

Development of the Avoidance Daily Activities Photo Scale for Patients With Shoulder Pain

Citation for published version (APA):

Ansanello, W., Reis, F. J. J., Tozzo, M. C., Zatiti, S. C. A., Meulders, A., Vlaeyen, J. W. S., & de Oliveira, A. S. (2022). Development of the Avoidance Daily Activities Photo Scale for Patients With Shoulder Pain. *Physical Therapy*, 102(2), [pzab268]. <https://doi.org/10.1093/ptj/pzab268>

Document status and date:

Published: 01/02/2022

DOI:

[10.1093/ptj/pzab268](https://doi.org/10.1093/ptj/pzab268)

Document Version:

Publisher's PDF, also known as Version of record

Document license:

Taverne

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license


Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Development of the Avoidance Daily Activities Photo Scale for Patients With Shoulder Pain

Walter Ansanello, PT, ME¹, Felipe José Jandre dos Reis, PT, PhD², Marcela Camargo Tozzo, PT¹, Salomão Chade Assan Zatiti, MD, PhD³, Ann Meulders, PhD⁴, Johan W.S. Vlaeyen, PhD^{5,6}, Anamaria Siriani de Oliveira , PT, PhD^{1,*}

¹Department of Health Sciences, Ribeirão Preto Medical School, University of São Paulo, Ribeirão Preto, São Paulo, Brazil

²Department of Physiotherapy, Federal Institute of Rio de Janeiro, Rio de Janeiro, Brazil

³Department of Orthopaedic Surgery, Hospital Especializado de Ribeirão Preto, Ribeirão Preto, São Paulo, Brazil

⁴Department of Medical, Clinical and Experimental Psychology, University of Maastricht, Maastricht, the Netherlands

⁵Research Group Health Psychology, KU Leuven, Leuven, Belgium

⁶Experimental Health Psychology, Department of Clinical Psychological Science, Maastricht University, Maastricht, the Netherlands

*Address all correspondence to Dr Siriani de Oliveira: siriani@fmrp.usp.br

Abstract

Objectives. The purpose of this study was to develop the Avoidance of Daily Activities Photo Scale (ADAP Shoulder Scale) to measure shoulder pain–related avoidance behavior in patients with shoulder pain and evaluate and report the structural validity and internal consistency of the scale.

Methods. Potential daily activities involving the shoulder were selected from the activities and participation domain of the International Classification of Functioning, Disability and Health. The selected activities were presented to an expert panel, health care professionals, and patients with shoulder pain with the question “How much do you think it is important to ask patients with shoulder pain about this activity?” Activities attaining a content validity index (CVI) ≥ 0.8 were represented using a digitally colored photograph. Activity photographs were evaluated by health care professionals and patients with shoulder pain. Photographs with a CVI ≥ 0.8 were included in the scale. To evaluate structural validity and internal consistency of the scale, exploratory factor analysis was performed to determine the presence of any scale domain. Cronbach alpha was calculated to indicate the internal consistency of each domain.

Results. Of the 107 preselected activities, 21 attained a CVI ≥ 0.8 . Eighteen photographs (CVI ≥ 0.8) were included in the scale after being analyzed by 120 health care professionals and 50 patients with shoulder pain. Exploratory factor analysis (N = 156) showed that the ADAP Shoulder Scale consists of 3 domains: free movement, high effort, and self-care. The internal consistencies of the domains were 0.92, 0.89, and 0.92, respectively.

Conclusion. The ADAP Shoulder Scale included 15 photographs distributed in 3 domains. All domains had a high internal consistency. The scale is easily applicable, well understood, and relevant for shoulder pain.

Impact. The ADAP Shoulder Scale can be used to rate shoulder pain–related avoidance behaviors.

Keywords: Emotions, Fear, Rehabilitation, Reproducibility of Results, Shoulder Pain, Validation Studies

Introduction

Shoulder pain is a prevalent musculoskeletal complaint^{1,2} that leads to increased individual suffering and disability as well as a significant socio-economic impact.³ Up to 41% to 46.0% individuals do not fully recover after their first pain episode.^{3,4} Patients commonly view pain as an accurate representation of tissue damage rather a multidimensional and complex experience.⁵ Misconceptions about pain contribute to unhelpful beliefs, pain and movement-related fear, avoidance behaviors, anxiety, and stress.^{6–9} Current theories of pain-related fear and avoidance behaviors propose that pain may be interpreted as threatening bodily integrity, which may result in patients prioritizing pain control over achieving valued life goals,^{10–12} leading to a vicious cycle involving disuse/disability/depression, increased pain, catastrophizing, hypervigilance, and avoidance/escape behavior.^{12–17} Pain-related fear and avoidance behavior have been associated with several clinical conditions involving the shoulder complex, such as shoulder atraumatic pain,^{7,8} postoperative pain,^{6,9} complex regional pain syndrome,¹⁸ and breast cancer-associated pain.¹⁹

Pain-related fear and avoidance in patients with shoulder pain have been measured using generic self-reported questionnaires such as the Tampa Scale for Kinesiophobia,²⁰ the Fear Avoidance Beliefs Questionnaire,²¹ and the Fear of Pain Questionnaire.²² These questionnaires were initially developed for patients with low back pain^{20,21} or for a broader group of patients with pain,²² although pain catastrophizing and pain-related fear are found to be significantly associated with high shoulder pain levels and disability.⁸ An alternative to fill this gap is to develop an instrument that measures pain-related avoidance using photographs representing daily activities, such as The Photograph Series of Daily Activities—Short Electronic Version (PHODA-SeV) for patients with low back pain²³ and the Pictorial Fear of Activity Scale-Cervical (PFAcS-C).²⁴ The development of a specific instrument to assess avoidance behaviors in patients with shoulder pain may be useful in clinical practice. This instrument could contribute in identifying daily activities disabilities due to shoulder pain and helping clinicians in treatment prescription such as exposure-based interventions. In the present study, we aimed to develop a photographic scale with daily activities involving the shoulder to investigate avoidance behavior due to pain in patients with shoulder pain. Moreover, the study also aimed to evaluate and report the structural validity and internal consistency of the developed scale.

