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PRS GLOBAL OPEN

ORIGINAL ARTICLE
Reconstructive

Spanish Translation and Validation of the LIMB-Q: A Patient-reported Outcome Measure for Lower Extremity Trauma

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Background: Hispanic patients represent a notable portion of the adult trauma population in the United States, yet their participation in studies collecting patient-reported outcome measure data following lower extremity injuries is limited. This study aims to translate and linguistically validate the LIMB-Q in Spanish for use in this population.

Methods: We followed guidelines from the World Health Organization and the Professional Society for Health Economics and Outcomes Research to conduct this translation. Two independent translators conducted a blind forward translation of the LIMB-Q from English to Spanish, followed by a back translation to confirm the conceptual preservation of each LIMB-Q item. Five patients then participated in cognitive debriefing interviews to collect feedback on comprehension, interpretation, and language.

Results: Translators occasionally differed in the vocabulary they used in their forward translations. All conflicts were resolved by discussion and selection of the option with the greatest colloquial recognition and medical relevance. Back translation identified 25 differences, including items that did not fully convey semantics (n = 12), were missing parts (n = 9), or were listed out of order (n = 4). All items with inadequate semantics were revised to ensure full retention of their original meaning. Five patients participated in cognitive debriefing interviews, resulting in 5 revisions for diction and syntax.

Conclusions: The Spanish (US) translation of LIMB-Q is now available. This instrument may be used in both clinical and research settings to better understand the quality of life and satisfaction of Hispanic patients after traumatic lower extremity injury. *(Plast Reconstr Surg Glob Open 2025; 13:e6511; doi: 10.1097/GOX.0000000000006511; Published online 5 February 2025.)*

INTRODUCTION

Traumatic lower extremity injuries affect thousands of individuals every year and are frequently associated with diminished patient satisfaction and quality of life.[1,2] The most severe of these injuries are often managed through amputation or limb salvage with soft tissue reconstruction. Despite optimal treatment, many patients continue to face significant adverse psychosocial,[3–6] financial,[7–11] and functional[12–17] challenges posttreatment. Given the diverse impact of these injuries, the use of valid patient-reported outcome measures (PROMs) is essential for comprehensively understanding treatment outcomes, interpreting the results of clinical trials, and advancing patient-centered outcomes research.[18,19]

Hispanic patients represent a substantial portion of the adult trauma population in the United States; however, their participation in studies that collect PROM data following lower extremity injuries is often limited.[20,21] One factor behind this disparity may be the lack of lower extremity trauma-specific PROMs available in Spanish.[22] This exclusion hinders the ability to capture the experiences of Hispanic patients and ultimately affects the generalizability of research findings.[23] To bridge this gap and improve the recruitment and retention of Hispanic

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Received for publication September 3, 2024; accepted December 13, 2024.

DOI: 10.1097/GOX.0000000000006511

Disclosure statements are at the end of this article, following the correspondence information.

patients in lower extremity trauma research, it is imperative to develop and validate Spanish-language PROMs.

The LIMB-Q is a validated PROM specifically designed for adult patients with lower extremity trauma.[24,25] Developed according to internationally recognized standards for PROM development, the LIMB-Q has been validated for patients with injuries distal to the mid-femur requiring fracture surgery, soft tissue reconstruction with a flap, or amputation.[24–26] The full LIMB-Q consists of 16 independently functioning scales that encompass a wide range of patient-reported outcome domains. Originally developed in English, the LIMB-Q has been translated and validated in Dutch, Danish, and German.[27,28] To better capture the experiences of Hispanic patients and ensure their inclusion in ongoing research, this study aimed to translate and linguistically validate the LIMB-Q in Spanish.

Takeaways

Question: We aimed to translate the LIMB-Q—a patient-reported outcome measure for patients with traumatic lower extremity injuries—to Spanish using International Society for Pharmacoeconomics and Outcomes Research guidelines.

Findings: We successfully translated and validated the LIMB-Q in Spanish (US).

Meaning: A Spanish (US) version of LIMB-Q is now available for lower extremity trauma research and clinical care.

METHODS

We complied with guidelines published by the World Health Organization (WHO) and the Professional Society for Health Economics and Outcomes Research (ISPOR) when conducting this translation.[29–32] An overview of our methodology is included in Figure 1.

