



# Cross-cultural adaptation and evaluation of the psychometric properties of the University of Wisconsin Running Injury and Recovery Index questionnaire in Spanish (UWRI-S)

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## ABSTRACT

**Objective:** To cross-culturally adapt and evaluate the psychometric properties of the University of Wisconsin Running Injury and Recovery Index questionnaire in Spanish (UWRI-S) in Chilean runners with a running-related injury.

**Design:** Cross-cultural adaptation and validation study, following the Consensus-based Standards for selecting health Measurement Instruments (COSMIN) recommendations.

**Setting:** Outpatient sports medicine clinic and running clubs.

**Participants:** UWRI was forward and backward translated, and culturally adapted. Thirty-one runners participated in the content validity of the UWRI-S; and fifty-seven in the assessment of psychometric properties.

**Main outcome measures:** Runners seeking care from a physiotherapist completed the UWRI-S (baseline and after 48–72 h for reliability), Lower Extremity Functional Scale (LEFS), Patient Specific Functional Scale (PSFS), Global Rating of Change scale (GROC), and Numeric Pain Rating Scale (NPRS).

**Results:** Suggestions about accuracy of wording and understanding of items were incorporated. UWRI-S showed a positive moderate correlation with LEFS ( $r = 0.6$ ;  $p < 0.05$ ), positive fair with GROC ( $r = 0.5$ ,  $p < 0.05$ ), negative fair with NPRS ( $r = -0.4$ ;  $p < 0.05$ ) and no correlation with PSFS ( $r = 0.3$ ;  $p = 0.1$ ). UWRI-S demonstrated acceptable internal consistency ( $\alpha = 0.87$ ) and test-retest reliability (ICC = 0.87).

**Conclusion:** UWRI-S is a valid and reliable measure to evaluate running ability of Chilean runners during recovery from a running-related injury.

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## 1. Introduction

Running is one of the most popular physical activities enjoyed by people around the world, and it is the third most practiced sport in Chile (Ministerio del Deporte Chile, 2016). Despite many well-reported health benefits of running (Oja et al., 2015; Hespanhol Junior et al., 2015), injuries commonly occur from its practice (Kakouris et al., 2021; Kluitenberg et al., 2015). The continuous

cycle of microdamage and fatigue, without an appropriate adaptation, might be responsible for or contribute to the development of overuse injuries (Dye, 2005; Gabbett, 2016; Kalkhoven et al., 2020). Appropriate monitoring of the recovery process is critical to guide clinical judgments for running-specific interventions and the return to sport decision-making process.

After an injury, athletes typically aim to return to the pre-injury level of performance (Ardern et al., 2016). Patient-reported outcome measures (PROM) are widely used to quantify perceived functional limitations during athletes' recovery from injury (Lynch et al., 2016; Tracey, 2003). This self-perception assessment is relevant across all stages of the rehabilitation process, from the

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medical/physiotherapy initial care to discharge, and allows the detection or mapping of characteristics that can negatively influence the return to sports (Arderm et al., 2012; Nelson et al., 2019). Monitoring the recovery of running-related injuries using valid measures that incorporate sport-specific features is paramount because each sport involves unique physical and psychological demands. For this reason, questionnaires should be specific to the sport discipline and to the construct being evaluated.

There are few validated questionnaires for specific sports in athletes with lower limb injuries (Bunster et al., 2020). For example, the Victorian Institute of Sport Assessment-Achilles (VISA-A) (Robinson et al., 2001; Silbernagel et al., 2005), Victorian Institute of Sport Assessment-Patella (VISA-P) (Frohm et al., 2004; Maffulli et al., 2008), Foot and Ankle Ability Measure (FAAM) (Martin et al., 2005), and Copenhagen Hip and Groin Outcome Score (HAGOS) (Thorborg et al., 2011), have been validated in sports populations, including runners. However, these focus on a single type or location of injury, rather than on the specific demands of the population suffering from running-related injuries. Other questionnaires have been cross-culturally adapted into Spanish (e.g., BFS-S, FAOS, ROFPAQ-S) (Navarro-Flores et al., 2018, 2020a, 2020b), including the evaluation of its psychometric properties, such as internal consistency and test-retest reliability, with acceptable validity and reliability results in people with ankle and foot dysfunction (Navarro-Flores et al., 2018, 2020a, 2020b). However, these questionnaires are not specifically validated in sports populations.