Methods

Ethical Considerations and Study Design

The present study consisted of 2 phases: (1) development of the scale (content validity), and (2) assessment of structural validity and internal consistency. Phase 1 involved the inputs of an expert panel, health care professionals, and patients with chronic shoulder pain. Phase 2 involved the evaluation of patients with chronic shoulder pain. All volunteers agreed to participate and signed an informed consent form. The study was approved by the local ethics committee (CAAE: 79517717.0.0000.5414). Data were collected from January to December of 2019.

Sample Characteristics

University professors with theoretical and practical experience in the musculoskeletal rehabilitation of the upper limb, selected from various centers, comprised the expert panel. Panelists were professors with a health professional degree who had been involved in research and/or teaching for more than 10 years, had practical experience in treating patients with shoulder pain, and had intermediate or advanced level knowledge of the International Classification of Functionality, Disability and Health (ICF). Professors were selected by convenience based on their experience with the ICF. All professors were considered as expert because they contribute in the ICF field with publications or national training courses on the ICF.

The 2 groups of health professionals involved in this study were physiotherapists, occupational therapists, orthopedists, psychologists, and nurses recruited from local clinical centers and from all over the country through social networks in Brazil. The inclusion criteria for the health professionals were clinical experience in the treatment of patients with shoulder pain and basic knowledge of the ICF.

A total of 3 convenience samplings from patients with different musculoskeletal conditions and symptoms of shoulder pain were selected from public and private rehabilitation centers. The inclusion criteria were patients complaining of (1) shoulder pain of traumatic or non-traumatic origin, (2) for more than 3 months, and (3) aged >18 years. The exclusion criteria were the presence of neurological or rheumatological diseases, active local or systemic infections, and a history of tumors or severe visual impairment. In addition, we excluded patients with traumatic conditions awaiting surgery or who were oriented to restrict shoulder function to attend the typical postoperative tissue repair period or conservative trauma treatment. Sample characterization consisted of demographic data, symptom duration, and the level of disability and pain. The Shoulder Pain and Disability Index (SPADI) was used to describe the shoulder function and pain.²⁵

Phase 1: Development of the Scale (Content Validity)

The development of the scale followed the international guidelines for the development of new methods for evaluating patient-reported outcomes²⁶ and Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN).²⁷ The defined latent construct of the scale was shoulder pain-related avoidance behavior. The developmental process was composed of 2 steps: Step 1 involved the selection of daily activities based on the ICF Activities and Participation Domain, and Step 2 involved the evaluation of the photographic representations of selected daily activities. The development of the scale followed the reflective model, which means that the item response reflected 1 consequence of the construct (activity avoided), and the items were designed to be easily interpreted and tailored to the target population (shoulder pain).²⁶ The pilot test was performed before phase 2.

Step 1: Selection of Daily Activities Based on ICF

The aim of this step was to identify the daily activities from ICF's "Activities and Participation Domain" that should be assessed in patients with chronic shoulder pain. This domain

