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EDITED BY
Antonio Caputi,
University Hospital "Policlinico" of Bari, Italy

REVIEWED BY
Eleuterio A. Sánchez Romero,
European University of Madrid, Spain
Jorge Gutiérrez Arroyo,
University of León, Spain

*CORRESPONDENCE
Pablo Bellosta-López
✉ pbellosta@usj.es

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Cross-cultural adaptation and validation of the Spanish version of the Prevent for Work questionnaire

Julia Blasco-Abadía[1], Pablo Bellosta-López[1]*, Víctor Doménech-García[1], Thorvaldur Skuli Palsson[2], Steffan Wittrup McPhee Christensen[3,4], Morten Hoegh[3], Pedro Berjano[5] and Francesco Langella[5]

[1]Facultad de Ciencias de la Salud, Universidad San Jorge, Zaragoza, Spain, [2]Department of Physiotherapy and Occupational Therapy, Aalborg University Hospital, Aalborg, Denmark, [3]Department of Health Science and Technology, Aalborg University, Aalborg, Denmark, [4]Department of Physiotherapy, University College of Northern Denmark, Aalborg, Denmark, [5]Department of GSpine4, IRCCS Ospedale Galeazzi-Sant'Ambrogio, Milan, Italy

Background: Musculoskeletal pain represents an increase in medical expenses due to disability and decreased quality of life among workers. Various biopsychosocial factors contribute to the development of persistent and disabling musculoskeletal pain. The Prevent for Work questionnaire (P4Wq) intended to analyze these factors. In this study, the original Italian version of the P4Wq was translated and culturally adapted to Spanish. Moreover, the psychometric properties were evaluated among Spanish workers with and without recent history of disabling spinal pain.

Methods: The first phase consisted of a forward-and-backward translation process and evaluating the face-validity of the questionnaire among 30 Spanish workers. The second phase involved 153 Spanish workers who completed the P4Wq, Oswestry Disability Index (ODI), and EQ-5D-5L questionnaires. Finally, 50 Spanish workers completed the P4Wq 2 weeks later to evaluate test–retest reliability and measurement error.

Results: Minor changes were made after the forward-and-backward translation process, which ensured that the Spanish versions was face-valid. The P4Wq demonstrated acceptable internal consistency for Spanish version (Cronbach's alpha: 0.91), a moderate negative association with the indicator of quality of life ($\rho < -0.39$; $p = 0.001$) and moderate positive association with the disability index ($\rho > 0.46$; $p = 0.001$). Furthermore, the P4Wq showed good to excellent item response stability (weighted kappa = 0.75–0.96) and good for the total score (ICC = 0.98).

Conclusion: The Spanish version of the P4Wq was face-valid and exhibited a similar structure as the original version. Additionally, good internal consistency and construct validity were found. This translated version of the questionnaire can therefore be considered acceptable for use by workers with and without history of disabling musculoskeletal pain.

KEYWORDS

musculoskeletal disorders, disabling pain, occupational setting, forward-backward translation, face validity, known-groups validity, reliability, minimal detectable change

1 Introduction

Musculoskeletal (MSK) disorders are the leading causes of disability and functional limitations in daily life and work participation worldwide (1). The impact on public health is considerable (2), requiring new ways of managing these conditions (3).

Pain is the cardinal symptom of MSK disorders and represents a challenge in occupational settings, serving as primary reason for increased medical expenditures tied to disability and compromised quality of life of workers (4). In a European context, MSK pain is responsible for more than half of work-absenteeism (5). This negative effect demonstrates that the repercussions of MSK pain extend beyond individual well-being, bearing significant economic consequences for employees, employers, and society at large (5, 6).

Multiple factors such as older age, unhealthy lifestyle, compromised mental health, comorbidities, and the presence of MSK symptoms contribute to the development and persistence of MSK pain, limiting daily activities and work capacity (3). There are also risk factors for MSK pain specific to the occupational setting (7), including physical work demands such as manual handling or awkward postures, as well as organizational factors related to an unhelpful workplace design, and poor job satisfaction (8). The interconnection of these factors underscores the multifaceted nature of work-related MSK pain and emphasizes the importance of a broad assessment of this condition.

Identifying modifiable risk factors is key to estimate the likely trajectory of a health condition, thus aiding healthcare professionals in making informed management decisions (9, 10). Moreover, an early identification of potential risk factors can aid in preventing the onset and persistence of chronic MSK pain (10, 11). While previous research has predominantly explored the correlation between self-reported work ability and return to work in rehabilitation settings, there is a urgent need for tools that comprehensively assess biopsychosocial factors associated with MSK pain in the occupational settings (12). Accurate and transparent information regarding workers' conditions is essential for devising effective rehabilitation strategies (13, 14) and facilitating a successful return to work (15–17). The Prevent for Work questionnaire (P4Wq) builds on MSK pain within a biopsychosocial framework (18).