The University of Wisconsin Running Injury and Recovery Index (UWRI) is the only running-specific PROM that assesses running ability following a running-related injury. The UWRI was developed within the running context and evaluates critical elements runners use to monitor running ability when recovering from injury (Nelson et al., 2019). The 9-item questionnaire represents 2 highly correlated factors, load management and symptom surveillance, that is a psychometrically sound assessment of perceived running ability following running-related injury (Nelson et al., 2020). The UWRI is quickly completed (mean = 3.25 min), has excellent test-retest reliability (ICC = 0.93, 95% CI [0.89, 0.96]), a standard error of measurement (SEM) of 1.7 points, and changes in UWRI score demonstrate moderate, positive correlation with the Global Rating of Change Scale (GROC) ( $r = 0.67$ ; 95% CI [0.57, 0.75]) (Nelson et al., 2019, 2020). Previous work found changes in UWRI score were associated with change measured by common patient-reported assessments used to evaluate running-related injuries including the Lower Extremity Functional Scale (LEFS) ( $r = 0.76$ , 95% CI [0.38, 0.92]), Patient-specific Functional Scale (PSFS) ( $r = 0.68$ , 95% CI [0.24, 0.89]), and Numeric Pain Rating Scale (NPRS) ( $r = -0.44$ ; 95% CI [-0.79, 0.12]) (Nelson et al., 2013). Clinically, the UWRI may be a more effective outcome measure because it is more responsive to changes in perceived running ability and avoids the ceiling effect present in more general measures (Nelson et al., 2020).

UWRI is an easy, self-administered tool; however, it is not currently available in Spanish. Therefore, the aim of this study was to cross-culturally adapt and evaluate the psychometric properties of the UWRI questionnaire in Spanish-speaking runners who are undergoing physiotherapy as a result of a running-related injury.

## 2. Methods

### 2.1. Study design

A clinical measurement study was conducted in accordance with the CONsensus-based Standards for the selection of health Measurement INSTRUMENTS (COSMIN) guidelines (Mokkink et al., 2010).

This study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional descriptive studies (Vandenbroucke et al., 2014). Ethical standards in human experimentation were followed based on The Declaration of Helsinki (Holt, 2014).

All participants signed an informed consent. This study was approved by the Scientific Ethics Committee of the Universidad del Desarrollo (approval number 2019-016).

### 2.2. Translation and cross-cultural adaptation

UWRI was translated and adapted into Spanish following standard guidelines (Beaton et al., 1976).

- Stage I: Initial translation - two independent Spanish native speakers translated the English version of the UWRI into Spanish.
- Stage II: Synthesis of translations - In a consensus meeting, the Spanish translators synthesised their versions to a preliminary Spanish version (UWRI-S) of the UWRI.
- Stage III: Back translation - two English native speakers translated the preliminary UWRI-S version back into English.
- Stage IV: An expert committee composed by four translators, an expert in research methodology, a linguist, a physiotherapist, a moderator, and the principal investigator, reviewed all the translations, and the semantic, idiomatic, experiential, and conceptual consensus was reached on all discrepancies. At this stage, the final UWRI-S was created.
- Stage V: The content validity of the final version of the UWRI-S was then tested, including accuracy of wording, and understanding of the different items. UWRI-S was used in the present study to determine its psychometric properties.

## 3. Participants

### 3.1. Cross-cultural adaptation

Thirty-one runners that were undergoing physiotherapy treatment due to at least one running-related injury participated in Stage V for content validity assessment of the final version of the UWRI-S.

#### 3.1.1. Psychometric properties

Inclusion criteria included runners between 18 and 65 years old, who were undergoing a rehabilitation process (at least one physiotherapy session) as a result of a running-related injury. The participants were recruited by physiotherapists from sports rehabilitation centres and coaches from running clubs in two main cities of XX, between May 2019 and February 2020.

Runners with musculoskeletal injuries in anatomical areas other than the lower limb, injuries not related to running, and those unable to independently communicate in Spanish were excluded. A running injury was defined as: "Running-related (training or competition) musculoskeletal pain in the lower limbs or lower back that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional" (Yamato et al., 2015).

