ORIGINAL ARTICLE

Zambonato BP, Assis MCS, Beghetto MG. Association of Braden subscales with the risk of development of pressure ulcer. Rev Gaúcha Enferm. 2013;34(1):21-28.

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ASSOCIATION OF BRADEN SUBSCALES WITH THE RISK OF DEVELOPMENT OF PRESSURE ULCER[a]

Bruna Pochmann ZAMBONATO[b], Michelli Cristina Silva de ASSIS[c], Mariur Gomes BEGHETTO[d]

ABSTRACT

Pressure ulcers (PU) may increase the incidence of hospital complications, and one should prevent this damage. The Braden Scale stands out as a tool to assess the risk of PU. The study aimed to identify changes in the score of the Braden subscales are associated with the risk of developing PU. Logistic regression was used in a retrospective cohort study conducted in Hospital de Clínicas de Porto Alegre in adults hospitalized in surgical clinical units from October 2005 to June 2006. We evaluated the records database of 1503 patients with a mean aged 55.5±16 years, 52.7% female. The incidence of PU was 1.8% and was associated with diabetes and heart failure. There was a higher PU in patients worst in sensory perception, mobility, and activity and the presence of moisture. No association was found between nutrition and PU. Except nutrition, the other Braden sub-scales shown to be predictive of PU.

Descriptors: Pressure ulcer. Nursing. Scales.

RESUMO

Úlceras por pressão (UP) podem aumentar a incidência de complicações hospitalares, devendo-se prevenir este dano. A Escala de Braden destaca-se como instrumento para avaliar o risco de UP. O estudo objetivou identificar quais alterações, na pontuação das subescalas de Braden, estão associadas com o risco do desenvolvimento de UP. Empregou-se regressão logística em uma coorte retrospectiva realizada no Hospital de Clínicas de Porto Alegre, em adultos hospitalizados em unidades clínicas e cirúrgicas, de outubro de 2005 a junho de 2006. Foram avaliados os registros de banco de dados de 1503 pacientes, com idade de 55,5±16 anos, sendo 52,7% do sexo feminino. A incidência de UP foi de 1,8%, e foi associada com diabetes e insuficiência cardíaca. Houve mais UP em pacientes com pior percepção sensorial, mobilidade, atividade e na presença de umidade. Não houve associação entre nutrição e UP. Exceto nutrição, as demais subescalas de Braden mostraram-se preditivas de UP.

Descritores: *Úlcera por pressão. Enfermagem. Escalas.*
Título: *Associação das sub-escalas de Braden com o risco do desenvolvimento de úlcera por pressão.*

RESUMEN

Úlceras por presión (UPP) pueden aumentar la incidencia de complicaciones hospitalarias, y se debe evitar este daño. La Escala de Braden se destaca como una herramienta para evaluar el riesgo de UPP. El objetivo fue identificar como los cambios en las subescalas se asocian con el riesgo de desarrollar UPP. Regresión logística fue utilizada en estudio de corte retrospectivo realizado en Hospital de Clínicas de Porto Alegre en adultos hospitalizados en unidades clínicas quirúrgicas de octubre 2005 a junio 2006. Se evaluó la base de datos de 1503 pacientes con edad de 55,5±16 años, 52,7% mujeres. La incidencia de UPP fue un 1,8% y se asoció con diabetes e insuficiencia cardiaca. Hubo mayor UPP en pacientes con peor percepción sensorial, movilidad y actividad y presencia de humedad. No se encontró asociación entre nutrición y la ocurrencia de UPP. Excepto nutrición, las otras subescalas de Braden demostraron ser predictivo de UPP.

