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# Application of the Braden Scale in the home setting: incidence and factors associated with pressure ulcers

Aplicação da Escala de Braden em domicílio: incidência e fatores associados a úlcera por pressão

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## Keywords

Nursing assessment; Nursing care; Pressure ulcer/epidemiology; Home visit; Continuity of patient care

## Descritores

Avaliação em enfermagem; Cuidados de enfermagem; Úlcera por pressão/epidemiologia; Visita domiciliar; Continuidade da assistência ao paciente

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## Abstract

**Objective:** Estimate the capacity of the Braden Scale for predicting the onset of pressure ulcers in the home environment, and learn the incidence of pressure ulcers in this group and their associated factors.

**Methods:** This is a prospective cohort study that included 183 patients. Demographic and clinical variables, degree of cognitive impairment and impairment of activities of daily living were studied. The Braden Scale was applied in six monthly home visits that were monitored for six months in a Homecare Monitoring Program.

**Results:** The incidence of pressure ulcers found was 20%. The score with the best representation as for the risk of ulcer development was the cutoff point 18. The degree of classification in the homecare monitoring program, Alzheimer disease and stroke were predictive factors in the emergence of the disorder.

**Conclusion:** The Braden Scale was effective in the home environment to predict the onset of pressure ulcers. The incidence of pressure ulcers in homecare monitoring was 20%, and the associated factors were the degree in the Homecare Monitoring Program, Alzheimer and activities of daily living.

## Resumo

**Objetivo:** Estimar a capacidade da Escala de Braden em prever o surgimento de úlcera por pressão no âmbito domiciliar, conhecer a incidência da úlcera por pressão neste grupo e os seus fatores associados.

**Métodos:** Trata-se de um estudo de coorte prospectivo que incluiu 183 pacientes. Foram estudadas variáveis demográficas e clínicas, grau de acometimento cognitivo e comprometimento de atividades da vida diária. A Escala de Braden foi aplicada em seis visitas domiciliares mensais acompanhadas por seis meses em um Programa de Acompanhamento Domiciliar.

**Resultados:** A incidência de úlcera por pressão encontrada foi de 20%. A pontuação com melhor representatividade para considerar risco de desenvolvimento de úlcera foi o ponto de corte 18. O grau de classificação no programa de acompanhamento domiciliar, Alzheimer e Acidente Vascular Encefálico foram fatores preditores ao surgimento do agravado.

**Conclusão:** A Escala de Braden demonstrou ser efetiva no âmbito domiciliar para prever o surgimento de úlceras por pressão. A incidência de úlcera por pressão no acompanhamento domiciliar foi de 20%. E os fatores associados foram: Grau no Programa de Acompanhamento Domiciliar, Alzheimer e Atividades da Vida Diária.

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## Introduction

Pressure ulcers affect patients with restrictions of movement and sensitivity. It is defined as an area of tissue necrosis that forms when the tissue is compressed between a bony prominence and a hard surface for a period of time.<sup>(1)</sup> Its treatment ranks third in health expenses, being surpassed only by cancer treatment and cardiac surgery.<sup>(2)</sup>

An international study identified an 8% prevalence of this disease in Germany, 20% in Sweden, 23% in Italy, and 24% in the Netherlands.<sup>(3)</sup> In Brazil, an incidence of 41% was identified.<sup>(4)</sup>

Pressure by contact is the major risk factor. Pressure higher than 32 mmHg for arterioles and 12 mmHg for venules for prolonged periods prevents adequate blood flow, reduces on-site nutrition and promotes tissue deterioration.<sup>(1,5,6)</sup>

Another risk factor, shear force, occurs when the patient remains immobile in bed, while the skin layers are moving, and it is common in patients positioned with a very elevated bed head ( $> 30^\circ$ ).<sup>(1)</sup>

Friction occurs when two surfaces rub up against one another. A common situation in episodes of agitation and when dragging the patient in bed and changing their position.<sup>(1)</sup>

