

Pressure Ulcer Scale for Healing (PUSH): interobserver reliability in the evaluation of venous ulcers

Gabriela Rodrigues Alves¹,
Suelen Gomes Malaquias²,
Maria Márcia Bachion³

ABSTRACT

The aim of this study was to evaluate interobserver reliability of the Pressure Ulcer Scale for Healing (PUSH) tool, in patients with venous ulcers. This methodological research was conducted in outpatient health care units, between June 2016 and August 2017. The participants were 10 nurses, who performed 46 observations of 35 wounds. Each observation was performed by a reference nurse, who provided the gold standard evaluation, and two clinical nurses participating in the research as subjects. To analyze the level of agreement, the Kappa index and intraclass correlation coefficient were used. Kappa values of the subscales ranged from 0.6 to 0.85 ($p < 0.001$). There was almost perfect interobserver agreement for "area" and "exudate quantity" and substantial interobserver agreement for "tissue type" and "total score". The intraclass correlation coefficients were > 0.9 , indicating excellent reliability. It is, thus, concluded that the PUSH presents satisfactory interobserver reliability for evaluating venous ulcers.

Descriptors: Wound Healing; Reproducibility of Results; Varicose Ulcer; Nursing Assessment.

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¹ Nurse, Master of Nursing. Email: gabrielarodriguesalves@gmail.com.

² Nurse, Doctor of Health Sciences. Adjunct Professor, School of Nursing of the Federal University of Goiás. Goiânia, GO, Brazil. Email: sgmalaquias@gmail.com.

³ Nurse, Doctor of Nursing. Full Professor, School of Nursing of the Federal University of Goiás. Goiânia, GO, Brazil. Email: mbachion@gmail.com.

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INTRODUCTION

Chronic ulcers, especially venous ulcers, are often assessed and treated unsystematically and inappropriately in clinical practice⁽¹⁾. Further aggravating this situation is the lack of an assessment tool that can monitor treatment results.

The established parameters for assessing wound healing include: size, depth, edges and periwound skin, tissue type and quantity, exudate, signs of infection and pain⁽²⁾.

Although originally developed to monitor the healing of pressure ulcers⁽³⁾, the Pressure Ulcer Scale for Healing (PUSH[®]) began to be used to monitor the healing of other chronic⁽⁴⁻⁶⁾ and acute⁽⁶⁾ wounds. Among the advantages of the PUSH tool are its simplicity and objectivity in applying the subscales of "wound area", "exudate amount" and "tissue type"^(3,7).

The PUSH⁽³⁾ tool has been translated into Portuguese for Brazil⁽⁴⁾ and the translation has been tested for interobserver reliability in people with leg ulcers and it presented satisfactory psychometric characteristics⁽⁸⁾.

The focus of this study emerged out of the importance of testing the psychometric properties of the PUSH in different contexts and populations, taking into consideration the etiology of more prevalent chronic ulcers⁽⁹⁾. The present study focuses specifically on the evaluation of venous ulcers by nurses working in clinical practice.

These wounds stand out as the most frequent presenting wound among leg ulcers, and their treatment occurs notably in basic health care outpatient clinics⁽¹⁰⁾. To systematize care for a patient with a venous ulcer, nurses need to assess the wound⁽¹¹⁾ and it can be helpful to apply a tool to describe the healing progress. In this context, the PUSH can be a promising tool, as it measures the main assessment parameters⁽¹²⁾.

However, when compared to pressure ulcers, wounds with particular characteristics concerning slough, exudate amount and variation in the area, may be more difficult for professionals to assess.

Thus, this study aimed to evaluate interobserver reliability of the Pressure Ulcer Scale for Healing (PUSH) tool in patients with venous ulcers.

METHODS

The study falls under the master project "Translation, cross-cultural adaptation, reliability and responsiveness of scales for evaluating functional capacity, healing and quality of life of people with venous ulcers" approved by the Research Ethics Committee of UFG (protocol no. 1.500.799). The study is authorized by NPUAP to use the PUSH.