Descriptores: *Úlcera por presión. Enfermería. Escalas.*
Título: *Evaluación de las subescalas de Braden en una corte de pacientes hospitalizados.*

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INTRODUCTION

Pressure ulcer (PU) is defined as a lesion in the skin or underlying tissue resulting from pressure associated with the strength of friction[1]. It is a common injury that contributes to increased risk of hospital complications[2] and is a negative indicator of the quality of nursing care[2,3]. In Brazil, studies on the incidence and prevalence of PU are scarce and their rates vary from 2% to 66%. In general, the studies on PU in Brazil are carried out in places such as intensive care units (ICU) or nursing home, making it difficult to generalize the results[4-6]. The main factors for the development of these injuries are divided into two groups: the extrinsic factors, related to exposure of the patient to the causing agents and the intrinsic factors, inherent to patient' clinical presentation[3,6,7]. The nursing staff plays a fundamental role in PU prevention for they guarantee patient's mobility in and out of bed, supply and administration of food, low moisture exposure, besides preventing friction and shearing[8]. Thus, prevention efforts should be disseminated and adopted in hospitals to prevent the development of this damage[4,6] and confirm that the low incidence of PU is associated with good nursing care[2].

The first systematic way to predict the risk of PU development was proposed by Norton[9], in 1962, when he developed and tested the Norton Scale (NS), in an evaluation of 600 patients from a nursing home. The NS was composed of five domains: physical condition, mental state, activity, mobility and incontinence; each one with four possible scores. Thus, the sum of the scale ranges between five and 20 points, with a score less than 14 indicating risk and less than 12 high risk for PU development[9].

Although the NS has been innovative for the time, other scales were developed, with different important risk factors for PU, and NS did not show consistent results outside elderly homes[10]. Currently, the Braden Scale is the most widely used instrument for early identification of the risk of PU [4,7,11].

The Braden Scale (BS) is a North American instrument where the authors developed a conceptual framework to study the etiology of PU, delimitating six subscales: sensory perception, activity, mobility, moisture, nutrition and friction and shearing[7]. The subscale sensory perception measures the ability to feel and describes the discomfort of the pressure. The subscales activity and mobility are different,

though related. Activity is measured by assessing movements out of the bed, while mobility estimates the ability to relieve pressure by changing position in the bed. The subscale moisture sizes the level of exposure of skin to moisture, considering bladder and bowel control, wound drainage and perspiration. The subscale nutrition assesses food intake by patient according to the route of administration, quantity and consistency of food, and friction and shearing measure the individual's ability to move his/her body to prevent it from sliding on surfaces such as sheets[4,7]. The subscales sensory perception, activity, mobility, moisture and nutrition are scored from one (least favorable) to four (most favorable), whereas in friction and shearing the scale ranges from one to three. The maximum sum to be achieved is 23. The authors identified the value of 16 as the cutoff point to define the risk of PU[7]. In fact, they performed an initial study to determine interrater reliability and two other studies to analyze the predictive validity of BS.

Other investigators[12] have also validated this scale, and it was adapted and validated for Portuguese[13]. The authors evaluated 34 adults from an ICU in a hospital in São Paulo, who underwent three assessments and identified the predictive properties of the scale[13]. The score 13 showed the best performance compare to the score 16 suggested by the authors of the scale[7]. The average scores for all ratings for sensitivity, specificity and positive and negative predictive values were 94%, 89%, 80% and 94%, respectively[13].

Two new scales were proposed and analyzed, one with only two subscales (activity and moisture) and another one with three subscales (mobility, moisture and friction and shearing)[14]. It was concluded that the BS has better predictive capacity than any other individual scale or simplified scale[14].

Although the BS is predictive of PU risk, the evaluation of each scale allows estimating the specific preventive measures that should be adopted to avoid this outcome[15,16]. A retrospective cohort study[16] suggests that nurses use both the total score of the BS as an assessment of warning of risk and the subscale score to perform more specific interventions for those patients at higher risk of developing PU. This has also been recommended in a study of literature review [17], which affirms that although the BS is a valid and reliable predictor of the risk of PU, its use cannot reduce to zero the

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incidence of PU. Therefore, the evaluation of the subscales alone should also be a means to assist the decision making of nurses to increase the effectiveness of risk assessment and improve the preventive measures of PU[15].

