

Translation and Validation of the Indonesian Version of the Diabetic Foot Ulcer Scale–Short Form (DFS-SF): A Psychometric Evaluation

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ABSTRACT

Background: Diabetic Foot Ulcer (DFU) is a common chronic complication of diabetes that significantly impairs patients' quality of life. However, a culturally adapted and validated Indonesian DFU specific quality of life instrument to support comprehensive nursing assessment is not yet available. **Objective:** This study aimed to adapt the DFS-SF (Diabetic Foot Ulcer Scale) into Indonesian using a standardized translation process and to evaluate its psychometric properties, specifically validity and reliability. **Methods:** This study used a cross-sectional quantitative design and recruited 118 patients from three urban wound care clinics. The original DFS-SF underwent forward-backward translation and cultural adaptation. Internal consistency and construct validity were examined using PLS-SEM (Partial Least Squares Structural Equation Modeling) analysis. **Results:** The Indonesian DFS-SF demonstrated robust psychometric properties, including high reliability and validity across all domains. Strong internal consistency was observed across all domains, with both Cronbach's alpha and composite reliability > 0.80. The construct demonstrated adequate convergent validity, evidenced by Average Variance Extracted (AVE) values of 0.60 or higher, and by employing the Fornell-Larcker criterion, discriminant validity was verified. Outer loadings for most indicators were above 0.70, with particularly high loadings for Leisure (≥ 0.95) and daily activity (≥ 0.91) domains, indicating robust construct measurement. **Conclusion:** The Indonesian version demonstrated validity and reliability for assessing quality of life in patients with DFU. To enhance generalizability, future studies should include more diverse populations. This research suggests that the Indonesian version of the DFS-SF can be effectively applied in clinical settings to assess the quality of life among patients with diabetic foot ulcers.

Keywords: *Diabetic Foot; Psychometrics; Quality of Life; Translation*

INTRODUCTION

The complications of type 2 diabetes mellitus, chronic Diabetic Foot Ulcer (DFUs) stands out as particularly severe (Swaminathan *et al.*, 2024). The occurrence of DFUs demonstrated significant cross-national variability (Zhang *et al.*, 2017). In Indonesia, the prevalence is estimated to be around 9.08% (Hariftyani *et al.*, 2021), while another study reports a prevalence of 8.7% (Yunir *et al.*, 2022). DFUs pose substantial economic and social burdens due to their long recovery times and expensive treatment (Russo *et al.*, 2025; Rusu *et al.*, 2025). Evidence indicates that diabetic foot ulcers also lead to various psychosocial issues. Moreover, beyond physical impairment, DFUs have a significant impact on patients' emotional well-being and employment, contributing to job loss (Alasfour *et al.*, 2025; Pouwer *et al.*, 2024). Consequently, DFUs have a profoundly negative effect on patients' Quality of Life (QoL).

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The QoL reflects a person's subjective evaluation of their life standing, shaped by cultural values, environmental context, and personal goals (WHO, 2012). In chronic illnesses such as diabetes and related complications like DFUs, QoL often declines notably due to physical restrictions, emotional strain, and social challenges. Several studies indicate that DFUs have an adverse impact on QoL, frequently highlighting their predominantly negative effects (Haryanto *et al.*, 2023; Paixão *et al.*, 2025). Qualitative research reveals that DFUs impose a substantial caregiving burden, cause mobility impairments, generate financial stress due to medical expenses, increase the likelihood of job loss, and negatively impact emotional well-being (Crocker *et al.*, 2021).

Recognizing patients' QoL is essential for proper DFU management because treatment addresses both physical recovery and patients' perceptions and experiences (Amato *et al.*, 2025; Ojo *et al.*, 2025). Furthermore, using a patient-centered approach to evaluate and treat DFUs and their related complications enables healthcare providers to gain a more comprehensive understanding of patients' clinical conditions, lived experiences, and individual needs, including physical, psychological, and social aspects. This holistic understanding supports shared decision-making, individualized education, self-management, and coordinated multidisciplinary care, ultimately leading to more effective and sustainable disease management (Ghadeer *et al.*, 2025).