Data was collected from April 2016 to August 2017, in a city in the Central-Western region of Brazil.

To perform at least 30 observations following the pattern of studies of this nature^(8,13), nurses were considered eligible if they had six months to one year of service in treating patients with venous ulcers three to four times per week or had worked in this area for a year or more, treating venous ulcer cases once or twice a week. Those who agreed to participate signed a consent form. The nurses were trained to use the scale in a meeting with an approximate duration of 30 minutes, at which time the evaluation protocol (Appendix 1) to be used by the observers in the research was explained.

The inclusion criteria of health clinic patients as participants of the study were: diagnosis of venous ulcers determined from the identification of specific clinical signs of this etiology (varicose veins, edema, hemosiderosis,

lipodermatosclerosis, among others), as well as an ankle-brachial index (ABI) result between 0.8 and 1.3. Patients who presented clinical signs of moderate or severe arterial compromise (elevation pallor, decreased/absent pulses, intermittent claudication) were excluded.

The PUSH includes three parameters or subscales⁽³⁾ – wound area, whose sub-scores range from zero to 10; exudate amount, classified as none, light, moderate and heavy, corresponding to sub-scores from zero to three, respectively, and tissue type in the wound bed, which relates to the worst tissue present in the wound bed⁽⁷⁾, which can be characterized as: closed, epithelial tissue, granulation tissue, slough and necrotic tissue, which are defined by a sub-score from zero to four, respectively. The final score is obtained by calculating the sum of the scores of the subscales and ranges from zero to 17. The higher the total score, the worse the healing of the ulcer is⁽⁷⁾.

When changing the dressing, the scale was applied simultaneously and independently by three observers. Two of the observers were clinical nurses and the third was a research nurse, with expertise in the area; the latter was taken as gold standard reference for the evaluation.

Data collection

When applying the scale, each observer visually evaluated the exudate amount and recorded the corresponding sub-score in their personal tool. After cleaning the wound with 0.9% saline solution, each observer evaluated the type of tissue present in the wound bed. Two observers then left the room and, one after the other, proceeded to measure the width and length of the wound by means of a sterile paper ruler graduated to millimetres. They then calculated the area in cm². When measuring the wound, it was necessary to use a tape recorder or research assistant to record the measurements, since the observers were wearing sterile gloves.

NPUAP does not define the parameters to assess exudate quantity; therefore, for this study, the moisture of the previous dressing, including the extent of the exudate area, were considered in relation to the size of the wound bed, and the degree of saturation of the dressing, where: zero (0) = no exudate (dry wound bed and no visible moisture)⁽¹⁴⁾, one (1) = small amount of exudate (saturation of 25 to 50% of the coverage used in the dressing, in an area corresponding to the size of the wound), two (2) = moderate amount of exudate (saturation 50-75% in area corresponding to the size of the wound) and three (3) = large amount of exudate (saturation greater than 75% of the coverage used in the dressing, in an area larger than the lesion bed)⁽¹⁵⁾. In addition, the length of time that the dressing was covering the wound was taken into consideration. Thus, the area permeated by the exudate, degree of saturation and time of contact of the dressing with the wound were taken into account.

In accordance with NPUAP instructions⁽³⁾ to evaluate the tissue present in the wound, the worst type of tissue in the bed or the edges of the wound was assessed. The tissue characteristics were considered and classified into four categories. A score of four (4) = necrotic tissue (eschar): black or brown colored tissue adhering firmly to the bed or edges of the wound and may be more harder or softer than the periwound skin; three (3) = slough: yellow or white colored tissue adhering to the wound bed and presenting as thick cords or crusts, and may be mucinous; two (2) = granulation tissue pink or red discoloration in tissue, shiny, moist and grainy in appearance; (1) = epithelial tissue: for superficial wounds, it appears as a new rosy or shiny tissue (skin) that develops from the

edges or as "islands" in the surface of the lesion; zero (0) = wound closed or covered: the wound is completely covered with epithelium (new skin).