Although there are studies[7,12,13] demonstrating the reproducibility and derivation of the cutoff point to define risk of BS, very few studies have described the power of each one of the categories of the subscales in predicting PU. Therefore, there is a gap in the current literature in what concerns describing to what extent any change in the Braden subscales (scores below 4) represent an early sign of PU risk, even if the final score of the Braden scale does not indicate risk (above 16)[7]. Thus, the present study was aimed to evaluate the association between changes in the categories of Braden subscales and the risk for PU.

MATERIALS AND METHODS

This is a retrospective cohort study[18], derived from a project designed to assess the factors associated to hospital morbidity and mortality in adults. The original project was performed in *Hospital de Clínicas de Porto Alegre (HCPA)* from October 2005 to June 2006. The original study titled "*Estado nutricional como preditor de morte, infecção e permanência hospitalar*"[19] (Nutritional status as a predictor of death, infection and hospital stay) included 1,503 adult patients hospitalized at the HCPA in the clinical and surgical units from October 2005 to June 2006. The present study analyzed data from the 1,503 patients of the previous study because they were assessed for the risk of PU.

All participants were assessed for demographic, clinical and anthropometric data, in the first 72 hours of admission and during hospitalization until discharge. The scale for assessment of PU adopted in the institution during the original study was applied upon admission and weekly. At the time of the evaluation, an instrument containing the Norton Scale (NS) was completed for each patient. Later, the data were entered into spreadsheets and stored in database in the PASW 18.0. software. On the date of the assessment, completion of all research instruments was revised by the main researcher and, the database was checked to minimize possible mistakes associated with improper completion of the form and typing.

The present study used data available in the aforementioned database so that a new collection was not necessary. From the database of the original project, a new database was created containing the items of interest to this study: patient identification, age, sex, clinical variables, development of PU and scoring of the subscales. For this reason, we were limited to the collected data and it has not been possible to analyze the six categories of the BS, since the scale used at the time of data collection was the NS. The BS was selected in the present study because it is the most widely used, validated and reliable scale[8,14]. Since the NS was the first scale predictive of PU, and the other scales derived from it, the scales used to assess the risk for developing PU are similar. So, in this study we used four subscales that correspond to the two scales for PU assessment (the BS and the NS): sensory perception/mental state, moisture/incontinence, physical activity/activity and mobility/mobility. The subscale nutrition is not included in the NS, but this data was collected in the original study. The subscale friction and shearing could not be evaluated because it is included in the BS, but not in the NS, and, thus, equivalence has not been possible.

Univariate logistic regression was performed to estimate the risk for PU when the patient was classified in each one of the categories, in each subscale. Analysis was carried out using SPSS 18.0 statistical software. At first, descriptive analysis was performed, taking into consideration the characteristics and distribution of the variables and the variance. Subsequently, univariate logistic regression analysis was performed where the presence/absence of pressure ulcer was considered as response variable (outcome).

This study was approved as to its methodological and ethical aspects by the Research Commission (COMPESQ) of the Nursing School of UFRGS and by the Ethics and Research Committee (CEP) of the HCPA under number 12-0162. The ethical principles relevant to studies that involve humans were observed, and the authors signed a Term of Commitment for the Use of Data (TCUD).

PRESENTATION AND ANALYSIS OF RESULTS

We evaluated data from 1,503 patients whose age was 55.5±16 (19-94) years, 52.7% being female.

As for the predominant clinical variables, these were systemic arterial hypertension (40.8%), presence of cancer (32.6%), diabetes mellitus (15,8%), congestive heart failure (5.7%), chronic heart failure (4.5%) and dementia (0.7%).

Of all patients, 1.8% (n=27) developed PU during hospitalization. Association was found between the presence of diabetes (37% *vs* 15.8%; p <0.01) and heart failure (11.1% *vs* 4.4%; p <0.01) with the outcome PU (Table 1).

Table 1 – Univariate analysis of the clinical variables and Braden subscales and the risk of developing pressure ulcer. Porto Alegre, RS, 2012.
Data presented as mean ± standard deviation, or absolute numbers (percentage).

