



## Assessment of chronic wounds in adults: an integrative review

Valoración de las heridas crónicas en el adulto: una revisión integrativa

Avaliação das feridas crônicas no adulto: uma revisão integrativa

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### ABSTRACT

**Objective:** To identify the main aspects that should be assessed in adults with chronic wounds. **Method:** This was an integrative review of the scientific literature published between 2010 and early 2015 in the PubMed and Web of Science databases. **Results:** Few studies exclusively address wound assessment. However, the review found many aspects to consider when assessing individuals with ulcers, grouped as follows: factors that significantly affect healing or the development of new wounds (age, nutritional status, functional capacity, or comorbidities), psychosocial factors, and wound characteristics (location, size, depth, type of tissue, time of evolution). **Conclusion:** The literature search did not result in any one aspect that must be considered when assessing chronic wounds, but a complex interaction of factors that include both physiological and social and psychological elements. Professionals should be aware of this multifactorial approach to achieve early detection of the development and evolution of ulcers and to intervene accordingly.

### DESCRIPTORS

Ulcer; Wounds and Injuries; Wound Healing; Risk Factors; Nursing Assessment; Review.

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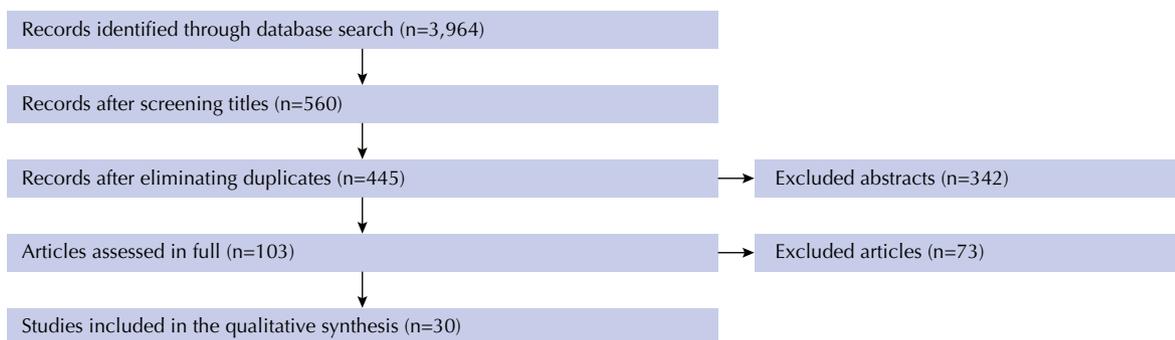
## INTRODUCTION

Life expectancy has grown in direct proportion to the increased prevalence of many chronic illnesses and the frequency of chronic wounds. It is estimated that 1% to 1.5% of the population in developed countries present chronic wounds, and in Europe, 2% to 4% of total healthcare costs are used in their treatment<sup>(1)</sup>. Furthermore, the great diversity of etiologies, concomitant factors, and diagnostic tools complicates the assessment of wounds, an essential element to establish care approaches to any type of chronic wound<sup>(2)</sup>. Assessment includes not only detecting the presence of wounds, but also considering it a collective problem, which affects both patients and their family members and caregivers<sup>(3)</sup>. Thus, the cornerstone of wound care in any individual is a holistic approach that contemplates elements beyond the wound itself<sup>(1)</sup>. Moreover, one of the priorities of chronic wound assessment is to establish etiology<sup>(4)</sup>. However, adequate diagnoses are not usually carried out, and are more likely to be given in specialized wound centers than in daily practice centers, therefore being not accessible to all patients<sup>(5)</sup>. Furthermore, assessment is essential to monitor wounds over time<sup>(6)</sup>, even though this aspect can be neglected if records are inadequate and incomplete<sup>(7)</sup>. However, even though these pathologies are very difficult to heal because of poor diagnosis and, therefore, inadequate treatment, few studies have focused on assessment, and many on treatment<sup>(8)</sup>.

Thus, the general objective of the present study was to identify the main aspects that must be considered when assessing adults with chronic wounds.

## METHOD

This was an integrative review conducted with systematic reviews, cohort studies and case-control studies published in PubMed or Web of Science databases. The search was conducted between March and May 2015 and was restricted to the years of 2010 to 2015 to obtain up-to-date information. Documents that fully or partially referenced the assessment of adult patients with pressure ulcers (PUs), ulcers in the lower limbs or the diabetic foot (the most frequent chronic wounds) were included; in English, Spanish or Portuguese. Documents that referenced the pediatric population or animals were excluded, as well as studies without abstracts, duplicates, and unclear procedural protocols or conflict of interests. To obtain studies that met these inclusion and exclusion criteria, the following descriptors were used: ulcer, wound, diabetic foot, healing, factor, assessment, monitoring, diagnosis, treatment, rat, mice, peptic, colitis, gastric and growth; and the Boolean operators AND, OR and NOT, in addition to truncations. The first studies were selected based on the title, and then submitted to a second screening based on the abstracts. Those that did not correspond to the objective of the present study and did not meet the eligibility criteria were excluded. When the abstract did not allow for a decision as to the study's inclusion or exclusion, full articles were requested and reviewed. Figure 1 shows the flowchart of the study selection process.