According to NPUAP, the measurement of the area is given by finding the greatest length and width, according to the cephalocaudal trend, along the longitudinal axis, using a graduated ruler. As venous ulcers can heal from a single wound to two minor wounds, or even two wounds converging to form a larger wound (Figure 1), it was standardized that two nearby lesions, with a distance less than 2 cm between them, would be considered as a single lesion⁽¹⁶⁾, the areas are recorded independently and, then, added together.

Figure 1: Venous leg ulcers (lateral plane), with a distance of less than 2cm between them. Inferior wound with island of epithelium. Goiânia, GO, Brazil, 2017.



Source: Archive of the Goiana Network for Research in Wound Evaluation and Treatment.

Furthermore, in cases of islands of epithelium, the largest extensions of the ulcer bed, without overlapping these regions, were found. In instances where this was not possible, the width or length was measured and the epithelial area of the region was discounted.

Data analysis

The data were analyzed using Stata, version 14.0 and the graphs were generated using Statistica, version 7.0. Descriptive statistics and measures of central tendency were used and, to calculate the agreement index, the kappa index was used, given that: $k < 0.20$ = slight agreement, 0.21 to 0.40 = fair agreement, 0.41 to 0.60 = moderate agreement, 0.61 to 0.80 = substantial agreement and 0.81 to 1.0 = almost perfect agreement⁽¹⁷⁾.

Moreover, the intraclass correlation coefficient (ICC) was used, where ICC less than 0.5 reveals poor agreement, 0.5 to 0.75 fair agreement, 0.75 to 0.90 good agreement and > 0.90 excellent agreement⁽¹³⁾.

RESULTS

Participating in this study were 10 nurses working in different health institutions, and who are referred to as clinical nurses. Of the nurses treating patients with venous ulcers, 20% had worked from six months to one year, 30% from one to five years and 50% for five years or more.

The three research nurses acted as a reference for the gold standard observation for analysis (Nur GS).

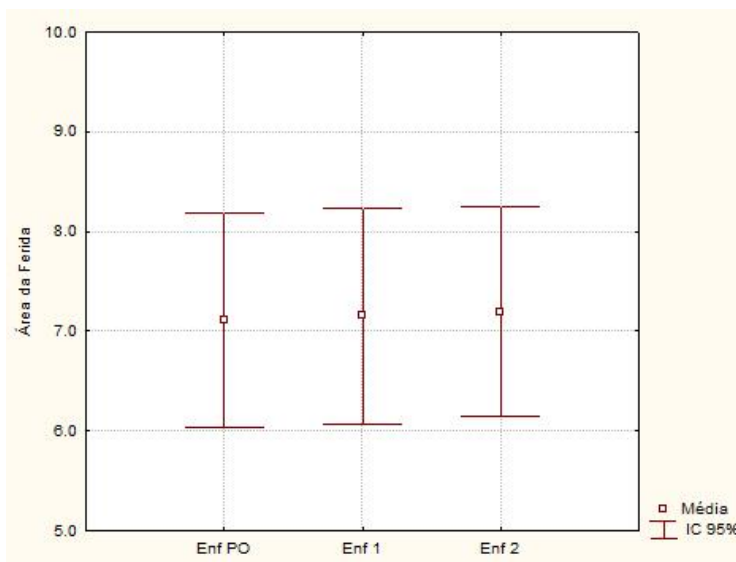
Three observers (two clinical nurses and one research nurse acting as a reference for the gold standard observation) analyzed thirty-five venous ulcers, in different combinations, which made a total of forty-six observations.

The wound size in the study ranged from 0.02 cm² to 551.0 cm², with a mean of 90.04 cm²±153 and median of 18.25 cm².

The results for the sub-scores of the three PUSH parameters and the total score for the three observers are presented below.