Measuring QoL in DFU patients involves using both generic and condition-specific instruments. Compared with generic tools, disease-specific measures are more effective at capturing changes in QoL over time, as they provide detailed information directly related to the condition's characteristics (Hogg *et al.*, 2012). Numerous studies reported that various tools have been used to assess QoL among DFU patients (Byrnes *et al.*, 2024; Ghadeer *et al.*, 2025). The DFU Scale (DFS) was specifically developed to assess QoL in these patients. Both patients and caregivers participated in semi-structured interviews, and focus group discussions were conducted as part of their development. The instrument demonstrated strong internal consistency and satisfactory validity, reliability, and sensitivity regarding wound condition (Abetz *et al.*, 2022). Similarly, the shortened version of the instrument, the DFS-Short Form (DFS-SF), has demonstrated satisfactory validity and reliability (Bann *et al.*, 2003). The reliability and validity of the DFS and DFS-SF have been examined through translations into different languages (Lee, 2019; Sobol *et al.*, 2015).

A validated QoL measurement tool is essential to support nursing assessment in patients with diabetic foot ulcers (DFU). A measurement tool with high validity and reliability can accurately assess patients' QoL, thereby ensuring that the interventions provided are appropriate, such as to support patient-centred care, inform treatment decisions, monitor treatment progress, and evaluate treatment efficacy (Steptoe *et al.*, 2015; Van Leeuwen *et al.*, 2019). However, neither instrument has yet been adapted or validated for use in the Indonesian context. Thus, the study was conducted with the primary goal of translating the DFS-SF into Indonesian (DFS-I), applying it to Indonesian patients, and testing its psychometric properties, including validity and reliability.

METHODOLOGY

Design of Research

The Indonesian version of the DFS-SF was examined for its psychometric properties, validity, and reliability in a cross-sectional study conducted in accordance with the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) guidelines (Mokkink *et al.*, 2010).

Instruments

The DFS-SF, applied in this study, is a condition-specific questionnaire for foot ulcer patients, consisting of 29 items across six areas: five items for leisure, physical health, and dependence/daily life, six items for negative emotions, four items focused on worries about ulcers/feet, and four items assessing disturbance caused by ulcer care. All questionnaire items were using a 5-point Likert scale. The original English version demonstrated strong test-retest reliability and adequate sensitivity, supporting its use in both clinical practice and research settings (Abetz *et al.*, 2002). Demographic characteristics were collected using a minimum data sheet, which included sex, age, educational level, employment status, duration of diabetes mellitus, duration of ulcer, wound site, trigger factors, and Wagner classification. A forward-backward translation of the instrument was performed, followed by an assessment of its validity and reliability. Before translating the instrument into Indonesian, formal permission was obtained from Mapi Research Trust (Lyon, France). The translation and cultural adaptation process followed a standardized six-step procedure (Beaton *et al.*, 2000):

Step 1: Forward translation

The original English version was independently translated into Indonesian by two bilingual translators: a wound specialist nurse familiar with the clinical context and an independent professional translator. This step aimed to achieve conceptual rather than literal equivalence.

Step 2: Synthesis of the translations

The two forward translations were compared and synthesized into a single preliminary Indonesian version through discussion and consensus, resolving discrepancies in wording and meaning.

Step 3: Back translation

The synthesized Indonesian version was independently back-translated into English by two native translators and one wound specialist nurse who were not involved in the forward translation. This step ensured that the translated version accurately reflected the original instrument's content.

Step 4: Expert committee review

An expert committee reviewed all versions (original, forward translations, synthesized version, and back translations) to evaluate semantic, idiomatic, experiential, and conceptual equivalence. Any inconsistencies were resolved, resulting in a pre-final Indonesian version.

Step 5: Pre-testing and cognitive debriefing

The pre-final version was pilot-tested among patients with diabetic foot ulcers to assess clarity, comprehensibility, and cultural relevance. Feedback from participants was used to refine wording and improve cultural appropriateness.