Besides external factors as risks for developing pressure ulcers, there are also internal factors such as malnutrition, anemia and chronic diseases.<sup>(1)</sup>

Staging classifies pressure ulcers as stages I, II, III and IV; in small, medium, large or extensive sizes; into fabric type: necrotic, granulation and epithelialization, and type and amount of secretion, among others.<sup>(7)</sup>

Scales for predicting ulcers have proved important to identify patients at risk, allowing to direct care. Among the indicators for validation of a scale, there are: sensitivity – which measures the proportion of true positives among the cases; specificity – measuring the proportion of true negatives among the controls; positive predictive value (PPV) – which measures the proportion of true positives among those exposed; negative predictive value (NPV) – measuring the proportion of true negatives among those not exposed.<sup>(8)</sup>

In general, a scale is considered to be validated when there are quantitative studies that demonstrate its effectiveness.<sup>(8)</sup>

The Braden Scale, the most broadly used in clinical practice in Brazil, was published in 1987 and validated in Brazil in 1999. It evaluates six different categories: sensory perception; moisture; activity; mobility; nutrition; friction and shear.<sup>(4-6)</sup>

The first five sub-scales are scored from one (less favorable) to four (more favorable); the sixth sub-scale, friction and shear, is scored from one to three. The total sum is between the values of six and 23. Low points indicate a low functional ability, therefore, the patient is at high risk of developing PU.<sup>(5)</sup>

A Brazilian study conducted in the home environment indicates that 70.2% of patients had risk of developing PU, with a prevalence of 19.1%.<sup>(9)</sup>

Literature suggests the need for further research to clarify the validity of the prediction scales, not only in hospitals but in other settings such as nursing homes and households to determine the best choice in predicting the risk of injury.<sup>(2)</sup>

The Homecare Monitoring Program is characterized by decreasing the rate of hospitalization, performing simple procedures and preventive activities at home, providing greater patient comfort and decreasing the cost to the agreements.<sup>(9)</sup>

The objectives of this study were to estimate the capacity of the Braden Scale for predicting the onset of pressure ulcers in the home environment and to learn the incidence of pressure ulcers in this group and their associated factors.

## Methods

This is a cohort, prospective study performed in a Homecare Monitoring Program in the city of Belo Horizonte, state of Minas Gerais, in the southeastern region of Brazil.

In this program, there is a subdivision of patients based on the number of diagnoses, level of cognition, impairment of activities of daily living, among others, providing the frequency of visits of professionals to be stipulated.

Activities of daily living indicate the individual's ability to perform activities such as bathing, dressing, toileting, feeding, getting in and out of bed.<sup>(10)</sup>

Cognitive impairment is a parameter that assesses the patient's mental capacity, their ability to store, assimilate and pass on information, temporal and spacial orientation. Patients are divided into the absence of deficit or light, moderate and intense deficit.<sup>(10)</sup>

Considering these parameters, patients are divided into four degrees: Degree I, II, III and IV, having an ascending scale of complexity, with patients in group IV having the highest level of clinical instability, impairment of activities of daily living and cognitive deficit.

The epidemiological study and clinical application of the Braden Scale were conducted with 183 patients enrolled in the program, residents from the South Central region of Belo Horizonte. Nursing visits for this population were scheduled once a month and in advance for cases of injury or those discharged from hospital. Patients belonging to the classification "degree III and IV" were included in the sample; without prior PU; participants in treatment for at least a month. Those who died; were discharged from hospital or excluded from the treatment were excluded from the study.

The study variables were sex, age, skin color, main diagnosis, time of monitoring in the program, use of medications, degree of cognitive impairment and impairment of activities of daily living. The Braden Scale was administered for each home visit during data collection, between January and June of 2012.