LIMB-Q

Details regarding the development and validation of the LIMB-Q are published elsewhere but summarized here for completeness.[24–26,33] Briefly, the LIMB-Q was developed through an iterative process beginning with qualitative interviews with 33 patients after traumatic lower extremity injuries.[33] The contents of these interviews were used to develop preliminary scales, which were subsequently utilized in cognitive debriefing interviews with 12 patients. Scales were further refined using input from 43 experts.[24] Finally, an international field test of 713 patients was conducted, and the final version of the LIMB-Q was created.[25] The instrument contains 164 items across 16 independently functioning scales.

Forward Translation

Two independent translators conducted a blind forward translation of the LIMB-Q from English to Spanish. Both translators were academic physicians and bilingual in English and Spanish. The translators conducted their forward translations with the goal of retaining the conceptual meaning of each original LIMB-Q item. Subsequently, a third bilingual translator conducted a blind review of each translation to assess comprehension, reconcile discrepancies, and suggest alternative phrasing. All translators then met for a consensus meeting to analyze the forward translations and develop a final forward translation (Spanish LIMB-Q Translation 1.0).

Back Translation

One translator used the Spanish LIMB-Q Translation 1.0 to conduct a back translation from Spanish to English. An independent researcher reviewed the back translation to confirm the conceptual preservation of each LIMB-Q item from the original English version. This researcher also indicated items where the translation could be altered or optimized. These suggestions were reconciled between the researcher and the back translator to produce Spanish LIMB-Q Translation 2.0.

Cognitive Debriefing Interviews

We recruited 5 patients with a history of traumatic lower extremity injuries to complete cognitive debriefing interviews on the Spanish LIMB-Q Translation 2.0. During these interviews, one translator reviewed the scale with patients to collect feedback on comprehension, interpretation, and language. Patients were invited to suggest alternative translations of items as needed. The translator conducted interviews until we achieved thematic saturation. Team members then met to discuss patient feedback and produce the final version, Spanish LIMB-Q Translation 3.0. Finally, translators proofread the scale to ensure proper grammar and spelling.

Ethical Approval

This study was reviewed and approved by the Johns Hopkins Medicine institutional review board (IRB00423735). Patients were compensated for their time during the cognitive debriefing interviews.

RESULTS

We completed the forward translation and consensus meetings between December 1, 2023, and April 8, 2024. We subsequently completed the back translation on May 10, 2024, and conducted cognitive debriefing interviews between June 11, 2024, and July 30, 2024. The final version of the Spanish (US) LIMB-Q was approved on August 12, 2024. From initiation to completion, translation and validation of this scale required 8 months.

Forward Translation

Given the existence of words or phrases with the same or practically similar meanings, translators occasionally differed in the vocabulary they used in their forward translation. The most notable example of this was a discrepancy in the translation of "limb." Although 1 translator used the word "miembro," which can refer either to a part of the body or a member of a group, the other translator used the word "extremidad," which may refer to the end or tip of an object, including an arm or a leg. Through the adjudication process, the translators reached a consensus

