PREDISPOSING FACTORS FOR THE DEVELOPMENT OF PRESSURE ULCERS: AN INTEGRATIVE REVIEW

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Predisposing factors for the development of pressure ulcers: integrative review

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ABSTRACT
Objective: To identify the predisposing factors for the development of pressure ulcers. **Method:** integrative review carried out in the databases Latin American and Caribbean Literature in Health Sciences (LILACS); Nursing Database (BDENF), Medical Literature Analysis and Retrieval System Online (MEDLINE) and the Scientific Electronic Library Online (SciELO), published between 2012 and 2022, in Portuguese, Spanish and English. **Results:** 20 publications were selected which found a total of 58 factors. **Discussion:** Length of stay, age and mobility were considered the most clinically relevant findings as they had the highest number of citations. **Final considerations:** the evidence presented will contribute to determining the diagnosis of pressure injury risk.
Keywords: Predisposing Factors; Pressure Injury.

RESUMO
Objetivo: identificar quais são os fatores predisponentes para o desenvolvimento de Lesão por Pressão. **Método:** revisão integrativa realizada nas bases de dados Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS); Base de Dados de Enfermagem (BDENF), Medical Literature Analysis and Retrieval System Online (MEDLINE) e na biblioteca Scientific Electronic Library Online (SciELO), publicadas entre os anos 2012 e 2022, nos idiomas português, espanhol e inglês. **Resultados:** foram selecionadas 20 publicações que encontraram, no total, 58 fatores. **Discussão:** o tempo de internação, a idade e a mobilidade foram considerados os achados de maior relevância clínica por apresentarem um maior número de citações. **Considerações finais:** as evidências apresentadas contribuirão para a determinação do diagnóstico de risco de Lesão por Pressão.
Palavras-chave: Fatores Predisponentes; Lesão por Pressão.

INTRODUCTION

Pressure Ulcers (PU) is an injury that usually occurs in regions of the body that have bony prominences, such as the sacral, trochanteric, calcaneal and scapular regions, among others. These ulcers are caused by the force of friction exerted between the body and the object (Araújo, et al., 2019). PU can affect any age group, however, they are more common in the elderly, due to their associated morbidities, and in hospitalized patients, since they are more exposed to the risk of injury associated with immobility and the use of medical devices (Carvalho, et al., 2019).

In the United States, it is estimated that around six hundred thousand patients die each year due to secondary complications of PU (Portela, et al., 2017). In Brazil, the lack of national data means that analysis is restricted to regionalized information. In one specific example, in the city of Manaus, a hospital identified a prevalence of 27% of patients with an lenght of stay of two months (Galvão et al., 2016).

The risk factors for developing PU are associated with diabetes mellitus, systemic arterial hypertension or other pathologies such as poor circulation, strokes and heart disease. Aging and prolonged hospital stays are also risk factors that should be considered (Souza, et al., 2017) (Rodrigues, et al., 2019).

PU is classified by stages and some of these are linked to an unfavorable prognosis, such as prolonged hospitalization, increased treatment costs and, most importantly, reduced quality of life (Barros, et al., 2021).

Borges *et al*, 2018, state that PI is largely preventable and an important indicator of the quality of nursing care in care institutions, making it a relevant topic for research.

METHODOLOGY

This study is an integrative review with the aim of answering the following question: what are the predisposing factors for the development of pressure ulcers?

The integrative literature review, a specific method that according to Souza, et al., 2010, is a methodology that seeks to synthesize existing knowledge in the literature. This type of review is divided into phases, namely: developing the guiding question; searching the literature; collecting the data obtained in the research; analyzing the selected studies; interpreting and discussing the results.

