The Use of Tools in the Assessment of Chronic Lower Limb Wounds: An Integrative Review

O Uso de Ferramentas na Avaliação de Feridas Crônicas de Membros Inferiores: Revisão Integrativa

El Uso de Herramientas en la Evaluación de las Heridas Crónicas de los Miembros Inferiores: Revisión Integradora

Natália de Carvalho Almeida¹, Mariana Millena da Silva Borges², Gabriel Rocha Marcelino³, Priscilla Roberta Silva Rocha⁴

ABSTRACT

Objective: to identify in the literature the instruments used in clinical practice for the assessment of chronic lower limb wounds. Method: this is an integrative review, with searches in PubMed, MEDLINE, Cochrane Library, CINAHL, and SciELO databases, as well as additional searches in the grey literature (Google Scholar and BDTD) and manual searches in reference lists. Primary studies with adult patients in Portuguese, English, or Spanish, without temporal delimitation, on assessment tools and healing staging of lower limb ulcers were included. Articles were selected regardless of wound etiology and treatment stage. Results: 1,415 articles were retrieved, 9 of which being included in the review. Among the tools listed in the articles, PUSH, DMIST, DFUAS, revPWAT, and CSSC can be highlighted, PUSH being the most used. Conclusion: The use of assessment tools to stage the healing of wounds in the lower limbs allows health professionals a more standardized approach and better therapeutic decision-making.

Descriptors: Wounds and Injuries; Leg Ulcer; Diabetic Foot; Healing; Nursing Assessment.

RESUMO

Objetivo: identificar na literatura os instrumentos utilizados na prática clínica para a avaliação de feridas crônicas de membros inferiores. Método: trata-se de uma revisão integrativa, com buscas nas bases de dados PubMed, MEDLINE, Cochrane Library, CINAHL, e SciELO, além de buscas adicionais na literatura cinzenta (Google Scholar e BDTD) e buscas manuais em listas de referências. Foram incluídos estudos primários com pacientes adultos em português, inglês ou espanhol, sem delimitação temporal, sobre instrumentos de avaliação e estadiamento de cicatrização de úlceras de membros inferiores. Os artigos foram selecionados independentemente da etiologia da ferida e da fase do tratamento. Resultados: foram recuperados 1.415 artigos, 9 dos quais sendo incluídos na revisão. Dentre as ferramentas listadas nos artigos, destacam-se a PUSH, DMIST, DFUAS, revPWAT, e CSSC, sendo a PUSH mais utilizada. Conclusão: O uso de ferramentas de avaliação para estadiamento da cicatrização de feridas em MMII permite aos profissionais de saúde uma conduta mais padronizada e uma melhor tomada de decisão terapêutica. Descritores: Ferimentos e Lesões; Úlcera da Perna; Pé Diabético; Cicatrização; Avaliação em Enfermagem.
RESUMEN

**Objetivo:** identificar en la literatura los instrumentos utilizados en la práctica clínica para la evaluación de las heridas crónicas de miembros inferiores. **Método:** se trata de una revisión integradora, con búsquedas en las bases de datos PubMed, MEDLINE, Cochrane Library, CINAHL, y SciELO, así como búsquedas adicionales en la literatura gris (Google Scholar y BDTD) y búsquedas manuales en las listas de referencias. Se incluyeron estudios primarios con pacientes adultos en portugués, inglés o español, sin delimitación temporal, sobre herramientas de evaluación y estadaje de la cicatrización de úlceras de miembros inferiores. Los artículos se seleccionaron independientemente de la etiología de la herida y de la fase de tratamiento. **Resultados:** Se recuperaron 1.415 artículos, 9 de los cuales se incluyen en la revisión. Entre las herramientas enumeradas en los artículos, destacaron PUSH, DMIST, DFUAS, revPWAT, y CSSC, PUSH siendo la más utilizada. **Conclusión:** El uso de herramientas de evaluación para estadificar la cicatrización de las heridas en los miembros inferiores permite a los profesionales sanitarios una conducta más estandarizada y una mejor toma de decisiones terapéuticas.