The P4Wq was developed under a European initiative between Italian, Spanish and Danish institutions aiming to develop a self-administered questionnaire that assesses factors related to the development of work-related MSK pain (18). While its adoption can facilitate a comprehensive understanding of the multifaceted nature of work-related MSK pain and aid in devising effective prevention and management, objective data on its adequate psychometric properties only exist in an Italian working population (19). The original Italian version provided a concise measure of risk factors for work-related back disorders that have demonstrated good content validity, construct validity, internal consistency reliability and high face validity. To expand this to other languages, it is important to translate and culturally adapt the questionnaire to other languages. In the future, this will allow for a comparison of work-related MSK pain in other populations of workers from different European countries.

This study aimed to cross-culturally adapt the original Italian version of the P4Wq into European-Spanish, as well as evaluate its psychometric properties (i.e., face validity, structural validity, internal consistency, construct validity, floor and ceiling effects, reliability, and measurement error) in workers.

2 Materials and methods

2.1 Study design

This study was set up in two phases: (i) a cross-cultural adaptation phase and (ii) a validation phase. The present study was conducted in consensus with the COnsensus-based Standards for the selection of health status Measurement INstruments (COSMIN) study design checklist (20). The study was conducted per the Helsinki Declaration and the study protocol was approved by the ethics committee at San Jorge University (N01-20/21). All participants provided informed consent before taking part in the study.

2.2 Study settings and participants

Participants were among active workers recruited in February–May 2021 from institutions in the autonomous community of Aragon (Spain), as part of the Prevent4Work project (4). Inclusion criteria established were (a) age between 18 and 65 years old, (b) ability to read and speak Spanish, and (c) one or more year of employment in the current position. People with (a) previous history of major surgery for a MSK disorder, (b) diagnosis of any persistent painful condition of specific pathology (e.g., rheumatoid arthritis, fibromyalgia, spinal stenosis), (c) habitual intake of antidepressants, and (d) medial history involving cancer, brain or spinal cord injury, or psychiatric and neurological disorders, were excluded. Notwithstanding the prior briefing about the criteria, each participant completed a self-reported checklist at the initiation of the questionnaire series to verify their compliance with the outlined selection criteria.

2.3 Cross-cultural adaptation

The translation and cross-cultural adaption was done following forward-and back-translation (21) from Italian into European-Spanish. This process involved two proficient translators, one with a medical background, who were native speakers of European-Spanish. They independently generated two translations of the original questionnaire from Italian to European-Spanish. Subsequently, these translations were compared and analyzed to detect any inconsistencies between them. These inconsistencies in the translations were discussed until a consensus on the final version was reached. In case of disagreements, a member of the research group (PB-L) was consulted to reach an agreement. Following this, a backward translation of the synthesized version was carried out from Spanish back to Italian by two independent native Italian translators, who were not previously familiar with the original Italian version of the questionnaire. Subsequently, an expert committee composed of the authors, convened to assess the final version of the translated questionnaire. The committee reviewed the entire forward-and back-translation process, specifically examining any potential inconsistencies and ensuring that the questions were comprehensible across the target populations.

2.4 Pilot study for face-validity

After the creation of the prefinal versions of the P4Wq, a group of thirty volunteer workers participated in pilot testing to assess its face validity. Each participant completed the questionnaire and subsequently underwent an interview, where the focus was on examining their understanding of each questionnaire item and the available responses. To quantify the face validity, two distinct 5-point Likert scales were employed to evaluate the clarity and comprehensibility of the questionnaire items. The face validity index was determined as the average value of the Likert scales, converted to a scale ranging from 0 (total lack of clarity or comprehension) to 100 (complete clarity or comprehension) (22); with a score > 80% considered satisfactory (23). Furthermore, completion time was registered.

2.5 Validity study

Participants completed a paper version of the Spanish version of the P4Wq, a questionnaire designed to assesses biopsychosocial factors related to the development of work-related MSK pain. The P4Wq includes sociodemographic data, disabling pain prevalence, and potential risk factors such as job satisfaction, mental stress, kinesiophobia, catastrophizing, and physical stress, with responses scored on a 5-point Likert scale where higher scores indicate greater risk. The Spanish version of the EuroQol Five-Dimensions Five-Levels levels (EQ-5D-5L) (24, 25) was used to evaluate general health status across five dimensions (mobility, self-care, usual activity, pain-discomfort, and anxiety-depression) using a 5-point scale, alongside a visual analogue scale (EQ-VAS) for overall health where higher scores represent better health. Lastly, the Oswestry Disability Index (ODI) (26, 27) was used to measure disability related to spinal disorders through 10 dimensions of daily activities, scored on a 6-point scale, with higher scores reflecting greater levels of disability. A detailed description of the questionnaires is provided in Supplementary Table A.