Step 6: Finalization and psychometric evaluation

The final Indonesian version was established after incorporating pre-testing feedback and subsequently evaluated for validity and reliability to confirm its suitability for use in the Indonesian clinical context.

Sample and Data Collection

Out of the 189 participants, 118 met the inclusion criteria (Figure 1). The study was conducted across three urban wound care clinics in Pontianak and Mempawah, Indonesia from August to November 2023, employing a purposive sampling. The inclusion criteria were being a native Indonesian speaker, understanding the Indonesian language, and having a diagnosis of DFU. Participants with a history of mental illness were exclusion criteria. The questionnaire was administered after participants provided informed consent.

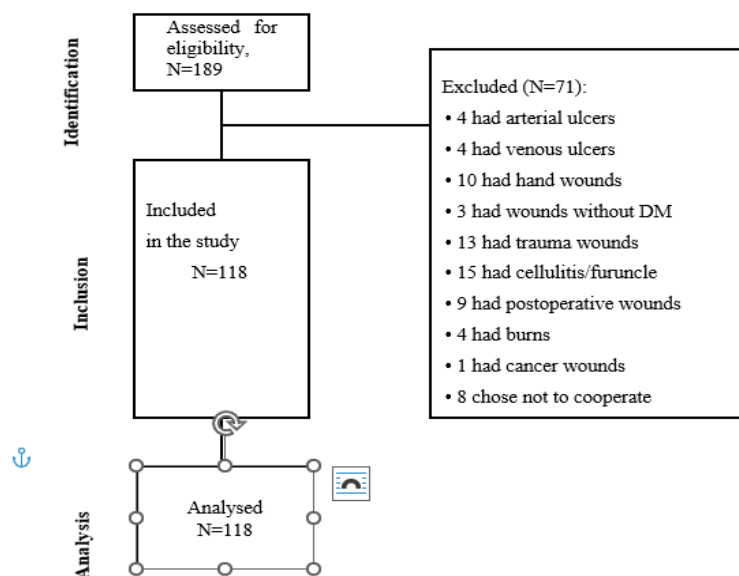


Figure 1: Flow Chart of the Participant Enrolment Process

Data Analysis

Standard deviations, frequencies, mean, and percentages were used to analyse participants' characteristics. To evaluate convergent validity, we used the average variance extracted (AVE) and outer loadings. Convergent validity is considered adequate when the AVE value exceeds 0.50, indicating the amount of variance explained by all indicators. An outer loading of 0.7 or above shows that the item strongly contributes to the measuring construct and should be retained. To examine discriminant validity, the Fornell-Larcker criterion was implemented by analysing the square root of each construct's AVE (diagonal values) with the correlations among different constructs (off-diagonal values). Discriminant validity holds when the square root of AVE > inter-construct correlations. Internal consistency was acceptable if CA > 0.70, whereas CR ≥ 0.7 confirmed sufficient reliability, or a value above indicates good construct reliability. Data were analysed using PLS-SEM.

Ethical Consideration

This study was approved by the Institutional Review Board of STIK Muhammadiyah Pontianak, Indonesia with reference number 223/II.1.AU/KET.ETIK/VIII/2021, on 16th August, 2023.

RESULTS

Demographic and Clinical Characteristics

This study involved 118 participants with DFU, of whom 68 were female (57.6%). The majority, aged 47-56, numbered 44 (37.2%), and 38 (32.2%) had completed senior high school. More than half (55.2%) were employed, and 82 (69.8%) had DM durations of one to ten years. Additionally, 57 (48.3%) experienced wound onset more than 60 days, caused by various triggers. Among them, 42 (35.6%) had lateral wound sites, and 43 (36.4%) were classified as Wagner grade 2, as shown in Table 1.