### 3.2. Procedures and measurements of psychometric properties

The UWRI-S, LEFS, GROC, Patient Specific Functional Scale (PSFS), and NPRS questionnaires were used to determine the construct validity. Additionally, self-reported questions on socio-demographic (age, gender, weight, height, and years of study),

injury (diagnosis, number of physiotherapy sessions, weeks in rehabilitation, duration of symptoms, and anatomical site of injury), and training (type of runner, years of running experience, frequency, hours, and weekly training volume before and after the injury) were included. Type of runner was defined as recreational (non-competitive or participating in races of less than 10 km) or competitive (marathon races, half marathon, or races greater than or equal to 10 km) (Kluitenberg et al., 2015).

The psychometric properties and description of the questionnaires used for construct validity are found in Appendices.

### 3.2.1. Content validity

During Stage V, content validity was assessed according to Beaton's guidelines (Beaton et al., 1976). Cognitive interviews were conducted using the "thinking-out-loud" methodology to confirm the understanding of the questionnaire (Schoua-Glusberg & Villar, 2014, pp. 51–67). Suggestions and comments on the title, instructions, questions, and response options were recorded.

### 3.2.2. Construct validity

Construct validity was assessed using a correlation of a single point in time between UWRI-S scores with LEFS, GROC, PSFS, and the usual pain level within the last 24 h (NPRS). A detailed description of these hypotheses can be found in Table 1.

As an exploratory process, we evaluated the correlation between UWRI-S and the number of physiotherapy sessions, between UWRI-S and LEFS in participants who were in their first week of rehabilitation, and between UWRI-S and NPRS in participants who were in their initial evaluation/session.

Because GROC, PSFS, and NPRS are composed of only a few items, it was decided to assess the face validity of the Spanish translations of these PROMs. This process consisted of a face-to-face meeting of an expert committee consisting of a methodologist, two sports physiotherapists, one runner, one Spanish native-speaking translator, and one linguist. The lead researchers (JB and MB) did not participate, but they overviewed the process. The meeting was guided by a moderator, and suggestions and discrepancies were resolved during the meeting. Then, seven runners completed the Spanish versions of GROC, PSFS, and were asked about the comprehensiveness and content of each questionnaire.

### 3.2.3. Reliability

Reliability was evaluated through test-retest reliability, standard error of measurement (SEM), and internal consistency. Test-retest

reliability was evaluated in two independent measurements 48–72 h apart. The second measurement was conducted online.

### 3.3. Sample size

According to COSMIN guidelines, at least 50 participants are recommended to determine construct validity and reliability of health instruments (Mokkink et al., 2010). For the present study, a sample size of at least 50 participants was considered. Appendices shows the calculation of the sample size for the proposed hypotheses.

### 3.4. Data analysis

Shapiro Wilk test was used to determine the distribution of quantitative data. The statistical package STATA (StataCorp. 2013. Stata Statistical Software: Release 15. College Station, TX: StataCorp LP) was used with a significance level of 5%.

Content validity of the UWRI-S was assessed using a content analysis of the cognitive interviews. The interviews were audio-recorded, and notes were undertaken by the interviewer (JB) and the principal investigator (MB) who listened to each audiotape but did not participate in the interviews. JB and MB analyzed the notes and audio recordings to establish consensus regarding necessary changes to optimize clarity of each item. We concurrently recruited and analyzed the data; therefore, participants' suggestions were incorporated, and the modified version was iterated over a five-stage process until no more suggestions were identified. Additionally, a general agreement score (as a percentage of "yes" or "no") was calculated to quantify items were understandable for each iteration. Two main components were assessed; understanding of "the last 7 days" and the construct/element assessed by each question. It was decided that a score >80% among participants would be required to reach an agreement.

Spearman's correlation coefficients were calculated for the construct validity. These were considered as good ( $r > 0.75$ ), moderate ( $0.5 \leq r \leq 0.75$ ), fair ( $0.25 \leq r < 0.50$ ), or no correlation ( $r < 0.25$ ) (Portney & Watkins, 2013). The test-retest reliability was evaluated through the intraclass correlation coefficient (ICC agreement, mixed model [2,1]) (Koo & Li, 2016). ICC was considered poor ( $<0.5$ ), moderate ( $0.5–0.75$ ), good ( $0.75–0.9$ ), and excellent ( $>0.9$ ) (Hopkins, 2000). The ICC and 95% confidence interval (CI) were reported. For the ICC analysis, the statistical package IBM SPSS version 25 (IBM Corp., Armonk, N.Y., USA) was used. As an