A subset of 50 individuals was randomly chosen to undergo a test–retest assessment of the Spanish version of the P4Wq after a 2-week interval, aimed at evaluating the test–retest reliability and measurement error. During this stage, all participants were asked to fill out a checklist to ensure the consistency of their responses over the interim period. This checklist included questions regarding the occurrence of any new episodes of disabling MSK pain, instances of sick leave, or the reception of physical or psychological treatment.

2.6 Hypotheses testing for construct validity

As contemplated in the COSMIN recommendations, construct validity was assessed by means of convergent validity and known-groups validity (20). Following a similar methodology to the original development of the P4Wq to evaluate convergent validity, we hypothesized that a significant moderate correlation would exist between the total scores of the Spanish version of the P4Wq, and existing measures of quality of life (i.e., the visual analogue scale of the EQ-5D-5L) and disability (i.e., the ODI). Furthermore, as the P4Wq was intended to measure risk factors for work-related MSK disorders in the spine (neck, thoracic, and low back regions), data from participants reporting 12 months prevalence of disabling spinal MSK pain were extracted for further analysis (i.e., disabling spinal pain vs. no disabling spinal pain). Disabling pain refers to pain that has limited daily activities (28). We hypothesized that workers with a history of disabling spinal pain would present higher scores in the P4Work compared to those workers classified as having no disabling spinal pain.

2.7 Sample size

The COSMIN recommendations determined the sample size for calculating the confirmatory factor analysis, which is considered an excellent sample size when it consists of 7 times the number of items (i.e., 140 participants) (20). However, after accounting for up to 10% of ineligible questionnaires, a sample size of 154 participants was intended. In fact, a sample size higher or equal to 100 participants was considered sufficient for testing internal consistency, construct validity or test–retest reliability, while was considered adequate if higher or equal to 50 participants (20).

2.8 Statistical analysis

Statistical analyses were performed using SPSS v.28 (IBM, Chicago, IL, USA), except for the confirmatory factor analysis, using STATA v.18.0 (StataCorp, College Station, TX, USA). Participant data containing blank items in the P4Wq were excluded from the analysis. Mardia's test was used to determine whether P4Wq data were multivariate normally distributed. The results were expressed as mean (± standard deviation (SD)), and/or 95% confidence intervals (CI). The level of significance was set at p-value <0.05. The detailed description of the statistical tests used in the present study is depicted in Table 1, for: (1) structural validity (29–33); (2) internal consistency (34); (3) construct validity by means of convergent validity (35), and known groups validity (36); (4) test–retest reliability (37, 38); (5) measurement error (39); and (6) floor and ceiling effects (40). Subgroup analyses were conducted for sex, age category (<45 years or ≥ 45 years) and work type (office, healthcare, blue-collar) using linear regression models and independent T-Student or ANOVA with Bonferroni correction as *post hoc* test.

3 Results

3.1 Cross-cultural adaptation and face-validity processes

There were no considerable differences between the forward translations of the original Italian version of the P4Wq into European-Spanish, except for minor variations in word order that did not alter the meaning of the items. Similarly, there were no major discrepancies

TABLE 1 Statistical tests used.