Table 1: Patients' Demographic and Wound Characteristics

Characteristics	Total participants (n=118)
Sex	n (%)
Female	68 (57.6)
Male	50 (42.4)
Age (years)	
27-36	3 (2.5)
37-46	20 (17.4)
47-56	44 (37.2)
57-66	30 (25.6)
Above 66	20 (16.9)
Education	
No education	6 (5.1)
Secondary School	36 (30.2)
Junior High School	20 (17.4)
Senior High School	38 (32.2)
Bachelor's Degree	18 (15.1)
Employment Status	
Housewife	43 (36.4)
Employed	65 (55.2)
Unemployed	5 (4.2)
Retired	5 (4.2)
Duration of Diabetes (years)	
Less than one year	3 (2.3)
One to ten years	82 (69.8)
More than ten years	33 (27.9)
Wound Duration (days)	
10-30	34 (28.8)
31-60	27 (22.9)
>60	57 (48.3)

Wound Site Location	
Toe	15 (12.8)
Dorsal	23 (19.8)
Plantar	16 (13.9)
Lateral	42 (35.6)
Heel	20 (16.9)
Cause of Ulcer	
Unknown	9 (7.6)
Trauma	45 (38.1)
Others	64 (54.3)
Wagner grading	
Grade 1	33 (28.0)
Grade 2	43 (36.4)
Grade 3	33 (28.0)
Grade 4	7 (5.9)
Grade 5	2 (1.7)

Construct Reliability

Internal consistency across all constructs was strong, with CA > 0.80, exceeding the conventional benchmark of 0.70 for adequate reliability. CR measure, including rho_a and rho_c, was also calculated for each construct. Excellent construct reliability was confirmed by rho_a and rho_c values of 0.84 or higher across all constructs. Table 2 presents the findings on construct reliability and convergent validity for this study.

Table 2: Reliability and Validity Analysis

Domains	Cronbach's alpha	Composite Reliability		Convergent Validity
		Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Bothered by ulcer care	0.801	0.846	0.873	0.640
Dependence/daily life	0.950	0.952	0.962	0.833
Leisure	0.976	0.977	0.981	0.913
Negative emotions	0.919	0.927	0.936	0.711
Physical health	0.839	0.845	0.886	0.608
Worried about ulcers/feet	0.917	0.928	0.941	0.801

Convergent Validity

All constructs in this study achieved AVE values of at least 0.61, indicating that the convergent validity criteria were met. Therefore, the constructs are considered to represent the concepts being measured accurately (Table 2).

Discriminant Validity Findings

Discriminant validity is supported when inter-construct correlations are lower than the square root of AVE, not when they exceed 0.70 (Table 3).

Table 3: Discriminant Validity

Variables	Bothered by Ulcer Care	Dependence/Daily Life	Leisure	Negative Emotions	Physical Health	Worried About Ulcers/Feet
Bothered by ulcer care	0.800					
Dependence/daily life	0.621	0.913				
Leisure	0.534	0.800	0.955			
Negative emotions	0.749	0.606	0.509	0.843		
Physical health	0.595	0.530	0.492	0.532	0.780	
Worried about ulcers/feet	0.712	0.683	0.619	0.832	0.426	0.895

Structural Model Evaluation: Outer Model Analysis

The evaluation of the structural model in Table 4 examines the correlation between observed indicators

and their corresponding latent constructs, as well as the effect of the latent constructs on the dependent variable, quality of life. Outer loadings were analysed to determine the strength of the correlation between indicators and their respective constructs. Indicators are considered to adequately and effectively represent their corresponding latent constructs when their factor loadings exceed 0.70.

In the leisure domain, all indicators (leisure 1–leisure 5) showed very high loadings (>0.95), reflecting a strong representation of the leisure construct. In the physical health domain, the factor loadings ranged from 0.70 to 0.81, indicating acceptable levels. In the dependence/daily life domain, all indicators had strong loadings (>0.91), confirming their reliability in measuring the construct. In the negative emotion’s domain, loadings varied from 0.81 to 0.83, demonstrating consistent measurement of negative emotions. In the worried about ulcers/feet domain, loadings ranged from 0.87 to 0.95, indicating a strong correlation with the worry about ulcers construct. In the area assessing discomfort due to ulcer care, all indicators had loading above 0.88, indicating excellent construct representation.