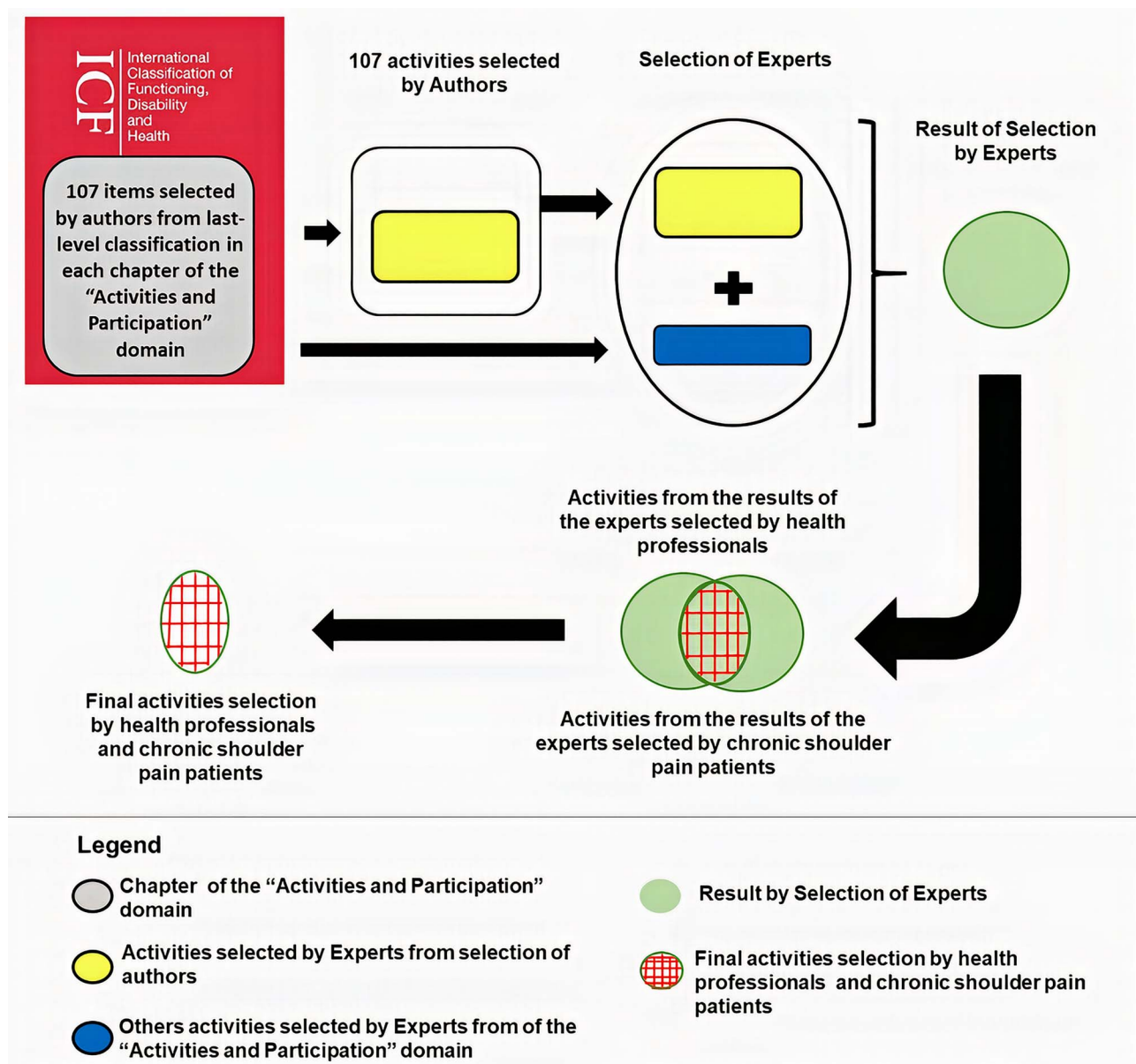


Figure 1. Step-by-step process of the development of the Avoidance Daily Activities Photo Scale for patients with shoulder pain (ADAP Shoulder Scale) from International Classification of Functioning, Disability and Health activities.

is composed of 9 chapters and includes 384 ICF codes.²⁸ The step-by-step process of activity selection is illustrated in Figure 1. The items of the scale were obtained from the "Activities and Participation Domain" of ICF. The total number of codes was 118 for the 2-level codes, whereas it was 266 for the 3-level codes.

Four researchers (W.A., F.J.J.R., M.C.T., S.C.A.Z.) independently selected items from the ICF. Discrepancies among the authors were resolved by consensus. In case of persistent disagreement, a fifth researcher was consulted (A.S.O.).

The last-level ICF codes were preselected by the authors (W.A., F.J.J.R., M.C.T., S.C.A.Z., and A.S.O.). The ICF codes identified were 107 daily activities considered relevant for evaluation in patients with shoulder pain. These activities were then presented to the expert panel.

Three professors comprised the expert panel that analyzed the relevance of each daily activity in evaluating patients with

shoulder pain as part of the content validity evaluation.^{27,29} Experts were required to answer the question: "How much do you think it is important to ask shoulder pain patients about this activity?" The options were on a 5-point Likert scale: inappropriate, partially adequate, adequate, totally adequate, or "I don't know." The experts, with formal education in ICF, were also invited to check the 107 codes and descriptions excluded from the first selection to suggest any of them to be included in the scale. The activity was considered relevant enough to be included in the scale if at least 2 experts considered it totally adequate or adequate. A total of 68 daily activities were considered totally adequate or adequate by at least 2 of the 3 members from the expert panel.

Next, the 68 daily activity items were presented to health care professionals (n = 15) with knowledge of the ICF and to patients with chronic shoulder pain (n = 30). Both were asked to judge the relevance of each daily activity for patients

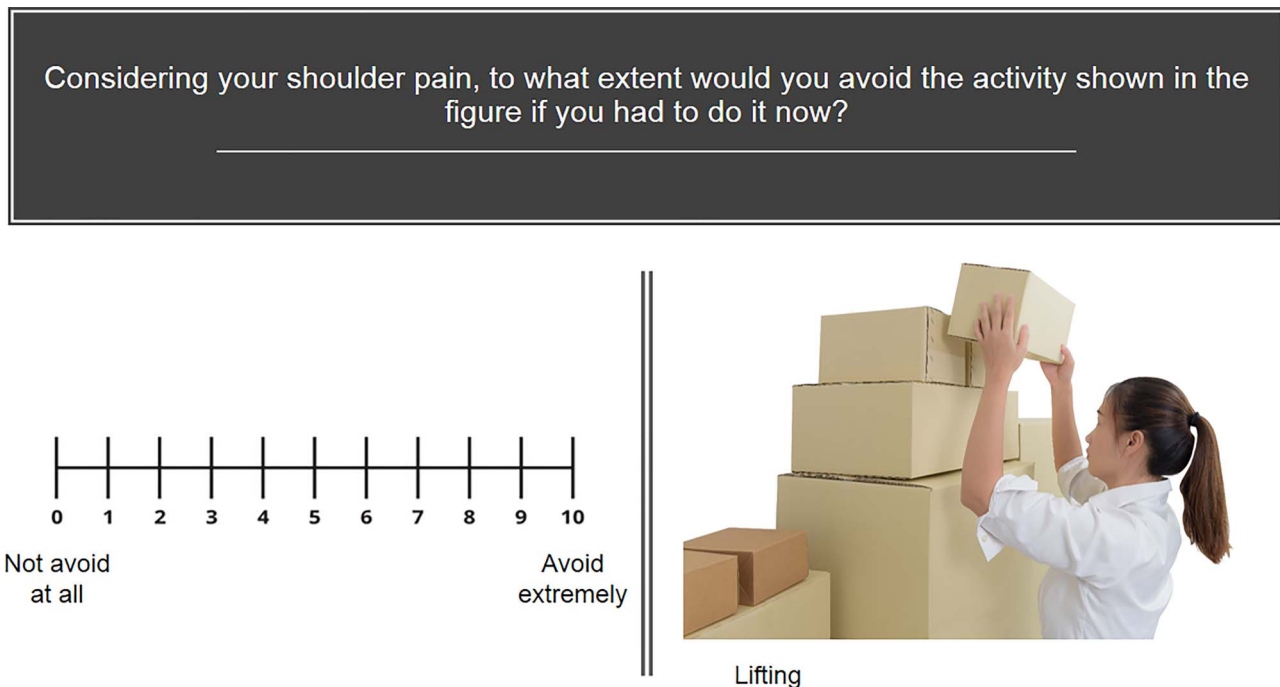


Figure 2. Visual representation of the numeric rating accompanying 1 photo-item from the ADAP Shoulder Scale.

with shoulder pain using the same 5-point Likert scale. Daily activity was considered relevant enough to be included in step 2 of the scale development if $\geq 80.0\%$ agreement was attained between health care professionals and patients.^{27,29}

The expert panel ($n=3$) and health care professionals ($n=15$) were interviewed face-to-face or online (Google Meeting) using an online form (Google Forms) customized to present selected ICF codes. Patients with chronic shoulder pain ($n=30$) were interviewed face-to-face in a clinical setting to present selected ICF codes using the same online customized form to collect data from experts and health professionals. The interviews for all participants were as follows: explanation of the scale's underlying latent construct, presentation of the daily activities (code + text) from the ICF, and judgement.