In the statistical analysis, comparison of categorical factors in the development of ulcers was performed. Pearson's Chi-square test or Fisher's exact test, Mann-Whitney's nonparametric test and Student's t test were used (univariate analysis/Epiinfo 7.0 with significance set at  $p < 0.05$ ). The variables that showed association probability  $< 0.25$  were recalculated in the multivariate analysis (Stata 10.3) in order to exclude any spurious association. Variables with  $p < 0.05$  were considered in the end of this stage. Besides the p-values, the odds ratio (OR) and a confidence interval of 95% (CI) were calculated.

Diagnostic or screening test was used to calculate sensitivity, specificity, PPV and NPV of the BS.

The study development complied with national and international ethical standards for research involving human beings.

## Results

A total of 126 (68.9%) patients in the sample were female and 57 patients (31.1%) were male. There was no statistical association between sex and the emergence of PU ( $p = 0.83$ ).

The mean age of participants who developed PU was  $82.5 \pm 12.1$  years and among those who did not develop PU, it was  $80.2 \pm 10.9$  years. There was no difference related to age among patients who developed ulcer, or not ( $p = 0.36$ ).

As for the skin color, the majority of patients were classified as leukodermic (133 patients), followed by feodermic (36 patients) and melanodermic (13 patients). There was no statistical significance between skin color and the onset of the injury ( $p = 0.22$ ).

Given the classification of home care, 64.9% of patients who developed ulcers were grade IV, whereas 61.6% of patients who did not develop ulcers were grade III ( $p = 0.00$ ).

Regarding cognitive deficit, 81% of the patients who developed ulcers developed severe and moderate deficit. No ulcers were observed in patients without cognitive impairment. This variable was relevant to the onset of injury ( $p = 0.00$ ).

The impairment of activities of daily living was significant in the onset of ulcer: 97.3% of patients who developed ulcers showed impairment in developing activities of daily living ( $p < 0.0001$ ).

As regards the number and classification of new ulcers, the appearance of 56 injuries, with an incidence of 20% was observed. As observed, 83% of patients had only one ulcer, 42.9% had ulcers in stage I and 32.7% in stage III, 96.2% of patients had small ulcers. In addition, 48.6% of patients developed PU in the sacral region, followed by the heels and trochanteric region, both with 19.2%.

The study of comorbidities present in the sample in connection with the development of pressure ulcers revealed that patients with Alzheimer's disease ( $p=0.00$ ), stroke ( $p=0.04$ ) and Parkinson's ( $p=0.00$ ) are the predisposing factors in the onset of the disorder, according to univariate analysis. Other comorbidities studied and which were not considered risk factors for ulcer were: hypertension ( $p=0.42$ ); heart disease ( $p=0.09$ ) and diabetes mellitus (DM) ( $p=0.94$ ).

Diseases in descending order of prevalence were: hypertension with 67.8%, followed by heart disease 30.1%, DM 27.3%, Parkinson's 20.2%, Alzheimer's 17% and stroke 14.2%.

Table 1 shows that anxiolytic and anti-dementia drugs were associated with the onset of pressure ulcers ( $p=0.00$  and  $p=0.03$  respectively), according to univariate analysis.

**Table 1.** Development of pressure ulcers, associated with drug use

Medication	Ulcer development		p-value
	Yes n(%)	No n(%)	
Anti-hypersensitive	22(59.5)	96(65.8)	0.51
Anxiolytics	20(54.1)	51(34.9)	0.03
Anti-coagulants	16(43.2)	60(41.1)	0.82
Anti-dementia	11(29.7)	13(8.9)	0.00
Anti-dementia	11(29.7)	35(24)	0.53
Diuretics	10(27)	51(34.9)	0.65
Hypoglycemic	10(27)	37(25.3)	0.84
Cardiotonic	7(18.9)	47(32.2)	0.12
Others	35(94.6)	128(87.7)	

Table 2 describes the Braden Scale scores (total and by category) among the participants. There was no statistical difference between all variables ( $p=0.00$ ). The lowest scores are present in patients who developed ulcers.