Table 4: Outer Model analysis

Variables	Indicators	Outer Loadings
Bothered by Ulcer Care	BUC 1	0.859
	BUC 2	0.897
	BUC 3	0.533
	BUC 4	0.857
Dependence/Daily Life	DL 1	0.914
	DL 2	0.932
	DL 3	0.876
	DL 4	0.931
	DL 5	0.910
Leisure	L 1	0.939
	L 2	0.963
	L 3	0.952
	L 4	0.957
	L 5	0.966
Negative Emotions	NE 1	0.812
	NE 2	0.836
	NE 3	0.846
	NE 4	0.908
	NE 5	0.835
	NE 6	0.818
Physical Health	PH 1	0.818
	PH 2	0.750
	PH 3	0.815
	PH 4	0.745
	PH 5	0.767
Ulcer/Foot Concern	WU 1	0.876
	WU 2	0.846
	WU 3	0.915
	WU 4	0.941

*BUC; bothered by ulcer care, DL; dependence/daily life, L; leisure, NE; negative emotions; PH; physical health; WU; worried about ulcer/feet

DISCUSSION

In the Indonesian context, the investigation is the pioneering work that evaluates the psychometric properties in patients with DFUs. This investigation aimed to adapt widely recognized DFS-SF for use with the Indonesian population and to assess its psychometric properties, including validity and reliability, in patients with DFU. The participant-to-item ratio and PLS-SEM rule of thumb are adequate for this initial validation. Although the sample size is modest it was adequate for initial validation.

The results demonstrated excellent internal consistency with CA and CR > 0.70. The current findings support previous research emphasizing the reliability and validity of psychometric tools in assessing quality of life among populations with chronic illnesses (Macioch *et al.*, 2017). Furthermore, convergent validity was confirmed, as all constructs achieved AVE values of 0.50 or higher, indicating that the instruments effectively

measured the intended latent variables (Hair *et al.*, 2019).

According to the Fornell-Larcker criterion, discriminant validity across all constructs was confirmed, with square root AVE exceeding inter-construct correlations. The QoL (0.90) and dependence/daily life (0.91) showed strong discriminant validity, indicating their unique contributions to the structural model. These findings align with those of Hu *et al.* (2020), highlighting the importance of discriminant validity in evaluating patient-reported outcomes. The reliability and validity analyses showed that all constructs met the established criteria. The high internal reliability and acceptable convergent validity confirm that the instruments are reliable and valid for measuring the intended constructs.

Most constructs demonstrated outer loadings above 0.70, indicating strong indicator reliability and confirming the indicators' dependability. Notably, indicators for leisure (≥ 0.95) and daily (≥ 0.91) exhibited exceptionally high loadings, underscoring their significant roles in the QoL construct. This aligns with studies emphasizing leisure activities and daily functioning as key factors in well-being for patients with DFUs (Crews *et al.*, 2016). However, these findings differ from those of Álvaro-Afonso *et al.* (2024), who reported that the physical health domain had the highest score. This discrepancy may be attributable to differences in the demographic, clinical, and cultural characteristics of the participants recruited in each study.

These findings highlight the importance of a comprehensive approach to managing recurrent DFUs that addresses both physical and psychosocial factors. Interventions should focus on wound care, physical therapy, and psychosocial support to enhance QoL. Additionally, the importance of leisure activities underscores the potential for incorporating recreational therapies into comprehensive care plans. Overall, these results suggest that the DFS-I is comparable to findings from other studies (Martinez-Gonzalez *et al.*, 2020; Naga Raju *et al.* 2022). In conclusion, the DFS-I represents a viable and clinically relevant instrument for evaluating quality of life among individuals with diabetic foot ulcers, and can be effectively utilized by health providers, particularly wound care nurses, in routine clinical practice.

The current study showed strong internal consistency and construct validity of the DFS-I. Meanwhile, psychometric properties related to temporal stability and measurement invariance were outside the scope of this initial validation and should be explored in future research.

Future research should explore longitudinal models better to understand the timing of QoL factors in DFU patients. Additionally, incorporating advanced wound care technologies and telehealth solutions could offer promising ways to enhance patient outcomes, as recent digital health advancements suggest. Additionally, integrating advanced wound care technologies and telehealth solutions may offer promising avenues for improving patient outcomes, as suggested by recent advancements in digital health (Chen *et al.*, 2020).

