Original Article

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CONSTRUCT VALIDITY AND RELIABILITY OF THE LEG ULCER MEASUREMENT TOOL SCALE ADAPTED FOR BRAZIL

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ABSTRACT

Objective: to validate the Portuguese version of the Leg Ulcer Measurement Tool regarding construct and reliability.
Method: this is a methodological research study. Data collection was conducted between January and July 2019. A total of 105 participants were included for construct validation and internal consistency and, of these, 50 were selected for intra-observer stability. For the analysis of construct validity, factor analysis was performed; for internal consistency, Cronbach's alpha coefficient was calculated, and for stability, the intraclass correlation coefficient.
Results: A total of 12items were confirmed for the Brazilian reality, meeting all the theoretical requirements of the factor analysis model. As for the internal consistency (reliability) analysis, the Cronbach's alpha coefficient values (α=0.711) showed that the set of items that make up the scale measures the same characteristics and presents internal consistency. In the global stability analysis (ICC=0.823), the *Leg Ulcer Measurement Tool* test and retest scores presented good agreement, showing that the adapted scale is stable.
Conclusion: the *Leg Ulcer Measurement Tool* scale adapted to the Portuguese language contains 12 items, with scores varying from 0 to 4 and, thus, produces a score from 0 to 48 points. It presents construct validity analyzed by means of factor analysis and reliability in terms of internal consistency and stability.

DESCRIPTORS: Methodological research in Nursing. Nursing evaluation. Validation studies. Leg ulcer. Varicose ulcer. Diabetic foot.

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VALIDADE DE CONSTRUTO E CONFIABILIDADE DA ESCALA *LEG ULCER MEASUREMENT TOOL* ADAPTADA PARA O BRASIL

RESUMO

Objetivo: validar o construto e a confiabilidade da versão em português da escala *Leg Ulcer Measurement Tool*.
Método: trata-se de uma pesquisa metodológica. A coleta de dados foi realizada entre janeiro e julho de 2019. Foram incluídos 105 participantes para a validação de construto e consistência interna e, desses, 50 participantes para a estabilidade intraobservador. Para a análise de validade de construto, foi realizada a análise fatorial; para a consistência interna, foi calculado o coeficiente alfa de Cronbach e para a estabilidade, o coeficiente de correlação intraclasse.
Resultados: foram confirmados 12 itens para a realidade brasileira, cumprindo todas as exigências teóricas do modelo da análise fatorial. Quanto à análise da consistência interna (confiabilidade), os valores do coeficiente de alfa de Cronbach (α=0,711) demonstraram que o conjunto de itens que compõem a escala mede as mesmas características e apresenta consistência interna. Na análise da estabilidade global (ICC=0,823), os escores da *Leg Ulcer Measurement Tool* no teste e reteste apresentaram boa concordância, demonstrando que a escalaadaptada é estável.
Conclusão: A escala *Leg Ulcer Measurement Tool* adaptada para a língua portuguesa contém 12 itens, com pontuação de 0 a 4, e produz, assim, um escore que varia de 0 a 48 pontos. Apresenta validade de construto analisada pela análise fatorial e confiabilidade em termos de consistência interna e estabilidade.

DESCRITORES: Pesquisa metodológica em enfermagem. Avaliação em enfermagem. Estudos de validação. Úlcera da perna. Úlcera varicosa. Pé diabético.

VALIDEZ DE CONSTRUCTO Y CONFIABILIDAD DE LA ESCALA *LEG ULCER MEASUREMENT TOOL* ADAPTADA A BRASIL

RESUMEN

Objetivo: validar el constructo y la confiabilidad de la versión en portugués de la escala Leg Ulcer Measurement Tool.
Método: investigación metodológica. La recolección de datos tuvo lugar entre enero y julio de 2019. Se incluyó a 105 participantes para la validación del constructo y la consistencia interna y, de ellos, 50 para la estabilidad intraobservador. Para el análisis de validez de constructo, se realizó un análisis factorial; para la consistencia interna, se calculó el coeficiente alfa de Cronbach y, para la estabilidad, el coeficiente de correlación intraclase.
Resultados: se confirmaron 12 ítems para la realidad brasileña, cumpliendo con todos los requisitos teóricos del modelo de análisis factorial. En relación con el análisis de la consistencia interna (confiabilidad), los valores del coeficiente alfa de Cronbach (α=0,711) demostraron que el conjunto de ítems que componen la escala mide las mismas características y presenta consistencia interna. En el análisis de la estabilidad global (ICC=0,823), las puntuaciones test-retest de la escala *Leg Ulcer Measurement Tool* presentaron buena concordancia, demostrando así que la escalaadaptada es estable.
Conclusión: la escala *Leg Ulcer Measurement Tool* adaptada para el idioma portuguéscontiene 12 ítems, con valores de 0 a 4 y, por lo tanto, genera una puntuación que varía entre 0 y 48 puntos. Presenta validez de constructo, la cual se analizó por medio del análisis factorial y confiabilidad en términos de consistencia interna y estabilidad.