The inclusion criteria adopted for the search and selection of publications were: selection of articles published in scientific journals dealing with the subject; published in Portuguese, English and Spanish, between the periods 2012 to 2022, and indexed in the databases: Latin American and Caribbean Health Sciences Literature (LILACS); Nursing Database (BDENF), Medical Literature Analysis and Retrieval System Online (MEDLINE) and the Scientific Electronic Library Online (SciELO) library; made available in full free of charge, directly through the database website or through the Virtual Health Library (VHL), locatable by combining the following descriptors registered on the Health Sciences Descriptors Portal (DeCS): "pressure injury" and "predisposing factors". The descriptors were combined with the Boolean operators AND and OR in order to refine the studies according to the topic in question.

The search was carried out in an orderly way, discarding in the first analysis articles that did not meet the criteria: period of time considered, availability of the full text and, in addition, duplicates (studies published on more than one basis) were also discarded. Subsequently, the title and abstract of each publication were carefully read to check that they were in line with the research question. When there was any doubt about the inclusion or exclusion of the study, the text was read in full to reduce the risk of missing publications relevant to the study.

Thus, those that did not address the topic "predisposing factors for the development of pressure injuries" were discarded in the second analysis (Figure 1).

Data collection took place between July and September 2022 and was supported by a data collection tool prepared in Microsoft Office Excel 2010 software, with the following

variables: title of the article, authors, journal, year of publication, country of origin of the study, type/approach of the study.

For the purposes of organization, this research prioritized the hierarchical classification of factors based on the frequency of citations in the selected articles, giving greater relevance to those that are repeatedly referenced and therefore of greater clinical importance.

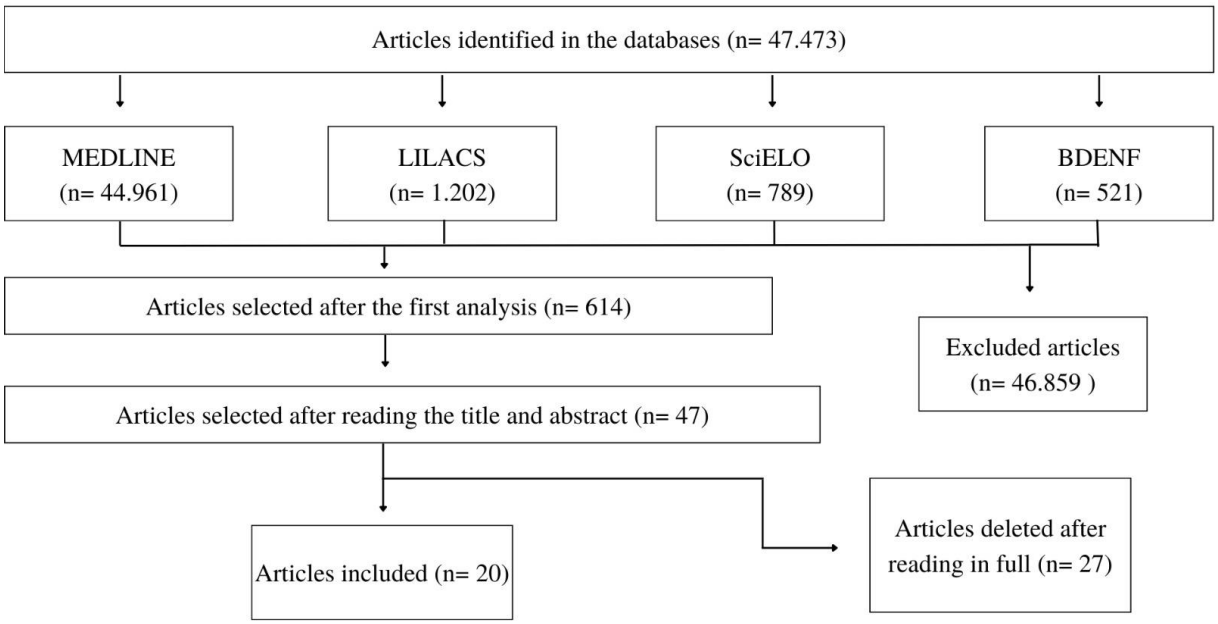
RESULTS

Twenty articles were identified which met the selection criteria (Chart 01). Of these, eleven were published in Brazil, six from the Southeast, four from the South and one from the Northeast. In addition, four articles were published in the United States of America, two in Portugal and another three from the United Kingdom, Finland and Colombia respectively.

