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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 (ICF). 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) of ≥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 of ≥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 of ≥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:** Reproducibility of Results, Fear, Shoulder Pain, Validation Studies, Rehabilitation, Emotions
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%–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 contributes 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 (TSK),\(^20\) the Fear Avoidance Beliefs Questionnaire (FABQ),\(^21\) 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 pain, and the Pictorial Fear of Activity Scale-Cervical (PFActS-C). 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 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.

[H1] Methods

[H2] Ethical considerations and study design

The present study consisted of two phases: i) development of the scale (content validity) and ii) 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 centres, comprised the expert panel. Panellists were professors with a health professional degree, who had been involved in research and/or teaching for more than 10 years, with
practical experience in treating patients with shoulder pain, and had intermediate or advanced level knowledge on the International Classification of Functionality, Disability and Health (ICF). Professors were selected by convenience based on their experience on ICF. All professors were considered as expert since they contribute in the ICF field with publications or national training courses on ICF.

The two groups of health professionals involved in this study were physiotherapists, occupational therapists, orthopaedists, psychologists, and nurses recruited from local clinical centres 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 on ICF.

A total of three convenience samplings from patients with different musculoskeletal conditions and symptoms of shoulder pain were selected from public and private rehabilitation centres. The inclusion criteria were patients complaining of (i) shoulder pain of traumatic or non-traumatic origin, (ii) for more than three months, and (iii) older than 18 years of age. The exclusion criteria were the presence of neurological or rheumatological diseases, active local or systemic infections, 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 characterisation 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 outcomes\textsuperscript{26} and Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN)\textsuperscript{27}. The defined latent construct of the scale was shoulder pain-related avoidance behavior. The developmental process was composed of two steps: Step 1 involved the selection of daily activities based on the ICF Activities & 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 one consequence of the construct (activity avoided), and the items were designed to be easily interpreted and tailored to the target population (shoulder pain).\textsuperscript{26} The pilot test was performance before the phase 2.

\textit{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 is composed of nine chapters and includes 384 ICF codes.\textsuperscript{28} The step-by-step process of activity selection is illustrated in Figure 2. The items of the scale were obtained from the "Activities & Participation Domain" of ICF. In this domain, there are nine chapters. The total number of codes was 118 for the two-level codes, whereas it was 266 for the three-level codes.

Four researchers (WA, FJJR, MCT, SCAZ) independently selected items from the ICF. Discrepancies among the authors were resolved by consensus. In case of persistent disagreement, a fifth researcher was consulted (ASO).

The last-level ICF codes were preselected by authors (WA, FJJR, MCT, SCAZ and ASO). The ICF codes identified were 107 daily activities and considered relevant
for evaluation in patients with shoulder pain. Then, these activities were 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. 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 written as "Inappropriate," "Partially Adequate," "Adequate," "Totally Adequate," or "I don't know." As the experts, they have formal education in ICF, they 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 two experts considered it "Totally Adequate" or "Adequate." A total of 68 daily activities were considered "Totally Adequate" or "Adequate" by at least two of the three members from the expert panel.

Next, the 68 daily activity items were presented to health care professionals (n = 15) with knowledge on ICF and to patients with chronic shoulder pain (n = 30). Both were asked to judge the relevance of each daily activity for patients 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 ≥80.0% agreement was attained between health care professionals and patients. 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 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 recognise the activity represented in this picture?" ("I don’t recognise it," "I recognise it a little," "I recognise it a lot," "I totally recognise 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 ≥ 80.0% of agreement in both questions considering ("I recognise a lot" or "I totally recognise" and "Represents a lot" and "Highly represented") 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.\textsuperscript{23,24,26} The initial formulation of the scale’s questions were based on the PFActS-C scale.\textsuperscript{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 one element instead of two or more.\textsuperscript{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,\textsuperscript{23,24} as shown in Figure 3.

**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 seven to ten participants per item on the scale.\textsuperscript{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). 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" and, "I totally recognize" and "I recognize a lot") divided by the number of evaluators. According to the CVI, the photo was considered relevant and included in the scale if it attained ≥ 80.0% agreement.

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. An analysis of the eigenvalues using the Scree test and a cut-off ≤1 was used to determine the number of factors. The adequacy of factor analysis was tested using the Kaiser-Meyer-Olkin (KMO) method and Bartlett’s sphericity test. The homogeneity and redundancy of all factors were analyzed. Once the model had satisfactory indices, Cronbach’s alpha was calculated to measure internal consistency. Cronbach’s 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.\textsuperscript{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. Armonk, NY: IBM Corp.

[H2] Role of the funding source

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

[H1] Results

Phase 1 - Development of the scale (content validity)

Step 1 involved the opinion of three 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 eight physiotherapists (53.3%), four occupational therapists (26.7%), and three 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), a mean weight of 75.7 kg (SD = 13.9), a mean height of 167 cm (SD = 89), a mean SPADI function score of 49.8 (SD = 20.3), a mean SPADI pain score of 58.2 (SD = 22.0), and a 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 two 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 three 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 (Supplemental material).