	With PU (n = 27)	Without PU (n= 1476)	p
Female	13 (48.1%)	779 (52.8%)	0.63[q]
Age	58.8±16,1	55.5±16.1	0.29[t]
SAH (n= 615)	13 (48.1%)	602 (40.8%)	0.44[q]
DM (n= 243)	10 (37%)	233 (15.8%)	≤0.01[F]
CHF(n= 86)	5 (18.5%)	81 (5.5%)	≤0.01[F]
CRF (n= 68)	3 (11.1%)	65 (4.4%)	0.12[F]
Dementia (n= 11)	1 (3.7%)	10 (0.7%)	0.18[F]
Cancer (n= 491)	10 (37%)	481 (32.6%)	0.62[q]
Hospitalization (n=579)	14 (51.9%)	565 (38.3%)	0.15[q]
Sensory perception			
No limitation	19 (70.4%)	1304 (89.3%)	
Slightly limited	4 (14.8%)	101 (6.9%)	
Very limited	2 (7.4%)	40 (2.7%)	≤0.01[q]
Completely limited	2 (7.4%)	15 (1%)	
Mobility			
No limitation	6 (22.2%)	985 (67.5%)	
Slightly limited	11 (40.7%)	289 (19.8%)	
Very limited	8 (29.6%)	164 (11.1%)	≤0.01[q]
Completely limited	2 (7.4%)	21 (1.4%)	
Activity			
Walks often	6 (22.2%)	1021 (69.9%)	
Walks occasionally	6 (22.2%)	192 (13.2%)	
Confined to the wheelchair	6 (22.2%)	111 (7.6%)	≤0.01[q]
Confined to bed	9 (33.3%)	136 (9.3%)	
Nutrition			
Excellent	15 (55.6%)	830 (56.2%)	
Adequate	9 (33.3%)	267 (18.1%)	
Probably inadequate	0	42 (2.8%)	0.13[q]
Very poor	3 (11.1%)	337 (22.8%)	
Moisture			
Rarely wet	16 (59.3%)	1254 (86.1%)	
Occasionally wet	1 (3.7%)	57 (3.9%)	≤0.01[q]
Very wet	4 (14.8%)	87 (6%)	
Constantly wet	6 (22.2%)	59 (4%)	

Legend: OR: *Odds Ratio*; IC95%: Confidence interval of 95%; PU: pressure ulcer; SAH: systemic arterial hypertension; DM: diabetes mellitus; CHF: congestive heart failure; CRF: chronic renal failure; [t]: t test for independent samples; [q]: Chi-square test; [F]: Fisher exact test.
Source: data from the authors.

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When assessing the subscales considering their four original categories we found higher frequency of PU in those patients with worse sensory perception l (p <0.01), mobility (p <0.01), activity (p <0.01) and in the presence of moisture (p <0.01). No association was found between nutrition and the occurrence of PU (p = 0.13) (Table 1).

By dichotomizing the categories of each subscale, by considering as reference category the one in the best condition and grouping all others, we found that having any change in sensory perception more than tripled the chances of PU occurrence (OR= 3.5; CI 95%: 1.5 − 8.2; p <0.01), while this risk estimate increased even more in the case of limited mobility (OR: 7.3; IC95%: 2.9 − 18.1), limited activity (OR= 8.1; IC95%: 3.3 − 20.3; p < 0.01) or when the moisture content of the patient is changed (OR: 4.2; IC95%: 1.9 − 9.2; p <0.01). On the other hand, there was no increase in the chances of PU in those patients whose nutritional status was not classified

Table 2 − Dichotomic analysis of Braden subscales to estimate the risk of development of pressure ulcer. Porto Alegre, RS, 2012.

