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by Prof. Dr. Muh. Nasrum Massi, Ph.d

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Inter-rater reliability assessment of new diabetic foot ulcers (The Diabetic Foot Ulcer Assessment Scale) based on photograph ☆

Hasniati Haeruddin [a], Saldy Yusuf [b,*], Ilhamjaya Patellongi [c], Kaharuddin Abdul Rasid [d], Harbaeni Harkam [a], Edy Supardi [e]

[a] Gema Insan Akademik College of Health Sciences Makassar, Indonesia
[b] Faculty of Nursing, Hasanuddin University, Makassar, Indonesia
[c] Faculty of Medicine, Hasanuddin University, Makassar, Indonesia
[d] Faculty of Cultural Science, Hasanuddin University, Makassar, Indonesia
[e] Nani Hasanuddin College of Health Sciences Makassar, Indonesia

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KEYWORDS
Wound healing;
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Abstract
Objective: The aim of this study is to evaluate the reliability of the Diabetic Foot Ulcer Assessment Scale (DFUAS) among different nurses.
Method: This research design was a comparison measurement between wound care nurses. The forward translation of DFUAS was translated into Indonesian and used to evaluated DFU status based on a photograph DFUAS that has been translated into Bahasa was used to evaluate the DFU status based on photographs. Cohen's kappa was used to evaluate inter reliability between nurses.
Results: The Cohen's kappa revealed that the inter-rater reliability for depth (0.76–0.80), size (0.80–0.86), size score (0.87–0.89), inflammation/infection (0.69–0.75), proportion of granulation tissue (0.73–0.79), type of necrotic tissue (0.65–0.73), proportion of necrotic tissue (0.87–0.89), proportion of slough (0.58–0.65), maceration (0.79–0.85), type of wound edge (0.91–0.93), and tunneling (0.90–0.91).
Conclusion: This study confirmed DFUAS has an adequate reliability between different wound nurses (inter-rater reliability).

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* Corresponding author.
E-mail address: saldy_yusuf@yahoo.com (S. Yusuf).

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Introduction

As a major complication of Diabetes Mellitus (DM), the prevalence of diabetic foot ulcers (DFU) was reported 25% among DM patient.[1] In Indonesia, DFU is a significant chronic wound in-home care setting,[2] and 12% in a hospital setting.[3] Thus, in the clinical setting, it is very important to assess the wound healing process, including DFU. Assessment of

FORMAT PENGKAJIAN DIABETIC FOOT ULCER ASSESSMENT SCALE (DFUAS) VERSI BAHASA INDONESIA*		
NO	VARIABEL	PENJELASAN
1.	Kedalaman	Kedalaman luka harus diukur pada bahagian luka yang terdalam. Jika luka tersebut menjadi dangkal, maka bahagian terdalamlah yang harus diukur. 0. Tidak tenyatu 1. lapisan luar/epidermis 2. subkutan/dermis 3. tendon 4. jaringan fascia, otot atau tulang
2.	Ukuran	Luka diukur berdasarkan panjang dan lebarnya.Panjang luka diukur berdasarkan ukuran terpanjang sedangkan lebarnya diukur berdasarkan ukuran terlebar yang tegak lurus dari panjang luka yang diukur.Warna kemerah-merahan yang ada di sekitar luka tidak harus diukur. Jika terdapat dua luka atau lebih yang penyebab dan karakteristiknya sama, maka "ukuran" luka tersebut merupakan jumlah dari keseluruhan luka yang diukur. Jika luka tidak bisa diukur secara akurat, seperti luka yang disertai dengan jaringan nekrotik atau bentuk luka yang tidak beraturan, maka "S" harus ditambahkan setelah pemeriksaan. 0. Utuh 1. ≤ 1 cm² 2. 1 cm² ≤ 4 cm² 3. 4 cm² ≤ 9 cm² 4. 9 cm² ≤ 16 cm² 5. 16 cm² ≤ 25 cm² 6. 25 cm² ≤ 36 cm² 7.36 cm² ≤ 49 cm² 8. 49 cm² ≤ 64 cm² 9. ≥ 64 cm²
3.	Penilaian Ukuran	Di bawah ini dijelaskan sistem penilaian luka kaki diabetes yang dipakai untuk mengevaluasi proses penyembuhan.Silakan ikuti instruksi cara perhitungan berikut: 1. Jika seluruh ibu jari terluka, maka perhitungan ukurannya adalah " 1 + 1= 2" 2. A –H: angka yang terdapat pada lingkaran yang merupakan nilai relatif. Anggaplah bahwa angka 5 merupakan nilai maksimum atau jumlah dari keseluruhan jari yang ada pada kaki, lalu berikan penilaian pada keseluruhan jari dari jari 1 hingga jari 5 menurut hasil observasi Anda. Sebagai contoh, jika luka meliputi keseluruhan jempol kaki dan meliputi 3/5 (60 %) dari tulang metatarsal pertama, penilaiannya adalah '1 + 1 + 3 = 5'. Jika Anda menemukan penurunan nilai sekitar 2/5 (40 %) dari tulang metatarsal pertama, maka hitunglah dengan cara '1 + 1 + 2 = 4'. 3. Anda tidak perlu menilai warna kemerah-merahan (undermining) yang ada di sekitar luka. 4. Nilai tidak boleh melampaui 50 % dari keseluruhan luka yang diukur.