Psychometric property	Data	Statistical test	Purpose	Criteria for interpretation
Structural validity	P4Wq 20 items	Bartlett's test of sphericity	To assess the adequate composition of the sample	Adequate if $p < 0.05$
		Kaiser-Meyer-Olkin		Adequate if KMO > 0.7
		Confirmatory factor analysis[#]	To assess the dimensionality of the questionnaire	Items with factor loadings >0.4 were considered acceptable.
		Goodness of fit statistics: • SRMR. • RMSEA. • CFI. • TLI.	To evaluate how well the proposed model fits the observed data and to assess the adequacy of the chosen dimensional structure	• SRMR: <0.08 "good fit," >0.08 "poor fit." • RMSEA: <0.08 "good fit," 0.08 to 0.1 "adequate fit," >0.1 "poor fit." • CFI&TLI: >0.9 "good fit," 0.9 to 0.8 "adequate fit," <0.8 "poor fit."
Internal consistency	P4Wq 20 items	Cronbach's α	To assess the accuracy and consistency of the questionnaire	• Acceptable if $\alpha > 0.7$
		Cronbach's α if item deleted		• Analyze variations from to the original α value
		Corrected item-total correlation	To assess the correlation between the item score and the scale score minus the contribution of that item to the score	• Acceptable if $r > 0.3$
Construct validity – Convergent validity	P4Wq total score, EQ-VAS, ODI	Pearson's correlation	To evaluate the correlation between P4Wq total score with EQ-VAS & ODI	• Pearson's coefficient p: >0.70 "strong," 0.40 to 0.69 "moderate," 0.10 to 0.39 "weak," <0.10 "negligible."
Construct validity – Known-groups validity	P4Wq total score and subdomains	Student T-Tests	To explore the differences in P4Wq total scores and subdomains sub-scores.	Differences between groups are present if $p < 0.05$.
		Cohen's d	To assess the effects sizes of group differences	• d: >0.8 "large effect," 0.79 to 0.5 "moderate effect," <0.49 "small effect"
Test–retest reliability	P4Wq total score and subdomains	Weighted Kappa correlation coefficient of agreement	To assess item response stability	• k: 0.81 to 1.0 "excellent," 0.61 to 0.80 "good," 0.41 to 0.60 "moderate," 0.21 to 0.40 "fair," <0.20 "poor."
		ICC with a 95% confidence interval[§]	To assess the reliability of the total score and subdomains sub-scores	• ICC: >0.90 "excellent," 0.90 to 0.75 "good," 0.75 to 0.50 "moderate," <0.50 "poor"
Measurement error	P4Wq total score and subdomains	SEM	To evaluate the variation of the sample mean	NA
		MDC_{95}	To calculate the smallest change beyond the margin of error for research purposes	NA
		MDC_{90}	To calculate the smallest change in ordinary clinical perspective	NA
Floor and ceiling effects	P4Wq total score	Frequency distribution of the total scores	To indicate whether the instrument is able to accurately measure the full range of the construct being assessed	Absence of floor and ceiling effects with a cut-off point of up to 15% within the highest or lowest scores

SRMR, Standardized Root Mean Square Residual; RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; TLI, Tucker-Lewis index; SEM, standard error of the mean; ICC, intraclass correlation coefficient; MDC, minimum detectable change.
[#]Confirmatory factor analysis using the robust maximum likelihood estimation with Satorra–Bentler adjustments.
[§]Intraclass correlation coefficient with a 95% confidence interval following a two-way mixed effects model with absolute agreement.

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between the backward translations, preserving the meaning of the original version.

Thirty workers in Spain (40.7 ± 9.2 years, 50% females) completed the prefinal version of the P4Wq. The median time to fill the P4Wq was 4 min [IQR 3–5] for the Spanish version. The face validity index was 93.8%. No clarity and comprehension difficulties were reported for the Spanish with all items scored 4 or 5 (i.e., clear or very clear). No further changes were implemented, and the final version of the P4Wq in European-Spanish is presented in the Supplementary material.

3.2 Participants characteristics for the validity study

Table 2 presents the sociodemographic and questionnaire scores of 153 out of 154 workers in Spain who completed the Spanish version of the P4W. One worker, for unknown reasons, did not complete all the items and was removed from the analysis. A total of 119 (77%) workers reported disabling musculoskeletal pain in the spinal region (i.e., neck, thoracic, or low back) in the previous 12 months, with a median pain intensity of 4 out of 10 [IQR 3–5].

3.3 Structural validity

Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity demonstrated adequate sample composition for the questionnaire (KMO = 0.872; $p < 0.001$) versions. The confirmatory factor analysis showed a four-factor model with almost all factor loadings greater than 0.40, confirming the biopsychosocial dimensions of the questionnaire with the 4 pre-established domains. The factor loadings of the different items are presented in Table 3.

All the goodness-of-fit statistics indicated a 'good fit' for the Spanish version of the P4Wq (Standardized Root Mean Square Residual, SRMR = 0.074; Root Mean Square Error of Approximation, RMSEA = 0.07; Comparative Fit Index, CFI = 0.93; Tucker–Lewis Index, TLI = 0.92).

3.4 Internal consistency

The internal consistency for the total score of the P4Wq was acceptable according to the Cronbach's alpha values ($\alpha = 0.91$). Similarly, acceptable internal consistency was found for the domains sub-scores ($\alpha_{JSS} = 0.90$; $\alpha_{MSS} = 0.85$; $\alpha_{KCS} = 0.91$; $\alpha_{PSS} = 0.88$). Corrected item-total correlations and Cronbach's α if item deleted was calculated are presented in Table 3.