**Table 2.** Development of pressure ulcer

BS and its Sub-scales	Ulcer development		p-value
	Yes n(Score)	No n(Score)	
Total Braden Scale	37 (12.5 ± 3.3)	146 (18.4 ± 4.1)	0.00
Sensory perception	37 (2.3 ± 0.9)	146 (3.4 ± 0.9)	0.00
Moisture	37 (2.4 ± 0.6)	146 (3.2 ± 0.7)	0.00
Physical activity	37 (1.7 ± 0.7)	146 (2.7 ± 0.8)	0.00
Mobility	37 (1.8 ± 0.7)	146 (3.6 ± 0.9)	0.00
Nutrition	37 (2.6 ± 0.6)	146 (3.2 ± 0.6)	0.00
Friction and shear	37 (1.6 ± 0.6)	146 (2.5 ± 0.6)	0.00

As regards the age of patients with their respective scores on the Braden Scale (total) and the onset of pressure ulcers, it is observed that, from 70 years of age on, there is a statistical difference between participants ( $p=0.00$ ). According to the statistical calculations for the smaller group of 60 years of age and between 60-69 years old,  $p=0.20$  has been found. For the group between 70-79 years of age, 80-89 years of age and > 90 years old, all showed  $p=0.00$ . It is therefore possible to say that from 70 years of age on, the low score on the scale has a strong relation with the onset of the disorder. The evaluation of patients with their respective risk ratings, among those classified as no risk (19-23 points), showed that no patient developed ulcers.

Table 3 shows the calculation results for the diagnostic evaluation or screening based on the scale scores suggested in literature. The cutoff point of 18 showed the highest rates of representation, with 100% sensitivity, defining the effectiveness of the scale in predicting the risk, as well as the best VPN index (100%) ensuring that all patients who did not develop ulcers were classified as no risk.

The Braden Scale was applied during the six month follow-up and fourteen patients showed a decrease in score. Among them, ten developed in-



**Table 3.** Values of sensitivity, specificity, positive predictive value and negative predictive value

Cut-off point	Sensitivity %	Specificity %	PPV %	NPV %
≤ 10	23.4	93.15	52.28	79.07
≤ 11	45.95	91.78	58.62	87.01
≤ 12	51.35	88.36	52.78	87.76
≤ 13	56.76	86.99	52.5	88.81
≤ 14	70.27	80.82	48.15	91.47
≤ 15	78.38	78.08	47.54	93.44
≤ 16	83.78	75.34	46.27	94.83
≤ 17	89.19	69.18	42.31	96.19
≤ 18	100	61.64	39.78	100

Legend: PPV – Positive Predictive Value; VPN – Negative Predictive Value

juries at home, associated with aggravation of the condition, i.e., there was a direct relation between the decrease in the scale score and the appearance of the ulcer.

A multivariate analysis correlated the factors studied with the development of pressure ulcers, showing that the degree in the Homecare Monitoring Program, Alzheimer's and stroke are significant and independent factors upon the onset of this disorder.

The classification of patients according to the degree in the program increases the chances of developing ulcers by 2.3 times (odds ratio=2.3,  $p=0.03$  and 95% confidence interval=1.05 to 5.23). Alzheimer's increases the odds by 4.1 times (odds ratio=4.1,  $p=0.00$  and 95% confidence interval=1.68 to 10.23). Stroke increases the odds by 2.9 times (odds ratio=2.9,  $p=0.02$  and 95% confidence interval=1.12 to 7.96).