**Figure 1** – Flowchart of the selection process – Valencia, Spain, 2015.

After selecting the studies, the following data were extracted by one reviewer and recorded in an Excel database: main author, country of the study, year of publication, study design, sample, intervention, results, and level of evidence/grade of recommendation. The strength of evidence and grade of recommendation were analyzed using the classification of the Oxford Centre for Evidence-Based Medicine (CEBM)<sup>(9)</sup>. This system considers different types of studies and clinical research scenarios (therapy, prevention, etiology and harm; prognosis and natural history; diagnosis; differential diagnosis and prevalence studies; and economic studies and decision analyses). Thus, to collect and interpret the data collected in the present review, the evidence was graded

according to the type of study considered most adequate for each thematic area.

Last, it was evaluated the aspects that should be considered regarding the assessment of adult patients with chronic wounds.

## RESULTS

The data were processed by grouping the results according to the characteristics of the studies and assessment of chronic wounds in adults.

Regarding the characteristics of the publications, there was a great variety in terms of the countries in which they were carried out. Half were conducted in Europe, followed by 13%

in the United States and the others in Asia, Africa, Australia, Brazil, the Middle East and Canada. Regarding methodological design, cohort studies were as frequent as case-control studies (37%), and the others were reviews (26%). The use of case-control studies was more suited to investigate prevention and cohort studies to learn about diagnosis, prognosis or the evolution of a process. The highest levels of evidence and the best grades of recommendation were found among cohort studies; however, overall, low levels of evidence and recommendation were found in 67% of the studies. Sample size was consistent with research

design, ranging from 26 to 36,031. Chart 1 presents the objectives and main results or conclusions of each study regarding the assessment of chronic wounds in adults.

Chart 1 shows several aspects that can be assessed in patients with wounds. Over half the studies focused on the diabetic foot (53%), followed by pressure ulcers (30%), chronic wounds (10%) and last, venous ulcers (7%). However, several aspects were common to different types of ulcers. The findings were classified into one of three groups: healing and risk factors, wound assessment, and psychosocial assessment.

**Chart 1** – Distribution of the studies according to first author, year or publication, objectives, and main results/conclusions – Valencia, Spain, 2015.