3.5 Convergent validity

The P4Wq total score showed a moderate negative association with the indicator of quality of life (i.e., EQ-VAS) ($\rho = -0.43$; $p < 0.001$) and moderate positive association with the disability index (i.e., ODI) ($\rho = 0.46$; $p < 0.001$). Figure 1 represents the score distribution and between variables association.

TABLE 2 Characteristics of the participants.

Age (years)	41.4 ± 11.6
Female *n* (%)	96 (63%)
Weight *(kg)*	68.7 ± 12.7
Height *(cm)*	168.5 ± 8.4
Body Mass Index (kg/m^2)	24.1 ± 3.8
Current position (years)	9.4 ± 7.6
Work type *n* (%)	
Healthcare workers	56 (37%)
Office workers	42 (27%)
Blue-collar workers	55 (36%)
Disabling MSK pain in the last 12 months *n* (%)	
Neck	82 (54%)
Shoulders	66 (43%)
Elbow	21 (14%)
Wrist/Hand	44 (29%)
Dorsal region	41 (27%)
Low back	82 (54%)
Hip	30 (20%)
Knee	47 (31%)
Ankle/Foot	19 (12%)
Regions affected per worker	2 [1–4]
EQ-5D-5L	
General Health – VAS (0/100)	81.3 ± 16.2
Mobility (0/4)	0.13 ± 0.34
Self-care (0/4)	0.03 ± 0.22
Usual activity (0/4)	0.19 ± 0.42
Pain-Discomfort (0/4)	0.75 ± 0.70
Anxiety-Depression (0/4)	0.28 ± 0.53
Oswestry Disability Index	
Total score (0/100)	8.1 ± 7.9
P4Wq	
Total score (0/80)	26.8 ± 11.8
JSS (0/16)	4.7 ± 3.0
MSS (0/24)	7.8 ± 4.2
KCS (0/16)	5.8 ± 4.1
PSS (0/24)	8.6 ± 5.7

Data are expressed in median ± standard deviation unless otherwise specified; MSK, muskuloskeletal; P4Wq, Prevent4Work questionnaire; JSS, job satisfaction subdomain; MSS, mental stress subdomain; KCS, kinesiophobia & catastrophizing subdomain; PSS, physical stress subdomain; VAS, visual analogue scale of the EuroQol questionnaire for self-percieved health status.

3.6 Known-groups validity

For the Spanish workers, the "disabling spinal pain" group showed higher total score (mean difference = 12.1; $p < 0.001$; $d = 1.10$) and the subscales of job satisfaction (mean

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TABLE 3 Confirmatory factor analysis, internal consistency indicators, and item's reliability of the Spanish version of the P4Wq.

Items label	Weighted Kappa (n = 50)	Corrected item–total correlation	Cronbach's alpha if item deleted	Components			
				JSS	MSS	KCS	PSS
1-Does your job give you the opportunity to improve your skills?	0.85	0.45	0.91	0.64			
2-Do you feel motivated by and involved in your work?	0.81	0.54	0.91	0.82			
3-Is there a satisfactory level of cooperation with your colleagues?	0.78	0.65	0.90	0.90			
4-Are you satisfied with the people you work with?	0.77	0.64	0.90	0.94			
5-In the last 4 weeks, have you felt calm and peaceful?	0.76	0.49	0.91		0.60		
6-I find it difficult to relax and enjoy myself.	0.75	0.50	0.91		0.66		
7-I find it difficult to deal with other people.	0.90	0.56	0.90		0.63		
8-I find it difficult to feel happy.	0.84	0.51	0.91		0.69		
9-In the last 4 weeks, have you had problems concentrating?	0.75	0.47	0.91		0.77		
10-In the last 4 weeks, have you found it difficult to think clearly?	0.82	0.54	0.91		0.81		
11-I avoid unnecessary movements to prevent the pain from getting worse.	0.79	0.49	0.91			0.70	
12-I fear the pain might increase.	0.84	0.64	0.90			0.81	
13-I feel as if I could no longer bear the pain.	0.81	0.68	0.90			0.94	
14-The pain is terrible, and I think it will never get better.	0.83	0.66	0.90			0.90	
15-Does your job involve having to lift heavy weights (over 5 kg)?	0.96	0.39	0.91				0.63
16-Does your job involve having to lift loads from an uncomfortable position?	0.96	0.65	0.90				0.84
17-Does your job involve having to simultaneously bend and rotate your trunk?	0.82	0.58	0.90				0.76
18-Does your job involve having to lift your arms above the shoulder height?	0.91	0.43	0.91				0.65
19-Do you have to keep uncomfortable postures at work?	0.90	0.66	0.90				0.83
20-Do uncomfortable postures at work prevent you from applying enough strength?	0.88	0.65	0.90				0.81