DESCRIPTORES: Investigación metodológica en Enfermería. Evaluación en Enfermería. Estudios de validación. Úlcera de pierna. Úlcera varicosa. Pie diabético.

INTRODUCTION

The use of a structured approach in the assessment and treatment of wounds is a central component for the success of the treatment and should integrate the practice of wound care[1]. It is important that nurses use an assessment tool, which assists in clinical support, judgment and decision-making, thus ensuring that more effective and appropriate care is offered[2].

There are several instruments to assess wounds published in the international scientific literature, but most of them have not yet gone through the cross-cultural adaptation and validation process, which impairs their application in Brazil[3]. Among the scales used for this assessment, the Pressure Ulcer Score for Healing (PUSH), originally developed for pressure injuries, was the most prevalent in the analyzed studies including leg ulcers[3–4]. However, a number of research studies have already shown that it is not valid for these ulcers, especially venous ones. In addition to that, it only assesses three dimensions, focusing exclusively on the wound[4–5].

Considering these aspects, an integrative review was carried out with an international search and analysis of ten instruments that addressed parameters for clinical evaluation[6]. Among these, the Leg Ulcer Measurement Tool (LUMT) stood out, as it is a specific tool for the evaluation of leg ulcers, which can be classified as vascular ulcers (for example, venous, arterial or mixed) and diabetic ulcers[7]. From 70% to 90% of the leg ulcers are of venous etiology, with the remainder (30%) divided between arterial, mixed, diabetic and other causes (trauma, lymphatic and/or hematological problems)[8].

LUMT is a very complete scale, encompassing items of clinical assessment, pain and quality of life, and has instructions for its correct fulfillment[9]. It was developed in Canada in 2004 and its authors submitted it to the clinical and content validation process[10].

In 2016, LUMT underwent the cross-cultural adaptation process with an assessment of its feasibility, when it was considered adequate and adapted to the Brazilian reality[9]. After these stages, the next step was to perform the clinical validation in order to ensure that the version translated into Portuguese is valid and reliable. In this sense, it is worth noting that the complexity of the healing process requires a dynamic and precise analysis. In addition to that, clinical and research instruments with reliable and valid measures are necessary to apply effective protocols[11].

Based on the described scenario, this study aims at validating the construct and reliability of the Portuguese version of the Leg Ulcer Measurement Tool (LUMT).

METHOD

A methodological research study based on the theoretical-methodological concepts of Psychometry, carried out in a Wound Repair Clinic of a university hospital and a polyclinic in Niteroi from January to July from 2019.

The study was approved by the Ethics Committee and the original authors[10] authorized the process of cross-cultural adaptation and the validation of the translated version through e-mail.

It was used in sequenced sampling, which consists in recruiting all the individuals from a population that met the eligibility criteria throughout a specific period of time to reach a given sample size[12].

The sample consisted of 105 participants for construct validity and internal consistency and, of these, 50 were selected for intra-observer stability. For construct validation, the literature recommends the inclusion of 5 to 10 participants for each item to be evaluated and, for stability, a subsample between 10 to 50 participants is recommended[12–14]. For construct validity, a sample size of more than 100 participants and at least 5 times the number of scale items is considered adequate; a very good sample for internal consistency has the inclusion of more than 100 participants, and an adequate sample for stability has the inclusion of 50 to 99 participants[15].

The inclusion criteria were as follows: age over 18 years old; leg ulcer of a venous, arterial, mixed or diabetic etiology, with a minimum time of 12 weeks. In participants with more than one lesion, the one selected was the largest in terms of extension. The following were excluded: circular ulcers, due to the difficulty measuring the area and, for stability, the participants who could not return for further treatment within 14 days.

LUMT was used for data collection, which is a scale consisting of two parts. Part A has 14 items classified as domains clinically rated by the professionals and Part B consists of 3 domains that are evaluated by the patients themselves. Each item has 5 response categories, scored from 0 to 4[9]. Part A scores vary from 0 to 56 points, and those of Part B from 0 to 12. The higher the score, the worse the healing, the pain and the quality of life[10]. In addition to LUMT, an instrument containing the participant's identification data, sociodemographic and clinical characterization was used.