Figure 2 shows the comparisons of wound area sub-scores. Mean scores of 7.11±3.62, 7.15±3.64 and 7.20±3.53 were attributed, by the reference nurse for the gold standard observation (Nur GS), clinical nurse one (Nur 1) and two (Nur 2), respectively.

Figure 2: Graph of the mean and 95% IC of sub-scores of the venous ulcer area subscale. Goiânia, GO, Brazil, 2017.



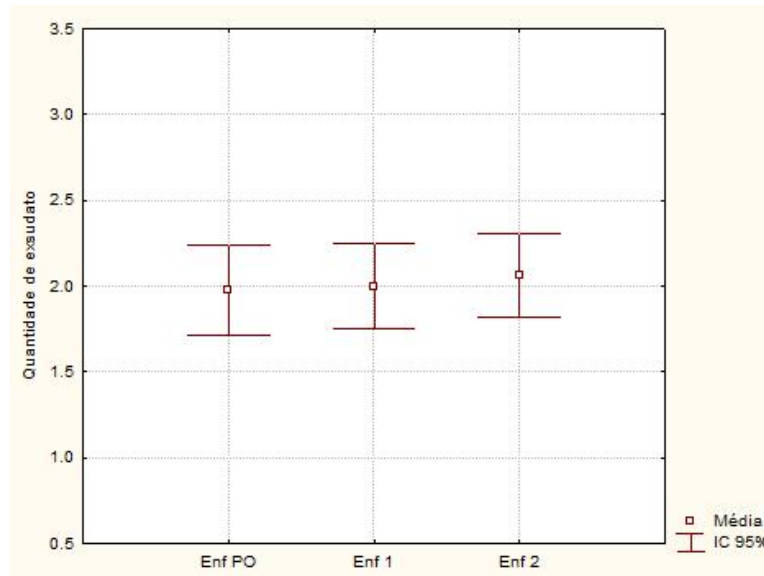
Key: Enf PO = reference nurse for the gold standard observation; Enf 1 = clinical nurse 1; Enf 2 = clinical nurse 2; Kappa Enf PO x Enf 1 = 0.881 - p < 0.001; Kappa Enf PO x Enf 2 = 0.853 - p < 0.001.

The analysis revealed agreement between Nur GS and Nur 1 of 91.3% (n = 42) and Nur 2 of 89.1% (n = 41) in evaluating the wound area; and k values were above 0.80, which indicates almost perfect interobserver agreement⁽¹⁷⁾.

Figure 3 shows the comparisons of the sub-scores of the exudate amount. Mean scores were 1.98±0.88, 2.00±0.84 and 2.07±0.82, by Nur GS, Nur 1 and Nur 2 respectively. There was agreement between Nur GS and Nur 1 of 89.1% (n = 41) and Nur 2 of 82.6% (n = 38) in assessing the exudate amount and k values, indicating good and excellent interobserver agreement⁽¹⁷⁾.

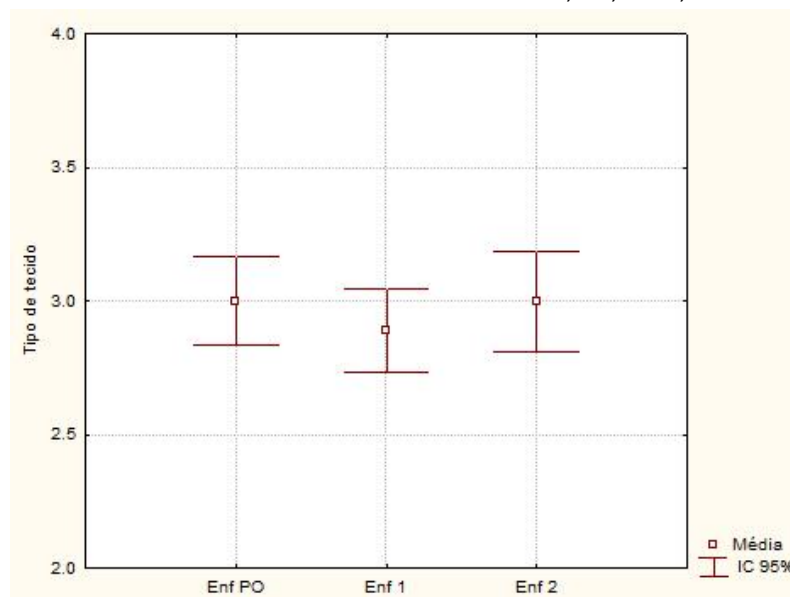
Figure 4 shows the comparisons between the tissue type sub-scores. The mean scores were 3.00±0.55, 2.89±0.52 and 3.00±0.63, by Nur GS, Nur 1 and Nur 2, respectively. There was agreement between Nur GS and Nur 1 of 87.0% (n = 40) and Nur 2 of 89.1% (n = 41) in evaluating the type of tissue present in the venous ulcer wound beds.