Figure 1 Indonesian version of the new diabetic foot ulcer assessment scale.

		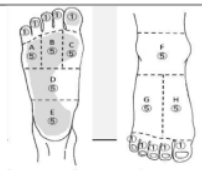
4.	Peradangan/infeksi	Osteomielitis dapat ditentukan berdasarkan hasil pengamatan klinis atau hasil informasi catatan klinis. 0. tidak ada 1. tanda-tanda peradangan (contohnya: hangat, kemerah-merahan, bengkak, nyeri) 2. tanda-tanda infeksi lokal (contohnya: indurasi, pus, bau busuk) 3. osteomielitis 4. osteomielitis dan tanda infeksi lokal 5. infeksi sistemik (demam, sepsis)
5.	Perbandingan Jaringan Granulasi	Berilah penilaian sesuai dengn perbandingan jaringan granulasi yang menutupi luka.Seratus persen merupakan keadaan semua luka yang ditutupi oleh jaringan granulasi. Ketika luka dipisahkan dari epitalisasi selama proses penyembuhan,perbandingan jaringan granulasi harus dinilai dari jumlah keseluruhan area luka. 0. tidak ada (granulasi tidak bisa dinilai karena luka tersebut telah sembuh atau sudah terlalu dangkal). 1. 76-100% 2. 51-75% 3. 26-50% 4. 11-25% 5. ≤ 10%
6	Jaringan Nekrotik: jenis jaringan nekrotik:	jenis jaringan nekrotik: jika terdapat berbagai jenis jaringan nekrotik, maka kondisi yang dominanlah yang harus dipilih. 0. tidak ada 1. jaringan nekrotik yang berwarna putih, kuning, dan/atau abu-abu 2. jaringan nekrotik yang berwarna hitam 3. gangren
7	Perbandingan Jaringan Nekrotik	Berikanlah penilaian sesuai dengan perkiraan perbandingan jaringan nekrotik yang menutupi ulkus yang harus berhubungan dengan semua jenis jaringan nekrotik! Seratus persen adalah keadaan seluruh luka yang ditutupi oleh jaringan nekrotik.Jika ulkus terdiri atas beberapa luka, maka ulkus tersebut harus dinilai secara keseluruhan. 0. tidak ada 1. ≤ 10% 2. 11-25% 3. 26-50% 4. 51-75% 5. 76-100%
8	Perbandingan Slough:	slough merupakan jaringan nekrotik yang lunak.Berikan penilaian yang sesuai dengan perkiraan perbandingan slough yang menutupi ukus! Seratus persen merupakan keadaan dari keseluruhan luka yang ditutupi oleh slough.Jika ulkus terdiri atas beberapa luka, maka luka tersebut harus dinilai secara keseluruhan. 0. tidak ada

Figure 1 Continued.