Author	Year	Main objective	Results/Conclusions
Lizaka <sup>(10)</sup>	2010	To investigate the impact of the nutritional status of home care patients with Pus	Malnutrition was associated with the development of PUs.
Takahashi <sup>(11)</sup>	2011	To determine risk factors for future PUs.	Age and comorbid medical conditions.
Bergquist <sup>(12)</sup>	2011	To identify risk factors for developing PUs at home.	Incontinence, level of dependency, and prior presence of PUs.
Michel <sup>(13)</sup>	2012	To identify the predicting factors of PUs.	Immobility and malnutrition
Coleman <sup>(14)</sup>	2013	To identify independent predicting risk factors of PU.	There is a complex interaction among different factors.
Joseph <sup>(15)</sup>	2013	To explore the literature about the use of tools by nurses to assess risk and identify patients at greater risk to develop PUs.	Assessment must be a combination of knowledge, clinical judgment and scales.
McGinnis <sup>(16)</sup>	2013	To identify the characteristics of patients and ulcers associated with healing of heel PUs.	Increased severity of ulcer and presence of peripheral arterial disease were related to poor prognosis.
García <sup>(17)</sup>	2014	To determine the capacity of risk assessment scales and clinical judgment of nurses to predict development of PUs.	Assessment must take into account clinical judgment and the use of validated scales.
Alex <sup>(18)</sup>	2010	To examine the risk factors for ulcers on patients with diabetes mellitus.	Insulin therapy, peripheral neuropathy, age, gender, callosity, deformities and ulcers.
Ikem <sup>(19)</sup>	2010	To assess the risk factors associated with diabetic foot ulcers.	Patients presented risk factors for peripheral arterial disease, their diagnosis could be made using a handheld Doppler.
Altenburg <sup>(20)</sup>	2011	To characterize the bio-psycho-social factors associated with the development of diabetic foot ulcers.	Patients with diabetic foot tend to present less conscientious health behaviors.
Apelqvist <sup>(21)</sup>	2011	To identify factors related to healing among patients with diabetic foot ulcers and peripheral vascular disease.	Comorbidity, extent of affected tissue and severity of peripheral vascular disease.
Monteiro <sup>(22)</sup>	2012	To identify studies about factors associated with diabetic foot.	Neuropathy, peripheral vascular disease, foot deformity and prior ulcers or amputation.
Moura Neto <sup>(23)</sup>	2013	To determine the epidemiological presentation of diabetic foot and understand whether there are easily assessed variables capable of predicting the development of the diabetic foot.	Predictors of diabetic foot were being male and the presence of neuropathy. The combination of neuropathy and peripheral vascular disease significantly increased risk of amputation.
Pickwell <sup>(24)</sup>	2013	To assess the influence of ulcer location (diabetic foot).	Worse results found for heel ulcers, followed by midfoot and toe ulcers.
Baba <sup>(25)</sup>	2014	To determine the prevalence and associated factors of foot ulcers among community-based patients with type 2 diabetes.	Peripheral sensitive neuropathy was a significant risk factor. However, peripheral arterial disease was also an important independent contributing factor.
Siersma <sup>(26)</sup>	2014	To identify factors responsible for low health-related quality of life associated with foot ulcers and the relative importance of these factors.	Treatment requires a multifactorial approach, going beyond just healing ulcers.
Iversen <sup>(27)</sup>	2015	To prospectively examine whether depressive symptoms increase risk of diabetes and diabetic foot ulcers.	Depressive symptoms were associated with a higher risk of ulcers.
Fawzy <sup>(28)</sup>	2014	To study the relationship between plantar pressure and neuropathy with or without ulceration.	Individuals with diabetes that presented neuropathy and/or ulcers presented elevated plantar pressure.
Nehring <sup>(29)</sup>	2014	To compare risk factors for diabetic foot among the population with type 2 diabetes and risk factors for diabetes among healthy individuals.	Patients who were inclined to develop diabetic foot presented different risk factors than the patients who were at risk for diabetes.
Moffatt <sup>(30)</sup>	2010	To determine factors associated with healing among patients with chronic leg ulcers of any type.	Duration of ulcer, deep vein thrombosis and absence of infection.
Dinh <sup>(31)</sup>	2012	Hypothesis: changes in the peripheral nerve function and the diabetes-associated proinflammatory state are related not only to the development of diabetic foot but with wound-healing failure.	Increased inflammation, expression of matrix metalloproteinase-9 and serum levels of fibroblast growth factor were associated with non-healing.

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Author	Year	Main objective	Results/Conclusions
Gil <sup>(32)</sup>	2015	Hypothesis: there is an underlying malignancy that could explain the chronic and non-healing nature of wounds.	The prevalence of malignancy may be greater than expected, thus it should be assessed through a biopsy.
Abolfotoub <sup>(33)</sup>	2011	To identify risk factors for diabetic foot among diabetic patients.	Duration of diabetes, neuropathy, level of erythrocyte sedimentation rate.
Nehring <sup>(34)</sup>	2015	To identify risk factors of diabetic foot of neuropathic origin occurrence in patients with type 2 diabetes.	Male gender, duration of diabetes, height, weight, and waist circumference.
Parker <sup>(35)</sup>	2015	To review the available evidence on risk factors for delayed healing of venous leg ulcers.	Larger ulcer area and longer ulcer duration, previous ulcers, venous abnormalities and lack of high compression.
Francia <sup>(36)</sup>	2015	To assess how ankle joint mobility can be useful in the identification of patients with diabetes at risk of foot ulcers.	The evaluation of ankle joint mobility can indicate which foot is at higher ulcer risk.
St-Supery <sup>(37)</sup>	2011	To identify existing methodologies available for wound healing assessment in clinical and research settings.	At the moment of the study, no ideal methodology was found.
Scotton <sup>(38)</sup>	2014	To identify clinical and therapeutic factors that influence healing of venous ulcers.	Longstanding ulcer, infection, lack of compression and longer use of antibiotics.
Beckman <sup>(39)</sup>	2014	To identify the association between incontinence-associated dermatitis, its most important etiologic factors, and PUs.	There was an association between incontinence, its etiologic factors, and PUs.

Note: n=30

## HEALING AND RISK FACTORS

### DEMOGRAPHICS AND AGE

Several studies showed that advanced age influenced the development of chronic wounds, whether diabetic foot<sup>(27,33)</sup>, venous ulcers<sup>(35)</sup>, or leg ulcers<sup>(30)</sup>. However, other studies also indicated that the occurrence of ulcers did not only increase with age, but also with the presence of comorbidities commonly found among this population<sup>(13-14,22,34,38)</sup>.