With regard to the methodological approach adopted in the studies chosen, the majority were cohort studies (n=6) and cross-sectional studies (n=6), while the others were divided into case-control studies (n=3), descriptive studies with prospective analysis (n=3) and retrospective analysis (n=2). As for the time distribution of the publications, one article was identified in 2015, one in 2017, one in 2018, one in 2019, four articles in 2020, nine in 2021 and three in 2022.

With regard to the origin of publication in the databases, eight articles were identified in the Scientific Electronic Library Online (SciELO), six in the Medical Literature Analysis and Retrieval System Online (MEDLINE), three in the Latin American and Caribbean Literature on Health Sciences (LILACS) and three in the Nursing Database (BDENF). Figure 1 below shows how the studies were selected and analyzed.

Figure 1. Study selection process.



Source: Own elaboration. Ponte Nova, Minas Gerais, Brazil 2023.

Table 1 below shows how the research was characterized.

Table 1. Characterization of scientific production on predisposing factors for the development of pressure injuries.

Title	Authors	Year and country of publication	Type of study	Journal
Determinants of pressure ulcers in critically ill people in intensive care	MORAIS, J.	2015 Portugal	Descriptive-correlational and retrospective study	Polytechnic Institute of Viana do Castelo
Pressure Ulcers in Long-Stay and Maintenance Units	LOPES, C.	2017 Portugal	A retrospective, descriptive, analytical study with a quantitative approach	Polytechnic Institute of Bragança
Pressure Injury in the Intensive Care Unit: a case-control study	PACHÁ, H. *et al.*	2018 Brazil	Case-control study promoted by multiple logistic regression	Brazilian Journal of Nursing
Incidence of Pressure Injury in an Oncology Intensive Care Unit	JOMAR, R; *et al.*	2019 Brazil	Longitudinal observational study	Brazilian Journal of Nursing

Incidence of Pressure Injury in hospitalized patients and associated risk factors	JESUS, M; *et al.*	2020 Brazil	Prospective, longitudinal and observational study	Revista Baiana de Enfermagem
Pressure injuries due to surgical positioning and associated factors	BUSO, F. *et al.*	2020 Brazil	Longitudinal observational study	Acta Paul Enfermagem
Risk of malnutrition and development of Pressure Injury in hospitalized patients in Brazil: a multicenter prospective cohort study	SERPA, L; *et al.*	2020 United States	Prospective cohort study	International Wound Journal
Risk factors for hospital-acquired pressure injuries in surgical intensive care patients	ALDERDEN, J; *et al.*	2020 United States	Retrospective cohort study carried out using logistic regression	Department of Health and Human Services - USA
Incidence and factors related to the appearance of Pressure Injuries in the Intensive Care Unit	RODRIGUES, J; *et al.*	2021 Brazil	Cohort, observational and prospective study	Journal of the Brazilian Association of Stomatherapy: stomas, wounds and incontinence
Occurrence of Pressure Injury in Intensive Care Unit Patients	SANTOS, S; *et al.*	2021 Brazil	Cross-sectional study	Revista Mineira de Enfermagem
Clinical evidence of the nursing diagnosis Pressure Injury in adults	SANTOS, C; *et al.*	2021 Brazil	Cross-sectional observational study	Journal of the USP School of Nursing
Pressure injuries in a cohort of critically ill patients: incidence and associated factors	LOPES, A; BATASSANI, E; BEGHETTO, M.	2021 Brazil	Prospective cohort study	Gaúcha Journal of Nursing
Pressure injuries related to medical devices in critically ill patients: prevalence and associated factors	GALETTO, S; *et al.*	2021 Brazil	Epidemiological, observational cross-sectional study with a quantitative approach	Journal of the USP School of Nursing
Risk assessment for Pressure Injury and associated factors in elderly inpatients	GRDEN, C; *et al.*	2021 Brazil	Cross-sectional study	Nursing Magazine
Risk factors for heel pressure injuries in Cardiovascular Intensive Care Unit patients	LEE, H; *et al.*	2021 United Kingdom	Retrospective case-control study	International Wound Journal