Data presented as absolute numbers (percentage)

	OR (CI95%)	p
Sensory Perception		
No limitation	1.0	-
Slightly limited	2.7 (0.9- 8.1)	0.07
Very limited	3.4 (0.7 − 15.2)	0.10
Completely limited	9.1 (2.0 − 42.8)	≤0.01
Altered Sensory Perception	3.5 (1.5 − 8.2)	≤0.01
Mobility		
No limitation	1.0	-
Slightly limited	6.2 (2.3 − 17.0)	≤0.01
Very limited	8.0 (2.7 − 23.4)	≤0.01
Completely immobilized	15.6 (3.0 − 82.0)	≤0.01
Limited Mobility	7.3 (2.9 − 18.1)	≤0.01
Activity		
Walks often	1.0	-
Walks occasionally	5.3 (1.7 − 16.6)	≤0.01
Confined to wheelchair	9.2 (2.9 − 29.0)	≤0.01
Confined to bed	11.2 (3.9 − 32.1)	≤0.01
Limited Activity	8.1 (3.3 − 20.3)	≤0.01
Nutrition		
Excellent	1.0	-
Adequate	1.8 (0.8 − 4.3)	0.14
Probably inadequate	0	0.99
Very Poor	0.5 (0.1 − 1.7)	0.26
Altered Nutrition	1.0 (0.5 − 2.2)	0.94
Moisture		
Rarely wet	1.0	-
Occasionally wet	1.4 (0.18 − 10.5)	0.75
Very wet	3.6 (1.2 − 11.0)	0.02
Constantly wet	8.0 (3.0 − 21.1)	≤0.01
Altered Moisture	4.2 (1.9 − 9.2)	≤0.01

Legend: OR: *Odds Ratio*; IC95%: Confidence interval of 95%.
Source: data from the authors.

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as excellent (OR= 1.0; IC95%: 0.5 − 2.2), even after we regrouped the categories of this subscale into "excellent + adequate" or "probably inadequate or very poor" (OR: 2.8; IC95%: 0.8 − 9.2) (Table 2).

DISCUSSION

In this study, we identified different risk weights for each subscale evaluated, with "limited activity" being the factor of highest strength of association with PU outcome, followed by "limited mobility", "altered moisture" and "altered sensory perception". The item "altered nutrition" was not associated to the outcome.

Although few studies[5,15,16] have evaluated separately the Braden subscales as a predictive factor for the development of PU, some authors obtained findings that corroborate our results, as will be seen in further discussions..

In this study we found that any reduction in the level of activity increased the risk of developing PU to eight times. In a study of critical patients[20], the author concluded that, for these patients, the referred subscale did not contribute significantly to the prediction of PU, perhaps because ICU patients have little variation in the activity levels. In a retrospective cohort study[16] it was observed that patients that scored two in activity (confined to the wheelchair) were four times more likely to develop PU than those patients with higher scores. In the long-stay hospital (nursing facility)[15] the subscale activity was the second largest predictor of PU, second only to friction and shearing (not evaluated in this study).

In the subscale mobility we found that the risk of developing PU was increased to seven times in the presence of any alteration in this item. We should consider that in some studies, particularly in ICUs, the patients are usually immobilized, which increases the risk of PU. As corroborating evidence, the mobility contributed significantly (p≤0.01) to predict PU in a study with critical patients[20] and in the nursing facility[15]. Other authors[16] found that mobility was predictive of PU (p≤0.01) when patients with score of two were at higher risk for PU than those with score one (OR= 3,57; IC95%: 2,78-4,58; p≤0,01).

Another important risk factor was skin moisture. We observed that moist skin increased to four times the risk of developing PU. Although the study that assessed critical patients[20] did not find a relationship between moisture and the risk of developing PU, the patients of that study had often devices that reduce skin exposure to moisture, such as urinary catheters and fecal containment devices. In the study conducted in the nursing home[15] significant values were obtained for the development of PU in this subscale, as well as in the retrospective cohort study[16], that found statistical significance between the subscale mois-ture and the development of PU, which was more important when associated to a low score in the subscale activity.