### GENDER

Some studies reported no significant differences between genders<sup>(22-23,35)</sup>. In contrast, others considered the male gender as a risk factor for diabetic foot<sup>(24,27,29,33-34)</sup>, pressure ulcers<sup>(16)</sup>, or foot ulcers<sup>(30)</sup>.

### RACE

Two studies did not consider race to be a significant factor<sup>(14,35)</sup>.

### LEVEL OF EDUCATION

Various studies found lower levels of education among groups with ulcers<sup>(20,33)</sup>.

### MARITAL STATUS

According to one study, marital status did not influence the development of PUs<sup>(11)</sup>.

### NUTRITIONAL STATUS

In studies about PUs, nutrition was indicated as an important predictor of pressure ulcers<sup>(10,13-14,16)</sup>. However, no consistent findings were presented determining its association with delayed healing of venous leg ulcers<sup>(35)</sup>.

### FUNCTIONAL CAPACITY

Several studies showed that lack of general mobility and the use of walking aids were risk factors for chronic wounds<sup>(12,14,24,35)</sup>. Others also reported on the importance of concomitant health conditions that can threaten functional capacity, such as falls,

fractures (hip or knee), chronic obstructive pulmonary disease (COPD), depression, or dementia<sup>(11,30)</sup>. Ankle joint mobility was mentioned as an associated factor in chronic wounds. Several studies showed that decreased ankle joint mobility was correlated to increased risk of diabetic foot<sup>(22,28,30)</sup>.

### SENSORIAL PERCEPTION

Different studies identified reduced visual acuity as a risk factor for chronic wounds<sup>(12,14,22,25)</sup>.

### HEMATOLOGICAL MEASUREMENTS

Albumin emerged as a significant factor, in addition to hemoglobin, creatinine, urea and decreased lymphocytes. C-reactive proteins were also mentioned but were not significant<sup>(14)</sup>.

Some studies showed that osteomyelitis only required assessment when erythrocyte sedimentation rates and C-reactive protein levels were high; however, this association was not significant<sup>(33)</sup>. Furthermore, the main factors associated with non-healing were increased serum levels of inflammatory cytokines, matrix metalloproteinase-9, and various growth factors<sup>(31)</sup>.

### MORBIDITIES

#### DIABETES

The presence of diabetes was a relevant factor for several studies<sup>(11,14,27)</sup>. Differences emerged relative to poor glycaemic control, with high values of HbA1c glycated hemoglobin<sup>(18,22,25,28-29)</sup>, except in two studies<sup>(20,38)</sup>. Significant differences were also found in terms of longer duration of diabetes<sup>(19,22,25,28,33)</sup>.

#### NEUROPATHY

Various studies identified neuropathy as one of the main risk factors for diabetic foot ulcers and amputation<sup>(18,20,22-23,25,28,31)</sup>.

#### VASCULAR DISEASE

Significant differences were found relative to the association between symptoms of vascular disease and the prevalence and incidence of chronic wounds<sup>(11,14,21,25,31)</sup>.

A solid relationship was demonstrated between the development of symptoms of peripheral arterial disease (intermittent claudication and absence of palpable pedal pulse) and the ankle-brachial index measurement as an independent risk factor<sup>(11,16,18,22,27)</sup>. Also, tobacco use, duration of diabetes, and systolic blood pressure were associated with damage to the tunica intima, which resulted in atherosclerotic changes and ischemia<sup>(19)</sup>. Furthermore, venous abnormalities were associated with delayed healing, especially among patients with deep vein pathophysiology<sup>(14,29-30,35)</sup>.

## NEPHROPATHY

Risk of ulceration among patients with renal failure was demonstrated by some authors<sup>(11,22,25)</sup>. However, one study found no significant differences<sup>(33)</sup>.

## OTHER MORBIDITIES

Patients with COPD were at higher risk for reduced mobility and skin oxygen tension. In this study, rheumatoid arthritis was also associated in univariate analysis<sup>(11)</sup>.

Furthermore, patients with spinal cord lesions were subject to non-specific risk factors associated with their disease: immobility, high blood pressure, sensory-motor deficits, and warm and moist skin<sup>(13)</sup>.

Among patients with depressed immune systems, the clinical importance of infections was inversely proportional to the patient's defenses<sup>(38)</sup>.

Patients with neoplasms presented high prevalence, but this factor was not included in the bivariate analysis<sup>(12)</sup>.

Another morbidity considered by some studies was urinary and fecal incontinence<sup>(12,13)</sup>.