Step 2: Photographic Representation of Selected Daily Activities

In this step, digital photographs were chosen to illustrate each of the selected daily activities in Step 1, including both genders with neutral backgrounds. Images were obtained from an online database at istock (<http://www.istockphoto.com>) using Getty Images. A group of health care professionals ($n=120$) and another group comprising patients with chronic shoulder pain ($n=50$) who were not involved in step 1 were formed. The health care professionals completed a customized online form (Google forms) with the selected photos. Patients with chronic shoulder pain were interviewed face-to-face in a clinical setting using the same online customized form to collect data from health care professionals sampled for this step of the study. Both groups were requested to judge whether the photo represented the ICF activity description answering the following questions: “Do you recognize the activity represented in this picture?” (“I don’t recognize it,” “I recognize it a little,” “I recognize it a lot,” “I totally recognize it,” and “I don’t know”) and “Does this photo represent the activity as described

below?” (“It does not represent it,” “It represents it a little,” “It represents it a lot,” “It represents it completely,” and “I don’t know”). The photo was considered representative if it attained $\geq 80.0\%$ of agreement in both questions considering “I recognize a lot” or “I totally recognize” and “represents a lot” and “highly represented”^{27,29} in both groups. New photos selected by the authors were presented to those with insufficient agreement levels during a new round.

The selected photos were used as pilot study to investigate the comprehension and response options of the scale in a group of 15 patients with chronic shoulder pain.^{23,24,26} The initial formulation of the scale's questions were based on the PFAcS-C scale.²⁴ However, we had to formulate different versions of the questions during the pilot test to improve the patients' understanding of the scale. Initially, we used the question “Considering your shoulder pain, to what extent would you fear and avoid the activity shown in the figure if you had to do it now?” However, it generated a lot of misunderstanding among patients. In fact, international guidelines recommend presenting only 1 element instead of 2 or more.²⁶ Therefore, the final version of the question was: “Considering your shoulder pain, to what extent would you avoid the activity shown in the figure if you had to do it now?” using a numerical rating scale from 0 to 10, with 0 (“not avoid at all”) and 10 (“avoid extremely”). The response options were based on scales using selected photos,^{23,24} as shown in Figure 2.

Phase 2: Evaluation of Structural Validity and Internal Consistency

We recruited a new sample of patients with chronic shoulder pain for the evaluation of the structural validity and internal consistency of the field-testing version of the scale. A detailed description of this group is provided in the Results section. The digital version of the scale was installed on a 10.2-inch tablet iPad (Apple, Austin, TX, USA). Eighteen photos were shown without restriction of time to respond in a random

sequence. The sample size was estimated based on the recommendation of 7 to 10 participants per item on the scale.²⁷

This phase was performed in a clinical setting. Participants were accommodated in a private and quiet room. All participants were instructed about the objective of the study, the scale construct, how to use the tablet, and how to evaluate the photos using an 11-point numerical rating scale (from 0 [not avoid at all] to 10 [avoid extremely]) to answer the question: “Considering your shoulder pain, to what extent would you avoid the activity shown in the figure if you had to do it now?” The time necessary to complete all items was recorded to estimate the mean duration of scale evaluation.

Statistical Analysis

Phase 1: Development Process (Content Validity)

Content validity was estimated using the content validity index (CVI).³⁰ The CVI is the result of the sum of acceptable answers (step 1: totally adequate and adequate; step 2: highly represented and represents a lot as well as “I totally recognize” and “I recognize a lot”) divided by the number of evaluators.³⁰ According to the CVI, the photo was considered relevant and included in the scale if it attained $\geq 80.0\%$ agreement.^{27,29}

Phase 2: Structural Validity and Internal Consistency

Structural validity was determined using exploratory factor analysis. The rotation of the varimax type was used to achieve better interpretability of the results considering a factor load > 0.50 to select the items.³¹ An analysis of the eigenvalues using the Scree test and a cut-off ≤ 1 was used to determine the number of factors.³¹ The adequacy of factor analysis was tested using the Kaiser-Meyer-Olkin method and Bartlett’s sphericity test.³¹ The homogeneity and redundancy of all factors were analyzed.³² Once the model had satisfactory indices, Cronbach alpha was calculated to measure internal consistency.³³ Cronbach alpha assesses the overall correlation between all items within a scale, and values of alpha ranging from 0.70 to 0.95 were considered acceptable.^{34,35}

The total scale score was added to vary between 0 and 100. Thus, the final score was multiplied by 10 and subsequently divided by the number of items as follows: $[\text{total} = (\text{SUM} \times 10) / \text{number of items on the scale}]$.

All analyses were performed using IBM SPSS Statistics for Windows (Version 21.0. IBM Corp., Armonk, NY, USA)

Role of the Funding Source

The funder played no role in the design, conduct, or reporting of this study.

Results

Phase 1: Development of the Scale (Content Validity)

Step 1 involved the opinion of 3 experts (E1, E2, and E3), 15 health care professionals, and 30 patients with chronic shoulder pain. The expert panel consisted of E1, a 51-year-old male physiatrist with 26 years of clinical experience; E2, a 57-year-old female physiotherapist with 36 years of clinical experience; and E3, a 59-year-old female occupational therapist with 37 years of clinical experience. The health care professionals were 8 physiotherapists (53.3%), 4 occupational therapists (26.7%), and 3 orthopedic surgeons (20.0%). The patient group consisted of 30 patients with chronic shoulder pain having a mean age of 51.8 years (SD = 19.9),

mean weight of 75.7 kg (SD = 13.9), mean height of 167 cm (SD = 89), mean SPADI function score of 49.8 (SD = 20.3), mean SPADI pain score of 58.2 (SD = 22.0), and mean SPADI total score of 53.5 (SD = 17.5).