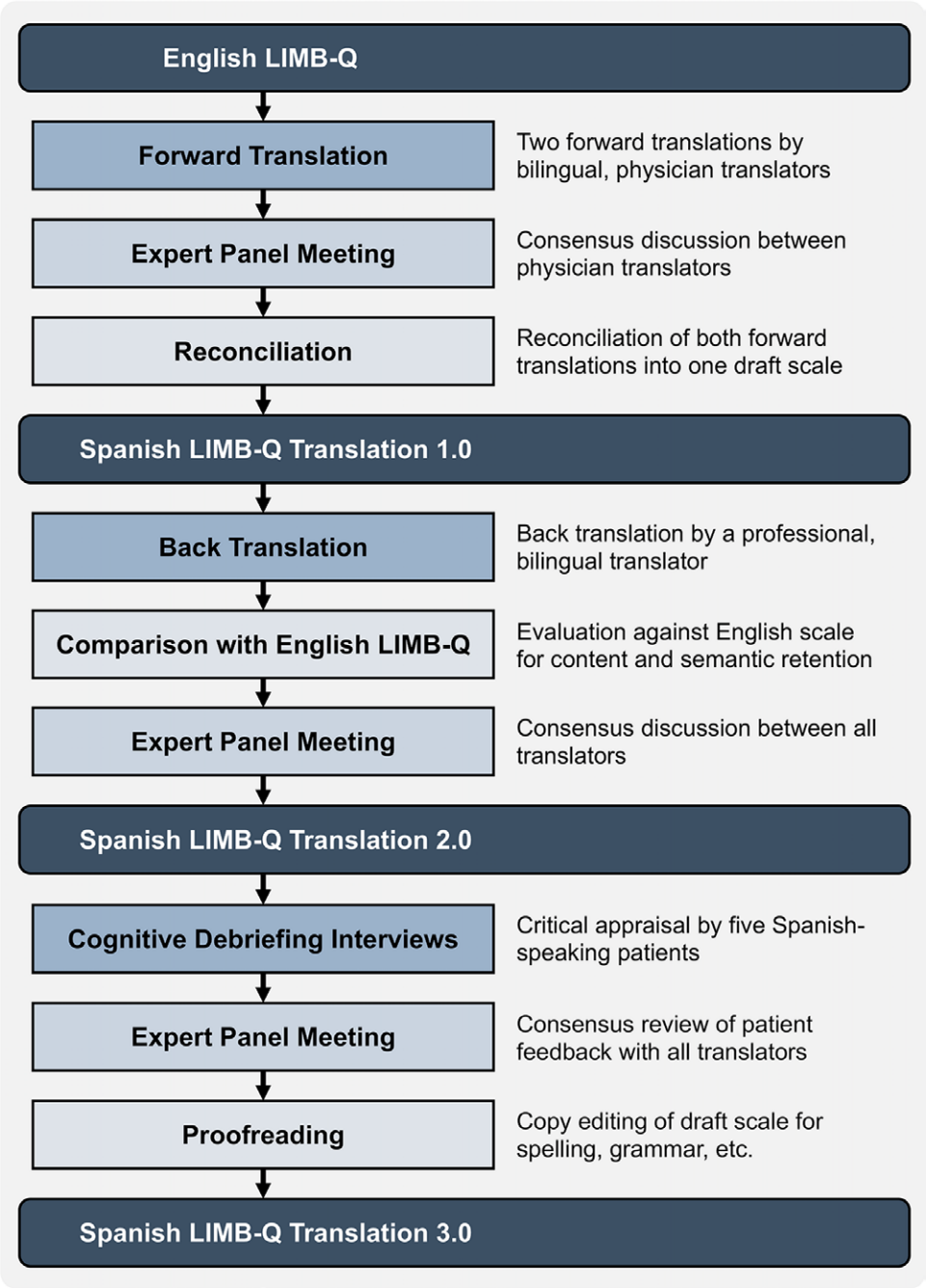

Fig. 1. Overview of the translation and validation process used to develop the Spanish (US) LIMB-Q.

on "extremidad inferior," meaning lower limb or lower extremity, which was found to be both more colloquially recognizable and medically relevant.

Translators also faced challenges ensuring translations retained the semantics of the English LIMB-Q. For example, the LIMB-Q uses "contour" and "shape" as distinct descriptors of the reconstructed or amputated lower extremity. The translators indicated that "contorno" was the most exact translation of "contour" but would likely be less recognizable to patients. Although the translators could use "forma" to mean "contour," this word was already used as the translation for the word "shape" in another item. Ultimately, the translators determined that the word "perfil" best captured the meaning of "contour," reflecting the notion of a profile or surface outline, while being sufficiently distinct from the word used for overall "shape," "forma."

Back Translation

Upon analysis of the back translation, 25 items were flagged due to differences from the English LIMB-Q. These differences included items that did not convey the full semantics of the English version (n = 12), items that

were missing parts of the English version (n = 9), and items that were listed out of order when compared with the English version (n = 4).

Items that failed to capture semantics were often the result of synonyms that incompletely captured the meaning of English concepts. For example, one item in the "Sexual Function" scale asked respondents if they "feel satisfied with [their] sex life." Back translation revealed that this question had changed to ask respondents if they, "feel satisfied during sexual activity." This translation appropriately addressed the physical aspect of sexual intercourse but failed to capture other factors about one's sexual well-being (eg, confidence, comfort). All scale items that were indicated to have inadequate semantics in the back translation were revised to ensure full retention of their original meaning. These semantic differences did not impact any 1 scale more than another (eg, expectations, financial impact). We addressed items with missing words by adding those omitted, and we addressed items written out of order by placing words in their correct sequence.