DFU status becomes the first corner in the management of DFU.[4]

There are several assessment tools that have been used for DFU, including the Bates-Jensen Wound Assessment Tool (BWAT),[5,6] and Pressure Ulcers Scale for Healing (PUSH).[7] By evaluating DFU correctly, the outcome of the wound care process can be evaluated and communicated between nurses. Therefore, a valid and reliable DFU assessment scale is pivotal needed to ensure the quality of data. Recently, a new assessment scale has been developed, namely the New Diabetic Foot Ulcer Assessment Scale (DFUAS). DFUAS has been reported excellent to measure sensitivity, specificity, positive predictive value, and negative predictive, respectively, 89%, 71%, 86%, and 77%.[8] Despite, it has good validity, the reliability particularly has not been known between nurses. Thus, this study aimed to evaluate the reliability of DFUAS among different nurses.

		1. ≤ 10% 2. 11-25% 3. 26-50% 4. 51-75% 5. 76-100%
9.	maserasi	merupakan kerusakan pada kulit di sekitar luka yang disebabkan oleh kelembaban/eksudat secara terus- menerus. Kulit di sekitar luka dibatasi sebagai area maserasi sepanjang 2 cm dari sekeliling tepi luka. 0. tidak ada 1. sedikit: hanya pada sekitar tepi luka saja 2. sedang: sekitar area luka. 3. berat: melebihi kulit yang ada di sekitar kulit 4. luas terlebar dari maserasi diukur dari tepi luka (cm) 
10	Tipe tepi luka:	Tipe tepi luka: 0. tidak ada tepi luka (epitalisasi sempurna) 1. tepi luka yang menyatu (tidak ada bagian khusus) 2. tepi luka berwarna merah muda 3. hiperkeratosis ataul ining 4. tepi luka berwarna merah 5. tepi luka tidak atau belum terbentuk (fase awal)
	Tunneling:	Tunneling: rongga/area luka harus diukur pada titik yang terpanjang. tidak ada 1. ≤ 2 cm 2. 2 cm ≤ 4 cm 3. 4 cm ≤ 8 cm 4. 8 cm<
	TOTAL SKOR	
	S	

Figure 1 Continued.

Method

Design and participants

This research design was a comparison measurement between wound care nurses. This research involved wound care nurses from seven cities in Indonesia and conducted from July to August 2017. The inclusion criteria were certified wound care nurses who hold wound certification, nursing education with at least hold a diploma degree, and work experience with DFU at least 2 years.

Translation process

The forward translation of DFUAS was translated into Bahasa by English expert and evaluated by two wound care nurses differently for clearance of the text meaning, then being revised particularly for the technical term. After that, the backward translation was performed to compare with the original version to compare content and construct appropriateness. Lastly, the Indonesian version was evaluated for structure and language content by Indonesian language expert from Hasanuddin University.

Interreliability evaluation

Eighteen photographs which reflect various clinical DFU status sent to participants via online (WhatsApp, Email, or Line application). The participants were asked to evaluate DFU status based on photograph for six days using the Indonesian version of DFUAS.

Data analysis

Cohen's kappa was used to evaluate inter reliability between nurses (SPSS 22, for Windows). This study was approved by the Ethics Committee, Faculty Medicine, Hasanuddin University (No. 275/H4.8.4.5.31/PP36-KOMETIK/2017).

Results

Characteristics of participants

Thirty-three wound care nurses participated in the current study and evaluated 18 photographs of DFU using Indonesian version of DFUAS (Fig. 1).

Table 1 Inter-rater reliability of the Indonesian version of DFUAS.