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 of 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 ≥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 score for each of the 18 photo items are shown in Figure 1.

**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 min. Bartlett's test of sphericity was significant with a KMO of 0.92. The exploratory factor analysis showed three factors, namely "free movement," "high effort," and "self-care". The items “Throwing” (d4454) and "Drying oneself” (d5102) were excluded in the first analysis, while 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 one 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.

The internal consistency of the total score of the 15 photo items by the Cronbach’s 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 three 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 three domains: free movement (Reaching - ICF: d4452; Washing body parts - ICF: d5100; Washing whole body - ICF: d5101; Putting on clothes - ICF: d5400; Taking off 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 (five items) was as follows: \[ \text{Total} = \frac{(\text{SUM} \times 10)}{5} \]; the high effort domain: \[ \text{Total} = \frac{(\text{SUM} \times 10)}{7} \]; self-care domain: \[ \text{Total} = \frac{(\text{SUM} \times 10)}{3} \]. Finally, the total score of the scale was calculated as follows: \[ \text{Total} = \frac{(\text{SUM} \times 10)}{15} \].

[H1] 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 three domains: "free movement," "high effort," and "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 time ranging from 2 to 7 minutes. The instrument is easy to apply in 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 exposure using the top three or five 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.

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 an instrument specifically designed for this condition and population, as recommended by COSMIN. Obtaining the activities from the "Activities & 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 & 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 PFActS-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. While experts in the field accomplished the chosen activities in the PHODA-SeV, the process of photo selection in the PFActS-C is less clear. The PHODA-SeV determines the perceived harmfulness of different physical
activities and movements, while the PFActS-C evaluates the fear of movement and activities. These constructs are different from the one analysed in the present study, since the question here refers directly to the pain avoidance behaviour 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. Thus, future studies should assess the implicit motivational impact evoked by the photos of the ADAP Shoulder Scale, or typical autonomic fear responses (heart rate deceleration and elevated skin conductance). Fear is an emotional response to threatening experiences that may not be conscious or socially well-accepted (social desirability bias), 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 three 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 when compared to 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,
while 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 three 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 three 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.

[H1] 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 XXXX; 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. In addition, the numerical rating scale is preferred by patients over the visual analog scale.

Although alpha coefficients of Cronbach between 0.70 and 0.95 are acceptable, some authors may consider items above 0.90 redundant. 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, which was not done in the present study. However, to minimize this limitation, the present study considered patients' opinions in selecting the activities.

[H1] Conclusion

The ADAP Shoulder Scale was developed with 107 activities. The final version consists of 15 items and three 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**

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

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

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

Fund procurement: W. Ansanello

Providing participants: W. Ansanello, 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

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

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Disclosure

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


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

<table>
<thead>
<tr>
<th>Variables</th>
<th>[Minimum-Maximum]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y, mean (SD)</td>
<td>47.8 (17.2)</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>92 (59.0 %)</td>
</tr>
<tr>
<td>Men</td>
<td>64 (41.0%)</td>
</tr>
<tr>
<td>Weight, kg, mean (SD)</td>
<td>76.2 (13.0)</td>
</tr>
<tr>
<td>Height, m, mean (SD)</td>
<td>1.59 (0.34)</td>
</tr>
<tr>
<td>Symptom Duration, mo, mean (SD)</td>
<td>43.0 (96.1)</td>
</tr>
<tr>
<td>SPADI Function, mean (SD)</td>
<td>38.0 (28.0)</td>
</tr>
<tr>
<td>SPADI Pain, mean (SD)</td>
<td>47.5 (31.6)</td>
</tr>
<tr>
<td>SPADI total, mean (SD)</td>
<td>41.7 (28.4)</td>
</tr>
</tbody>
</table>

\(^a\)SPADI= Shoulder Pain and Disability Index.

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

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

Note: ICF = International Classification of Functioning, Disability and Health; SD = standard deviation.

**Figure legends**
<table>
<thead>
<tr>
<th>Activity - ICF Code</th>
<th>Picture</th>
<th>CVI</th>
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<tbody>
<tr>
<td>1. Lifting - d4500</td>
<td><img src="image1.jpg" alt="Image" /></td>
<td>93.3</td>
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<td>2. Carrying in the hands - d4501</td>
<td><img src="image2.jpg" alt="Image" /></td>
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<td>3. Carrying in the arms - d4502</td>
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<td>4. Carrying on shoulders, hip and back - d4503</td>
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<td>5. Pushing - d4451</td>
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<tr>
<td>6. Reaching - d4452</td>
<td><img src="image6.jpg" alt="Image" /></td>
<td>86.7</td>
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</tbody>
</table>

**Figure 1.** Content Validity Index (CVI) for each photo scale activities. Two and Three-level classification of the International Classification of Functioning, Disability and Health (ICF) Code (N=120).
**Figure 2.** 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.

**Figure 3.** Visual representation of the numeric rating accompanying one photo-item from ADAP Shoulder Scale.