**Descriptores:** Heridas y Lesiones; Úlcera de Pierna; Pie Diabético; Cicatrización; Valoración de Enfermería.

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INTRODUCTION

Chronic wounds are considered an important public health problem, both in Brazil and worldwide. They are characterized by a persistent inflammatory, progressive state, being sometimes accompanied by tissue destruction or the presence of necrotic tissue.¹

Research estimates that about 14% of the world population has some type of chronic wound throughout their lives.² Among these, wounds of the lower limbs have significant clinical relevance, being identified by the irregular or limited loss of skin in the lower limbs, which may extend to the subcutaneous tissue and underlying tissues.³

Several conditions may result in the formation of wounds in the lower limbs, which may also be referred to in the scientific literature as Leg Ulcers (LU). Among these conditions are Chronic Venous Disease (CVD), Peripheral Arterial Disease (PAD), Systemic Arterial Hypertension (SAH), and Diabetic Neuropathy (DN).⁴⁻⁵ Approximately 70% of LU result from tissue oxygenation deficiency and valve insufficiency caused by CVD, and are called venous ulcers.⁶⁻⁷ PAD, in turn, generates damage to small and large caliber vessels, with total or
partial blockage of blood flow, resulting in the appearance of the so-called arterial ulcers.⁸ SAH and Diabetes Mellitus (DM), in turn, interfere in the process of wound appearance and healing from poor circulation caused by vascular complications.⁷

Chronic ulcers in the lower limbs require rigorous and persistent care since they course for long periods and do not progress according to the classical phases of healing.⁹ In this sense, the proper evaluation of wounds and patients allows for the choice of interventions aimed at the healing process. The initial assessment, for example, should include basic aspects of the wound, such as pain, edema, extent and depth, wound bed, as well as specific characteristics for each etiology.¹⁰ For that reason, it is extremely important to use instruments that rigorously assess the wound and the key elements of the healing process.

The scientific literature has shown, since the 2000s, an increase in the number of publications related to wound assessment tools, especially internationally.¹¹ However, despite the number of available tools, few are used in Brazil, due to the lack of cross-cultural adaptation.¹¹ Moreover, some of the tools found are directed to the assessment of injuries of specific etiology, while others make a broad assessment.¹² Such factors may compromise the appreciation and use of these tools in clinical practice.¹¹

Still, the literature also shows that the use of validated wound assessment tools brings quality to the care of patients with chronic wounds since it seeks to standardize the conduct and base clinical practice on the best evidence.¹¹ Therefore, knowing the different instruments and their specificities is essential to support the adequacy and assertiveness of the evaluative method, as well as the standardization of these evaluative criteria and therapeutic approaches.¹² Professionals involved in care, especially nurses, are required to have evidence-based scientific and methodological knowledge about wound assessment.¹⁰,¹³-¹⁴

**OBJECTIVE**

To identify the instruments used in clinical practice for the assessment of chronic lower limb ulcers in the literature.

**METHOD**

This is an integrative literature review prepared according to the PECO (Population of Interest, Exposure, Comparator and Outcomes) framework.¹⁵ The guiding question was: “What are the tools used in nursing clinical practice (E) in the care of lower limb ulcers (O) in adults (P)?”. The review was conducted in six steps: (1) elaboration of the guiding
question; (2) literature search or sampling; (3) data collection; (4) critical analysis of the included studies; (5) discussion of results; (6) presentation of the integrative review.¹⁶-¹⁷

Searches occurred on 12th July, 2021 in the CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Library, MEDLINE (Medical Literature Analysis and Retrieval System Online), Pubmed/NIH (National Institutes of Health), and SciELO (Scientific Electronic Library Online) databases. Additional searches were done in the grey literature of Google Scholar and BDTD (Biblioteca Digital Brasileira de Teses e Dissertações – the Brazilian Digital Library of Theses and Dissertations), as well as manual searches in reference lists.

The following DeCS (Descriptors in Health Sciences) and MeSH Terms (Medical Subject Headings) were used: Leg Ulcer; Varicose Ulcer; Foot Ulcer; Diabetic Foot; Tools Evaluation; Tools; Evaluation; Wound Healing and Nursing Care, combined with the Boolean operators AND (for different descriptors) and OR (for similar descriptors), adjusted according to the specificities of each base (chart 1).

