

Portuguese translation and validation of the Braden Q scale for predicting pressure ulcer risk in pediatric patients

Tradução para a língua portuguesa e validação da escala de Braden Q para avaliar o risco de úlcera por pressão em crianças

Traducción para la lengua portuguesa y validación de la escala de braden q para la evaluación del riesgo de úlcera por presión en niños

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ABSTRACT

Objective: To translate and culturally adapt the Braden Q scale into a Portuguese version and to test its properties (reliability and validity).

Methods: The Braden Q scale was translated and adapted according to internationally accepted methodology. The instrument was forward and back translated, and the translations were reviewed by a multidisciplinary committee. In the cultural adaptation process, three groups of ten nurses each interpreted the Brazilian version of the Braden Q scale until they fully understood the instrument. In order to evaluate the reliability of the Brazilian version, two other nurses administered the tool to pediatric ICU patients at different time points; the first nurse administered the instrument also in a second time. Statistical analysis was performed using Cronbach's α to evaluate the internal consistency of the scale, and the Spearman and intra-class correlation coefficients were calculated as a measure of reliability.

Results: There were no differences between scales translated by different translators during the forward and back translation process. All items of the scale culturally adapted by the 30 nurses were considered relevant. Cronbach's α for internal consistency was 0.936; intra-class correlation coefficient for intra-rater reliability was 0.995 and for inter-rater reliability was 0.998, both indicating high reliability.

Conclusions: The Braden Q scale was successfully translated and adapted, and demonstrated validity and reliability.

Key-words: pressure ulcer; pediatrics; intensive care units.

RESUMO

Objetivo: Traduzir para a língua portuguesa, adaptar ao contexto cultural brasileiro e testar as propriedades de medidas, reprodutibilidade e validade da escala de Braden Q.

Métodos: A escala de Braden Q foi traduzida e adaptada de acordo com metodologia aceita internacionalmente. Realizou-se tradução e tradução reversa do instrumento, intercaladas de revisões feitas por comitê multidisciplinar. Na fase de adaptação cultural, três grupos de dez enfermeiras avaliaram a versão brasileira da escala de Braden Q até obter seu entendimento integral. Na validação da reprodutibilidade, outras duas enfermeiras aplicaram a versão brasileira em crianças internadas na UTI em tempos diferentes, sendo que a primeira enfermeira avaliou também em um segundo momento. Na análise estatística, para testar a consistência interna da escala, foi calculado o α de Cronbach e, para testar a reprodutibilidade, o teste intraclass e a correlação de Spearman.

Resultados: No processo de tradução e retrotradução, não houve diferença nas escalas feitas pelos diferentes tradutores.

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Na adaptação cultural realizada pelas 30 enfermeiras, todos os itens da escala foram considerados relevantes. A consistência interna testada pelo α de Crombach foi de 0,936; a correlação intraclasse da reprodutividade intraobservador foi de 0,995 e da reprodutividade interobservador foi de 0,998, ambas apontadas como excelentes.

Conclusões: A escala de Braden Q foi traduzida e adaptada com sucesso, demonstrando ser válida e reprodutível.

Palavras-chave: úlcera por pressão; pediatria; unidades de terapia intensiva.

RESUMEN

Objetivo: Traducir a la lengua portuguesa, adaptar al contexto cultural brasileño y probar las propiedades de medidas, reproductibilidad y validez de la Escala de Braden Q.

Métodos: La Escala de Braden Q fue traducida y adaptada conforme a la metodología aceptada internacionalmente. Se realizó la traducción y la traducción reversa del instrumento, intercaladas por revisiones realizadas por comité multidisciplinar. En la etapa de adaptación cultural, tres grupos de diez enfermeras evaluaron la versión brasileña de la Escala de Braden Q hasta obtener su entendimiento integral. En la validación de reproductividad, otras dos enfermeras aplicaron la versión brasileña en niños internados en la UTI en tiempos distintos, siendo que la primera enfermera evaluó también en un segundo momento. En el análisis estadístico, para probar la consistencia interna de la escala, se calculó el Alpha de Crombach y para probar la reproductibilidad, la prueba interclase y la correlación de Spearman.