Figure 3: Graph of the mean and 95% CI of the sub-scores of the venous ulcer exudate amount subscale. Goiânia, GO, Brazil, 2017.



Key: Enf PO = reference nurse for the gold standard observation; Enf 1 = clinical nurse 1; Enf 2 = clinical nurse 2; Kappa Enf PO x Enf 1 = 0.835 - $p < 0.001$; Kappa Enf PO x Enf 2 = 0.739 - $p < 0.001$.

Figure 4: Graph of the mean and 95% IC of the sub-scores of the tissue type present in the venous ulcer wound bed subscale. Goiânia, GO, Brazil, 2017.

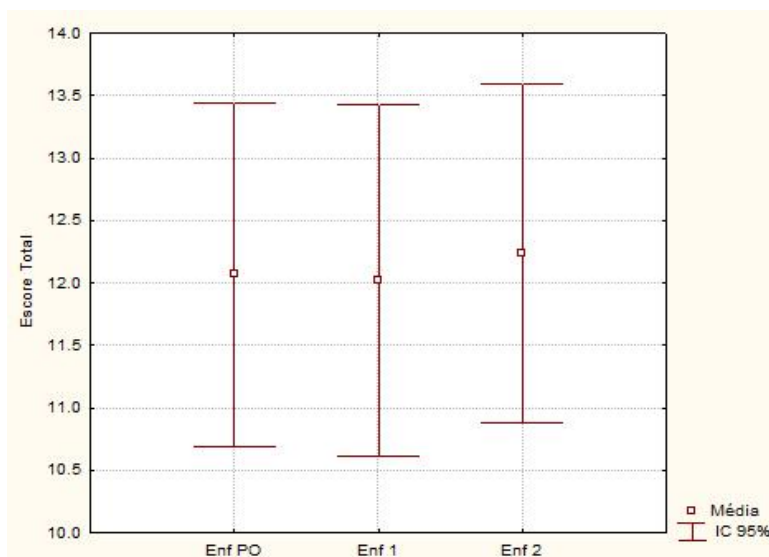


Key: Enf PO = reference nurse for the gold standard observation; Enf 1 = clinical nurse 1; Enf 2 = clinical nurse 2; Kappa Enf PO x Enf 1 = 0.715 - $p < 0.001$; Kappa Enf PO x Enf 2 = 0.789 - $p < 0.001$.

The k values indicate substantial agreement⁽¹⁷⁾.

Figure 5 shows the comparisons of the total PUSH scores. Mean scores were 12.07 ± 4.62 , 12.02 ± 4.73 and 12.24 ± 4.57 , by Nur GS, Nur 1 and Nur 2, respectively. There was agreement between Nur GS and Nur 1 of 78.3% ($n = 36$) and Nur 2 of 67.4% ($n = 31$) in assessing the healing of venous ulcers. The k values indicate that there was substantial interobserver agreement⁽¹⁷⁾ in the overall assessment.

Figure 5: Graph of the mean and 95% IC of the total PUSH scores in the assessment of venous ulcers. Goiânia, GO, Brazil, 2017.