## Discussion

Considering the demographic data of the population studied, a higher frequency in the elderly was observed

(96.2%). This result is justified by the nature of the research, because the situations of limited mobility are more common in this age group.<sup>(9)</sup>

Age was not statistically significant upon the onset of pressure ulcers, although aging is associated with a decrease in elasticity, texture, circulation and in peripheral sensitivity.<sup>(3)</sup>

The predominance of female patients was expected, considering that, in Brazil, women have greater survival than men.<sup>(9)</sup> The relation of sex with the onset of pressure ulcers was not relevant in this study ( $p=0.83$ ). Similarly, a study conducted in a hospital in northeastern Brazil indicated a greater percentage of pressure ulcers in females. Demographic data show that women have greater longevity than men, which leads to longer periods of chronic diseases.<sup>(11)</sup>

The non-relevance of skin color in the appearance of the ulcer may be related to the low rate of melanodermic patients in the sample, compared to the vast majority of leukodermic patients.

The ratio of patients with severe and mild cognitive impairment with the development of pressure ulcers is due to staying in bed, since the degree of cognition impairment interferes with the ability to move.<sup>(10)</sup>

The impairment of activities of daily living was statistically significant for the onset of pressure ulcers since the reduction in functional capacity is associated with decreased mobility.<sup>(9)</sup>

As to the number of ulcers per patient in other Brazilian studies in the same region, 48% to 57% of patients had a single injury.<sup>(12)</sup>

There are few publications mentioning the size of the injuries, the results of this variable in this study is comparable with another one which indicates 55.9% of small to medium-sized lesions.<sup>(12)</sup>

The highest incidence of ulcers in the sacral region followed by the heels was also reported in a study conducted in intensive care units of Brazilian teaching hospitals.<sup>(7)</sup>

A study conducted in homecare in the city of São Paulo revealed that 63.8% of patients had circulatory system disorders, such as hypertension and heart disease, followed by 48.9% of degenerative disorders like Alzheimer's disease and

Parkinson's disease.<sup>(9)</sup> These results agree with the present investigation.

The ratio found in univariate analysis between the use of anxiolytic drugs, anti-dementia drugs and the development by pressure ulcers was described in literature. Anxiolytics may be related to changes in sensory perception arising from the continuous use of psychotropics. While anti-dementia drugs may be related to physical disabilities caused by dementia for whoever uses this type of medicine.

Concerning the relevant aspects of the Braden Scale, the predominance of new ulcers in patients with a low score is a feature that is confirmed in this study. A study on the predictive validity of this scale revealed that the scores show a decrease in all sub-scales when subjects have an injury.<sup>(5)</sup>

The low score for patients over 70 years of age is significant for the emergence of the disorder, a result also reported in a study conducted in a nursing home in the same Brazilian region, in which 50% of patients over 70 years had pressure ulcers.<sup>(13)</sup>

In the present study, a score of 18 proved to be a delimiter for patients without risk for developing injury. Thus, it is possible to say that among the group of patients studied, those scoring below this limit have some risk of developing the disorder and deserve prophylactic attention.

The cutoff point of 18 as the definition of patients at risk resembles a study also performed in the home setting, in which the sensitivity and NPV were 100%.<sup>(6)</sup>

The recommended frequency for the application of the Braden Scale is controversial. The study recommends that institutional protocols determine this frequency according to the characteristics of the unit where the patient is being treated.<sup>(4)</sup> The present investigation used the monthly frequency, according to the eventualities.

The independent and significant relation found in this study by multivariate analysis between classification of HMP degree and the onset of PU, is due to the fact that the IV rating level encompasses patients with the worst levels of mobility. Alzheimer's and stroke are due to

the fact that these diseases bring consequences, such as changes in perceptual capacity, blood circulation, oxygenation and mobility, favoring the formation of PU.<sup>(7)</sup>

## Conclusion

The incidence of pressure ulcers in homecare monitoring is 20%. Degree in the Homecare Monitoring Program, Alzheimer's and activities of daily living are predicting factors in the emergence of this disease. The Braden Scale was found effective in the home setting to predict patients with greater risk of developing pressure ulcers.

## Collaborations

Freitas JPC, Alberti LR contributed to the project design, analysis and interpretation of data, drafting the article, critical revision of the relevant intellectual content and final approval of the version to be published.

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