The expert panel excluded 41 items from 107 previously selected by the authors and suggested including 2 items (d850 and d855), resulting in 68 daily activities. Twenty-one items attained 80.0% agreement between health care professionals and the patient group. The authors consensually decided to exclude 3 items (d850: remunerative employment; d855: non-remunerative employment; and d9201: sports) due to the difficulty of representing the activities using photos. At the end of step 1, 18 ICF items were selected to be represented by digital photos (Suppl. Table).

Step 2 included 120 health care professionals and 50 patients with chronic shoulder pain. The health care professionals group (mean age, 33.6 years [SD = 9.6], mean clinical experience, 11.1 years [SD = 9.2]) consisted of 96 physiotherapists (80.0%), 10 occupational therapists (8.3%), 9 orthopedic surgeons (7.5%), 3 psychologists (2.5%), and 2 nurses (1.7%). In the patient group, the mean age was 55.2 years (SD = 19.7), the mean SPADI function score was 47.6 (SD = 22.7), the mean SPADI pain score was 58.9 (SD = 21.0), and the mean SPADI total score was 52.6 (19.8).

The patients attained $\geq 80.0\%$ agreement with the CVI values in the first round. Nine digital photos (d4451: pushing; d4454: throwing; d5100: washing body parts; d5400: putting on clothes; d550: eating; d560: drinking; d6400: washing and drying clothes and garments; and d6402: cleaning living area) had to be substituted after failing to meet the agreement criteria in the first round of judgement by the health care professionals. One photo (d4454: throwing) had to be substituted in the second round. Agreement in the health care professionals’ group was reached in the third round. The final CVI scores for each of the 18 photo items are shown in Figure 3.

Phase 2: Structural Validity and Internal Consistency

We recruited patients with chronic shoulder pain for evaluation of the structural validity and internal consistency of the field-testing version of the scale. A detailed description of this group is provided in Table 1. Exploratory factor analysis was performed on the patients who responded to the field-test version of the scale with 18 photo items. The mean time to respond was approximately 5 minutes. Bartlett’s test of sphericity was significant, with a Kaiser-Meyer-Olkin of 0.92. The exploratory factor analysis showed 3 factors: free movement, high effort, and self-care. The items “throwing” (d4454) and “drying oneself” (d5102) were excluded in the first analysis, and the item “washing and drying clothes and garments” (d6400) was excluded in the second one. These photo items were excluded because the factorial load was approximately equal in more than 1 domain (throwing [d4454] in free movement and high effort domains; drying oneself [d5102] in free movement and self-care domains; washing and drying clothes and garments [d6400] in free movement and self-care domains). The free movement domain explained 26.4% of the variance, the high effort domain accounted for 52.2%, and the self-care domain explained 72.2% of the accumulated variance. The final third exploratory factor analysis with 15 items is presented in Table 2.


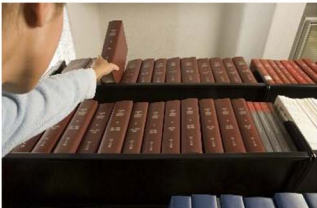
Activity - ICF Code	Picture	CVI
1-Lifting - d4300		93.3
2- Carrying in the hands - d4301		86.7
3- Carrying in the arms - d4302		86.7
4- Carrying on shoulders, hip and back - d4303		86.7
5- Pushing - d4451		80.0
6- Reaching - d4452		86.7

Figure 3. Content validity index (CVI) for each photo scale activities. Two and 3-level classification of the International Classification of Functioning, Disability and Health (ICF) Code (N = 120).

The internal consistency of the total score of the 15 photo items by Cronbach alpha coefficient was 0.92 for free movement (factor 1), 0.89 for high effort (factor 2), and 0.92 for self-care (factor 3) domains, respectively. The intercorrelations among the 3 domains were moderate between free movement and high effort, with a value of 0.69; between free movement and self-care, with a value of 0.60; and between high effort and self-care, with a value of 0.49. Free movement (factor 1) showed internal consistency ranging between 0.61 and 0.82,

high effort (factor 2) ranged from 0.41 to 0.67, and self-care (factor 3) ranged from 0.75 to 0.83. The domain's internal consistency indicated that each photo item was moderately to highly related to the other items.

The scale was named the Avoidance Daily Activities Photo Scale for patients with chronic shoulder pain (ADAP Shoulder Scale) and consists of 3 domains: free movement (reaching, ICF: d4452; washing body parts, ICF: d5100; washing whole body, ICF: d5101; putting on clothes, ICF: d5400; taking off







7-Throwing - d4454		86.7
8-Driving human-powered transport - d4750		93.3
9- Washing body parts - d5100		93.3
10- Washing whole body - d5101		93.3
11-Drying oneself - d5102		93.3
12-Caring for teeth - d5201		93.3

Figure 3. Continued.

clothes, ICF: d5401), high effort (lifting, ICF: d4300; carrying in the hands, ICF: d4301; carrying in the arms, ICF: d4302; carrying on shoulders, hip and back, ICF: d4303; pushing, ICF: d4451; driving human-powered transport, ICF: d4750; cleaning living area, ICF: d6402), and self-care (caring for teeth, ICF: d5201; eating, ICF: d550; drinking, ICF: d560). The total score varied between 0 and 100. The calculation for the free movement domain (5 items) was as follows: [total = (SUM × 10)/5]; the high effort domain: [total = (SUM × 10)/7]; self-care domain: [total = (SUM × 10)/3]. Finally, the

total score of the scale was calculated as follows: [total = (SUM × 10)/15].