The participants were invited to participate in the research during the routine appointments in the outpatient services selected. For construct validity and internal consistency, the data were collected a single moment in the total sample. For stability, the participants were included to the extent that those selected for the analysis of construct validity and internal consistency had the possibility of returning within 14 days (because they are chronic lesions with a prolonged tissue repair process), until reaching the sample of 50 participants.

The researcher was the only person in charge of data collection in all the stages. She is a nurse with more than 5 years of experience in wounds at the time of collection, in addition to having conducted a previous study with LUMT.

The data collected were arranged in a *Microsoft Excel* 2013 spreadsheet. The statistical analysis was performed in the *IBM SPSS* program, version 22.0. For the analysis of construct validity, the *Kaiser-Meyer-Olkin* (KMO)and Bartlett's Sphericity Test (BST) were calculated to assess the suitability of the sample and assess the null hypothesis that there is no correlation between the items. The expected values for the KMO tests are between 0.5 and 1 and, for BST, a *p-value* below 0.5[16].

To determine the number of factors, Kaiser's latent root criterion was used, where the number of factors corresponds to the number of eigenvalues greater than or equal to an accumulated explained variance above 60%[16–17]. After extracting the factors, the Varimax rotation method was applied to obtain an interpretation of the factors by finding significant and negligible loading groups through factor loadings[16–17]. A commonality represents how much a variable is explained by the factor solution. It is necessary that at least 50% of the variance of the variable is explained by extraction of the factors; the higher the load, the higher its representativeness in the factor. Considering a sample of 100 (closest value of the sample of this study), factor loads equal to or higher than 0.55 are considered significant[16–17].

Reliability was analyzed through internal consistency and stability. For internal consistency, Cronbach's alpha coefficient was calculated and an alpha value > 0.7 was considered adequate[17]. For stability, the agreement between the test and retest scores was evaluated by means of the Intraclass Correlation Coefficient (ICC) and an ICC > 0.80 was considered adequate, expressing good agreement[18].

RESULTS

Sociodemographic and clinical characteristics of the participants

The predominant profile was as follows: 60 male participants (57.1%); 63 belonging to the age group from 60 to 80 years old (60.0%), with a mean of 65.9 years old. 77 had hypertension (73.3%); 85, Chronic Venous Insufficiency (81.0%); 80, venous ulcers (76.2%); 59 located in the malleolus (56%); 57 for more than 40 months (54.3%) and 66 without recurrence (62.9%). Duration of the ulcer ranged from 3 to 600 months (mean of 84.9 months).

Regarding the characteristics of the lesions: 96 participants had serous exudate (91.4%); 42 in small amounts (40.0%); 64 with size > 10.1 cm² or more (61.0%); 105 with full-thickness skin loss (100.0%); 104 with 0 cm undermining (99.0%); 71 with necrotic tissue (67.6%); 67 with a maximum of 25% necrotic tissue (63.8%); 82 with bright healthy red granulation tissue (78.1%); 67 with more than 50% of granulation tissue (63.8%); 70 with less than 50% of the borders of the epithelium advancing (66.7%); 60 with 2 or 3 elements of compromised perilesional viability (57.1%); 47 with firm swelling or no pitting (44.8%); 30 with edema located up to the middle of the calf (28.6%) and 104 with little colonization (99.0%).

When pain was assessed, 32 participants with no pain (30.5%) and 31 with worst pain (>7) (29.5%) were observed. The pain frequency values are mainly distributed in the following answers: none (32 [30.5%]), occasional (31 [(29.5%]) and position dependent (33 [(31.4%]). 47 (44.8%) were satisfied with their quality of life.

Construct validity of the *Leg Ulcer Measurement Tool*

Factor Analysis

A correlation analysis of the scale items was performed for adequacy of the factor analysis. Initially, the "Depth" variable was removed, which was constant for all the cases. In the first correlation analysis, the "Assessment of Bioburden" variable was removed, which did not present any correlation with the scale items. In the second attempt, removing the two variables, the results showed a small number of significant correlations and the statistic of KMO=0.577< 0.6, indicating that the factor analysis with the configuration of all the variables that were being used would be inadequate.