## MEDICATION

### SYSTEMIC TREATMENTS

Decreased risk of PUs was observed in patients taking antidepressants<sup>(13)</sup>. The use of topical and systemic antibiotics was associated with a poor prognosis at 12-months follow-up, suggesting that these drugs were not effective in promoting long-term healing of venous ulcers<sup>(38)</sup>.

Another study showed that patients in need of insulin therapy presented higher risk of developing skin ulcers when compared with those with prescribed dietary therapy and oral antidiabetic medication<sup>(18)</sup>. The use of sedatives, dopamine, oxygen, and postoperative steroid treatment were also identified<sup>(14)</sup>.

### LIFE STYLE

Tobacco use was significantly associated with diabetic foot<sup>(18-19)</sup>; however, it was not significant in the development of PUs<sup>(12)</sup>. Another factor related to diabetic foot was alcohol consumption<sup>(25)</sup>. Overweight, tobacco use, and the harmful consumption of alcohol were considered negative factors, or indirect forms of self-harm. However, no significant differences were found in terms of smoking among groups<sup>(20)</sup>. Another study reported on the importance of

self-management, including lifestyle factors (such as exercise) and adherence to treatment<sup>(25)</sup>.

## MISCELLANEOUS

### TEMPERATURE

Increased body temperature emerged as a significant factor in all the studies with patients admitted to intensive care units<sup>(14)</sup>.

### MOISTURE

Moisture was also significant, especially when caused by mixed incontinence (urinary and fecal)<sup>(12-14,39)</sup>.

### HEIGHT

Two studies found that taller men with type 2 diabetes were at higher risk for diabetic foot. The demyelination process was associated with the length of peripheral nerves and the emergence of neuropathy<sup>(29,34)</sup>.

### DEFORMITY

Foot deformity and callosity also emerged as important factors<sup>(18,22)</sup>, together with pressure, friction and shear. Increased pressure was identified as a risk factor<sup>(13,22)</sup>. Another study emphasized friction, shear, mobility-related factors and interface pressure<sup>(14)</sup>.

## WOUND ASSESSMENT

### LOCATION

There was a progressive reduction in healing in heel<sup>(11,16,24)</sup> and sacrum ulcers<sup>(13)</sup>.

### TIME OF EVOLUTION

Time of active ulceration was directly proportional to difficulty in healing<sup>(24,30,35)</sup>. Another study revealed that the presence of chronic wounds may be a predisposing factor for the development of malignant tumors<sup>(32)</sup>.

### AREA

Many studies used size of ulcer as an indirect marker of wound evolution<sup>(24,30)</sup>.

### DEPTH/VOLUME

The severity or depth of wounds emerged as a relevant factor<sup>(16,21)</sup>. Another study included ulcer volume, considering that they heal from the bottom up. However, exact measurements are difficult to obtain, as debridement, edemas, and patient position can produce false results<sup>(37)</sup>.

### WOUND BED

One study posited that the color and characteristics of the granulation tissue reflected tissue viability and health. Its findings suggested that a granulation tissue surface  $\geq 75\%$  for prolonged periods indicated an interruption in the healing process and incapability to progress the epithelization phase due to an underlying disease<sup>(32)</sup>. Another study showed

the presence of fibrin in over >50% as a factor related to delayed healing<sup>(30)</sup>.

### INFECTION

In terms of venous ulcers, no significant association was found between delayed healing and type/number of bacteria or signs of infection<sup>(35)</sup>. In contrast, other studies reported infection as an important factor related to worse prognosis<sup>(24,38)</sup>.

### EXUDATE

Only one study conducted a multivariate analysis including exudate, and found no significant associations<sup>(10)</sup>.

### PERILESIONAL SKIN

According to some authors, the overall skin condition is also important<sup>(14)</sup>. One study showed that only 28% of patients with ulcers had healthy perilesional skin<sup>(16)</sup>. Others found no relationship between erythema/maceration or the status of adjacent skin and wound healing<sup>(16,35)</sup>.

### PREVIOUS ULCERS

One predicting factor for the development of ulcers was a history of previous ulcers<sup>(12,14,18)</sup> and amputation<sup>(22)</sup>.

### PAIN

Pain and frequency of pain were not associated with the development of PUs<sup>(12)</sup>. Pain at rest was found in 52% of patients with diabetic foot<sup>(21)</sup>.

### TOPICAL TREATMENT

A significant factor in venous ulcers was the absence of compression<sup>(35)</sup>. Even though local ulcer care plays an important role in wound bed preparation to optimize healing, one study found that applying the prescribed dressing did not impact the healing process<sup>(38)</sup>. Another study reported that contraction greatly influenced the reduction of wound size, concluding that special care should be given to factors that influence contractile forces, such as type of dressing and presence of blood clots<sup>(37)</sup>.