Discussion

The ADAP Shoulder Scale was developed to evaluate pain-related avoidance behavior during daily activities in patients with shoulder pain. The final version of the scale consisted of 15 daily activities from ICF represented by photos and distributed in 3 domains: free movement, high effort, and







13-Putting on clothes - d5400		86.7
14-Taking off clothes - d5401		93.3
15-Eating - d550		93.3
16-Drinking - d560		93.3
17-Washing and drying clothes and garments - d6400		86.7
18-Cleaning living area - d6402		93.3

Figure 3. Continued.

self-care. The ADAP Shoulder Scale was tested as a self-administered scale, and the total time to respond lasted approximately 5 minutes on average, with a range from 2 to 7 minutes. The instrument is easy to apply in a clinical setting, easy to understand, and can be relevant for patients with chronic shoulder pain. The domains of the ADAP Shoulder Scale have high internal consistency, showing that the photo items included to assess the same construct yielded similar scores.

Photos included in the ADAP Shoulder Scale can be used to guide and monitor exposure-based interventions, such as gradual exposure. Following context-based patient education

focusing on the multidimensional nature of pain and disability, gradual exposure³⁶ using the top 3 or 5 most scored pictures from the ADAP Shoulder Scale can be hierarchically organized from the least avoided to the most avoided, thereby encouraging patients to perform normal daily shoulder functions.³⁷⁻³⁹

The development of the ADAP Shoulder Scale involved the input of different stakeholders of an expert panel, health care professionals, as well as the target population (patients with chronic shoulder pain). The development of this scale can be considered the first step to better understand the influence of pain-related avoidance in patients with shoulder pain using

Table 1. Sample Characteristics of the Patients With Shoulder Pain Sampled to the Factorial Exploratory Analysis (N = 156)^a

Variables	Value	Minimum–Maximum
Age, mean (SD), y	47.8 (17.2)	18–89
Sex, n (%)		
Women	92 (59.0%)	
Men	64 (41.0%)	
Weight, mean (SD), kg	76.2 (13.0)	49.5–107.0
Height, mean (SD), m	1.59 (0.34)	1.68–1.91
Symptom duration, mean (SD), mo	43.0 (96.1)	3–840
SPADI Function, mean (SD)	38.0 (28.0)	3–100
SPADI Pain, mean (SD)	47.5 (31.6)	4–100
SPADI Total, mean (SD)	41.7 (28.4)	6–100

^aSPADI = Shoulder Pain and Disability Index.

Table 2. Rotated Component Matrix Using the Principal Components Extraction (N = 156)

Activity (ICF Code)	ADAP Shoulder Scale Points: Mean (SD)	Communalities	Factor Loading		
			Free Movement	High Effort	Self-Care
Reaching, ICF: d4452	5.06 (3.41)	.66	.70		
Washing body parts, ICF: d5100	3.50 (3.61)	.83	.79		
Washing whole body, ICF: d5101	3.72 (3.55)	.78	.82		
Putting on clothes, ICF: d5400	3.70 (3.45)	.76	.73		
Taking off clothes, ICF: d5401	3.71 (3.55)	.78	.78		
Lifting ICF: d4300	4.98 (3.25)	.56		.60	
Carrying in hands, ICF: d4301	3.22 (3.33)	.70		.79	
Carrying in arms, ICF: d4302	3.98 (3.58)	.73		.72	
Carrying on shoulders, hip and back, ICF: d4303	6.98 (3.10)	.65		.67	
Pushing, ICF: d4451	5.82 (3.37)	.61		.68	
Driving human-powered transport, ICF: d4750	3.29 (3.85)	.63		.70	
Cleaning living area, ICF: d6402	3.96 (3.34)	.56		.65	
Caring for teeth, ICF: d5201	1.69 (2.46)	.85			.83
Eating, ICF: d550	1.55 (2.55)	.88			.88
Drinking, ICF: d560	1.67 (2.64)	.86			.88

^aICF = International Classification of Functioning, Disability and Health.

an instrument specifically designed for this condition and population, as recommended by COSMIN.⁴⁰ Obtaining the activities from the “Activities and Participation Domain” of the ICF can be considered the strongest point of the scale, potentializing the communication between different professionals and future cross-cultural adaptations.

All items in the ADAP Shoulder Scale were chosen from the “Activities and Participation Domain” of the ICF according to the agreements of the judgement of experts, health care professionals, and patients with chronic shoulder pain. The PHODA-SeV and PFAcS-C scales also propose assessing similar constructs and use photos to illustrate everyday situations in the lives of patients with low back pain and cervical spine pain, respectively.^{23,24} Although experts in the field accomplished the chosen activities in the PHODA-SeV, the process of photo selection in the PFAcS-C is less clear. The PHODA-SeV determines the perceived harmfulness of different physical activities and movements,²³ and the PFAcS-C evaluates the fear of movement and activities.²⁴ These constructs differ from the one analyzed in the present study, because the question here refers directly to the pain avoidance behavior in movements involving the shoulder complex. The term “shoulder pain-related avoidance behavior” refers to

behavior that leads to disuse, but without consideration of the exact reasons why the patient is avoiding movement. The probable reasons for this behavior could be fear, dysfunctional beliefs, or misunderstanding of instructions given by health professionals or online information obtained by patients’ searches, among others.^{5–9} Thus, future studies should assess the implicit motivational impact⁴¹ evoked by the photos of the ADAP Shoulder Scale or typical autonomic fear responses (heart rate deceleration and elevated skin conductance).⁴² Fear is an emotional response to threatening experiences that may not be conscious⁴³ or socially well-accepted (social desirability bias),⁴² which would make it even more difficult to directly address during the patient’s assessment. Thus, the avoidance of activities in the ADAP Shoulder Scale construct refers to an anticipatory behavior related to potential pain perception in daily activities involving the shoulder complex.

The exploratory factor analysis revealed items cluster-related to both role and level of effort perceived, which were distributed into 3 relatively independent domains of free movement, high effort, and self-care. In the ADAP Shoulder Scale, the activities composing the “free movement” domain (factor 1) have a similar characteristic of causing less overload

in the shoulder complex structures compared with those comprising the “high effort” domain (factor 2). On the other hand, basic daily life activities comprise the domain of self-care (factor 3). The domains within the scale were scored individually. Thus, practitioners can estimate the impact of avoidance on activities that exert biomechanical effects on the shoulder complex or have an impact on basic daily life activities, such as self-care.