Resultados: En el proceso de traducción y retrotraducción, no hubo diferencia en las escalas realizadas por los distintos traductores. En la adaptación cultural realizada por las 30 enfermeras, todos los ítems de la escala fueron considerados relevantes. La consistencia interna probada por el Alpha de Crombach fue de 0,936 y la correlación intraclase de la reproductibilidad intraobservador fue de 0,995 y de la reproductibilidad interobservador fue de 0,998, ambas señaladas como excelentes respecto a la reproductibilidad.

Conclusiones: La Escala de Braden Q fue traducida y adaptada con éxito, demostrando ser válida y reproductible.

Palabras clave: úlcera por presión; pediatria; unidades de terapia intensiva.

Introduction

Proper care of hospitalized children entails recognition of their specific needs by the multidisciplinary team of treating professionals, taking into account the various stages of child development^(1,2). Studies have been conducted of care outcomes that are indicative of care quality, to the benefit of hospitalized patients⁽³⁾. Skin integrity is an important component of positive patient outcomes⁽⁴⁾. Nevertheless, maintenance of skin integrity is not always considered a priority in pediatric patients, particularly those in critical condition^(5,6). Pressure ulcers (PUs) are localized injuries to the skin or underlying tissue, usually occurring over a bony prominence, as a result of pressure, friction and/or a combination thereof^(7,8). PUs are an important topic in the field of health due to their complex nature. Aggravating factors such as infection, disfigurement, and other sequelae can prolong duration of hospital stay, worsen suffering, and increase treatment costs^(1,6,9-13).

The more immature the child and the more critical its condition, the less tolerant the skin and underlying structures and, consequently, the higher the risk of pressure sores^(14,15). Studies conducted in the U.S. pediatric population have revealed a prevalence of PUs ranging from 0.47% to 17%^(4,16-18). Development of PUs is particularly common in movement-limiting conditions, in the intensive care unit (ICU) setting, and in the postoperative period⁽¹⁹⁾. The most common risk factors associated with PU development in children are immobility, presence of friction and shear forces, malnutrition, and compromised tissue perfusion and oxygenation⁽¹²⁻¹⁴⁾. Effective prevention requires assessment of the risk factors that affect this population.

Specific instruments validated for detection of PU risk in children can guide clinical reasoning and help determine the intensity

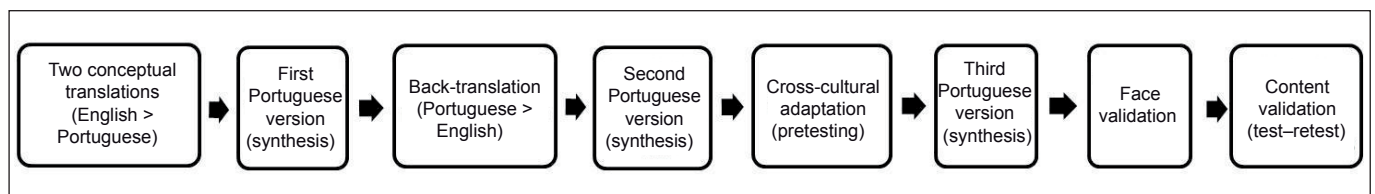


Figure 1 - Stages of translation and cross-cultural adaptation of the Braden Q scale

of prevention efforts^(20,21). The Braden Q scale, a pediatric version of the Braden scale, was developed by Curley *et al* in 2004 as an English-language instrument based on the specific risk factors for PU in pediatric populations⁽¹³⁾. The Braden Q scale assesses risk by means of two parameters⁽²²⁾: the first takes into account the intensity and duration of pressure by assessing mobility, activity, and sensory perception, whereas the second estimates tissue tolerance by assessing moisture, shear forces, nutritional status, and tissue perfusion and oxygenation. Although other scales have been developed from direct observations of children, the Braden Q scale has hitherto been the most widely studied and employed scale at the international level^(5,22-26).