We identified which alteration in sensory perception increased to three times the risk of de-veloping PU. In the study with critical patients[20], those who developed PU had lower scores in this subscale, although this variable was not statistically significant. Another study with ICU patients also found that the lower the score in the subscale the higher the risk for PU[6]. In the retrospective cohort study[16] the authors reported that the patients with low scores in sensory perception and mobility were 67% more likely to develop PU than those with low mobility and higher sensory perception. Of the two articles on the issue, only the study in the nursing home[15] did not obtain statistical significance in the referred subscale.

A poor nutritional status is identified as a main factor in PU occurrence for contributing to decrease tissue tolerance to pressure and to slow the healing process[2,4]. No association was found between PU and the subscale nutrition. In other studies[15,16,20] statistical significance was found between this subscale and the risk for PU. A study[5] aimed to assess the predictive capacity of this subscale found that although the BS had contributed to predict the risk for PU, this has not happened in the isolated evaluation of the subscale when the mean values of nutritional acceptance between patients with and without PU were similar (p=0.17), concluding that this subscale is weak and incapable of predicting the risk for PU in the studied population[5]. In a study conducted in a nursing home[14], an association was also found between all subscales and the risk for PU, except for the nutrition subscale (p=0.06).

In Brazil, where there are no precise data on the incidence and prevalence of PU, their rates vary from 2% to 66.6%, depending on the type of hospital and the unit studied[5]. In the present study, 1.8% of the patients developed PU, revealing a

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lower incidence than other Brazilian studies[4,6,8,11]. However, it is important to stress that 2/3 of our sample consisted of patients of surgical specialties, albeit in a highly complex institution.

There is disagreement between association of PU and gender in Brazil, and this variable is not so precise regarding the outcome[11]. A study in Recife[3] suggests that as women have a longer life expectancy, they have longer periods of chronic diseases and, thus, are at higher risk of developing PU. In what concerns a single inpatient hospital stay, no statistical difference was found between the variable gender and the presence of PU.

As for age, patients with PU had a higher mean age, though without statistical association. This has also been observed in the nursing home[14]. Other studies[16,20] found significance (p≤0.01) between the variable age and outcome PU. The aging process causes changes in the skin, subcutaneous tissue, cardiovascular system, decreased sweat and sebaceous glands and muscle atrophy that impair oxygenation and skin healing, which could explain the increased risk for PU[3,4,20].

As for the predominant clinical variables it was found that the presence of DM and CHF was associated with the outcome. Other disorders were also observed, though without statistical association with the outcome. A study in Belo Horizonte[4] noted that injuries such as stroke (CVA), SAH and other chronic diseases affect sensory perception, circulation, oxygenation and mobility, favoring the occurrence of PU. An association was observed between cardiovascular disease, administration of norepinephrine and length of stay in ICU with the development of PU[20] and another study[16] found no association between DM and PU (p=0.44).

CONCLUSION

It was observed that any alteration in the subscales activity, mobility, sensory perception and moisture, regardless of its intensity, is associated with the risk of developing PU. Any change in the subscale activity increased the risk of developing PU to eight times a followed by mobility, increasing such risk to seven times; moisture, increasing the risk to more than four times and sensory perception, to more than three times. Only in the subscale nutrition no association was found between change of score in the subscale and the outcome.

A possible limitation of this study lies in that it is a retrospective analysis derived from a cohort study whose main objective was not to identify association between changes in subscales and the occurrence of PU. It is suggested then that further studies with prospective analysis are conducted.

It is for nurses to evaluate the BS in a more analytical way, not stopping only in the total score of the BS, but also analyzing the subscales in detail as an evaluation of risk warning, with the purpose of identifying specific care to be implemented in patients to a more effective prevention of PU. Therefore, we can minimize the occurrence of PU, providing targeted care to patients even when they are not at risk of developing PU, according to the total score of the BS.

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Author's address / *Endereço do autor / Dirección del autor*
Bruna Pochmann Zambonato
Rua Dom Pedro II, 407, ap. 205, São João
90550-142, Porto Alegre, RS
E-mail: bruna.zambonato@gmail.com