Limitation

Several constraints should be noted in this study. The first limitation is that the study was conducted in only three clinical settings; therefore, the findings may not accurately represent patients from more diverse environments. Secondly, the participants were recruited through convenience sampling, which limits the representativeness of the study population and reduces the generalizability of the results. Lastly, this study did not assess test-retest reliability; therefore, the temporal stability of the DFS-I could not be determined. In addition, measurement invariance across demographic or clinical subgroups was not examined, as the study employed a cross-sectional design with a single administration and limited sample size. Future studies using longitudinal designs and multigroup analyses are warranted to establish stability and invariance.

CONCLUSION

After translation and cultural adaptation, the DFS-SF showed acceptable validity and reliability for use among Indonesian patients with DFUs. This study is important for nursing practice because a validated QoL instrument enables nurses to conduct systematic, patient-centered assessments, support evidence-based interventions, and track patient outcomes in clinical settings. The DFS-I can help nurses identify patients' quality of life issues and plan targeted care to enhance overall well-being. Future research should include more diverse populations and longitudinal designs to better assess the instrument's applicability and responsiveness

in various clinical settings.

Conflict of Interest

The authors reported no potential conflicts of interest.

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REFERENCES

- Abetz, L., Sutton, M., Brady, L., McNulty, P., & Gagnon, D. D. (2002). The Diabetic Foot Ulcer Scale (DFS): A quality of life instrument for use in clinical trials. *Practical Diabetes International*, 19(6), 167-175. <https://doi.org/10.1002/pdi.356>
- Alasfour, L., Alboloushi, A., Kirwan, E., McIntosh, C., MacGilchrist, C., & Hurst, J. E. (2025). Mapping the evidence to determine the influence of stress, anxiety, and depression on wound healing in patients with diabetes-related foot ulcers: A Scoping Review. *Journal of Tissue Viability*, 100935. <https://doi.org/10.1016/j.jtv.2025.100935>
- Álvaro-Afonso, F. J., García-Madrid, M., García-Morales, E., López-Moral, M., Molines-Barroso, R. J., & Lázaro-Martínez, J. L. (2024). Health-related quality of life among Spanish patients with diabetic foot ulcer according to Diabetic Foot Ulcer Scale–Short Form. *Journal of Tissue Viability*, 33(1), 5-10. <https://doi.org/10.1016/j.jtv.2023.11.011>
- Amato, E., Giangreco, F., Iacopi, E., & Piaggese, A. (2025). Patient-Reported Experience (PREMs) and Outcome (PROMs) Measures in Diabetic Foot Disease Management—A Scoping Review. *Journal of Clinical Medicine*, 14(17), 6116. <https://doi.org/10.3390/jcm14176116>
- Bann, C. M., Fehnel, S. E., & Gagnon, D. D. (2003). Development and validation of the Diabetic Foot Ulcer Scale-short form (DFS-SF). *Pharmacoeconomics*, 21(17), 1277-1290. <https://doi.org/10.2165/00019053-200321170-00004>
- Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, 25(24), 3186-3191. <https://doi.org/10.1097/00007632-200012150-00014>
- Byrnes, J., Ward, L., Jensen, S., Sagoo, M., Charles, D., Mann, R., ... & Lazzarini, P. A. (2024). Health-related quality of life in people with different diabetes-related foot ulcer health states: A cross-sectional study of healed, non-infected, infected, hospitalised and amputated ulcer states. *Diabetes Research and Clinical Practice*, 207, 111061. <https://doi.org/10.1016/j.diabres.2023.111061>
- Chen, L., Cheng, L., Gao, W., Chen, D., Wang, C., & Ran, X. (2020). Telemedicine in chronic wound management: systematic review and meta-analysis. *JMIR mHealth and uHealth*, 8(6), e15574. <https://doi.org/10.2196/15574>
- Crews, R. T., Schneider, K. L., Yalla, S. V., Reeves, N. D., & Vileikyte, L. (2016). Physiological and psychological challenges of increasing physical activity and exercise in patients at risk of diabetic foot ulcers: a critical review. *Diabetes/Metabolism Research and Reviews*, 32(8), 791-804. <https://doi.org/10.1002/dmrr.2817>
- Crocker, R. M., Palmer, K. N., Marrero, D. G., & Tan, T. W. (2021). Patient perspectives on the physical, psychosocial, and financial impacts of diabetic foot ulceration and amputation. *Journal of Diabetes and its Complications*, 35(8), 107960. <https://doi.org/10.1016/j.jdiacomp.2021.107960>