**Chart 1 - Search Strategy. Brasilia (DF), Brazil, 2021.**

<table>
<thead>
<tr>
<th>Database</th>
<th>Search Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed/NIH</td>
<td>(Leg Ulcer OR Varicose Ulcer OR Foot Ulcer OR Diabetic Foot) AND (Tools Evaluation OR Tools OR Evaluation) AND (Wound Healing) AND (Nursing Care)</td>
</tr>
<tr>
<td>MEDLINE</td>
<td>Leg Ulcer OR Varicose Ulcer OR Foot Ulcer OR Diabetic Foot) AND (Tools Evaluation OR Tools OR Evaluation) AND (Wound Healing) AND (Nursing Care)</td>
</tr>
<tr>
<td>Cochrane Library</td>
<td>(Leg Ulcer OR Varicose Ulcer OR Foot Ulcer OR Diabetic Foot) AND (Tools Evaluation OR Tools OR Evaluation) AND (Wound Healing) AND (Nursing Care)</td>
</tr>
<tr>
<td>CINAHL</td>
<td>(Leg Ulcers OR Chronic Leg Ulcers OR Venous Leg Ulcers) AND (Tools OR Instruments) AND (Evaluation OR Assessment) AND (Nursing Care OR Nursing Interventions) AND (Leg Ulcer Management)</td>
</tr>
<tr>
<td>SciELO</td>
<td>(Leg Ulcers) AND (Nursing Care)</td>
</tr>
<tr>
<td>Google Scholar</td>
<td>(adulto com feridas de perna) AND (ferramenta OR instrumento) AND (cuidado ambulatorial)</td>
</tr>
</tbody>
</table>

Articles published in Portuguese, English, or Spanish, without temporal delimitation, as well as primary studies with adult patients which addressed the use of instruments and/or tools in the staging and/or evaluation of LU, regardless of the etiology (vasculogenic,
diabetic or neuropathic), of the phase of treatment, the healthcare setting and the professional involved were included. Secondary studies (reviews), editorials, expert opinions and studies on LU of other etiologies (e.g. oncologic wounds) and body segments were excluded, as well as those that did not use assessment instruments/tools.

The studies found were exported to the Endnote Web® program, duplicate references being excluded electronically and manually and then forwarded to the Raayan QCRI® software for the first phase of the review. Screening of the articles was carried out by reading the titles and abstracts according to the established inclusion criteria. The selected articles were read in full for data extraction. Both steps were performed by two independent reviewers, the divergences being evaluated by a third reviewer.

For data extraction and synthesis, the instrument of Ursi and Galvão (2005) was adapted. The information extracted was: author, year of publication, country, objective and type of study, professionals involved, tool used, type of LU evaluated, and level of evidence according to the criteria of Melnyk and Fineout-Overholt.19

RESULTS

A total of 582 articles were retrieved from the databases and 833 from the grey literature. Duplicates were removed, leaving 1,380, out of which 16 were selected for reading in full and 9 were included in the review (figure 1).

Figure 1 - Flowchart according to study selection criteria. Brasilia (DF), Brazil, 2021.
From the articles included, most were published in English \((n=7)\),\textsuperscript{20-26} between the years 2007 and 2020. Most articles were developed in the United States \((n=3)\),\textsuperscript{20,24,26} followed by Canada \((n=2)\),\textsuperscript{21,25} Brazil \((n=2)\),\textsuperscript{27-28} Japan \((n=1)\),\textsuperscript{23} and Indonesia \((n=1)\).\textsuperscript{22} Not all studies reported the professionals involved, but nurses are the most cited category \((n=6)\).\textsuperscript{21-25,28} Among the studies, there was a predominance of cohort studies \((n=4)\),\textsuperscript{22-23,27-28} with level of evidence IV (table 1).

The most common aspects of assessment among the instruments \((n=8)\) were: wound
area (n=7, 87.5%),20-23,25-28 and type of tissue in the wound bed (n=6, 75%).20-23,25,27-28 Regarding ulcer type, all studies (n=9)20-28 evaluated Diabetic Foot Ulcers (DFU), 5 evaluated vasculogenic ulcers,21,25-28 and 3 evaluated Pressure Ulcers (PU).21,25-26 Data extracted from the studies included in this review are outlined in table 1.