In light of the dearth of studies on PUs in Brazilian children and the importance to healthcare professionals of an instrument for assessment of PU risk in children, the present study sought to translate the Braden Q scale into Brazilian Portuguese, adapt it to the Brazilian cultural context, and test its measurement properties, reproducibility, and validity.

Method

The project was approved by the *Universidade Federal de São Paulo* Research Ethics Committee. This descriptive study consisted of translation and cross-cultural adaptation of the Braden Q scale (with the permission of author Martha Curley) into the Brazilian context and validity and reproducibility testing of the adapted scale. The validation stage was carried out at the Hospital São Paulo Pediatric Intensive Care Unit. The translation and cultural adaptation process was standardized according to the guidelines proposed by Guillemin *et al*⁽²⁷⁾, which indicate that translation and cross-cultural adaptation should be carried out so as to maintain content validity at the conceptual level. The validation and cross-cultural adaptation process thus followed the steps outlined in Figure 1.

The study sample comprised 35 children. The final stage of the adaptation process is pretesting, in which, according to recommendations, the pre-final version of the measure should be administered to a sample of subjects or patients, preferably comprising 30 to 40 individuals, as the purpose of the study was translation and cultural adaptation of the scale followed by face and content validation. The criteria for inclusion were hospitalization at the Hospital São Paulo Pediatric ICU on the date of the study (which was carried out by designated nurses) and age between 1 month and 13 years, 11 months and 29 days. The sole criterion for exclusion was age ≥ 14 years or < 1 month.

The Braden Q scale was translated into the target language (Brazilian Portuguese) by two independent translators. The two translations were compared and synthesized by a multidisciplinary committee composed of four doctoral-level healthcare professionals, producing an initial Brazilian Portuguese version. Two independent translators, both fluent in English and neither aware nor informed of the existence of the original scale and of the objectives of this study (naïve translators), produced a back-translation of the synthesized instrument into the original language (English). The multidisciplinary committee then compared both back-translations and the original English-language scale to create a second Brazilian Portuguese version, maintaining idiomatic, semantic, conceptual, and cultural equivalence. The contents of the translation and back-translation were analyzed and compared to the content of the original scale, bearing in mind the idiomatic aspects and technical jargon used in Brazil, to validate the translation and its adaptations. For the pretesting stage, 10 nurses provided individual assessments of their understanding and perceived relevance of each item of the scale, using the second Portuguese version. These nurses, who had been working for at least 2 years at the hospital's pediatric unit, were informed of the purposes of the study and asked to provide: a) an explanation of each item in their own words, to the best of their understanding; b) suggested changes to make the scale more easy to understand, if necessary; c) an assessment of the extent to which they believed each item was actually related to what the scale is meant to measure (that is, an assessment of how important each item of the scale is to assessment of PU risk). Nurses ranked items according to importance on a scale of 1 to 5, with 1 being "not at all important" and 5 being "extremely important." Relevance was calculated as $R = F \times I$ (R, relevance; F, frequency; I, importance on scale of 1 to 5). Inclusion of the changes and adaptations required to make the scale understandable to nurses produced the third Portuguese version. This version was presented to consecutive groups of 10 nurses until one group was formed in which all members were able to fully understand each item in the scale. The final Portuguese-language version of the scale was the result of one final assessment by the multidisciplinary committee, which tested face validity (to check if the instrument was consistent with the research project) and content validity (relevance of each item of the scale to measurement of the topic of interest and isolated importance of each item of the scale) of the instrument and reached a consensus as to their appropriateness.