Prevalence and incidence of Pressure Injury in acute inpatients and related risk factors: a cross-sectional national study	TERVO-HEIKKINEN, T; *et al.*	2021 Finland	Multicenter cross-sectional observational study	International Wound Journal
Risk of Pressure Injury in Intensive Care Unit Patients	CAMPOS, M; SOUZA, M; WHITAKER, I.	2021 Colombia	Cross-sectional study	Cuidarte Magazine
Factors associated with the incidence of pressure injuries in critically ill patients: a cohort study	TEIXEIRA, A; *et al.*	2022 Brazil	Prospective cohort study	Brazilian Journal of Nursing
Hospital-Acquired Pressure Injuries and Acute Skin Failure in Intensive Care: A Case-Control Study	PITTMAN, J; *et al.*	2022 United States	Case-control study	Department of Health and Human Services - USA
Development of Subsequent Pressure Injury in Mechanically Ventilated Critically Ill Patients with Hospital-Acquired Pressure Injury: A Retrospective Cohort Study	ALDERDEN, J; CADAVERO, A; DOUGHERTY, D.	2022 United States	Retrospective cohort study	Department of Health and Human Services - USA

Source: Own elaboration. Ponte Nova, Minas Gerais, Brazil, 2023.

Table 2 summarizes the main findings related to predisposing factors for the development of PI.

Table 2. Summary of the main research findings.

Title	**Main findings**
Determinants of pressure ulcers in critically ill people in intensive care	It was found that low levels of hemoglobin, albumin and other proteins were identified at the time of patient admission and are a risk factor for pressure ulcer development in critically ill people.
Pressure Ulcers in Long-Stay and Maintenance Units	There was a prevalence of 35.3% and an incidence of 6.7% of pressure ulcers in the unit in question. The associated factors found were: malnutrition, immobility, urinary and fecal incontinence and length of stay.
Pressure Injury in the Intensive Care Unit: a case-control study	The risk factors found were length of stay of more than 7 days, age over 60 and admissions due to infectious, parasitic and neoplastic diseases.
Incidence of Pressure Injury in an Oncology Intensive Care Unit	The incidence rate analyzed per 100 patient days was 1.32%. A higher incidence was observed in patients who had a chronic illness associated with at least one episode of diarrhea, enteral nutrition or administration of vasoactive drugs.