Among the tools used in the studies that make up the present sample, the following stand out: PUSH (Pressure Ulcer Scale for Healing),20-23,27-28 DMIST (Deep, moisture, infection/inflammation, size, tissue type of wound bed, type of wound edge and tunnelling/detachment),23 DFUAS (Diabetic foot ulcer rating scale),22-23 revPWAT (Revised Photographic Wound Assessment Tool),25 and CSSC (Clinical Signs and Symptoms Checklist).24 The most commonly used instrument was PUSH (n=6, 66.6%).20-21,27-28 Other cited tools were BWAT (Bates-Jensen Wound Assessment Tool),22 DESIGN-R (Depth, Exudate, Size, Infection/Inflammation, Granulation Tissue and Necrotic Tissue),23 and Computerized Planimetry26 (table 2).
<table>
<thead>
<tr>
<th>Author/Year/ Country</th>
<th>Objective and Type of Study/ Level of Evidence</th>
<th>Professionals involved/ Tool used</th>
<th>Type of ulcer assessed/ Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GARDNER, S. et al.; 2011.</td>
<td>To evaluate the predictive validity of the PUSH tool in monitoring the healing of diabetic neuropathic ulcers.</td>
<td>Not specified.</td>
<td>DFU (neuropathic grade 2 or less on the sole of the foot without PAD).</td>
</tr>
<tr>
<td>United States of America.</td>
<td>Prospective descriptive study; level of evidence IV.</td>
<td>PUSH.</td>
<td>In addition to clinical wound assessment, it allows prediction of wound healing time with good reliability.</td>
</tr>
<tr>
<td>HON, J. et al; 2010.</td>
<td>To validate and evaluate the responsiveness of PUSH (version 3.0) in patients with chronic wounds of all etiologies.</td>
<td>Nurse, occupational therapist, chiropodist and physical therapist.</td>
<td>VLU, DFU, PU.</td>
</tr>
<tr>
<td>Canada.</td>
<td>Prospective multicenter study; level of evidence IV.</td>
<td>PUSH (surface measured with acetate tracings).</td>
<td>PUSH suitable for not only the assessment of PU, DFU and VLU, but also effective in differentiating healing and non-healing ulcers.</td>
</tr>
<tr>
<td>ARISANDI, D. et al.; 2016.</td>
<td>To evaluate a DFU rating scale for validity.</td>
<td>Dermatologist and stomal therapist nurse.</td>
<td>DFU.</td>
</tr>
<tr>
<td>Indonesia.</td>
<td>Cohort study; level of evidence IV.</td>
<td>DFUAS, compared to BWAT and PUSH.</td>
<td>Effective for assessing the infection status of DFU, with a specific domain for this condition.</td>
</tr>
<tr>
<td>Authors</td>
<td>Research Question</td>
<td>Participants</td>
<td>Setting</td>
</tr>
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<td>---------------------------------</td>
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<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>OE, M. et al; 2020.</td>
<td>To verify the validity of DMIST and investigate the effects of nursing wound care in 3 stages of a study: 1. Prospective cohort study; level of evidence IV; 2. Evaluation and validation of a new scale for DFU assessment; 3. Randomized controlled trial; level of evidence II.</td>
<td>Specialist Nurses.</td>
<td>Japan.</td>
</tr>
<tr>
<td>THOMPSON, N. et al; 2013.</td>
<td>To examine the reliability and concurrent validity of revPWAT in digital imaging of chronic healing wounds.</td>
<td>Clinical nurses, stomal therapist nurses, occupational therapists.</td>
<td>Canada.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
<td>Study Design</td>
<td>Level of Evidence</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td>MAYROVITZ, H.; N. SOONTUPE, L.;</td>
<td>To determine the accuracy and reliability of measuring wound surface areas from images recorded by digital photography and Computerized Planimetry.</td>
<td>Descriptive study; level of evidence V.</td>
<td>Not specified.</td>
</tr>
<tr>
<td>United States of America.</td>
<td>Nursing students.</td>
<td>DFU, VLU, sacral PU.</td>
<td>Computerized digital imaging planimetry (wound surface area).</td>
</tr>
<tr>
<td>ESPÍRITO SANTO, P. et al; 2013.27</td>
<td>To describe the evolution of chronic leg ulcer healing using the PUSH instrument.</td>
<td>Cohort study; level of evidence IV.</td>
<td>Not specified.</td>
</tr>
<tr>
<td>Brazil.</td>
<td>Clinical nurses and stomal therapist nurses.</td>
<td>PUSH.</td>
<td>It guides clinical reasoning, favors recording the evolution of the healing process, as well as the choice of appropriate dressing.</td>
</tr>
<tr>
<td>SANTOS, V. et al.; 2007.28</td>
<td>To test the interobserver reliability of the PUSH tool (Portuguese) in patients with chronic LU.</td>
<td>Retrospective cohort study; level of evidence IV.</td>
<td></td>
</tr>
<tr>
<td>Brazil.</td>
<td>Clinical nurses and stomal therapist nurses.</td>
<td>PUSH.</td>
<td>A practical instrument; its components are fundamental for assessing the healing of any chronic wound, including lower limb ones.</td>
</tr>
</tbody>
</table>