Two nurses who had not taken part in the pretesting stage were selected and separately administered the Braden Q scale for assessment of 35 children admitted to the Hospital São

Paulo Pediatric ICU on a single day. The first nurse reassessed children after one week. Three sets of results were obtained and used to calculate the intraclass correlation coefficient. Scale

Chart 1 - Braden Q scale for assessment of pressure ulcer risk in pediatric patients, translated into Brazilian Portuguese

<p>MOBILIDADE Capacidade de mudar e controlar a posição do corpo.</p>	<p>1. Completamente Imóvel : Não faz mudanças, nem mesmo pequenas, na posição do corpo ou das extremidades, sem ajuda.</p>	<p>2. Muito limitado: Faz pequenas mudanças ocasionais na posição do corpo ou extremidades, mas é incapaz de fazer mudanças completamente sozinho.</p>	<p>3. Levemente limitado: Faz mudanças frequentes, embora pequenas, na posição do corpo ou das extremidades, sem ajuda.</p>	<p>4. Nenhuma limitação: Faz mudanças importantes e frequentes na posição do corpo, sem ajuda.</p>
<p>ATIVIDADE Grau de atividade física.</p>	<p>1. Acamado: Permanece no leito o tempo todo.</p>	<p>2. Restrito à cadeira: A capacidade de deambular está gravemente limitada ou inexistente. Não consegue sustentar o próprio peso e/ou precisa de ajuda para sentar-se em uma cadeira ou cadeira de rodas.</p>	<p>3. Deambulação ocasional: Deambula ocasionalmente durante o dia, porém por distâncias bem curtas, com ou sem ajuda. Passa a maior parte do turno no leito ou na cadeira.</p>	<p>4. Crianças jovens demais para deambular ou deambulam frequentemente: Deambula fora do quarto pelo menos duas vezes por dia e dentro do quarto pelo menos uma vez a cada duas horas durante as horas está acordado.</p>
<p>PERCEPÇÃO SENSORIAL Capacidade de responder de maneira apropriada ao desconforto relacionado à pressão</p>	<p>1. Completamente limitada: Não responde ao estímulo doloroso (não geme, não se encolhe ou se agarra), devido à diminuição do nível de consciência, ou sedação ou limitação da capacidade de sentir dor na maior parte da superfície corporal.</p>	<p>2. Muito limitada: Responde apenas ao estímulo doloroso. Não consegue comunicar desconforto, exceto por gemido ou inquietação; ou apresenta alguma disfunção sensorial que limita a capacidade de sentir dor ou desconforto em mais da metade do corpo.</p>	<p>3. Levemente limitada: Responde aos comandos verbais, mas nem sempre consegue comunicar o desconforto ou a necessidade de ser mudado de posição, ou apresenta alguma disfunção sensorial em uma ou duas extremidades que limita a capacidade de sentir dor</p>	<p>4. Nenhuma alteração: Responde aos comandos verbais. Não apresenta déficit sensorial que limite a capacidade de sentir ou comunicar dor ou desconforto.</p>
<p>UMIDADE Grau de exposição da pele à umidade.</p>	<p>1. Constantemente úmida: A pele fica constantemente úmida por suor, urina, etc. A umidade é percebida cada vez que o paciente é movimentado ou mudado de posição.</p>	<p>2. Frequentemente úmida: A pele está frequentemente, mas nem sempre, úmida. A roupa de cama precisa ser trocada pelo menos a cada oito horas.</p>	<p>3. Ocasionalmente úmida: A pele está ocasionalmente úmida, necessitando de troca de roupa de cama a cada 12 horas.</p>	<p>4. Raramente úmida: A pele geralmente está seca, as trocas de fraldas são feitas de rotina e as roupas de cama necessitam ser trocadas apenas a cada 24h</p>