N = 153. P4Wq, Prevent4Work questionnaire; JSS, job satisfaction subdomain; MSS, mental stress subdomain; KCS, kinesiophobia & catastrophizing subdomain; PSS, physical stress subdomain. Weighted kappa values represent items' reliability after a 2-week period. Component values represent items' weights after the robust maximum likelihood estimation with Satorra-Bentler adjustments.

difference$_{JSS}$ = 3.0; $p < 0.001$; $d = 0.80$), mental stress (mean difference$_{MSS}$ = 3.7; $p < 0.001$; $d = 0.90$), kinesiophobia & catastrophizing (mean difference$_{KCS}$ = 2.8; $p = 0.001$; $d = 0.70$), and physical stress (mean difference$_{PSS}$ = 2.5; $p = 0.022$; $d = 0.50$) domains compared with the "no disabling spinal pain" group. Descriptive statistics depicted by the group are presented in Table 4.

3.7 Floor and ceiling effects

The analyses of the distribution of frequencies regarding the total score indicated an absence of floor or ceiling effects, presented in Figure 1. No responders achieved the highest or lowest scores in the total score.

3.8 Test–retest reliability and error of measurement

Test–retest reliability and error of measurement were tested. More specifically, fifty workers (36.8 ± 10.1, 64% females) completed the test–retest after a two-week period (14 ± 2 days).

The test–retest reliability was good to excellent for all items with the weighted Kappa coefficients ranging from 0.75 to 0.96 as presented in Table 3.

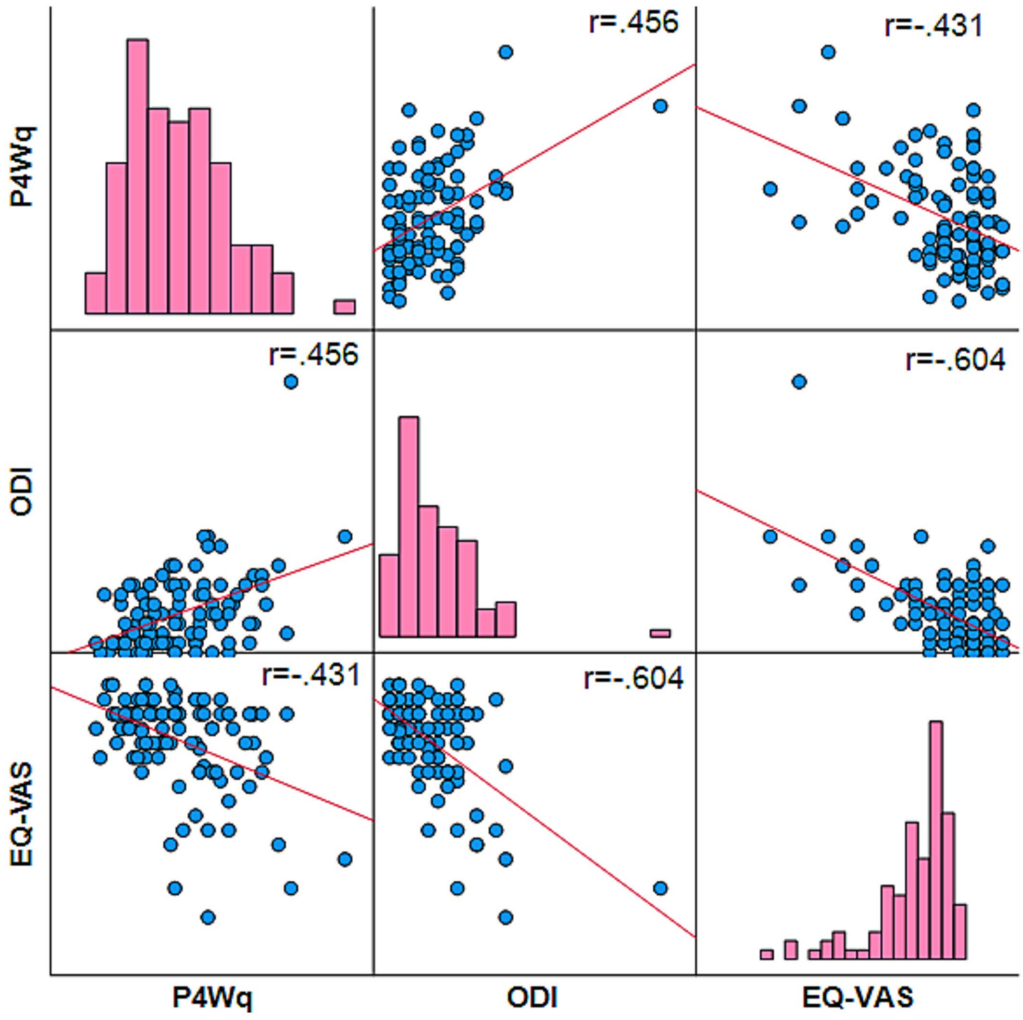

FIGURE 1
Scatter plots and histograms for the P4Wq, ODI, and EQ-VAS. P4Wq, Prevent for Work Questionnaire; ODI, the Oswestry Disability Index; EQ-VAS, visual analogue scale for the general health status of the EuroQol questionnaire. The associations were statistically significant for all variables after Pearson's correlation test (two-tailed, $p \leq 0.001$).