### PSYCHOSOCIAL ASSESSMENT

Anxiety, depression, social isolation, and low income were associated with delayed healing<sup>(20,35)</sup>. Patients with diabetic foot presented poorer quality of life, and health-related quality of life was considered a predicting measure of morbidity and mortality<sup>(26)</sup>. In contrast, anxiety disorders and psychotherapy seemed to be effective protection factors against this pathology. Self-inflicted behaviors were also measured, but no significant differences were found<sup>(20)</sup>.

In general, mental status did not emerge as a risk factor, but it was included as an important variable. Correlations were found between ulcers and mental status (cognitive function, frequency of confusion, memory deficits, deteriorated decision-making capacity, disruptive verbal behavior, and aggressive physical conduct)<sup>(14)</sup>.

Other important factors include access to health care<sup>(30)</sup> and the experience and knowledge of professionals involved in clinical decisions<sup>(13,17)</sup>. The presence of caregivers<sup>(13)</sup> and the ignorance of caregivers and patients<sup>(10)</sup> proved to be risk factor for ulcers, in addition to length of hospital stay<sup>(11-12)</sup>, and surgery<sup>(30)</sup> and intensive care<sup>(13)</sup>.

Frequency of assistance, type of care or type of residence were not identified as risk factors for the development of new PUs<sup>(12)</sup>.

## DISCUSSION

This review identified several intrinsic and extrinsic factors that significantly impacted outcomes of different types of chronic wounds.

In terms of demographic factors, age was significant, a finding that can reflect decreased self-care ability and mobility<sup>(11)</sup>; however, other studies did not reach this conclusion<sup>(13-14,22,34)</sup>. Additionally, in some studies, the male gender emerged as significant, explained in other studies by hormonal differences and male susceptibility to developing neuropathy and vascular disease, in addition to a lower probability of presenting self-care behavior and higher levels of health absenteeism (favorable recommendation)<sup>(23,29,34)</sup>. In contrast, other studies did not consider the male gender to be significant<sup>(22-23,35)</sup>.

In terms of general health condition, nutritional status did not appear in studies about venous ulcers<sup>(35)</sup>; however, in others, it was considered a significant factor associated with metabolic alterations (favorable recommendation)<sup>(22,29)</sup>. Also significant were general mobility and ankle joint mobility, which has only recently emerged as an assessment item in the literature, considering that adequate overall mobility does not necessarily mean that patients make effective use of their leg muscle pump. Decreased ankle joint mobility can also be the effect of metabolic disorders, which increase skin rigidity, joint capsule, ligaments and tendons (favorable recommendation)<sup>(12,36)</sup>. Furthermore, decreased visual acuity can delay the identification of the presence or severity of ulcers and reduce capacity of skin care, in addition to interfering with mobility.

Regarding morbidities, the presence of comorbidities was significant (extremely recommended)<sup>(16,21)</sup>, namely: diabetes (connective tissue alterations), neuropathy (lack of protective sensation, atrophic changes in foot muscles, reduced joint mobility) and vascular diseases. Furthermore, these findings are corroborated by other studies in which advanced age and the presence of comorbidities indicated a significantly higher risk of complications (amputation, graft survival, and delayed healing)<sup>(21,23)</sup>. Thus, when assessing chronic wounds, greater attention should be given to the population most at risk, which also happens to be the population with the most complex conditions: patients with spinal cord injury, depressed immune systems, and older adults with comorbidities. Patients submitted to surgery and admitted to intensive care units, or those with any factor that can limit mobility, should also be considered at risk<sup>(13,30)</sup>.

Other factors emerged in the studies that are worthy of assessment. Although they did not present statistical significance, they can be easily altered and indirectly improve outcomes. For example, poor glycemic control can negatively impact cytokines, the release of growth factors, and collagen

synthesis<sup>(38)</sup>. Other factors include excess moisture, prolonged tissue pressure, friction, shear, and the presence of deformities, which elevate pressure because of uneven foot loading (favorable recommendation)<sup>(28)</sup>. Managing wound moisture was a relevant measure<sup>(14)</sup>, especially excess moisture<sup>(12)</sup>. In this sense, even though they were frequently classified as a type of pressure ulcer, damage associated with humidity include intertrigo associated with transpiration, damage caused by wound exudate, and incontinence-associated dermatitis. Exposure to urine and feces produce hyperhydration and increased skin pH, in addition to the harm provoked by enzymes and intestinal flora, decreasing the tissue tolerance. The microclimate of the skin surface includes temperature and moisture. More recent studies have considered the measurement of subepidermal moisture and temperature as objective noninvasive methods to assess tissue damage, associating high values with worse results, even though the evidence was not sufficient<sup>(40)</sup>. Subepidermal moisture is defined as changes in interstitial fluid; thus, apoptosis, necrosis, and inflammatory process usually result in the blood vessel regression and other changes that modify the underlying structure of the damaged tissue. Elevated skin temperature is also considered a sign of infection, as well as the result of pressure or shear, because skin increases in temperature before the development of ulcers, due to inflammation and enzymatic autolysis of tissue related to deep inflammation and repeated trauma.