Chart 1 - Continuation

<p>FRICÇÃO E CISCALHAMENTO</p> <p>Fricção: a pele se move contra as estruturas de suporte.</p> <p>Cisalhamento: a pele e a superfície óssea adjacente deslizam uma sobre a outra.</p>	<p>1. Problema importante: A espasticidade, a contratura, o prurido ou a agitação levam a criança debater-se no leito e há fricção quase constante.</p>	<p>2. Problema: Necessita de ajuda moderada a máxima para se mover. É impossível se levantar completamente sem deslizar sobre os lençóis do leito ou cadeira, necessitando de reposicionamento frequente com o máximo de assistência.</p>	<p>3. Problema Potencial: Movimenta-se com dificuldade ou necessita de mínima assistência. Durante o movimento, provavelmente ocorre atrito entre a pele e os lençóis, cadeira, coxins ou outros dispositivos. A maior parte do tempo mantém uma posição relativamente boa na cadeira e no leito, mas ocasionalmente escorrega.</p>	<p>4. Nenhum problema aparente: Capaz de levantar-se completamente durante uma mudança de posição. Movimenta-se sozinho na cadeira e no leito, e tem força muscular suficiente para levantar-se completamente durante o movimento. Mantém uma posição adequada no leito e na cadeira o tempo todo.</p>
<p>NUTRIÇÃO</p> <p>Padrão habitual de consumo alimentar.</p>	<p>1. Muito pobre: Em jejum e/ou mantido com ingesta hídrica ou hidratação IV por mais de 5 dias ou albumina < 2,5 mg/dl ou nunca come uma refeição completa. Raramente come mais da metade de algum alimento oferecido. O consumo de proteínas inclui apenas duas porções de carne ou derivados de leite por dia. Ingere pouco líquido. Não ingere suplemento dietético líquido.</p>	<p>2. Inadequada: Dieta líquida por sonda ou NPP que fornece calorias e minerais insuficientes para a idade ou albumina < 3 mg/dl ou raramente come uma a refeição completa. Geralmente come apenas a metade de algum alimento oferecido. O consumo de proteínas inclui apenas três porções de carne ou derivados de leite por dia. Ocasionalmente ingere suplemento dietético.</p>	<p>3. Adequada: Dieta por sonda ou NPP que fornece calorias e minerais suficientes para a idade ou come mais da metade da maioria das refeições. Consome um total de quatro porções de proteínas (carne, derivados de leite) por dia. Ocasionalmente recusa uma refeição, mas geralmente toma suplemento dietético, se oferecido.</p>	<p>4. Excelente: Dieta geral que fornece calorias suficientes para a idade. Por exemplo, come/ bebe a maior parte de cada refeição/ alimentação. Nunca recusa uma refeição. Geralmente come um total de quatro ou mais porções de carne e derivados de leite. Ocasionalmente, come entre as refeições. Não necessita de suplementação.</p>
<p>PERFUSÃO TISSULAR E OXIGENAÇÃO</p>	<p>1. Extremamente comprometida: Hipotenso (PAM <50 mmHg; <40 mmHg em recém-nascido) ou o paciente não tolera as mudanças de posição.</p>	<p>2. Comprometida: Normotenso. Apresenta saturação de oxigênio <95% ou a hemoglobina <10 mg/dl ou o tempo de enchimento capilar >2 segundos. O pH sérico <7,40.</p>	<p>3. Adequada: Normotenso. Apresenta saturação de oxigênio <95% ou a hemoglobina <10 mg/dl ou o tempo de enchimento capilar >2 segundos. O pH sérico é normal.</p>	<p>4. Excelente: Normotenso. Apresenta saturação de oxigênio >95%, a hemoglobina normal e o tempo de enchimento capilar <2 segundos.</p>

Variação: 7-28 pontos: Escore 28: sem risco de úlcera de pressão; Escore 7: risco máximo.

reproducibility was tested by means of three interviews carried out by the two nurses mentioned above. To prevent memorization of scores, nurses were informed of the objectives of the study but were blind to the other interviews. This enabled assessment of inter- and intra-rater reproducibility, to validate the accuracy of the instrument for measurement of PU risk in children.

Internal consistency (correlation between the items of the scale) was calculated by means of Cronbach's alpha coefficient. Validity was tested with Pearson's linear correlation coefficient, which also has a range of -1 to $+1$. Reproducibility was tested with the intraclass correlation coefficient and the Spearman rank correlation coefficient.

Results

The Braden Q scale translated and adapted into Brazilian Portuguese for this study is shown in Chart 1. The mean relevance of all items, as assessed by the administering nurses, was >4.0 points (Table 1). Internal consistency between the items of the scale was measured with Cronbach's alpha, which yielded a coefficient of 0.936. Table 2 shows the overall alpha coefficient and the coefficients obtained if each item were to be removed from the scale, thus showing the level of correlation between the items.