Incidence of Pressure Injury in hospitalized patients and associated risk factors	Most of the sample was made up of elderly people with hypertension and diabetes. There was a 24.3% incidence of PI and the risk factors highlighted by the study were: diaper use, loss of mobility and change of decubitus.
Pressure injuries due to surgical positioning and associated factors	The majority of the sample was made up of white, adult males, and the occurrence of PI was 37.7%. The associated factors were: age and higher risk according to the Risk Assessment Scale for the Development of Injuries Resulting from Surgical Positioning (ELPO) score.
Risk of malnutrition and development of Pressure Injury in hospitalized patients in Brazil: a multicenter prospective cohort study	It has been confirmed that patients who are at high risk of malnutrition are also at high risk of developing PI.
Risk factors for hospital-acquired pressure injuries in surgical intensive care patients	The occurrence of PI was 7.8% and the predictors found were: length of stay in the ICU, minimum score on the Braden scale and skin irritation.
Incidence and factors related to the appearance of Pressure Injuries in the Intensive Care Unit	The incidence of PI was 20% and the main associated risk factor was length of stay.
Occurrence of Pressure Injury in Intensive Care Unit Patients	The occurrence of PI was 30.3%, most of whom were female patients with previous pathologies such as diabetes mellitus, acute myocardial infarction and stroke. In addition, acute kidney disease increased the risk of developing PI by 3.5 times.
Clinical evidence of the nursing diagnosis Pressure Injury in adults	Related factors included pressure on bone protrusions, friction, shear and incontinence. The population at risk was mostly elderly and the associated conditions were: pharmacological agent, loss of mobility, decreased tissue perfusion and impaired circulation.
Pressure injuries in a cohort of critically ill patients: incidence and associated factors	The incidence of PI was 36% and the risk factors found were: Braden score less than 13, history of stroke, age over 60, fasting and days of physiotherapy.
Pressure injuries related to medical devices in critically ill patients: prevalence and associated factors	The prevalence of PI was 62.4%. Orotracheal, nasogastric and urinary catheters were the medical devices that caused the most PI and the associated factors found were: low Braden and Glasgow scores, length of hospital stay and diagnosis.
Risk assessment for Pressure Injury and associated factors in elderly inpatients	27.7% of the elderly were classified as low risk, 14.4% as moderate risk and 17.3% as high risk for developing PI. The associated factors were: Braden score, age group, multimorbidity, length of hospital stay, use of medical devices, type of diet offered, skin turgor and texture.
Risk Factors for Heel Pressure Injury in Cardiovascular Intensive Care Unit Patients	The occurrence of heel injury was 33.6% and the risk factors identified were: heart surgery, length of operation, use of mechanical ventilation, use of sedatives, use of vasoconstrictors and cardiopulmonary bypass.

Prevalence and incidence of Pressure Injury in acute inpatients and related risk factors: a cross-sectional national study	The prevalence of PI was 12.7% and the incidence was 10%. Clinical patients developed more lesions than surgical patients and the risk increased when the patient was underweight, of advanced age and unable to move. Lack of skin assessment on admission was also a risk factor.
Risk of Pressure Injury in Intensive Care Unit Patients	14.2% of patients developed PI and the associated risk factors were: age, length of hospitalization and stay in the ward before the ICU.
Factors associated with the incidence of pressure injuries in critically ill patients: a cohort study	The incidence of PI was 11.4% and patients who had been hospitalized for more than 4 days and used a delayed bladder catheter, nasoenteric catheter and tracheostomy were at greater risk of developing the lesion.
Hospital-Acquired Pressure Injuries and Acute Skin Failure in Intensive Care: A Case-Control Study	The main clinical characteristics and risk factors that are associated with the development of avoidable or unavoidable hospital-acquired PI are acuity, organ failure, tissue perfusion, sepsis and a history of previous pressure injury.
Development of Subsequent Pressure Injury in Mechanically Ventilated Critically Ill Patients with Hospital-Acquired Pressure Injury: A Retrospective Cohort Study	77 patients developed a second PI and the independent risk factors for subsequent PI formation were lower hemoglobin, vasopressin infusion and longer hospital stay.

Source: Own elaboration. Ponte Nova, Minas Gerais, Brazil, 2023.

Fifty-eight predisposing factors to PU were identified. However, following the principle of selection by relevance of importance, we highlight the most cited factors: length of stay, age and mobility with, respectively, ten, eight and five mentions in selected studies.

It is important to emphasize that, even though other factors have been reported in smaller numbers, their importance in this investigation should not be underestimated, since the main objective is to determine the predisposing factors for the development of PU. Each element, regardless of its frequency of citation, contributes in a unique way to a comprehensive and holistic understanding of this clinical issue.

Within the scope of this research, the following factors were also identified with the respective number of citations in the selected articles: vasopressin and Braden score (n=4); anemia and increased hemoglobin, chronic diseases, poor perfusion, urinary and fecal incontinence (n=3); sedation, malnutrition, enteral nutrition, dehydration, low albumin levels, previous history of pressure injury, length of surgery, body temperature, edema, use of medical devices, nasoenteric tube and delayed bladder catheter (n=2).