TABLE 4 P4Wq scores comparisons between participants with and without history of disabling spinal pain in the last 12 months.

	Disabling spinal pain (n = 119)	No disabling spinal pain (n = 34)	p value
Total score (0/80)	33.3 ± 14.2	21.2 ± 8.9	<0.001
JSS (0/16)	6.7 ± 4.2	3.6 ± 2.9	<0.001
MSS (0/24)	9.9 ± 4.8	6.2 ± 3.5	<0.001
KCS (0/16)	6.5 ± 4.3	3.7 ± 4.1	0.001
PSS (0/24)	10.2 ± 5.8	7.6 ± 5.0	0.022

Data are expressed in median ± standard deviation. P4Wq, Prevent4Work questionnaire; JSS, job satisfaction subdomain; MSS, mental stress subdomain; KCS, kinesiophobia & catastrophizing subdomain; PSS, physical stress subdomain. The "disabling spinal pain" group consisted of workers reporting disabling musculoskeletal pain in the last 12 months in the spinal region (i.e., neck, dorsal, and/or low back region). p values represent significance level after independent samples T-test.

The test–retest reliability was 'good' for the total score (ICC = 0.98) and JSS (ICC = 0.91), MSS (ICC = 0.94), KCS (ICC = 0.96), and PSS (ICC = 0.98) domains. The specific values of the ICC (3,1) with 95% confidence interval, SEM, MDC_{95} and MDC_{90} for the total scores and domains sub-scores of the P4Wq are presented in Table 5.

3.9 Subgroups analysis

Subgroups analysis for sex, age categories, and work type are detailed in the Supplementary material. All subgroups showed comparable levels of adequate internal consistency and convergent validity.

The linear regression models showed that the work type was associated with the P4Work total score ($p = 0.003$), and the domains of KCS ($p = 0.004$) and PSS ($p < 0.001$). The linear regression models showed no associations with sex or age categories. Specifically, office workers

TABLE 5 Test–retest reliability and measurement error indicators.

	ICC $_{(3,1)}$ (95% CI)	SEM		MDC_{95}		MDC_{90}	
		raw score	Cohen's *d*	raw score	Cohen's *d*	raw score	Cohen's *d*
Total score (0/80)	0.98 (0.97–0.99)	1.7	0.14	4.6	0.39	3.9	0.33
JSS (0/16)	0.91 (0.84–0.95)	0.9	0.30	2.5	0.83	2.1	0.70
MSS (0/24)	0.94 (0.90–0.97)	1.0	0.23	2.9	0.69	2.4	0.57
KCS (0/16)	0.96 (0.94–0.98)	0.8	0.19	2.3	0.56	1.9	0.46
PSS (0/24)	0.98 (0.96–0.99)	0.8	0.14	2.2	0.39	1.9	0.33

$ICC_{(3,1)}$: intraclass correlation coefficient for a two-way mixed effects model with absolute agreement; CI, confidence interval; SEM, standard error of measurement; MDC_{95}, minimum detectable change at 95% of confidence; MDC_{90}, minimum detectable change at 90% of confidence; JSS, job satisfaction subdomain; MSS, mental stress subdomain; KCS, kinesiophobia & catastrophizing subdomain; PSS, physical stress subdomain.

showed lower total P4Work score and PSS domain than healthcare workers and blue-collar workers ($p < 0.001$), while blue-collar workers showed higher scores in the KCS domain than office workers ($p = 0.010$).

4 Discussion

The objective of this study was to translate and culturally adapt the original Italian version of the P4Wq into European-Spanish, and subsequently assess its psychometric properties in a working population. This version demonstrated good face validity, structural validity, internal consistency, construct validity, known-groups validity, floor and ceiling effects, and test–retest reliability.

4.1 Cross-cultural adaptation and face-validity processes

The translation of the P4Wq underwent a rigorous and systematic process to ensure semantic equivalence with the original version in Italian. Spanish participants demonstrated adequate interpretation and understanding of all questionnaire items, with no items requiring special attention. Minor discrepancies encountered in the forward-and backward-translation process, primarily related to the use of verbs and synonymous words, are considered normal in translations and cultural adaptations of questionnaires (41) and were resolved by the group.