Analyzing the individual Measure of Sampling Adequacy (MSA) of each variable, it was noticed that the "Exudate type", "Undermining", "Granulation Tissue Type", "Pain" and "Pain frequency" variables were below 0.50. Although Bartlett's sphericity test revealed that the correlations were collectively significant (p-value < 0.001), the other results suggested the exclusion of at least one of the variables. Thus, a new model was chosen, excluding each of the variables that presented MSA values below 0.5, to verify if the exclusion of one of these variables would improve the sample adequacy statistics.

It was verified that removing the minimum number of variables that would maximize KMO and minimize the number of variables with MSA values below 0.5 would remove the "Pain frequency" variable. Thus, the third factor analysis was performed and presented only two variables with individual MSA values below 0.5 (Exudate Type and Granulation Tissue Type) but, as the global KMO statistic was equal to 0.615, greater than 0.6, with a p-value < 0.001, it was decided not to exclude either of the two variables.

Using Kaiser's latent root criterion, the number of factors to be retained was chosen, depending on the number of eigenvalues greater than 1 and accumulated variance above 60%. In the current research, it was possible to extract, initially, four factors that represent about 64.45% of the total variance present between the items, as shown in Table 1.

By extracting the 4 factors, the commonalities of the variables and the factor loads obtained by the VARIMAX Rotation method were calculated, shown in Table 2. The results show that the "Undermining" and "Borders" variables have commonalities and factor loads below the levels recommended, indicating little representation of these variables and, therefore, they were removed.

Finally, the scale was validated externally and can be divided into 4 factors, the main one being represented by the Necrotic Tissue Type, Necrotic Tissue Amount, Granulation Tissue Type and Granulation Tissue Amount variables; the second factor comprised by the Exudate Amount, Size of the ulcer, Viability and Edema Type and Location variables, another factor represented by the Pain and Quality of Life variables, and the weakest factor represented only by Exudate Type. Factor 1 variables are the main contributors to the LUMT scale score.

Table 1 – Number of factors to be extracted according to Kaiser's criterion for the eigenvalues and cumulative percentage of explained variance. Niterói, RJ, Brazil, 2019. (n=105).

Component	Initial eigenvalues	Percentage of the explained variance	Cumulative percentage of the explained variance
1	3.656	26.115	26.115
2	2.748	19.626	45.741
3	1.513	10.804	56.545
4	1.107	7.908	64.453
5	.988	7.055	71.508
6	.967	6.906	78.414
7	.799	5.705	84.119
8	.616	4.400	88.518
9	.520	3.711	92.229
10	.438	3.125	95.354
11	.304	2.171	97.525
12	.182	1.300	98.825
13	.162	1.154	99.979
14	.003	.021	100.000

Table 2 – Commonalities of the variables and factor loads obtained by the VARIMAX Rotation method with Kaiser Normalization. Niterói, RJ, Brazil, 2019. (n=105).

Variable	Commonalities	Factor Loads			
		Factor 1	Factor 2	Factor 3	Factor 4
Necrotic tissue type	0.712	0.756	0.238	0.194	-0.216
Necrotic tissue amount	0.946	0.967	0.058	0.088	-0.016
Granulation tissue type	0.695	0.813	-0.153	-0.093	0.052
Granulation tissue amount	0.908	0.932	0.130	0.140	-0.045
Exudate amount	0.718	-0.298	0.562	0.420	-0.37
Size of the ulcer	0.659	-0.131	0.584	0.500	-0.226
Viability	0.516	0.168	0.682	0.129	0.081
Type	0.737	0.089	0.840	-0.062	0.137
Location	0.753	0.076	0.845	-0.176	0.057
Pain	0.708	0.038	-0.05	0.810	0.217
Quality of life	0.503	0.214	-0.015	0.643	-0.114
Exudate type	0.553	0.002	-0.045	-0.038	0.741
Undermining	0.326	-0.155	0.228	0.057	0.497
Borders	0.319	0.363	0.330	-0.043	-0.277

Reliability of the Leg Ulcer Measurement Tool (internal consistency and stability)

The Internal Consistency results are shown in Table 3. Factor 1 presents very good internal consistency, while Factor 2 has reasonable consistency. The consistency of Factor 3 is unacceptable, which means that the items do not measure the same concept, which can be explained, given that they assess Pain and Quality of Life, which are not correlated with the other items. The scale with the Factor 3 variables and without the "Undermining" and "Borders" variables was also internally validated, as it presents α=0.711, which is above 0.7. Therefore, it was decided to remove the "Undermining" and "Border" variables in order to have a parsimonious scale and with all variables presenting commonalities and valid factor loads, that is, fully validated in all statistical requirements.