**Source:** The authors, based on data from the compilation of the articles that make up this review. CSSC – Clinical Signs and Symptoms Checklist; DFU – Diabetic Foot Ulcer; DFUAS – Diabetic Foot Ulcer Assessment Scale; DMIST – Deep, Moisture, Infection/inflammation, Size, Tissue type of wound bed, Type of wound edge and Tunnelling/detachment; PU – Pressure Ulcer; PUSH – Pressure Ulcer Scale for Healing; revPWAT - revision Photographic Wound Assessment Tool; VLU – Venous Leg Ulcer.
**Table 2** - Characterization of the instruments studied by the selected articles. Brasília (DF), Brazil, 2021.

<table>
<thead>
<tr>
<th>Instrument/Purpose of use</th>
<th>Points evaluated by the instrument</th>
<th>Interpretation</th>
</tr>
</thead>
</table>
| **PUSH**<sup>20-23,27-28</sup> | 3 items:  
1. Size of the wound (length x width - in cm);  
2. Exudate amount;  
3. Tissue type present in the wound bed. | Each item has different maximum scores, and can range from 0 to 17 points. Lower scores represent a closer to healing wound, and scores closer to 17 indicate a more severe wound. |
| **BWAT**<sup>22</sup> | 13 items:  
1. Size (width x height);  
2. Depth;  
3. Edges;  
4. Detachment;  
5. Necrotic tissue type;  
6. Necrotic tissue amount;  
7. Exudate type;  
8. Exudate amount;  
9. Skin color surrounding wound;  
10. Peripheral tissue edema;  
11. Peripheral tissue induration;  
12. Granulation tissue;  
13. Epithelialization. | Each item scores from 1 to 5 points (Likert scale type, score 5 indicates worst state). The total score is the sum of all items (ranges from 13 to 65 points). Scores closer to 13 indicate a process of wound regeneration, while scores closer to 65 indicate a process of degeneration. |
| **DFUAS**<sup>22-23</sup> | 9 items:  
1. Depth;  
2. Size (area); | The items evaluated by DFUAS have different maximum score values. From the characteristics presented by the wound, it is possible to... |
Examine diabetic foot ulcers.

3. Size scores by region;
4. Inflammation/infeccion;
5. Proportion of granulation tissue;
6. Necrotic tissue (type, proportion and proportion of slough);
7. Maceration;
8. Type of wound edge;

assign a specific value for each item.

The score ranges from 0 to 98 points, where higher scores mean greater severity of DFU.