Spearman coefficients of correlation between the items of the scale were used to assess reproducibility. The scale was administered to 35 inpatients of the pediatric ICU, by two observers, at three different points in time. Coefficients showed weak correlation (0.26-0.49) between the Tissue perfusion and oxygenation item and the remaining items of the scale (Table 3).

Intra-rater reproducibility was assessed by means of two different assessments of 35 patients by the same nurse. The intraclass correlation coefficient was 0.995, which is indicative of excellent reproducibility. Pearson's correlation coefficients for intra-rater reproducibility yielded $r=0.9949$. Assessment of inter-rater reproducibility was based on two different assessments of the aforementioned 35 patients, but by two different nurses. The

intraclass correlation coefficient was 0.998, which again shows excellent reproducibility. Analysis of agreement between total scores yielded an inter-rater Pearson correlation coefficient of $r=0.9982$. Therefore, reproducibility between different observations by a single nurse (intra-rater) and between observations of the same patient by two different nurses (inter-rater) was demonstrated, and the instrument proved reproducible.

On analysis of face validity, the multidisciplinary committee ruled, by consensus, that the instrument is able to measure the risk of PU in a child. On analysis of content validity, the committee again approved the content of the questionnaire's items by consensus, concluding that the instrument indeed measures the risk of development of pressure ulcers in children.

Table 1 - Relevance of each item as scored by each nurse

	Mean	Min	Max
Mobility	4.83	3	5
Activity	4.43	3	5
Sensory Perception	4.63	3	5
Moisture	4.60	3	5
Friction / Shear	4.80	3	5
Nutrition	4.20	3	5
Tissue perfusion and oxygenation	4.50	3	5

Table 2 - Cronbach's alpha coefficients for each item in the scale

Item removed from scale	*Cronbach's alpha
Mobility	0.918
Activity	0.927
Sensory Perception	0.916
Moisture	0.923
Friction / Shear	0.913
Nutrition	0.926
Tissue perfusion and oxygenation	0.953
†Total	0.936

*Value obtained if corresponding item removed from the scale.

†Value obtained if no items removed from the scale.

Table 3 - Spearman correlation coefficients between items of the Braden Q scale

	Mobility	Activity	Sensory Perception	Moisture	Friction / Shear	Nutrition	Perfusion & oxygenation
Mobility	1.00	0.81	0.81	0.80	0.88	0.76	0.47
Activity	-	1.00	0.78	0.80	0.79	0.72	0.25
Sensory Perception	-	-	1.00	0.84	0.88	0.79	0.40
Moisture	-	-	-	1.00	0.84	0.74	0.26
Friction / Shear	-	-	-	-	1.00	0.77	0.45
Nutrition	-	-	-	-	-	1.00	0.49
Perfusion & oxygenation	-	-	-	-	-	-	1.00

Discussion

Among the various studies of PU epidemiology^(2,15-19). Baldwin found an incidence rate of 0.29% in a nationwide U.S. study of hospitalized or non-hospitalized children⁽²⁾. Neidig *et al* reported a 4.8% incidence of PU in children aged 36 months or younger status post cardiac surgery⁽¹⁷⁾, and Curley *et al* found PUs in 27% of children admitted to pediatric intensive care units⁽¹³⁾.

PUs are associated with increased length of hospital stay. Risk assessment is an important predictor of PU formation, and should be conducted on admission to provide a baseline for PU prophylaxis^(24,21). Choosing an appropriate instrument for assessment and identification of at-risk patients constitutes an important step in determining proper measures for prevention and management of PUs⁽²⁰⁻²²⁾. Care teams also benefit from the use of risk assessment scales as a guideline. In addition to providing uniformity in assessment results by keeping the focus on risk, assessment scales enable standardization of PU management and optimization of supply and human resource use in pediatric PU prevention efforts.