In the results shown in Table 4, the Intraclass Correlation Coefficients (ICC) attest to very good agreement between the test and retest scores of Parts A and B and of the Global score. The values are significantly good, according to the requirements described in the method, as the confidence intervals are contained in the ICC > 0.60 interval (lower limit of good agreement), concluding that the LUMT scale is stable.

New values of the score of the adapted Leg Ulcer Measurement Tool

The originally proposed version of LUMT has 17 items, each one receiving integer scores from 0 to 4, and producing a score that varies from 0 to 68 points. Validation by factor analysis and internal consistency for the Brazilian data removed 5 items from the original scale, namely: depth, bioburden assessment, pain frequency, undermining and borders, each item receiving a score from 0 to 4 in formation of the score. Such being the case, the adapted LUMT proposed in this paper has 12 items and produces a score that varies from 0 to 48. After going through the stages of construct validation and reliability analysis (internal consistency and stability), the adapted version of LUMT was obtained, as shown in Chart 1.

Table 3 – Reliability and internal consistency analysis of the factors and of the entire scale. Niterói, RJ, Brazil, 2019. (n=105).

Factor	Cronbach's Alpha
Factor 1	0.911
Factor 2	0.766
Factor 3	0.438
Factor 4	*
Total (without the Undermining and Borders variables)	0.711
Total	0.715

*Not calculable, as this factor only has 1 variable.

Table 4 – Stability analysis of the adapted *Leg Ulcer Measurement Tool*, comparing two applications performed independently. Niterói, RJ, Brazil, 2019. (n=105).

Domain	Intraclass Correlation Coefficient	Confidence Interval of the Intraclass Correlation Coefficient
Part A	0.841	(0.736-0.906)
Part B	0.833	(0.723-0.902)
Global Score	0.828	(0.715-0.898)

Chart 1 – Version of the *Leg Ulcer Measurement Tool* adapted in Portuguese, obtained and Construct Validity and Reliability Analysis (internal consistency and stability). Niterói, Rio de Janeiro, Brazil, 2019.

ADAPTED LEG ULCER MEASUREMENT TOOL (LUMT): PORTUGUESE LANGUAGE	
Item/Domain	**Response categories**
(A) Clinician rated domains	
A1. Exudate type	0 None 1 Serosanguinous 2 Serous 3 Seropurulent 4 Purulent
A2. Exudate amount	0 None 1 Scant 2 Small 3 Moderate 4 Copious
A3. Size (from edge of advancing border of epithelium)	(Length x Width)0 Healed 1 <2.5cm2 2 25-5.0 cm2 3 5.1-10.0cm2 4 10.1cm2 or more
A4- Necrotic tissue type	0 None 1 Loose white to yellow slough 2 Attached white to yellow slough or fibrin 3 Soft grey to black eschar 4 Hard dry Black eschar
A5- Necrotic tissue amount	0 None visible 1 1 to 25%of wound bed covered 2 26 to 50% of wound bed covered 3 51 to 75% of wound bed covered 4 76 to 100% of wound bed covered
A6- Granulation tissue type	0 Healed 1 Bright beefy red 2 Dusky pink 3 Pale 4 Absent
A7- Granulation tissue amount	0 Healed 1 76 to100% of wound bed covered 2 51 to75% of wound bed covered 3 26 to 50% of wound bed covered 4 1 to 25% of wound bed covered
A8- Periulcerskin viability – Callus – Dermatitis(pale) – Maceration – Induration – Erythema (bright red) – Purple blanchable – Purple non-blanchable – Skin dehydration	Number of factors affected: 0 None 1 One only 2 Two or three 3 Four or five 4 Six or more factors
A9- Leg edema type	0 None 1 Non-pitting or firmness 2 Pitting 3 Fibrosis or lipodermatosclerosis 4 Indurated

Chart 1 – Cont.

ADAPTED LEG ULCER MEASUREMENT TOOL (LUMT): PORTUGUESE LANGUAGE	
A10- Leg edema location	0 None 1 Localized periulcer 2 Foot, including ankle 3 To mid-calf 4 To knee
Total (A) Clinician rated domains:	
B) Patient (proxy) rated domains	
B1- Pain amount (as it relates to the leg ulcer). Rate your pain, experienced in the last 24 hours, on a scale from 0 to 10, where 0 is “no pain” and 10 is the “worst pain”.	Numerical rating scale (0–10) 0 None 1 >0–2 2 >2–4 3 >4–7 4 >7
B2- Quality of life (as it relates to the leg ulcer).“How do you feel about the quality of your life at the present time?”	0 Delighted 1 Satisfied 2 Mixed 3 Dissatisfied 4 Terrible
Total (B) Patient (proxy) rated domains:	
Proxy completed by:	
TOTAL LUMT SCORE:	

Below are the instructions for the correct filling out of the adapted LUMT scale in Portuguese:

Section A – Clinician-rated domains

Assessments are to be done predebridement but after cleansing the wound. Evaluators should note the exudate type and amount on removal of dressings. Whenever possible, the time since the last dressing change should be consistent from one assessment to the next.