<table>
<thead>
<tr>
<th>7 item(s):</th>
<th>Each item has a specific score, with lower values indicating less severity, and higher values indicating greater severity.</th>
<th>The total score of the instrument is equal to the sum of the scores of all criteria, ranging from 0 to 34.</th>
<th>Scores closer to 34 indicate greater severity of DFU, and scores closer to 0 indicate less severity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depth;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Maceration;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Inflammation/infeccion;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Size;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Tissue type of wound bed;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Type of wound edge;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Tunneling/detachment.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>7 item(s):</th>
<th>Specific, increasing and variable score for each of the items assessed (acronym DESIGN + addition of the detachment criterion).</th>
<th>Qualitative assessment: each item has lower or higher severity, being represented by lower or upper case letters respectively (e.g. D4 - E6 s12 I9 G5 N3 p9:10).</th>
<th>Quantitative assessment: total score ranges from 0 (healed wound) to 66 (most severe wound). <strong>NOTE:</strong> The Depth (D) criterion is not considered in the sum of the total score.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depth;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Exsudate;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Size;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Infeccion/inflammation;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Granulation tissue;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Necrotic tissue;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Detachment.</td>
<td></td>
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</tr>
</tbody>
</table>

**CSSC**

13 items:

1. Increasing pain;

The item may or may not be present. If present = 1 point. If absent = 0 points.
Assess the clinical signs of local infection in chronic wounds.


The total score (sum of items) ranges from 0 to 13 points. Lower scores mean less chance of wound infection/inflammation, while higher values mean increased chances.

**revPWAT**

Examine wounds, especially DFU, VLU and PU where at least 50% of the wound base can be visualized.

8 items:


The score is the sum of the scores for all 8 items, each of which has values ranging from 0 to 4.

Higher scores indicate worse wound conditions, and lower scores show improvement/healing.

**Computerized Planimetry**

Measuring lesion size from different softwares and algorithms.

Computerized Planimetry is not an assessment scale with defined parameters; however, its purpose is to assess the wound area.

The wound area can be calculated by different softwares from digital images. The interpretation of the result must be performed by the healthcare professional, because this instrument does not have scores.

*Source: The authors, based on data from the compilation of the articles that make up this review.*
The articles selected in this review reveal the main instruments evidenced in the literature for the assessment of LU in clinical practice, as well as raising discussions about their respective applicability, benefits and limitations. Although the results show instruments with distinct objectives and techniques of use, the use of these scales allows for the standardization of assessment and conduct related to wounds, making it possible for health professionals to select the best care tool based on the best available evidence.\(^1\)

With regard to the generality of wound assessment, it is relevant to describe an acronym known as TIME prior to the discussion of each instrument raised by this review. Although no included studies used this method, the acronym TIME (T - Tissue; I - Infection; M - Moisture and E - Edge) is a dynamic tool that allows for the assessment and preparation of the wound bed based on the assessment of the tissue, infection/inflammation, moisture, and edge criteria, respectively. This acronym, created in 2003, establishes an order of clinical observation of lesions and can be used for any type of wound.\(^1\) Thus, TIME serves as a basis not only for the following discussions, but also for the creation of new instruments for wound assessment.

The studies that were analyzed in this review demonstrated that the instruments were validated and have easy applicability in clinical practice. The scales covered in these studies were: PUSH,\(^20\)-\(^23\), DMIST,\(^23\) DFUAS,\(^22\)-\(^23\) revPWAT,\(^25\) CSSC,\(^24\) BWAT,\(^22\) DESIGN-R,\(^23\) and Computerized Planimetry.\(^26\) Despite the particularities found in the instruments regarding the items analyzed in wound assessment, the use of some common elements, such as size and/or depth,\(^20\)-\(^23\),\(^25\)-\(^28\) phlogistic signs,\(^22\)-\(^24\) quantification and characteristics of exudation,\(^20\)-\(^24\),\(^27\)-\(^28\) tissue types,\(^20\)-\(^25\),\(^27\)-\(^28\) and presence of odor,\(^24\) is generally perceived. Such findings are in agreement with those found in the literature, as Garbuio and colleagues,\(^12\) in an integrative review published in 2018, describe that the most assessed characteristics are size, exudate, tissue type, and signs of infection or inflammation.