DFU photo	Depth	Size	Size score	Inflammation/ infection	Proportion of granulation tissue	Type of necrotic tissue	Proportion of necrotic tissue	Proportion of slough	Maceration	Type of wound edge	Tunneling
Photo 1	0.78	0.82	0.88	0.72	0.74	0.68	0.89	0.59	0.80	0.92	0.91
Photo 2	0.80	0.81	0.88	0.75	0.73	0.67	0.89	0.61	0.82	0.92	0.90
Photo 3	0.80	0.82	0.88	0.72	0.75	0.71	0.88	0.58	0.80	0.93	0.91
Photo 4	0.78	0.84	0.88	0.74	0.73	0.67	0.88	0.59	0.80	0.92	0.91
Photo 5	0.80	0.82	0.87	0.74	0.77	0.73	0.89	0.58	0.82	0.92	0.91
Photo 6	0.79	0.83	0.89	0.72	0.77	0.72	0.88	0.62	0.85	0.93	0.91
Photo 7	0.77	0.83	0.88	0.74	0.77	0.71	0.89	0.62	0.83	0.92	0.91
Photo 8	0.78	0.82	0.88	0.74	0.79	0.72	0.89	0.63	0.83	0.92	0.91
Photo 9	0.79	0.85	0.89	0.74	0.79	0.72	0.89	0.61	0.83	0.92	0.91
Photo 10	0.78	0.86	0.89	0.77	0.79	0.72	0.89	0.62	0.83	0.92	0.91
Photo 11	0.76	0.83	0.88	0.74	0.77	0.72	0.89	0.65	0.83	0.92	0.91
Photo 12	0.77	0.83	0.89	0.73	0.77	0.72	0.89	0.61	0.82	0.92	0.91
Photo 13	0.80	0.85	0.87	0.69	0.75	0.72	0.88	0.60	0.82	0.92	0.90
Photo 14	0.80	0.82	0.87	0.72	0.76	0.70	0.88	0.60	0.80	0.92	0.91
Photo 15	0.79	0.81	0.88	0.71	0.75	0.67	0.88	0.63	0.80	0.92	0.91
Photo 16	0.79	0.81	0.87	0.71	0.74	0.65	0.88	0.60	0.79	0.92	0.91
Photo 17	0.79	0.82	0.87	0.70	0.74	0.67	0.87	0.58	0.80	0.91	0.91
Photo 18	0.79	0.80	0.87	0.70	0.76	0.69	0.87	0.59	0.79	0.92	0.90

The mean age of participants was (32.21 ± SD 5.68) years old, majority from undergraduate (*n*: 28, 84.8%), with working experience dominantly ≤5 years (*n* = 28, 84.8%), and with various wound care certification (data not shown). The Cohen's kappa revealed that the inter-rater reliability for depth (0.76–0.80), size (0.80–0.86), size score (0.87–0.89), inflammation/infection (0.69–0.77), proportion of granulation tissue (0.73–0.79), type of necrotic tissue (0.65–0.73), proportion of necrotic tissue (0.87–0.89), proportion of slough (0.58–0.65), maceration (0.79–0.85), type of wound edge (0.91–0.93), and tunneling (0.90–0.91), with overall reliability was 0.93, and similar based on experience (0.92, ≤5 years) and (>0.92, 5 years) (Table 1).

Discussion

The current study was set out with the aim to evaluate inter-reliability of the Indonesian version of DFUAS among wound care nurses. It is interesting to note that in all eleven sub-scale were moderate, strong, and almost perfect.[9] Regarding the proportion of slough, the reliability from weak to moderate, it seems possible that these result due to evaluation based on a photograph. However, using photographs to evaluate reliability of the assessment scale of wound healing has been used previously.[10] In this study, we also found the interrater reliability was stable between different experience, therefore, it can be assumed that the Indonesian version of DFUAS can be useful as assessment scale between wound care nurses. However, our major limitation is that we performed evaluation based on photographs instead of direct evaluation, which result in some sub variable unable to evaluate. Therefore, the recommendation for further study should be performed in a clinical setting.

Conclusion

This study confirmed DFUAS has an adequate reliability.

Conflict of interest

The authors declare no conflict of interest.

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