The domains can be used individually; therefore, the free movement domain explores the movements in different ranges of amplitude with relatively light loads, and the high effort domain requires images of movements that imply a relatively greater effort in the upper limb. Considering the free movement domain activities, the patients gave the reach image (CIF: d4452) the highest avoidance score (mean 5.06 [SD 3.41]). In the high effort domain, the activity of carrying on the shoulders, hips, and back (ICF: d4303) presented the highest avoidance score related to shoulder pain (mean 6.98 [SD 3.10]). In the self-care domain, the 3 activities on the scale exhibited relatively similar mean avoidance scores: caring for teeth, ICF: d5201 (mean 1.69 [SD 2.46]), eating, ICF: d550 (mean 1.55 [SD 2.55]), and drinking, ICF: d560 (mean 1.67 [DP 2.64]). The interpretation of the avoidance mean scores in the 3 domains showed that daily life activities involving self-hygiene (self-care domain) are not avoided in the same way as activities that involve light physical (free movement) and relatively more intense efforts (high effort). Further studies are needed to demonstrate whether patients with some degree of movement phobia, according to the original psychology concept of inaccurate and irrational fear, will present higher scores in the self-care domain than patients who are fearful of pain-related movements because they were, for instance, instructed that pain may mean risk of injury or re-injury.

Limitations

The present study has some limitations. Although the scale has been designed with the end goal of being easily applicable in actual clinical practice by various health care professionals, participants involved in the scale development process were predominantly physiotherapists (83.0%), which can be considered a sample selection bias. This study was designed and conducted in Brazil; therefore, it needs to be culturally adapted before being used in other countries.

The ADAP Shoulder Scale item response is an 11-point (range, 0–10) numerical rating scale, with 0 representing “not avoid at all” and 10 representing “avoid extremely.” There will, of course, be circumstances when applying the ADAP Shoulder Scale will be impossible, such as in patients with cognitive impairment. However, the numerical rating scale is less abstract and easier to understand.⁴³ In addition, the numerical rating scale is preferred by patients over the visual analog scale.⁴⁴

Although alpha coefficients of Cronbach between 0.70 and 0.95 are acceptable,^{34,35} some authors may consider items above 0.90 redundant.^{26,35} Therefore, the free movement and self-care domains could be shortened in future studies.

Finally, regarding the methodology used to obtain the ADAP Shoulder Scale items, the COSMIN guide recommends qualitative interviews with patients as the best option for selecting items,³⁹ which was not done in the present study. However, to minimize this limitation, the present study considered patients’ opinions in selecting the activities.

The ADAP Shoulder Scale was developed with 107 activities. The final version consists of 15 items and 3 domains with high internal consistency. The clinical application of this scale is easy, and it is adequately comprehensible and relevant for patients with shoulder pain. Further studies are needed to assess its psychometric properties, including reliability and construct validation studies, and to associate it with patients’ clinical presentations.

Author Contributions

Concept/idea/research design: W. Anselmo, F.J.J. Reis, S.C.A. Zatiti, J.W.S. Vlaeyen, A.S. Oliveira

Writing: W. Anselmo, M.C. Tozzo, J.W.S. Vlaeyen, A.S. Oliveira

Data collection: W. Anselmo, S.C.A. Zatiti, M.C. Tozzo

Data analysis: W. Anselmo, M.C. Tozzo

Project management: W. Anselmo, S.C.A. Zatiti

Fund procurement: W. Anselmo

Providing participants: W. Anselmo, S.C.A. Zatiti

Providing facilities/equipment: S.C.A. Zatiti

Providing institutional liaisons: S.C.A. Zatiti

Consultation (including review of manuscript before submitting): F.J.J. Reis, M.C. Tozzo, A. Meulders, J.W.S. Vlaeyen

Funding

The authors thank Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—Brazil (CAPES, Finance Code 001) for financial support.

The contribution of J.W.S. Vlaeyen was supported by a grant of the Asthenes Research Program (“From Acute Aversive Sensations to Chronic Bodily Symptoms”), a long-term structural Methusalem funding (METH/15/011) from the Flemish government (Belgium).

Ethics Approval

The study was approved by the local ethics committee (CAAE: 79517717.0.0000.5414).

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

References

1. Bot SDM, van der Waal JM, Terwee CB, et al. Incidence and prevalence of complaints of the neck and upper extremity in general practice. *Ann Rheum Dis*. 2005;64:118–123.
2. Urwin M, Symmons D, Allison T, et al. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis*. 1998;57:649–655.
3. Kuijpers T, van Tulder MW, van der Heijden GJMG, Bouter LM, van der D Windt a WM Windt. Costs of shoulder pain in primary care consulters: a prospective cohort study in the Netherlands. *BMC Musculoskelet Disord*. 2006;7:83.
4. Van Der Windt DAWM, Koes BW, Boeke AJP, Devillé W, De Jong BA, Bouter LM. Shoulder disorders in general practice: prognostic indicators of outcome. *Br J Gen Pract*. 1996;46:519–523.
5. Cuff A, Littlewood C. Subacromial impingement syndrome – what does this mean to and for the patient? A qualitative study. *Musculoskelet Sci Pract*. 2018;33:24–28.