Key: Enf PO = reference nurse for the gold standard observation; Nur 1 = clinical nurse 1; Nur 2 = clinical nurse 2; Kappa Enf PO x Nur 1 = 0.738 - p < 0.001; Kappa Enf PO S x Nur 2 = 0.605 - p < 0.001.

Table 1 shows the analysis of the intraclass correlation coefficient (ICC) for the total PUSH scores and subscales in the assessment of venous ulcer healing. For the total score, both ICCs were above 0.9 indicating that the PUSH scale has excellent interobserver reliability⁽¹³⁾ in evaluating the healing of venous ulcers.

Table 1. The intraclass correlation coefficient (ICC) between scores and sub-scores attributed by the reference nurse for gold standard observation (Nur GS) compared to clinical nurses 1 and 2 (Nur 1 and Nur 2). Goiânia, GO, Brazil, 2017.

<i>PUSH</i> Parameter	ICC ¹	F	P ² -value
Wound area			
Nur GS vs. Nur 1	0.997	607.42	< 0.001
Nur GS vs Nur 2	0.993	301.05	< 0.001
Exudate amount			
Nur GS vs. Nur 1	0.927	25.90	< 0.001
Nur GS vs Nur 2	0.881	16.19	< 0.001
Tissue type			
Nur GS vs. Nur 1	0.672	5.25	< 0.001
Nur GS vs Nur 2	0.754	7.00	< 0.001
Total score			
Nur GS vs. Nur 1	0.992	246.82	< 0.001
Nur GS vs Nur 2	0.985	132.18	< 0.001

Key: ¹Intraclass correlation coefficient; ²p≤0.05

DISCUSSION

The focal object of the present investigation were the psychometric properties of the PUSH tool related to its use by more than one observer in evaluating the healing of venous ulcers. Kappa index values were found revealing substantial or almost perfect interobserver reliability and intraclass correlation coefficient scores ranged from fair to excellent, indicating satisfactory reliability when applied to evaluate venous ulcers.

Interobserver reliability for use of the PUSH outside its original context (pressure wound assessment) had already been studied, however, only in patients with leg ulcers, of which 36% were venous ulcers⁽⁸⁾. The present study, therefore, is the first study to evaluate interobserver reliability of the PUSH exclusively in evaluating venous ulcers.

This result is especially relevant for building evidence for the use of PUSH in cross-sectional studies, profile characterization of healing conditions, and for mapping the characteristics of ulcers undergoing treatment in a given scenario.

The PUSH has been applied to evaluate the evolution of wound healing of diverse etiologies⁽⁶⁾, including leg ulcers^(8,18), and venous ulcers⁽⁸⁾. In this context, intervals of at least two weeks⁽⁸⁾ are recommended between applications.

Although the scale has been shown to be reliable when applied by different observers, further research is necessary to evaluate its internal consistency and responsiveness in the evolution of venous ulcer healing, since the macroscopic characteristics of these wounds are different from arterial ulcers, pressure wounds, and diabetic foot ulcers⁽²¹⁾.

The PUSH gives a maximum score of 10 for wounds with an area greater than 24 cm², but the area of venous ulcers varies substantially, as can be seen in this study, with values ranging from 0.02 cm² and 551.0 cm². Although observed in other countries, with a variation in mean wound size, such as 29.3 cm² ⁽²²⁾ and 51.04 cm² ⁽²³⁾, the Brazilian studies present more extensive wounds, such as 50 cm² ⁽⁹⁾, 100 cm² and greater than 160 cm² ⁽²⁴⁾.

This points to the need to study the responsiveness of the scale to evaluate the evolution of venous ulcer healing in future studies to better establish its psychometric properties for application beyond its original purpose.

In addition, the PUSH evaluates only the worst tissue present in the wound, and venous ulcers usually present concomitant shedding and granulation, in different proportions⁽²⁰⁾, which also highlights the need to further study its responsiveness.