Another aspect to consider is the influence of medications and treatment adherence, as these can produce systemic changes that in turn cause severe reactions in the human body. Treatments that cause deteriorated skin integrity and changes in the healing process are also relevant, although they did not appear in any of the chosen studies, such as: radiotherapy, chemotherapy, immunosuppressant, and anti-inflammatory drugs.

Life style should also be considered. Tobacco use was shown to be significantly correlated among patients with diabetic foot and who presented characteristics of peripheral vascular disease (favorable recommendation)<sup>(28)</sup>. Alcohol consumption presented adverse effects on nutrition and wounds<sup>(25)</sup>. Indirect self-harm can also be considered, including passive conflict-resolution strategies used by subjects with chronic wounds that present a challenge in their relationship with health professionals<sup>(20)</sup>.

Regarding the wounds themselves, different factors should be considered when assessing the healing process. The use of new technologies such as digital photography can help strengthen prevention<sup>(41)</sup>. They usually consider the specific characteristics of wounds that can be related with physiological processes that result in healing (location, size, depth, type of tissue, time of evolution). Time of evolution provokes excessive amounts of enzymes, cell alterations (fibroblasts), hypoxic microenvironment, and increased probability of colonization<sup>(38)</sup>. Another study emphasized the importance of conducting biopsies on wounds of prolonged duration and atypical evolution, despite optimal treatment, to discard their malignancy<sup>(32)</sup>, an aspect which is not usually considered. Biopsies can also help identify unusual wounds such as vasculitis and pyoderma gangrenosum.

Wound area was another variable that appeared as an indirect marker<sup>(24,30)</sup>, even though it can lead to significant error in

the case of irregular shapes. Furthermore, healing is not limited to the simple involution of wound borders, as early healing begins before changes in size are noticeable. Other aspects can be used to assess increased severity (extremely favorable)<sup>(16,21)</sup> such as wound bed<sup>(37)</sup> and depth; which can result in the complete destruction of skin structures and therefore, in the absence of growth factors<sup>(35)</sup>. Infection only emerged as a determinant in one study<sup>(24)</sup>, in which its correct identification was considered essential to better understanding and fighting it. In another study<sup>(35)</sup>, infection was not considered important, although this may be because adequate therapy was always provided when this condition was diagnosed, thus mitigating its influence on the healing process. The assessment of exudate was not considered important<sup>(10)</sup>, but it is a response to the wound etiology, physiology, environment and aggravating processes, such as infection. Another factor that has not been studied much is the assessment of perilesional skin, perhaps because of the great number of descriptors and technologies for its assessment, which make it difficult to interpret; it is an essential piece to assessment of the condition of wounds and thus their future treatment, in addition to being key to the diagnosis of some etiologies. In contrast, the presence of a history of ulcers or amputations (favorable recommendation)<sup>(11)</sup> appeared as an important factor in several studies, probably because previously ulcerated tissue does not stretch in the presence of edemas and ulceration, and thus new ulcers are more likely to develop over old scars. Furthermore, scar tissue does not have blood vessels, which compromises ulcer healing even more<sup>(35)</sup>. Also, patients with previous risks usually present the same underlying risks.

Few studies included assessment of pain as key to a diagnosis and patient quality of life (favorable recommendation), although high levels of pain are frequently reported<sup>(26)</sup>.

Last, the assessment of topical treatment pointed to the importance of compression therapy for venous ulcers<sup>(35)</sup>, thus the importance of its correct diagnosis. Occlusive dressings should also be assessed as possible barriers to contractile forces<sup>(37)</sup>.

Another aspect that did not emerge in this review was the assessment of allergic contact dermatitis induced by topical medications when treating chronic wounds, which is a factor of great prognostic significance.

Furthermore, establishing a good therapeutic relationship or patient participation in decision-making must not be forgotten, as it facilitates other assessment factors. Only one study addressed the role of psychosocial factors in self-inflicted wounds<sup>(20)</sup>, reinforcing the role of psychologists in relation to wound assessment. The knowledge and presence of caregivers are also relevant, as well as that of health professionals<sup>(10,13)</sup>, considering that professionals should not only deliver care to patients, but also expand it to those around them, educating caregivers.