The scale that showed the highest prevalence in the studies was PUSH, with 6 articles (66.6\%).\(^20\)-\(^23\),\(^27\)-\(^28\) With widespread use, other reviews\(^11\)-\(^12\) have also depicted PUSH as the most prevalent instrument. This tool was developed in 1996 by specialists with the purpose of assessing the progress or return of PU healing, having been validated for the Portuguese language in 2005.\(^31\) The initial proposal of the instrument was to be used in PU; however, it was adapted for lesions of other etiologies, such as leg ulcers, diabetic ulcers and chronic wounds of various etiologies.\(^20\)

The items assessed by PUSH are the size of the wound, the amount of exudate, and the type of tissue present in the wound bed.\(^28\) In addition to the practicality, another highlight of this instrument is the ability to guide the clinical reasoning of the professional evaluator, assisting in the analysis of the healing process and in the choice of the most appropriate dressing for the wound.\(^21\) However, the absence of a specific domain to assess the presence of signs of infection can compromise the quality of the assessment, which may lead to serious consequences, including amputation due to an infectious process not detected in a timely manner.\(^29\)

DMIST is a relatively recent scale, specific for the evaluation of DFU, through which it is possible not only to indicate the healing process or deterioration of a wound, but also to assess
items that are indispensable for promoting healing, such as maceration, infection, the type of tissue in the wound bed, the type of wound edge, and tunneling.\textsuperscript{23} In their study, Suriadi and Bhakti reveal that a score of 9 is valid as a predictor of non-healing in four weeks, where higher scores indicate the possibility of more aggressive treatments (such as surgery).\textsuperscript{23,30} There are gaps in macroscopic findings of osteomyelitis in their domains. Since it is a relevant complication in DFU, diagnosing osteomyelitis is fundamental for therapeutic decision-making; therefore, it must be identified from other sources, such as medical records and infrared thermography.\textsuperscript{23}

DFUAS was also created specifically for the assessment of DFU and has an interesting composition as it assembles only criteria (table 2) that can influence wound healing. Compared to the BWAT and DMIST tools, its domains can reliably represent the status of chronic wounds and predict the tendency or not to heal, making it an extremely convenient tool for clinical practice in DFU care.\textsuperscript{22} However, it has been validated in only one specific location in Indonesia, a country whose specific characteristics of its population may differ from those found in other territories.\textsuperscript{22} Thus, a wider application and validation of this scale is needed to ensure greater reliability of its results.

The revPWAT tool is an update of the Photographic Wound Assessment Tool (PWAT), being based on digital photographs. It is reliable, especially when compared to bedside wound assessments, having proven to be a valid tool for assessing chronic wounds of various etiologies.\textsuperscript{25} However, the main disadvantage of this methodology is the lack of assessment of aspects that cannot be observed through static features in digital images, such as skin odor, temperature, and texture. In addition, the requirement for digital photographs can compromise the convenience of the method, besides causing flaws in the records of the evolution of the evaluated wounds.

Computerized Planimetry also uses digital methods (digital photographs and software) to measure the wound. This makes it possible to document and evaluate the wound in a fast and inexpensive way without direct contact with the patient, also favoring the exchange of full details among the professionals involved in the care, having been proven accurate and reliable for measuring and documenting the wound area, as well as for following the clinical outcome.\textsuperscript{26} However, digital assessment applies only to the external surface of the wound, which makes it impossible to know the quality of the underlying repair tissue. Thus, Computerized Planimetry is indicated for use in superficial wounds that do not have complicating factors.\textsuperscript{31}

Authors also point out that the use of digital photographs, as occurs in revPWAT and in Computerized Planimetry, besides offering a source of information about the care provided, can generate a permanent database for consultation by the healthcare professional.\textsuperscript{33}

CSSC is intended for the evaluation of clinical signs and symptoms of infection, a factor that when identified early assists in the prevention of serious complications such as osteomyelitis and amputation.\textsuperscript{24,29} It is also indicated for the evaluation of specific signs of wound healing by secondary intention.\textsuperscript{24} However, there is low interobserver reliability due to the use of subjective evaluation criteria, such as heat, coloration, and odor.\textsuperscript{24}

BWAT emerged from the 2001 revision of PSST (Pressure Sore Status Tool), created in 1990 for the evaluation of PU.\textsuperscript{22} As a result of this update, BWAT started being used for the evaluation of chronic wounds of various etiologies.\textsuperscript{22} It is a robust tool that, based on the
evaluation of the established criteria, can differentiate chronic wounds in the process of healing or not, which makes it appropriate for the assessment of DFU, having a good correlation with DFUAS.22 The limitations of this tool are the absence of a specific domain for infection/inflammation, as well as the difficulty in analyzing the coloration of the skin around the wound in dark-skinned patients.22,33