A1. Exudate type:
Reminder: Some wound care products may change the appearance of the exudate, eg, silver sulfadiazine or hydrocolloids. Definitions:

1 Serosanguineous: thin, watery, pale red to pink;

2 Serous: thin, watery, clear, pale yellowish;

3 Seropurulent: thin, opaque;

4 Purulent: thick, opaque, yellow to green with foul odour (as distinct from body or foot odour).

A2. Exudate amount:
Reminder: Consider time since last dressing change.

0 None: ulcer healed or wound tissue dry (if wound dressings changes are not regular);

1 Scant: wound bed moist with dressing dry;

2 Small: wound bed moist with some drainage on dressing;

3 Moderate: obvious fluid in wound bed and > 50% of dressing soaked;

4 Copious: overwhelming the dressing system.

A3- Size: Measure length as the longest diameter; width is perpendicular to length. Avoid diagonals. Calculate wound area as length by width. Write this in space provided and select appropriate response category. The Figure 1, shown below, illustrates guidance on lesion measurement.

A4- Necrotic tissue type:
Reminder: The wound should be thoroughly cleansed before evaluating. Pick the predominant type of necrotic tissue, eg, if most of the wound bed is attached fibrin with small amount of black eschar, choose attached fibrin as tissue type.

A5- Necrotic tissue amount of predominant type selected in A4. The sum of the percentages in A4 and A7 may be less than but should not exceed 100%.

A6- Granulation tissue type: Choose predominant type of granulation tissue.

A7- Granulation tissue amount: (The sum of the percentages in A5 and A7 may be less than but should not exceed 100%.) The percentage of granulation tissue refers only to the non epithelialized (open) portion of the wound. The advancing border of epithelium is not considered part of the wound surface.

A8- Periulcer skin viability: Select the following items that are present; count the number selected; then use this total to determine appropriate response category. Definitions:

- Callus: thick, dry epidermis;
- Scaling dermatitis: scaling, red skin which may be weeping;
- Maceration: wet, white, opaque skin;
- Induration: feels firmer than surrounding skin when pressed;
- Erythema: skin redness (bright red)