The following factors were found with only one citation in the articles investigated (n=1): tracheostomy, orotracheal tube, mechanical ventilation, cardiopulmonary bypass, previous stroke, previous hospitalization, diarrhea, male gender, low weight, weight extremes, increased C-reactive protein, admission to SUS ICU, infectious disease diagnoses, diagnoses of neoplastic diseases, diagnoses of parasitic diseases, sepsis, heart surgery, kidney damage, ELPO score, fasting time, decubitus change time, Glasgow score, diagnosis of hospitalization as "other causes", dry skin, decreased turgor, greater demand for care from the nursing team, organ failure, pressure on bone protrusions, friction, shear, insufficient knowledge of pressure injuries, impaired circulation, peripheral neuropathy, decreased tissue oxygenation, altered sensation, smoking and pharmacological agents (corticosteroids, non-steroidal anti-inflammatory drugs, chemotherapy, radiotherapy, immunosuppressants, analgesics and anxiolytics).

DISCUSSION

According to the 2018 Science-Metrix international report, Brazil is one of the countries with the highest number of scientific productions made freely available, with a rate of 74%, which may directly influence the findings of this study.

Length of stay was the predisposing factor with the highest number of references among the articles selected. Ten studies (Morais, 2015; Lopes, 2017; Pachá, *et al*., 2018; Rodrigues, *et al.*, 2021; Santos, et *al., 2021;* Galetto, et *al*., 2021; Grden, et *al., 2021;* Campos; Souza; Whitaker, 2021; Teixeira, *et al.*, 2022; Alderden; Cadavero; Dougherty, 2022) stated that length of stay is an important factor in the onset of PI, although there was no consensus among the studies as to the number of days considered.

The lack of consensus and the heterogeneity of perspectives regarding the length of hospitalization are notably illustrated in the subsequent description. While some studies suggest that a patient admitted to a general inpatient unit is at risk of developing PU after an average of seven days, other studies highlight a minimum length of stay of twenty-four hours in an Intensive Care Unit as a critical risk point.

Despite the divergence, they all state that the longer the hospital stay, the greater the risk. Tsaras *et* al., 2016 corroborate this statement and explain that patients hospitalized for long days remain immobilized for a long time, favoring pressure on bony prominences, which

culminates in the appearance of lesions. Prolonged exposure to pressure causes ischemia and can lead to tissue death. This is because the constant pressure exerted on a certain area of the body can also compress the blood vessels, preventing the supply of oxygen and essential nutrients to the tissue. Thus, without scheduled decompression, known as decubitus change, the tissue loses its viability and becomes devitalized (Domansky; Borges, 2014).

Age was also a relevant predisposing factor for the study, since it is cited by eight studies (Pachá, et *al*., 2018; Buso, *et al.,* 2020; Santos, et al., 2021; Santos, *et al., 2021;* Lopes; Batassani; Beghetto, 2021; Grden, *et al.,* 2021; Tervo-heikkinen, et *al., 2021*; Campos; Souza; Whitaker, 2021). Ageing triggers some physiological processes that directly interfere with the resistance of the integument, such as a decrease in muscle mass, a reduction in tissue vascularization and the potential loss of sebaceous and sweat glands; all these associated changes make the bone structure even more prominent (Matos, *et al*., 2022). Therefore, when pressure is applied to areas that have undergone this aging process, there is a greater risk of skin lesions developing.

Another physiological process of ageing is the manifestation of sarcopenia, a condition in which the elderly person's muscle mass potentially decreases, which can cause weakness and reduced mobility. Linked to this, there is a decrease in the protection of bone tissue, making the patient more vulnerable to the application of pressure and shear forces, which can increase the risk of injury (Junior, 2014).

In addition, with advancing age there is a greater susceptibility to chronic diseases, another predisposing factor mentioned in some articles in this study (Jomar, *et al*., 2019; Grden, *et al.,* 2021; Tervo-heikkinen, et *al., 2021*), such as diabetes *mellitus*, vascular and neurological diseases, these pathologies can be harmful not only to health in general, but also to the individual's mobility and functionality (Leite, *et al.,* 2012).