Two flagged items were the result of fundamental linguistic variability between English and Spanish. Both items included the phrase, "How well the prosthesis *fits* your limb." In both cases, we had translated these items to, "How well the prosthesis *sits on* your limb," as there is no single word translation for "fits" in Spanish. The difference between "fits" and "sits on" items were subsequently flagged as back translation errors. However, we retained the original forward translation in these cases because they maintained the appropriate semantics.

Cognitive Debriefing Interviews

We conducted five cognitive debriefing interviews using the Spanish LIMB-Q Translation 2.0 to evaluate comprehensibility and establish validity. Patient interviewees included 3 women and 2 men ranging in age from 22 to 35 years. All patients had experienced prior lower extremity trauma, with a median time from injury of 10.4 months (range: 0.4 to 25.7 mo). Similarly, all patients had undergone surgical management, with a median of 1 operation (range: 1–11 operations) (Table 1). Our sample size agrees with ISPOR recommendations and was sufficient for obtaining thematic saturation among the interviewees.[30–32]

Seven suggestions from patients resulted in 5 changes to the final scales. Two patients suggested exchanging the word for "jump" from "brincar" to "saltar," which we incorporated into the final scale. Another patient recommended that the word "handrail" could be translated as either "pasamanos" or "barandilla," depending on dialectical variability; we incorporated both terms into the final scale item.

Patients also suggested that we clarify the focus of some questions. For example, the Appearance scales ask patients to report, "How noticeable the reconstructed part of [their] limb is." Although this scale is intended to measure visual appearance, one patient noted that the limb may be "noticeable" for other reasons (eg, pain, swelling). This patient recommended that we add the term "visiblemente," meaning "visually," to indicate that the question specifically addresses outward appearance. We incorporated this suggestion into the final scale.

Table 1. Demographic and Injury Characteristics of Patient Interviewees

Patient Characteristic	No. Patients (N = 5)
Sex	
Female	3
Male	2
Age, y, mean (range)	28 (22–35)
Operations, No., median (range)	1 (1–11)
Injury type	
Fracture, closed	3
Fracture, open	2
Fracture type	
Tibia-fibula, shaft	1
Tibia-fibula, pilon	1
Tibial shaft	1
Tibial plateau	1
Trimalleolar	1
Fracture laterality	
Unilateral (R/L)	5 (4/1)
Mechanism of injury	
Motorcycle or scooter	2
Motor vehicle collision	1
Nonaccidental trauma	1
Fall	1
Management*	
ORIF	3
Intramedullary nail	2
Autologous reconstruction	1
Complications†	
Chronic osteomyelitis	1
Nonunion	1
None to date	4

*Total count includes one fracture that required both an intramedullary nail and autologous reconstruction.
†Complication count includes one fracture complicated by both osteomyelitis and nonunion.
L, left; ORIF, Open reduction and internal fixation; R, right.

DISCUSSION

In this study, we translated the LIMB-Q from English to Spanish and validated the scale in compliance with WHO and ISPOR guidelines for PROM development.[29–32] This iterative process engaged physician, academic, and patient stakeholders to guarantee both conceptual retention and linguistic accessibility of the Spanish (US) LIMB-Q. Additionally, this project centered feedback from Hispanic patients and researchers to ensure the Spanish (US) LIMB-Q would be useful not only for clinical applications but also for patient-centered outcomes research. The final Spanish (US) LIMB-Q includes 16 independently functioning scales and 164 individual items. The shortest scale includes 6 items, whereas the longest includes 15 items, consistent with the English LIMB-Q.

The rigorous methodology in this study is necessary to create linguistically valid and culturally coherent PROMs. The ISPOR Good Practice guidelines for the Translation and Cultural Adaptation of PROMs offer consensus guidance for systematic translation and linguistic validation of PROMs.[30–32] Compliance with these guidelines requires at least 2 independent forward translations, back translation, and cognitive debriefing interviews with 5–8 patients.