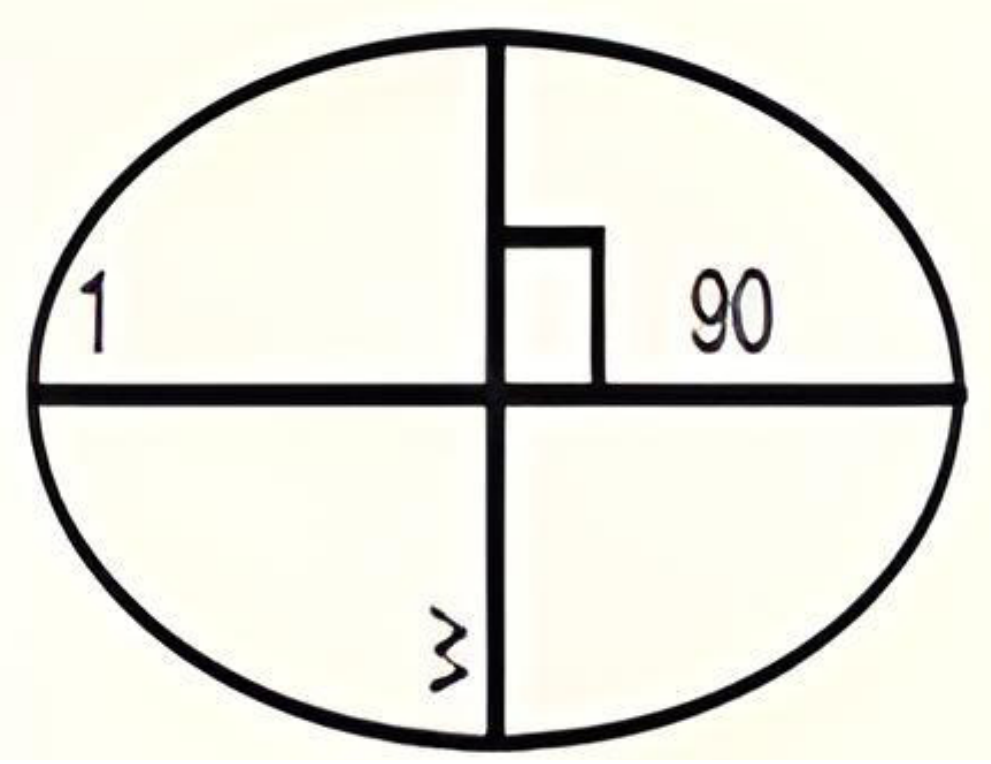

Figure 1 – Guidance on measuring the lesion area.

A9- Leg edema type: Indicate the worst edema type located anywhere on leg. Definition: Lipodermatosclerosis: waxy, white, firm tissue.

A10- Leg edema location: Indicate the most proximal location of any type of edema. Clinical example: pitting edema ankles with nonpitting edema to mid-calf: For A10, leg edema type =2> pitting; A11, leg edema location =3> to mid-calf.

Section B – Patient- (Proxy) rated domains

Read the questions "as they are" to the patient. It is important to qualify that the questions refer to the last 24 hours. If the patient is unable to understand the questions due to cognition or language deficits, section B should not be completed or it may be completed by a proxy only if the proxy knows the patient well and has been with the patient for most of the last 24 hours. The same person should provide proxy information for each assessment; do not complete section B by proxy if the person providing proxy information is not the same.

B1- Pain amount as it relates to the leg ulcer in the last 24 hours. Determine the rating based on a numerical rating scale ranging from 0-10, then place response in appropriate category.

B2- Quality of life as it relates to the leg ulcer in the last 24 hours.

DISCUSSION

The LUMT scale developed in Canada has 17 assessment items. After conducting the study, 12 items were confirmed for the Brazilian reality. In the factor analysis, the "depth" and "assessment of bioburden" variables were removed, as they did not present variability or correlation with the scale items.

Regarding depth, most of the participants in this research had ulcers of venous etiology that tend to be superficial[19]. Thus, it is believed that non-variability of this item can be justified by this.

In assessing the bioburden, the criteria established in the LUMT instructions were adopted: poorly colonized (small amount of serous exudate); heavily colonized (large amount of foul-smelling seropurulent drainage, with no other cardinal signs of inflammation); localized infection (large amount of foul-smelling seropurulent drainage, in addition to erythema, heat, or pain); systemic infection (advanced cellulitis or osteomyelitis)[10]. There was predominance of poorly colonized lesions and, therefore, this item had minimal variability. In a study carried out in the same scenario, *Staphylococcus aureus* was detected in 71.4% (25/35) of the wounds in samples collected by swab, 2 patients had Methicillin-resistant *Staphylococcus aureus* (MRSA); however, according to the clinical criteria, 8 (22.9%) patients presented signs of infection in their wounds. Wounds colonized with MRSA did not show a strong correlation with the presence of a greater number of clinical signs of infection[20]. Most of the wounds are colonized by bacteria, while only a few have clinically relevant wound infection characteristics[21]. Other signs can be related to wound infection, in addition to those considered classics contemplated by LUMT; therefore, it is believed that the bioburden item showed little variability[22]. Thus, with the removal of the bioburden item, special attention is recommended to some items: characteristic and amount of exudate (purulent exudate in large amount), type of opaque/dark granulation tissue, perilesional area (erythema and/or induration), swelling and increased pain. It should be noted that the changes should not be evaluated in isolation, but together, seeking to identify the presence of infection in the lesion through these assessment items present in LUMT.

The "Pain frequency" variable was also removed for factor model fit. This item assesses if pain is occasional, related to the position, constant or if it disturbs sleep. It is understood that removal of this variable does not exert a negative impact on pain assessment, as it is a non-specific data,

which can vary greatly individually and is not included in other scales. A systematic review on pain in people with venous ulcers identified that the most frequently used pain intensity assessment methods were visual analogue scales[23]. Pain intensity is the most assessed and, documented characteristic addressed by LUMT.

The "Undermining" and "Borders" variables were removed, in order to have a more parsimonious scale and with all variables presenting commonalities and valid factor loads, that is, fully validated in all statistical requirements. Using the parsimony principle, adequacy of the method represents the simplest and sufficient choice to respond to the objective proposed[24].