Several scales are available for assessment of PU risk in adult patients, including the Braden scale^(21,27). This scale was adapted for use in children by Curley *et al*⁽¹⁴⁾ as the Braden Q scale, which is based on pediatric population-specific risk factors^(22,27).

The Braden Q scale assesses tissue perfusion and oxygenation, using oxygen saturation, hemoglobin level, and serum pH measurements⁽¹³⁾. Parameters related to intensity and duration of pressure are measured by the mobility, activity, and sensory perception items. Each of the seven items that make up the scale are assigned a score of 1 to 4, with the total score ranging from 7 (highest risk) to 28 (no risk)⁽¹⁴⁾.

The first item on the scale is mobility, which measures the ability to change and control body position. Mobility contributes to the physical and psychological well-being of everyone; immobile patients are unable to relieve pressure over bony prominences⁽¹⁴⁾. The activity item assesses the degree of physical activity of the child, that is, whether the child remains confined to bed or spends time in a chair as well, or whether the patient is too young to ambulate⁽¹⁴⁾. The sensory perception item grades the child's ability to respond to painful stimuli and pressure-related discomfort, with reactions ranging from complete unresponsiveness (in case of sedation or sensory dysfunction limiting ability to feel and express pain) to normal sensory perception⁽¹⁴⁾. Diminished level of consciousness is associated (directly or indirectly) with sensory perception,

mobility, and activity. When perception of pressure-related discomfort is compromised and spontaneous movement is impaired, due to use of physical restraints for safety reasons or to sedation, the patient is unable to relieve pressure on the soft tissues that overlie bony prominences, and the risk of PU increases significantly⁽¹⁴⁾.

On the Braden Q scale, tolerance of the skin and underlying structures is measured by the moisture, friction / shear, nutrition, and tissue perfusion and oxygenation items⁽¹⁴⁾. Assessment of moisture measures skin exposure to perspiration, urine, and contact with other fluids. It is measured by the number of linen and diaper changes⁽¹⁴⁾. Skin maceration and injury due to excessive moisture destroys the natural barrier function of the epidermis. Urinary and fecal incontinence are potential risk factors for PU^(2,28). In a comprehensive review of the literature, patients with urinary and anal incontinence were found to be at a 22-fold risk of pressure sores as compared to continent patients^(29,30). Approximately 30% of normal 4-year-olds and 10% of 6-year-olds are unable to maintain nocturnal continence⁽³⁰⁾. Children are also highly susceptible to the presence of skinfold lesions (due to excess adiposity, for instance), caused by a buildup of sweat or other fluids in contact with the skin. Moisture-induced maceration can also occur with concomitant pressure, particularly if straps, cords, collection systems, restraints, or supports are in contact with the body. Friction occurs in patients who are unable to reposition themselves in bed unassisted, whereas shear is caused by the interaction of gravity and friction as parallel forces against the skin. As gravity pushes down on the patient's body, resistance between the patient and the surface of the bed or chair (friction) prevents downward displacement of the body and the skin moves against its underlying support structures, particularly over bony prominences. The friction / shear item of the scale assesses agitation of the child, pruritus (if present) and the way in which the child moves, considering friction against the skin⁽¹⁴⁾. Many chairfast children engage in leisure activities and play in the hospital environment; these activities are even encouraged, as they can improve well-being. Nevertheless, in the presence of motor and sensory deficits, recreational activities can lead to greater shear stress in the hip and sacral area. Nutrition is classified according to the number of meals and route of feeding. This item takes into account albumin level, age-specific energy requirements, whether the child is gaining weight and whether the diet required adjustment. As it contributes to decreased tissue tolerance to pressure, malnutrition is one of the primary risk factors