**Table 1**  
Hypothesis testing and fulfillment for construct validity of UWRI-S.

N° Hypothesis about UWRI-S	Justification
1 It is expected to find at least a moderate and positive correlation between UWRI-S and LEFS scores (single point) in the total population.	Because the UWRI-S items require higher functional demands (related to running ability) compared to the LEFS items. In addition, a moderate correlation between UWRI (Nelson et al., 2013, 2019) and LEFS is reported; hence, it is expected that its culturally adapted version will behave similarly.
2 It is expected to find at least a moderate and positive correlation between UWRI-S and PSFS scores (single point) in the total population.	Because PSFS asks directly about the three greatest activity limitations, it is expected that these will mainly be sports-related activities (i.e., running).
3 It is expected to find at least a moderate and positive correlation between UWRI-S and GROC scores (single point) in the total population.	As runners perceive positive functional changes during rehabilitation, UWRI-S scores should increase, preparing for a return to sport. In addition, a moderate correlation is reported between UWRI and GROC (Nelson et al., 2013, 2020); hence, it is expected that its culturally adapted version will behave similarly.
4 It is expected to find at least a fair and negative correlation between UWRI-S and NPRS scores (single point) in the total population.	Because only one item of UWRI-S evaluates pain experienced during running, it is expected that the functionality perceived by runners with a running-related injury will be different between participants with different levels of pain intensity. This could be explained by other components related to self-perception of recovery in runners (i.e., confidence during running, or recovery of performance to pre-injury levels). In addition, a negative and weak correlation is reported between UWRI and NPRS; (Nelson et al., 2013, 2019), hence, it is expected that its culturally adapted version will obtain a similar behavior.

Abbreviations: UWRI-S: University of Wisconsin Running Injury and Recovery Index-Spanish; LEFS: Lower Extremity Functional Scale; PSFS: Patient Specific Functional Scale; NPRS: Numeric Pain Rating Scale; GROC: Global Rating of Change Scale.

agreement measurement, the absolute measurement error was expressed through the standard error of measurement ( $SEM_{\text{Agreement}} = SD * \sqrt{1-ICC}$ ). In addition, the minimal detectable change ( $MDC = 1.96 \times \sqrt{2} \times SEM$ ) was calculated, which corresponds to the real change of the participant above the measurement error (Hopkins, 2000). Cronbach's alpha ( $\alpha$ ) coefficient was used to assess the internal consistency of each factor (factor 1, item 6–8; factor 2, item 1–5.9). Values between 0.7 and 0.95 were considered acceptable (Bland & Altman, 1997).

#### 4. Results

##### 4.1. Translation and cross-cultural adaptation

Forward and back translation of the UWRI-S version revealed no major semantic or language difficulties (Stages I-III). All the discrepancies concerned synonyms for particular terms. These unclear items were clarified during the expert committee meeting (Stage IV).

**Table 2**  
Description of sociodemographic, injury, and UWRI-S scores of participants from cross-cultural adaptation.

	Total (n = 31)	Males (n = 22)	Females (n = 9)
Age (years) <sup>a</sup>	40 (29–48)	40 (29–47)	30 (29–48)
Educational level (years) <sup>b</sup>	18.6 (1.65)	18.5 (1.65)	18.8 (1.72)
Duration of symptoms (months) <sup>a</sup>	2 (1.5–4)	2 (1.5–3)	3 (2–6)
Number of physiotherapy visits <sup>a</sup>	6 (1–11)	4 (1–8)	10 (8–20)
UWRI-S score <sup>b</sup>	18.1 (7.61)	18.4 (7.9)	17.6 (7.42)

<sup>a</sup> P50 (P25–P75).

<sup>b</sup> Mean (standard deviation). Normality test using Skewness-Kurtosis Test. UWRI-S: University of Wisconsin Running Injury and Recovery Index-Spanish.

**Table 3**  
Summary of frequency of agreement (%) for each item. Agreement is shown for each modification of the UWRI-S.