Systematic evaluations conducted on a regular basis and the computerization of data are key to wound assessment. Unfortunately, such assessment is not available to all patients. This reality was also reflected in studies in which Doppler exploration was not carried out to determine arterial etiology<sup>(30,33)</sup>. This exam is hardly ever carried out, especially in the absence of symptoms (progressive claudication, pain at rest), resulting in delayed diagnosis and consequently, late vascular interventions<sup>(11,21)</sup>. This occurs because many centers lack the

material and human resources to perform such care, which also happens with the necessary chiropodist assessment in cases of diabetic foot. Furthermore, health providers may be wasting resources due to poor diagnoses or the use of high-costing innovative technologies on patients that are not inclined to benefit from them. Also, barriers related to communication among care levels and the greater resources allocated to specialized care than primary care result in lower levels of health promotion and disease prevention and in a greater number of people with complications that could have been avoided.

Limitations of this study include the high volume of results found and the heterogeneity of the interventions. There is a need for a framework to classify wounds (the literature about PUs tends to encompass other etiologies such as ulcers due to friction, shear or humidity). On the other hand, a contribution of this study despite insufficient studies that clearly establish the role of assessment is the gathering of data and possible explanations for each, reducing uncertainty when making decisions.

There were no studies investigating the wound assessment process when the association between interventions

and outcomes was uncertain. Future lines of action can include professional education, the involvement of patients and caregivers, inter- and multi-disciplinary care, resource allocation, and further research in the area.

## CONCLUSION

No one factor was found in the present literature review about the assessment of chronic wounds. Instead, such assessment includes a complex interaction of factors that cover both physiological and social and psychological aspects. The multifactorial nature of ulcers poses a challenge to their management and requires the work of multidisciplinary teams. Thus, more information about which aspects to assess in patients with chronic wounds allows professionals to exercise more adequate clinical judgment and practices. Even though some aspects were not statistically significant in the studies, they should still be considered, as they are easier to change and can indirectly improve wound healing outcomes.

## RESUMEN

**Objetivo:** Identificar los principales aspectos a valorar en personas adultas con heridas crónicas. **Método:** Revisión integrativa de la literatura científica publicada, entre 2010 y principios del año 2015, en las bases de datos PubMed y Web Of Science. **Resultados:** Existe un número muy limitado de estudios que se centraran exclusivamente en la valoración de las heridas. Sin embargo, se encontraron muchos aspectos a tener en cuenta en la valoración de personas con úlceras. Por lo que, estos aspectos fueron agrupados en: factores que afectaban significativamente a la cicatrización o desarrollo de nuevas heridas (como la edad, el estado nutricional, la capacidad funcional o la presencia de cormobilidades), factores psicosociales y aspectos relacionados con la lesión (localización, tamaño, profundidad, tipo de tejido, tiempo de evolución). **Conclusión:** En general, no se ha encontrado un aspecto único que se deba contemplar en la valoración de las heridas crónicas, sino una compleja interacción de factores que incluyen tanto aspectos fisiológicos, como sociales y psicológicos. De modo que, los profesionales deben ser conscientes de este enfoque multifactorial; para reconocer tempranamente el desarrollo y la evolución de la úlcera, e intervenir consecuentemente.

## DESCRIPTORES

Úlcera; Heridas y Lesiones; Cicatrización de Heridas; Factores de Riesgo; Evaluación en Enfermería; Revisión.

## RESUMO

**Objetivo:** Identificar os principais aspectos a ser avaliados em pessoas adultas com feridas crônicas. **Método:** Revisão integrativa da literatura científica publicada, entre 2010 e princípios do ano 2015, nas bases de dados PubMed e Web Of Science. **Resultados:** Existe um número muito limitado de estudos que se centraram exclusivamente na avaliação das feridas. No entanto, foram encontrados muitos aspectos a levar em conta na avaliação de pessoas com úlceras. Portanto, esses aspectos foram agrupados em: fatores que afetavam significativamente a cicatrização ou desenvolvimento de novas feridas (como idade, estado nutricional, capacidade funcional ou presença de comorbidades), fatores psicossociais e aspectos relacionadas à lesão (localização, tamanho, profundidade, tipo de tecido, tempo de evolução). **Conclusão:** Em geral, não foi encontrado um aspecto único que deva ser contemplado na avaliação das feridas crônicas, mas sim uma complexa interação de fatores que incluem tanto aspectos fisiológicos, quanto sociais e psicológicos. De modo que os profissionais devem ser conscientes desse enfoque multifatorial, para reconhecer precocemente o desenvolvimento e a evolução da úlcera e fazer a consequente intervenção.

## DESCRIPTORIOS

Úlcera; Ferimentos e Lesões; Cicatrização de Feridas; Fatores de Risco; Avaliação em Enfermagem; Revisão.

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