6. George SZ, Wallace MR, Wu SS, et al. Biopsychosocial influence on shoulder pain: risk subgroups translated across preclinical and clinical prospective cohorts. *Pain*. 2015;156:148–156.
7. Menendez ME, Baker DK, Oladeji LO. Psychological distress is associated with greater perceived disability and pain in. *J Bone Joint Surg Am*. 2015;97:1999–2003.
8. Martinez-Calderon J, Meeus M, Struyf F, Morales-Asencio JM, Gijon-Nogueron G, Luque-suarez A. The role of psychological factors in the perpetuation of pain intensity and disability in people with chronic shoulder pain: a systematic review. *BMJ Open*. 2018;8:e020703.
9. Jain NB, Ayers GD, Fan R, et al. Predictors of pain and functional outcomes after operative treatment for rotator cuff tears. *J Shoulder Elb Surg*. 2018;27:1393–1400.
10. Timmers I, Quaedflieg CWEM, Hsu C, Heathcote LC, Rovnaghi CR, Simons LE. The interaction between stress and chronic pain through the lens of threat learning. *Neurosci Biobehav Rev*. 2019;107:641–655.
11. Soberg HL, Engebretsen KB, Juel NG, Roe Y, Brox JI. Associations between shoulder pain and functioning on the ICF checklist and the disabilities of the arm, shoulder, and hand scale—a cross-sectional study. *Disabil Rehabil*. 2019;0:1–8.
12. Meulders A. From fear of movement-related pain and avoidance to chronic pain disability: a state-of-the-art review. *Curr Opin Behav Sci*. 2019;26:130–136.
13. Crombez G, Vlaeyen JWS, Heuts PHTG, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain*. 1999;80:329–339.
14. Boersma K, Linton SJ. Psychological processes underlying the development of a chronic pain problem a prospective study of the relationship between profiles of psychological variables in the fear-avoidance model and disability. *Clin J Pain*. 2006;22:160–166.
15. Leeuw M, Goossens MEJB, Linton SJ, Crombez G, Boersma K, Vlaeyen JWS. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *J Behav Med*. 2007;30:77–94.
16. Vlaeyen JWS, Crombez G, Linton SJ. The fear-avoidance model of pain. *Pain*. 2016;157:1588–1589.
17. Lethem J, Slade PD, Troup JDG, Bentley G. Outline of a fear-avoidance model of exaggerated pain perception-I. *Behav Res Ther*. 1983;21:401–408.
18. De Jong JR, Vlaeyen JWS, Van Eijsden M, Loo C, Onghena P. Reduction of pain-related fear and increased function and participation in work-related upper extremity pain (WRUEP): effects of exposure in vivo. *Pain*. 2012;153:2109–2118.
19. Lee D, Hwang JH, Chu I, Chang HJ, Shim YH, Kim JH. Analysis of factors related to arm weakness in patients with breast cancer-related lymphedema. *Support Care Cancer*. 2015;23:2297–2304.
20. Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, Van Eek H. Fear of movement/ (re)injury in chronic low back pain and its relation to behavioral performance. *Pain*. 1995;62:363–372.
21. Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A fear-avoidance beliefs questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*. 1993;52:157–168.
22. McNeil DW, Rainwater AJ. Development of the fear of pain questionnaire—III. *J Behav Med* 1998; 21:389–410.
23. Leeuw M, Goossens MEJB, van Breukelen GJP, Boersma K, Vlaeyen JWS. Measuring perceived harmfulness of physical activities in patients with chronic low back pain: the photograph series of daily activities-short electronic version. *J Pain*. 2007;8:840–849.
24. Turk DC, Robinson JP, Sherman JJ, Burwinkle T, Swanson K. Assessing fear in patients with cervical pain: development and validation of the pictorial fear of activity scale-cervical (PFAcS-C). *Pain*. 2008;139:55–62.
25. Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of a shoulder pain and disability index. *Arthritis Rheum*. 1991;4:143–149.
26. de Vet HC, Terwee CB, Mokkink LB, Knol DL. *Measurement in Medicine. A Practical Guide*. 1st ed. New York, NY, USA: Cambridge University Press; 2011.
27. Terwee CB, Prinsen CAC, Westerman ACMJ, Alonso DLPJ, Bouter LM. COSMIN methodology for evaluating the content validity of patient-reported outcome measures: a Delphi study. *Qual Life Res*. 2018;27:1159–1170.
28. World Health Organisation. *International Classification of Functioning, Disability and Health (ICF)*. 2018. Accessed January 20, 2020. <http://www.who.int/classifications/icf/en/>
29. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol*. 2010;63:737–745.
30. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations *Res Nurs Health*. 2006;29:489–497.
31. Johnson RA, Wichern DW. *Applied Multivariate Statistical Analysis*. 5th ed. Upper Saddle River, NJ, USA: Prentice Hall; 2002.
32. Crocker L, Algina J. *Introduction to Classical and Modern Test Theory*. 6th ed. New York, USA: Holt, Rinehart, and Winston; 1986.
33. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16:297–334.
34. Bland J, Altman D. Statistics notes: Cronbach's alpha. *Br Med J*. 1997;314:572.
35. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ*. 2011;2:53–55.
36. Dekker C, Goossens M, Winkens B, Remerie S, Bastiaenen C, Verbunt J. Functional disability in adolescents with chronic pain: comparing an interdisciplinary exposure program to usual care. *Child Aust*. 2020;7:288.
37. De Jong JR, Vlaeyen JWS, Onghena P, Goossens MEJB, Geilen M, Mulder H. Fear of movement/(re)injury in chronic low back pain: education or exposure in vivo as mediator to fear reduction? *Clin J Pain*. 2005;21:9–17.
38. Leeuw M, Goossens MEJB, van Breukelen GJP, et al. Exposure in vivo versus operant graded activity in chronic low back pain patients: results of a randomized controlled trial. *Pain*. 2008;138:192–207.
39. Den Hollander M, Goossens M, De Jong J, et al. Expose or protect? A randomized controlled trial of exposure in vivo vs pain-contingent treatment as usual in patients with complex regional pain syndrome type 1. *Pain*. 2016;157:2318–2329.
40. Mokkink LB, Prinsen CAC, Bouter LM et al. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) and how to select an outcome measurement instrument. *Braz J Phys Ther*. 2016;20:105–113.
41. Tracey TJG. A note on socially desirable responding. *J Couns Psychol*. 2016;63:224–232.
42. Mokkink LB, Prinsen CC, Patrick DL, et al. COSMIN methodology for systematic reviews of Patient—Reported Outcome Measures (PROMs). *Qual Life Res*. 2018;27:1147–1157.
43. LeDoux JE, Pine DS. Using neuroscience to help understand fear and anxiety: a two-system framework. *Am J Psychiatry*. 2016;17311:1083–1093.
44. Dworkin RH, Turk DC, Farrar JT, et al. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2005;113:9–19.