The Undermining variable presented little representativeness, with the possibility of being explained by the predominance of shallow and non-cavitary ulcers. Regarding the "Borders", in general, protocols and study assess the characteristics of the tissue present in the border. LUMT assesses whether the border is adhered, undermined, or advancing (contraction, evolving towards lesion closure). It is inferred that the low representation of this variable with a predominance of "< 50% of the borders of the epithelium that advance" is related to the chronicity of these lesions and, consequently, to the delay in the process of progression of the wound border in relation to contraction and epithelialization.

Other studies also removed items from instruments/scales in order to achieve adjustment of the factor model and meet the necessary conditions for carrying out the factor analysis[25–26].

Consequently, the scale validated with 12 items meeting the theoretical requirements of the factor analysis model can be divided into 4 factors. Factor 1 can be called "Tissues", as all the items that assess the characteristics of the tissue present in the wound bed were grouped in this factor. Factor 2 can be called "General characteristics", as various items related to area, exudate, viability of the perilesional area, type and location of edema were grouped in this factor. Factor 3 can be called "Subjective aspects", as the Pain and Quality of life items were grouped in this factor. And Factor 4 can be called "Exudate type", as this item was separated from the others. The factors represent how much each item corresponds to the total LUMT score; thus, it is believed that the Exudate Type item was left alone, as it did not present much variability and relevance in the total score. The only significant correlations found were for the Exudate Amount and Size/Area of the ulcer scores, showing that the larger the size/area of the ulcer, the greater the amount of exudate, which explains the fact that, statistically, the amount of exudate is present in Factor 2 and the type of exudate is separated from the other factors.

Once the content of the scale was validated, a reliability analysis was carried out (internal consistency and stability) to conclude that the set of items that comprise LUMT is one-dimensional.

In the analysis of internal consistency, it was found that the variables from Factor 1 (main factor) are, therefore, the variables of main contributions to the LUMT score. Thus, Tissue Type was the variable with the greatest representation of the scale. A scale can be considered to have internal consistency when all its subparts measure the same characteristic[12]. The consistency of Factor 3 is inadmissible, which means that the items in Factor 3 do not measure the same concept, which can be explained given that they assess Pain and Quality of life. This finding is justified because the other variables are clinical evaluation items of the lesion, while Pain and Quality of Life are subjective variables and answered by the patient. However, it is worth noting that factor analysis confirms the Pain and Quality of life variables in the same factor, as proposed in the original scale.

In the overall stability analysis, the test and re-test LUMT scores attested good agreement, concluding that the scale is stable. The scores do not have to be identical, but the differences should not be significant; therefore, care is recommended by the professional to evaluate these items for an accurate classification[15].

The originally proposed LUMT scale has 17 items and produces a score that varies from 0 to 68 points. The LUMT scale validated for Brazilian data has 12 items, with a score from 0 to 4, and generates a score that varies from 0 to 48 points.

In relation to the use of LUMT in other countries, some studies used it as a clinical evaluation tool in their research studies[27–30]. However, the validation study was performed only by the authors themselves, who evaluated the content with a panel of 9 wound experts, reaching consensus that all suitable domains were included. Concurrent validity was assessed by comparing the total LUMT score with the size of the lesion area and intra-examiner reliability, was reported as excellent; responsiveness was determined using monthly reassessments by a single appraiser for 4 months[10].

A study evaluating several wound rating scales concluded that LUMT shows intra- and inter-examiner reliability and is sensitive to monthly changes in the ulcers[31]. Another review study on epidemiology and management of chronic leg ulcers recommended LUMT as a validated tool designed to assess leg ulcers and track wound changes over time[32].

Regarding the limitations of this study, the absence of a scale considered the gold standard for the assessment of leg ulcers that would allow for criterion validation is highlighted. There is also a limitation related to the scale, LUMT does not include other signs of infection specific to chronic lesions in the bioburden assessment, in addition to the signs considered classic.

CONCLUSION

Of the 17 original items and after the analysis of the psychometric properties, the LUMT scale adapted to the Portuguese language validated 12 items to the Brazilian reality, with a score from 0 to 4, and thus produces a score varying from 0 to 48 points, obtaining a brief, easy-to-fill-in scale that presents evidence of construct validity and reliability in terms of internal consistency and stability. The adapted LUMT scale can be an important tool for the evaluation and documentation of leg ulcers, given the lack of validated tools specifically for this purpose in the national scenario.

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NOTES

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CONFLICT OF INTEREST

There is no conflict of interest.

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