Because the quality of PROMs is dependent upon the quality of data from which they are derived, these comprehensive methods help ensure the quality and linguistic accuracy of translated PROMs.[34] This process has been proven to yield effective and reliable translations of other PROMs, including the translation of the LIMB-Q from English to Danish, Dutch, and German.[27,28]

Translation and validation of the Spanish (US) LIMB-Q was challenging due to the presence of numerous Spanish dialects. For example, Peninsular Spanish, which is the language spoken in Spain, has several notable differences in vocabulary, pronunciation, and grammar when compared with Latin American Spanish. Furthermore, within Latin America, Spanish varies by region, with distinct Mexican, Rioplatense (eg, Argentina, Paraguay, Uruguay), Andean (eg, Bolivia, Ecuador, Peru), and Caribbean (eg, Cuba, Dominican Republic, Puerto Rico) dialects.[35] Patient interviews helped broaden the geographical and cultural reach of the LIMB-Q by highlighting areas of ambiguity secondary to dialectical differences. For example, the verb "to jump" can be translated as "brincar" or "saltar." Although the former refers to the physical act of jumping, the latter may be interpreted either literally (eg, jumping over a puddle) or metaphorically (eg, jumping ahead in a book). Two patients were confused by our original use of "brincar" and expressed a strong preference for the word "saltar," which we adopted in the final version of the scale. In scenarios where alternative translations were deemed equally acceptable, both words were included for greater patient accessibility. It should be noted that the Spanish (US) LIMB-Q was developed using Spanish-speaking patients in the United States, hence the parenthetical US in its name.

The development of the Spanish (US) LIMB-Q is fitting given the large number of Spanish speakers globally and the evidence that Hispanic patients face disparate clinical outcomes.[20,21] Spanish is the second most spoken language in the United States and the fourth most spoken language globally.[36,37] Per 2020 census data, more than 13.5% of the United States population speaks Spanish at home, and approximately 8.2% (25 million people) have limited English proficiency (LEP).[38,39] Compared with persons proficient in English, adults with limited English experience lower-quality inpatient care,[40,41] receive fewer outpatient services,[42–45] and face greater challenges accessing specialty care.[39,46] They also report lower levels of satisfaction with their healthcare and are more likely than English-proficient adults to forgo necessary medical care.[45,47,48] They are also at a greater risk of lower extremity injuries due to high-velocity trauma[20] and workplace injuries[49,50] and have been shown to have worse functional outcomes and more postoperative pain following treatment of lower extremity fractures.[20,51]

The Spanish (US) LIMB-Q may be used in both clinical and research settings to better understand the outcomes of Hispanic patients after traumatic lower extremity injury. Because patients with LEP are particularly vulnerable to suboptimal clinical outcomes, the availability of PROMs in several languages overcomes barriers stemming from linguistic incompatibility. Additionally, the use of valid, translated PROMs eliminates the need for researchers to translate existing instruments, a process that risks the loss of content validity and complicates subsequent data analysis. For example, because the Spanish (US) LIMB-Q matches all other versions of the LIMB-Q (eg, English, German) in length, content, and scoring, any of these scales may be used in the same study to accommodate the preferred first language of participants. This adaptability both enhances patient accessibility and ensures that vulnerable populations, such as those with LEP, can be equitably included in patient-centered outcomes research.

Limitations of this study are inherent to any translational work. First, dialectical variations may limit the accessibility of the LIMB-Q to all Hispanic patients. To account for this limitation, we followed best practice guidelines for PROM development, translation, and validation. Furthermore, our translators—both forward and back—were bilingual Spanish speakers from different cultural backgrounds. Therefore, all translations incorporated personal dialectical variations which we refined through consensus discussion. The study is also limited by the absence of audio recordings of consensus discussions and cognitive debriefing interviews. To overcome this challenge, we took notes during all meetings and interviews to document key pieces of data and considerations during the translation process.

CONCLUSIONS

We translated and validated a Spanish version of the LIMB-Q in adherence with WHO and ISPOR guidelines to ensure its conceptual accuracy and cultural adaptability. The Spanish (US) LIMB-Q may be used in both clinical and research settings to better understand the quality of life and satisfaction of Hispanic patients after traumatic lower extremity injury. The Spanish (US) LIMB-Q is available upon request (QPortfolio.org) and completion of a licensing agreement.

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DISCLOSURES

Dr. Mundy is a co-developer of the LIMB-Q and could potentially receive a share of any license revenue on the inventor sharing policies from the institutions that own the LIMB-Q if the instrument is used by for-profit companies. Dr. Rivera Perla is a consultant for Qral Group and Consultant/Data Analyst for Braid-Forbes Health Research. Neither of these entities are mentioned in this work, nor do we discuss medical devices or anything of the sort in this article. The other authors have no financial interest to declare in relation to the content of this article.

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