	Pre-final (n = 8) ID #1–8	1st change (n = 8) ID #9–16	2nd change (n = 4) ID #17–20	3rd change (n = 3) ID #21–23	4th change (n = 8) ID #24–31
<b>Question 1</b>					
“7 days”	7 (87.5)	8 (100)	6 (85.7)	11 (100)	8 (100)
Daily activities	7 (87.5)	3 (37.5)	5 (71.43)	11 (100)	8 (100)
<b>Question 2</b>					
“7 days”	6 (75)	8 (100)	6 (85.7)	11 (100)	8 (100)
Frustration	8 (100)	8 (100)	7 (100)	11 (100)	8 (100)
<b>Question 3</b>					
“7 days”	7 (87.5)	8 (100)	6 (85.7)	10 (90.9)	8 (100)
Recovery	8 (100)	7 (87.5)	5 (71.4)	9 (81.8)	8 (100)
<b>Question 4</b>					
“7 days”	6 (75)	8 (100)	7 (100)	11 (100)	8 (100)
Pain during running	8 (100)	8 (100)	7 (100)	11 (100)	8 (100)
<b>Question 5</b>					
“7 days”	5 (62.5)	8 (100)	6 (85.7)	10 (90.9)	8 (100)
Pain 24hrs after running	8 (100)	8 (100)	7 (100)	11 (100)	8 (100)
<b>Question 6</b>					
“7 days”	5 (62.5)	8 (100)	5 (71.4)	10 (90.9)	8 (100)
Changes in volume	8 (100)	5 (62.5)	7 (100)	11 (100)	8 (100)
<b>Question 7</b>					
“7 days”	5 (62.5)	8 (100)	6 (85.7)	11 (100)	8 (100)
Changes in longest distance	8 (100)	8 (100)	8 (85.7)	11 (100)	8 (100)
<b>Question 8</b>					
“7 days”	6 (75)	8 (100)	6 (85.7)	11 (100)	8 (100)
Changes in pace/speed	31 (100)	8 (100)	7 (100)	11 (100)	8 (100)
<b>Question 9</b>					
“7 days”	6 (75)	8 (100)	5 (71.4)	10 (90.9)	8 (100)
Confidence	6 (75)	4 (50)	4 (57.1)	10 (90.9)	8 (100)

UWRI-S: University of Wisconsin Running Injury and Recovery Index-Spanish.

#### 5. Content validity

During Stage V, four main changes were made to the questionnaire based on the thirty-one participant's suggestions (description of demographics, injury and UWRI-S scores on participants in stage V are presented in Table 2). First, we incorporated “en los últimos 7 días/in the last 7 days” into each question. Second, this was modified to “considerando los últimos 7 días/considering the last 7 days”. Third, we added “sin incluir actividades deportivas/excluding sports activities” to question 1. Fourth, we modified question 9 to “¿Qué tan confiado estás hoy .../How confident are you today ...”. After this last version, no new suggestions or modifications were made. A summary of the agreement after each modification is presented in Table 3. The final version of UWRI-S that was used to test its psychometric properties can be found in Appendices.

##### 5.1. Participants and descriptive data

Fifty-seven participants were enrolled (33 males [57.9%], median age of 34 years [IQR 28–4]), and 46 (80%) completed the second UWRI-S measurement for test-retest analysis. Description of participants is shown in Table 4.

The median (IQR) of the questionnaire scores were 17 (10–22) for UWRI-S, 66 (58–75) for LEFS, 4 (2–5) for PSFS, 2 (1–3) for NPRS, and 5 (3–6) for GROC.

##### 5.2. Construct validity

Of the 4 hypotheses initially proposed, 75% of them were confirmed. A positive and moderate correlation ( $r = 0.70$ ;  $p \leq 0.000$ ) was found between UWRI-S and LEFS; fair and positive correlation ( $r = 0.30$ ;  $p = 0.024$ ) between UWRI-S and PSFS; moderate and positive correlation ( $r = 0.50$ ,  $p < 0.01$ ) between

**Table 4**  
Sociodemographic, anthropometric, training and injury characterization of participants included in psychometric properties evaluation.