Diabetes *mellitus*, for example, is a metabolic syndrome which, when uncontrolled chronically, can cause peripheral neuropathy and peripheral arterial obstructive disease, reducing the level of sensitivity, perception of pain in the limb and local circulation, which can culminate in a lack of awareness on the part of the individual themselves about the need to change the pressure exerted on a particular region (Nascimento; Pupe; Cavalcanti, 2016).

Immobility was the third most mentioned predisposing factor. Five studies (Lopes, 2017; Jesus, *et al*., 2020; Santos, *et al.*, 2021; Grden, *et al., 2021*; Tervo-heikkinen, et *al.*, 2021)

considered mobility to be a relevant predisposing factor for the development of PU. It is important to mention that this factor plays a fundamental role in gerontology, considered to be one of the "giants of geriatrics" which also includes postural instability, cognitive impairment, incontinence and iatrogenesis (Santos, 2022). Therefore, it is understood that with advancing age, there is a greater predisposition of the individual to a decrease in mobility.

Patients with reduced mobility may find it difficult to change their position, as is the case with individuals who spend a lot of their time bedridden, restricted to wheelchairs or who suffer from illnesses that affect their ability to move (ANVISA, 2018). In this sense, there is increased exposure to constant pressure on the bony prominence, which can lead to tissue ischemia due to a lack of oxygen supply, as mentioned above.

It's worth noting that immobility often affects elderly patients, but it also encompasses other age extremes, including newborn babies, especially those considered preterm. Newborns' skin makes up only 13% of their body surface, which explains the instability in temperature regulation and makes them more vulnerable to contact with microorganisms. In addition, this thin and fragile layer of skin leads to a decrease in bone protection. Thus, the newborn is susceptible to developing PU, all of which, combined with the need for intensive care involving the use of medical devices, can increase the risk of PI (Faria; Kamada, 2017).

The Braden scale is a resource used worldwide to classify a patient's risk of developing PU. It is based on five factors: sensory perception, humidity, activity, nutrition and friction and shear, which should be scored from 1 to 4, according to the individuality of each patient, at the end the result is added up and the risk is determined (Barbosa; Beccaria; Poletti, 2014). It is important to note that all the predisposing factors for the onset of PI, as outlined in the Braden scale, were identified as results of this research. However, it is worth noting that the factors that received the highest number of mentions in this study - length of hospitalization and age - are not part of the original composition of this scale. This raises the hypothesis of a potential need for adaptation.

FINAL CONSIDERATIONS

Based on the evidence obtained, it is possible to conclude that length of stay, age and mobility emerge as highly relevant predisposing factors for the development of PU. Although

the other factors identified in the research were not mentioned as frequently in the studies analyzed, this does not eliminate the risk of PU. However, it highlights the importance of carrying out further research to gain a more comprehensive and accurate understanding of the impact of these factors, reinforcing the need for additional studies to deepen knowledge in this area.

An important consideration of this research is the restriction to the selection of articles made available free of charge. Although a comprehensive approach was adopted for the search for information, the choice to restrict the analysis to free articles may have had an impact on the breadth and diversity of the resources used. This limitation may have influenced the inclusion of varied perspectives, resulting in a partial view of the field of study. It is important to recognize this restriction when interpreting the results and to consider the possibility that other relevant sources may not have been approached due to this limitation of access.

It can therefore be concluded that the early identification of risk factors plays a crucial role in reducing the incidence of PI, making it imperative for the nursing team to keep constantly up to date. This updating not only strengthens the team's ability to promptly recognize predisposing elements, but also ensures the provision of quality care, which is fundamental for the effective prevention and appropriate treatment of patients susceptible to developing PI. Keeping abreast of the latest practices and research in the field is essential for optimizing the care provided and promoting better clinical outcomes.

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