DESIGN-R, a tool that derived from the DESIGN (Depth, Exudate, Size, Inflammation/Infection, Granulation tissue and Necrotic tissue) update in 2008, is an instrument created to assess the severity of PU and monitor its healing process. It has proven interobserver reliability and validity, allowing for the comparison between wounds in the same patient and in different patients.34-35 Its use is limited to assessment of chronic stage PU, and assessment of acute stage wounds is not possible because of the constant change in wound status.35

The use of measurement tools is an efficient resource in wound assessment and nursing care since it positively affects data production, the analysis of the adopted therapeutic approaches, and the systematization of assertive behaviors in clinical practice.36 Moreover, these tools can have implications not only for nursing care, but also for the teaching and learning process, as they allow future professionals to learn to draw strategies for organizing the work process, treatment and prevention of injuries. Finally, they enable an approach to the individual as a whole, taking into account the holistic care beyond the assistance to the injury.36

However, the nomenclatures used to evaluate and describe wounds vary, which may hinder the establishment of a consensus on the most appropriate criteria for evaluations.11 Depending on the conditions and organization of health services, this factor may become an obstacle to the actual application of the instruments in clinical practice.

In this logic, it becomes important to discuss the role of the professionals involved in the care of patients with chronic wounds. When considering the care process of patients with LU, nurses are essential both in terms of direct patient care and in the supervision of the nursing team during care.37 The correct assessment of the lesion is important for the implementation of a targeted therapeutic regimen.13 Nursing professionals should constantly rethink the care they offer and seek to update technical and scientific knowledge and methods in order to improve wound assessment.38

Therefore, from the evidence gathered in this review, it was possible to realize that the use of assessment tools for wound healing staging in LU allows health professionals to seek standardization of clinical management, to provide quality care, and to choose the instruments and procedures to be adopted in each situation.

As described by Cardinelli and collaborators in their study,11 the limitations of this research are the lack of research on the clinical application of LU healing assessment tools, as well as the few cross-cultural adaptations and validations for the Portuguese language.

CONCLUSION

In this review, the assessment tools for injuries listed in the included studies were: PUSH, DMIST, DFUAS, revPWAT, CSSC, BWAT, DESIGN-R, and Computerized Planimetry. The use
of assessment tools for staging the healing of wounds in the lower limbs has several implications for the care for allowing health professionals a more standardized approach and better therapeutic decision-making.

Although the instruments described are validated tools, their routine and systematized use in clinical practice is still incipient as not all of them have cross-cultural adaptation to Portuguese. Thus, the importance of validation and cross-cultural adaptation studies to consolidate the applicability of the instruments in the Brazilian context is evident, allowing for a scientific refinement of LU management.

In addition, the lack of training of professionals in the use the instruments impacts the quality and safety of the health care provided in Brazil. The training of healthcare teams should be adopted as a way to avoid malpractice during clinical practice.

Most of the studies analyzed reported the number of samples during the validation process as a methodological limitation; therefore, new studies with larger samples are necessary. According to the findings, there is a scarcity of data regarding the prevalence of chronic ulcers, as well as regarding the standardization of the use of assessment instruments for LU.

Thus, the main contributions of this study can be grouped as follows: a) the systematization of the main instruments used in clinical practice for the evaluation of leg ulcers based on evidence available in the scientific literature; b) the discussion about the importance of the use of evaluative instruments for the care of chronic wounds in the lower limbs, as well as aspects related to the standardization of these instruments and clinical procedures; and c) the study of the evaluation of chronic wounds and their instruments as an attribution of nursing professionals.

The results found and the articles included in the review build a range of significant evidence, which culminate in the contributions mentioned above. Hence, this article is relevant for clinical practice and for nursing knowledge.

CONTRIBUTIONS

Almeida, NC; Borges, MMS; Marcelino, GR; and Rocha, PRS contributed individually to the study design and planning, data analysis and interpretation, and writing and critical revision of the article.

CONFLICT OF INTERESTS

Nothing to declare.

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