Characteristics	Participants (n = 57)
Age (years) <sup>a</sup>	34 (28–40)
Gender (male) <sup>b</sup>	33 (57.9)
Weight (kg) <sup>c</sup>	66.7 (10.7)
Height (cm) <sup>c</sup>	170 (8.7)
Years of study <sup>b</sup>	
Less than 8 years	0 (0)
Between 8 and 12 years	3 (5.3)
More than 12 years	54 (94.7)
Type of runner <sup>b</sup>	
Recreational	7 (12.3)
Competitive	50 (87.7)
N° of physiotherapy sessions <sup>a</sup>	5 (3–9)
Body place of injury <sup>b</sup>	
Foot/ankle	14 (24.3)
Low leg	8 (14)
Knee	27 (47.3)
Thigh	0 (0)
Hip/pelvis	6 (10.2)
Lower back	2 (3.5)
Training frequency (days per week) <sup>a</sup>	
Prior to injury	4 (3–5)
In the last 7 days	2 (0–4)
Training hours per week a	
Prior to injury	6 (4–7)
In the last 7 days	2 (0–4)
Training volume per week (km) <sup>a</sup>	
Prior to injury	38 (21–60)
In the last 7 days	5 (0–25)

Abbreviations: kg: kilograms; cm: centimeters; km: kilometers.

<sup>a</sup> Data presented with median and interquartile range (IQR = P25–P75).

<sup>b</sup> Data presented with absolute frequency and percentage.

<sup>c</sup> Data presented with mean and standard deviation.

UWRI-S and GROC; and fair and negative correlation ( $r = -0.36$ ,  $p < 0.01$ ) between UWRI-S and NPRS. These correlations are graphically shown in [Appendices](#).

The exploratory analysis showed no correlation between UWRI-S and LEFS in the first week of rehabilitation ( $r = 0.21$ ;  $p = 0.5$ ). No correlations were found between UWRI-S and NPRS in the initial evaluation (first physiotherapy session) ( $r = 0.30$ ;  $p = 0.50$ ), or between the number of physiotherapy sessions and the total UWRI-S score ( $r = 0.13$ ;  $p = 0.31$ ).

### 5.3. Reliability

#### 5.3.1. Test-retest reliability and standard error of measurement

A good test-retest reliability was found (ICC = 0.82; [95% CI; 0.69, 0.90]) between the first (15; IQR 9–21) and second measurement (17; IQR 10–23). SEM was 1.6 points, and MDC 6.2 points.

#### 5.3.2. Internal consistency

Internal consistency was acceptable ( $\alpha = 0.95$  for factor 1 [items 6–8],  $\alpha = 0.8$  for factor 2 [items 1–5, 9]).

## 6. Discussion

The aim of this study was to cross-culturally adapt and evaluate the psychometric properties of UWRI-S, which assesses the limitation in running ability following a running-related injury (Nelson et al., 2019). Core elements of the UWRI were translated to the UWRI-S to create a comparable assessment that can be used with Spanish speaking runners who are recovering from an injury. Small changes in the UWRI-S were made following the cognitive interviews to enable consistent interpretation of each item. UWRI-S was found to be a valid and reliable PROM in Chilean runners

who were undergoing physiotherapy treatment as a result of a running-related injury.

### 6.1. Validity

According to COSMIN, construct validity is considered acceptable when at least 75% of the hypotheses proposed by the authors are met, which was found in the current study. Concerning the construct validity between LEFS and UWRI-S, participants with the greatest limitation in running ability did not necessarily have difficulty performing other daily life activities involving the lower limb (Hypothesis 1, [Table 2](#)). The LEFS predominantly evaluates activities of daily life that involve the lower limb, including only 3-items related to running (“running on flat ground”, “running on uneven ground”, “making sharp turns when running fast”) (Cruz-Díaz et al., 2014). The LEFS, as a non-specific measure, may not be able to sufficiently detect running injury limitations that affect daily activities to a lesser extent than the ability to run. In the initial UWRI study (Nelson et al., 2013), a null correlation between UWRI and LEFS was observed at the beginning of rehabilitation, improving after 8 weeks of rehabilitation, which indicates that LEFS scores do not vary much in people with running-related injuries. Similar findings were found in the UWRI development study – LEFS scores were very high when runners first presented to the clinic to receive care for their running injury (Nelson et al., 2019).

For our second hypothesis ([Table 2](#)), no correlation was observed between UWRI-S and PSFS. This may be due to most of the activities reported in PSFS being related to other grouped activities such as activities of daily living, squats, changes of direction, jumps and other sports, such as swimming and walking on a hill. This correlation was improved when PSFS responses were limited to those related to running (38% of total reported activities). PSFS was not used in the original UWRI construct-related validity study (Nelson et al., 2020), and therefore it is not possible to make comparisons.