for development of PUs⁽³⁰⁾. Childhood energy requirements are twice to three times as high as those of adults. In the first year of life, 40% of ingested calories are used to meet the requirements of the growth and development process⁽⁷⁾. The perfusion and oxygenation item quantifies tissue perfusion according to oxygen saturation, hemoglobin level, and serum pH. Tissue perfusion and oxygenation play an intrinsic role in skin tolerance; hypotensive patients may be more prone to PUs than normotensive ones. This scale item is particularly important for children in critical condition and receiving vasopressor support⁽³⁰⁾. Hemoglobin levels increase with age, but remain practically constant during the age range in which iron deficiency anemia is most common. Between the ages of 6 months and 5 years, the lower limit of normal for hemoglobin is 11 g/dL⁽²⁸⁾. The normal serum pH range for children is 7.35–7.45. When blood bicarbonate levels rise or carbon dioxide levels decline, pH rises above normal, which indicates alkalosis. Reduced serum bicarbonate or increased carbon dioxide levels lead to a decline in pH, and thus determine acidosis. In the absence of these measurements, assessment is based on oxygen saturations⁽¹⁴⁾.

The high relevance coefficients assigned to the Braden Q scale showed that nurses understood the scale well during the cross-cultural adaptation stage. Assessment of reproducibility is very important, as the Braden Q scale will be applied by nurses—as were the professionals who took part in this stage of the study. Analysis of scores obtained from the various uses of the scale showed a high level of correlation between observations made by the same rater. The intraclass correlation coefficient showed similar values for the same observer at different points in time and similar values among different observers (0.995 and 0.998 respectively; no significant differences). The reproducibility of the scale indicates that widespread use of this instrument, as adapted to the Brazilian reality, in pediatric units across the country is viable, regardless of nurse shifts.

Internal consistency was checked by assessing the correlation between scale items, with Cronbach's alpha used for statistical calculations. When the items of a scale are highly correlated, it is assumed that they measure a single concept and, therefore, are internally consistent. The Cronbach's alpha coefficient for the items included in the final Brazilian Portuguese version of the Braden Q scale was 0.936, which is indicative of internal consistency.

Intra- and inter-rater reproducibility was assessed by the intraclass correlation coefficient, as measured by the Spearman correlation between the various items of the scale. Spearman's

correlation coefficient ranges from -1 to 1; the closest to 1, the higher the intra- or inter-rater reproducibility. As was found in internal consistency analysis with Cronbach's alpha, the Spearman correlation coefficients obtained for the Tissue perfusion and oxygenation item were lower, which suggests that this item had a low correlation with the remaining items of the scale (Table 3). However, this finding does not jeopardize the overall validity of the scale, which, as a whole, remained significantly able to assess PU risk in children.

A cohort study carried out by Braden and Curley⁽¹⁴⁾ in a sample of 322 patients admitted to U.S. pediatric intensive care units between the ages of 21 days and 8 years (excluding children with congenital heart defects) reported a score of 16 as indicative of high risk of PU development. At this score, the Portuguese version of the scale had a sensitivity of 0.88 and a specificity of 0.58.

Additional testing of the psychometric properties of this scale on large, homogeneous samples is highly recommended. The translated Braden Q scale is directed at pediatric patients in critical condition and was not devised for use in neonates, preadolescents or adolescents, which limits its applicability to patients between the ages of 1 month and school age. As inpatient populations may vary widely in terms of clinical condition, the use of this scale by professionals in different locations and at various centers should also be assessed, and its application required team-wide training and consensus-building. Therefore, we believe that this instrument should still be applied to diverse populations of pediatric patients in order to assess the scope of its ability to predict PU risk. Finally, it should be noted that each item of the scale can be targeted individually in case of compromise, so as to optimize and facilitate the necessary care interventions.

In short, we conclude that the Brazilian Portuguese translation and adaptation of the Braden Q scale was a credible (satisfactory face validity), valid, reproducible, and reliable instrument for assessment of PU risk in children, and constitutes a useful tool to guide the care actions of pediatric nursing professionals according to the individual risk of each patient, thus personalizing care. The initial nature of this validation effort presupposes a need for further research, with larger sample sizes, for proper analysis and comparison of results in the Brazilian reality. Scores should be established and validated according to the specific risks of pediatric populations with different clinical and pediatric profiles—that is, specific conditions, physical and mental deficits, different age ranges and activities, among other characteristics.

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