI)			−0.01 (−0.04 to 0.02)	.63
	Disability (RMDQ)			−0.06 (−0.12 to 0.00)	.06
	Pain (NRS)			−0.09 (−0.25 to 0.54)	.20
	Fear of movement (TSK)			−0.02 (−0.05 to 0.02)	.35
	Work status				
	Employed part-time			0.57 (−0.07 to 1.22)	.08
	Employed full-time			−0.36 (−0.16 to 0.18)	.17
Final model	(Constant)	7.24	16% (14%)		<.001
	Age			0.02 (0.00 to 0.04)	.02
	BMI			0.04 (0.01 to 0.07)	.02
	Disability (RMDQ)			−0.11 (−0.16 to −0.06)	<.001
Dependent variable: Time spent in MVPA per day*					
Base model	(Constant)	1.52	4% (1%)		<.001
	BMI			−0.01 (−0.02 to 0.01)	.33
	Disability (RMDQ)			−0.01 (−0.03 to 0.01)	.31
	Fear of movement (TSK)			−0.01 (−0.02 to 0.01)	.37
Final model	None of the variables remained in the final model				
Dependent variable: Disability (RMDQ)					
Base model	(Constant)	8.70	45% (40%)		<.001
	Age			0.09 (0.03 to 0.15)	.007
	BMI			0.12 (0.02 to 0.21)	.02
	Depression (BDI)			0.02 (−0.08 to 0.11)	.75
	Pain (NRS)			0.78 (0.35 to 1.21)	.001
	Fear of movement (TSK)			0.21 (0.11 to 0.31)	<.001
	Self-reported PA (BPAQ)			−0.51 (−1.11 to 0.09)	.09
	Time spent in MVPA per day*			1.10 (−1.28 to 3.49)	
	Number of steps per day*			−3.79 (−10.01 to 2.49)	
	Work status				
	Employed part-time			−1.98 (−3.90 to −0.07)	.04
	Employed full-time			−1.57 (−3.01 to −0.040)	.04
Final model	(Constant)	12.36	44% (40%)		<.001
	Age			0.08 (0.02 to 0.14)	.01
	BMI			0.12 (0.26 to 0.22)	.01
	Pain (NRS)			0.84 (0.43 to 1.25)	<.001
	Fear of movement (TSK)			0.21 (0.11 to 0.31)	<.001
	Self-reported PA (BPAQ)			−0.54 (−1.09 to 0.00)	.04
	Work status				
	Employed part-time			−2.12 (−4.01 to −0.24)	.03
	Employed full-time			−1.62 (−3.13 to −0.10)	.04

Abbreviations: β, unstandardized B coefficient; BPAQ, Baecke Habitual Physical Activity Questionnaire; BDI, Beck Depression Inventory; NRS, numerical rating scale; PA, physical activity.

* Variable log-transformed before inclusion in the model.

findings support a cumulative negative effect of different elevated psychosocial factors (ie, fear of movement, depression, and catastrophizing) on long-term levels of pain and work disability.[43,44] Another proposed model is the avoidance-endurance model.[45] Proponents of this model argue that in addition to the fear-avoidance response, there is potentially another opposite pathway leading to the development and maintenance of chronic pain. In this alternate pathway, patients develop endurance-related responses, including physical overuse or overload instead of physical disuse as the main mediators. Further research is needed to test these new models of behavior.

Study limitations

A limitation of this study is the cross-sectional design, which gives limited information about causality. In addition, we have focused

on only 1 fear-related construct. Given that a recent study[46] has questioned whether the TSK should be described as a measure of fear of movement/(re)injury, future studies should test the association of physical activity measures with other fear-related constructs, such as pain anxiety, fear-avoidance beliefs, and catastrophizing.

Conclusions

Fear of movement is not associated with physical activity levels in patients with chronic LBP. The lack of association was found regardless of the physical activity assessment method used, accelerometry, or self-reported questionnaires. In accordance with previous studies, fear of movement was associated with disability. Future studies are needed to fully understand the role of fear of movement, and its interaction with other psychological factors, in the development and persistence of pain-related disability.

Suppliers

a. Triaxial accelerometer; ActiGraph, LLC.
b. SPSS version 20.0; IBM Corp.

Keywords

Activities of daily living; Fear; Low back pain; Motor activity; Rehabilitation

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