Despite finding a moderate correlation between GROC and UWRI-S (Hypothesis 3, [Table 2](#)), the correlation improved when only factor two (“psychological” items 2 and 9) of the UWRI-S was used. Runners with a better psychological response may perceive greater global changes in function. The GROC is known to be temporally unstable because patient responses do not evenly consider the entire recall period, but rather are heavily influenced by status preceding GROC completion (Garrison & Cook, 2012). This classic assessment of construct validity is known to be inconsistent (Garrison & Cook, 2012; Kamper et al., 2009). The current association is lower than the association of change in the UWRI and GROC found in previous research using the Pearson correlation ( $r = 0.61$  and  $r = 0.67$ ) (Nelson et al., 2013, 2020).

A fair correlation was observed between UWRI-S and NPRS (Hypothesis 4, [Table 2](#)). This finding might be explained by the time frame that each questionnaire uses. UWRI-S asks for the last 7 days, whereas NPRS only considers the last 24 h. This difference would allow participants to respond “unable to run” in the last 7 days (item 4), but “mild or no pain” in the last 24 h (hypothesis 5). Similarly, most of the participants who reported having only one physiotherapy session reported “moderate pain”, “significant pain” or “unable to run” in item 4 of UWRI-S yet reported “mild or no pain levels” in the last 24 h with NPRS. It is important to note that runners monitor their symptoms while running (Nelson et al., 2019), so participants may have experienced pain while running in their last week but not in the last 24 h due to rest or self-restraint from training.

Items related to frustration and confidence of the UWRI-S had the lowest scores across all participants. The greater the number of sessions and weeks in rehabilitation, the higher scores related to training progression were evidenced, but frustration and confidence items increased to a lesser extent. This suggests that as

rehabilitation progresses, the distance, time, or pace of running are re-establishing towards pre-injury levels, but not frustration and confidence, which are probably the last to be restored to normal levels (Ardern et al., 2012; Nelson et al., 2019). The progressive increase in an athlete's confidence after an injury is known to play an important role in a successful return to sport (Ardern et al., 2012; Johnston & Carroll, 1998; Webster et al., 2008). Clinicians should constantly evaluate the psychological aspects related to running and address them accordingly for a safe and successful return to sport. In the UWRI-development study, runners consistently reported that their running ability was fully restored when they established the confidence to train without fear of re-injury (Nelson et al., 2019). Clinical studies of the UWRI psychometric properties also found runners' confidence increased after runners were able to experience symptom reductions and report increases in running load (volume or intensity) (Nelson et al., 2020).

In Chile, there is a direct relationship between the educational level (years of study) and the level of physical activity in leisure time and running (Besomi et al., 2018; Celis-Morales et al., 2009). The interpretation of the UWRI-S questionnaire could vary within different educational levels, being an important variable that reflects some social aspects of the person. In the present study, most of the runners presented a high educational level, both for the cross-cultural adaptation and the assessment of the psychometric properties. Therefore, whether these results are applicable to people with other educational levels is yet to be determined.

## 6.2. Reliability

UWRI-S showed good test-retest reliability. The period of time chosen between each measurement was limited to 48–72 h because injuries could vary throughout longer periods. The internal consistency was within the acceptable values for both factors, which is consistent with the English version (Nelson et al., 2019).

## 7. Limitations

The small sample size for some of the exploratory hypotheses may explain the lack of correlation and statistical significance found between questionnaires, leading to a type II error due to a lack of statistical power. Although the administration mode for the test-retest was not similar between sessions, reliability findings support the use of this questionnaire in its online version. The structural analysis of the English version of the UWRI identified two factors; however, a confirmatory analysis of UWRI-S is warranted to appropriately interpret its internal consistency.

### 7.1. Future directions

Future studies are needed to determine other relevant psychometric properties of the UWRI-S, such as responsiveness and cross-cultural validity in runners at different stages of their rehabilitation process, with different injury types, and performance abilities. Determining the minimal clinically important difference (MCID) will enable the implementation and evaluation of the response to clinical interventions in Chilean runners, and potentially other Spanish-speaking countries, and the prognosis of recovery.

## 8. Conclusion

UWRI-S is a valid and reliable PROM to assess running ability after a running-related injury in Spanish-speaking runners who are undergoing physiotherapy rehabilitation. UWRI-S can be used to monitor the rehabilitation process, recovery, and make informed decisions on return to running.

## Ethical approval

Approval for this study was obtained from the institutional Human Research Ethics Committee and participants provided written consent.

## Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendices. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ptsp.2022.05.007>.

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