For this research, due to the absence of NPUAP parameters for exudate evaluation, a standardization was necessary, and it may be different from that adopted in the other studies^(6,8-9), which omitted the criteria for such assessment in the procedures. It is expected that future studies may clearly describe the method of evaluation adopted so that there is consistency in future comparisons.

The classification adopted in the present investigation seems to have been appropriate to favor the clinical assessment of the observers, as there was substantial or almost perfect reliability between the evaluated parameters and the PUSH score.

The type of tissue in the venous ulcer bed had a lower score for interobserver reliability, although it was still considered good, and had a fair ICC.

Classically described tissue types include epithelializing, granulation, slough, necrotic or eschar^(12,21). It is known from clinical experience that granulation tissue can range from dark red, bright red, brick red to pale red, and that necrotic tissue may take on the appearance of softened or hardened brown, tightly adhered yellow, loosely adhered yellow, or mucinous-looking yellow⁽²⁴⁻²⁵⁾ and may be of different densities. It may present as a thin layer or mosaic covering the granulation tissue, thus demanding careful assessment by the professional using the PUSH to determine the type of tissue (worst tissue) present in the lesion bed.

In addition, the use of the term "tissue type in the wound bed" may lead the practitioner to pay less attention to the small scabs that may be present at the edges. Pruritus is not uncommon and can cause itching that results in friction injury at the site.

Thus, although apparently simple, the PUSH requires training, just like any other tool. Therefore, it is necessary to consider that the training of the subjects done in the present study may have contributed to the concordance index obtained. For use in research or clinical practice, this training should be carefully developed.

The small sample of participants with venous ulcers is a limitation of the present study. However, it is noted that the heterogeneity of its clinical characteristics may have contributed to the expression of the variety of conditions that the observer is challenged to assess in the application of PUSH within this population.

CONCLUSION

The Pressure Ulcer Scale for Healing (PUSH) showed satisfactory interobserver reliability when applied in valuating venous ulcers, in a context where training preceded use. This training provided additional instructions for evaluating and assessing the exudate and for measuring the wound area.

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APPENDIX 1¹

SUPPORTING TOOL FOR EVALUATING VENOUS ULCERS BY *PRESSURE ULCER SCALE HEALING (PUSH)*

I-Personal details

Date: ___/___/___

City: _____ Unit: _____

Participant's name: _____

II- Wound condition

-Location of the ulcer: LLL () RLL() Zones: 1 () 2 () 3 ()

Plane: () Anterior () Posterior () Lateral () Medial () Other _____

- Exudate amount:

Degree of permeation	Degree of saturation of the dressing	Duration	Dressing type	Assessment
() < than the wound	() moist	() 24h	_____ pad	() none
() equal	() wet	() 48h	_____ gauze	() light
() slightly larger	() saturated	() 72h	_____ foam	() moderate
() much larger		() > 72h	_____ Unna boot	() heavy
			_____ Other	

- Measurement: length _____ width: _____ area: _____ cm²

III – Applying the PUSH tool⁽³⁾

Length X Width in cm ²	0	1	2	3	4	5	Sub-score
		< 0.3	0.3-0.6	0.7-1.0	1.1-2.0	2.1-3.0	
	0	6	7	8	9	10	
	0	3.1 – 4.0	4.1-8.0	8.1-12.0	12.1-24.0	> 24.0	
Exudate Amount	0 None	1 Light	2 Moderate	3 Heavy			Sub-score
Tissue Type	0 Closed wound	1 Epithelial Tissue	2 Granulation Tissue	3 Slough	4 Necrotic Tissue		Sub-score
							Total Score

“Used with permission from the National Pressure Ulcer Advisory Panel (Mar 1, 2016)”

¹ Source: Alves GR. Confiabilidade e Responsividade da *Pressure Ulcer Scale for Healing (PUSH)* na avaliação de úlceras venosas [dissertation]. Goiânia; Programa de Pós-Graduação em Enfermagem/UFG; 2017.