4.2 Structural validity and internal consistency

The four-factor solution for the Spanish version closely resembled the results obtained in the original P4Wq version, in which the four subdomains (JSS, MSS, KCS, and PSS) comprehensively assess the worker from a biopsychosocial perspective (18, 19). Additionally, all goodness-of-fit statistics indicated a 'good fit' for the Spanish version.

Moreover, the internal consistency values, reflected by the Cronbach's α, resembled the original version for the total score ($\alpha = 0.89$) and domains sub-scores ($0.82 < \alpha < 0.91$) (19).

4.3 Construct validity and floor/ceiling effects

In line with the original version with Italian workers, the total scores of the Spanish version of P4Workq showed a moderate positive correlation with the ODI and a moderate negative correlation with the EQ-VAS. Based on the analysis in the sample of Spanish workers, the P4Wq appears to mitigate the floor effect observed in the ODI and the ceiling effect seen in the EQ-VAS (19). This result suggests a higher sensitivity of the P4Wq for classifying populations of active workers. Furthermore, the P4Wq offers promising ability to stratify differentiate between healthy workers with a history of disabling spinal pain, which could be predictive of future musculoskeletal pain events or long-term sick leave from work (42). Additionally, the differences in effect sizes between groups would be considered as moderate-large for the total score and most domain sub-scores, which were at or above the SEM. However, despite being statistically significant, the physical stress subdomain showed a lower discriminative ability between groups compared to the rest of the subdomains. These differences not only in the physical domain reinforces the biopsychosocial view of MSK pain, which extends beyond exclusively physical and ergonomic factors (18), which reinforces the P4Wq ability to capture the multifactorial nature of work-related pain.

4.4 Test–retest reliability and error of measurement

For the reliability results after 2 weeks, item response stability demonstrated good to excellent reliability for all items based on the weighted Kappa coefficients (43), comparable to the values obtained in the original version (19).

Notably, this study is the first to evaluate test–retest reliability for the P4Wq, finding a moderate to excellent reliability for both the total and domain sub-scores, and allowing the calculation of the SEM and the MDC to be considered in future studies. In this study, both the MDC_{90} and MDC_{95}, ranged between 4 to 5 points for the total score and between 2 to 3 points for the domain subscores, suggesting that the smallest detectable change would lie between 6 to 13% of the maximum scores.

4.5 Clinical implications

The validation of the P4Wq into Spanish extends its utility beyond the original Italian population, offering a reliable and culturally adapted tool for Spanish workers. Given the multifaceted nature of work-related MSK pain, this questionnaire allows healthcare professionals to assess key factors contributing to MSK pain within a biopsychosocial framework. For example, the questionnaire allows for early identification of workers at risk of developing pain indifferent activity sectors (e.g., office workers,

healthcare workers, blue-collar workers). Moreover, the Spanish version of the P4Wq supports cross-cultural research initiatives and the development of evidence-based occupational policies to reduce MSK pain and improve workers' health.

4.6 Limitations

The primary limitation of the Spanish version of the P4Wq was the exclusion of workers on sick leave from the study sample, restricting the generalizability of results to the active working population. Given the association between negative pain beliefs and early withdrawal from the labor market (44), future studies should assess the psychometric properties of the Spanish version of the P4Wq in samples of workers on sick leave, and also in workers with self-reported chronic spinal pain. More importantly, a broad implementation of the questionnaire in working population would be valuable as this might help understanding whether the questionnaire can identify workers at risk of developing debilitating MSK pain. Future evaluations should thus include responsiveness and predictive capacity for new occurrences of MSK pain or long-term sick leave (42).

5 Conclusion

In conclusion, the Spanish version of the P4Wq was face-valid and exhibited a similar structure to the original version, as well as good internal consistency and construct validity. Furthermore, the Spanish version exhibited excellent test–retest reliability and, for the first time, provided values for measurement error. Additionally, it is suitable for use within the active working population and are valuable tools for a brief yet comprehensive biopsychosocial evaluation of factors related to the development of work-related MSK pain.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Research Ethics Committee at San Jorge University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JB-A: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. PB-L: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. VD-G: Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – review & editing. TP: Conceptualization, Methodology, Supervision, Writing – review & editing. SC: Conceptualization, Methodology, Writing – review & editing. MH: Conceptualization, Methodology, Writing – review & editing. PB: Conceptualization, Investigation, Methodology, Writing – review & editing. FL: Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2024.1453492/full#supplementary-material

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