- Ghadeer, A., Yan, T., Claire, M., Ellen, K., Caroline, M., & McIlwaine, A. (2025). Diabetic foot ulcer related pain and its impact on health-related quality of life. *Journal of Tissue Viability*, 34(2), 100856. <https://doi.org/10.1016/j.jtv.2025.100856>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.) Annabel Ainscow. https://eli.johogo.com/Class/CCU/SEM/_Multivariate%20Data%20Analysis_Hair.pdf
- Hariftyani, A. S., Novida, H., & Edward, M. (2021). Profile of diabetic foot ulcer patients at tertiary care hospital in Surabaya, Indonesia. *Jurnal Berkala Epidemiologi*, 9(3), 293-302. <https://doi.org/10.20473/jbe.V9I32021.293-302>
- Haryanto, H., Makmuriana, L., Hartono, H., Arini, D. D., Ariyanti, S., Sari, Y., ... & Ervita, L. (2023). Quality of life in patients with recurrent diabetic foot ulcers. *Central European Journal of Nursing and Midwifery*, 14(1), 833. <https://doi.org/10.15452/cejnm.2022.13.0025>
- Hogg, F. R. A., Peach, G., Price, P., Thompson, M. M., & Hinchliffe, R. J. (2012). Measures of health-related quality of life in diabetes-related foot disease: A systematic review. *Diabetologia*, 55(3), 552-565. <https://doi.org/10.1007/s00125-011-2372-5>
- Hu, X., Zhao, Z., Zhang, S. K., Luo, Y., Yu, H., & Zhang, Y. (2020). CA-PROM: validation of a general patient-reported outcomes measure for Chinese patients with cancer. *Cancer Epidemiology*, 67, 101774. <https://doi.org/10.1016/j.canep.2020.101774>
- Lee, Y. N. (2019). Translation and validation of the Korean version of the diabetic foot ulcer scale-short form. *International Wound Journal*, 16, 3-12. <https://doi.org/10.1111/iwj.13025>
- Macioch, T., Sobol, E., Krakowiecki, A., Mrozikiewicz-Rakowska, B., Kasproicz, M., & Hermanowski, T. (2017). Health related quality of life in patients with diabetic foot ulceration—translation and Polish adaptation of Diabetic Foot Ulcer Scale short form. *Health and Quality of Life Outcomes*, 15(1), 15. <https://doi.org/10.1186/s12955-017-0587-y>
- Martinez-Gonzalez, D., Dòria, M., Martínez-Alonso, M., Alcubierre, N., Valls, J., Verdú-Soriano, J., ... & Mauricio, D. (2020). Adaptation and validation of the diabetic foot ulcer scale-short form in Spanish subjects. *Journal of Clinical Medicine*, 9(8), 2497. <https://doi.org/10.3390/jcm9082497>
- Mokkink, L. B., Terwee, C. B., Patrick, D. L., Alonso, J., Stratford, P. W., Knol, D. L., Bouter, L. M., & de Vet, H. C. W. (2010). The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *Journal of Clinical Epidemiology*, 63(7), 737–745. <https://doi.org/10.1016/j.jclinepi.2010.02.006>
- Ojo, O., Boateng, J., Pacella, R., Hanrahan, A., Essex, R., & Dibley, L. (2025). Factors influencing the care and management of diabetic foot ulcers: A scoping review. *Endocrine Practice*, 31(3), 380-389. <https://doi.org/10.1016/j.eprac.2024.11.010>
- Paixão, L. O., Zanchetta, F. C., de Aquino Pereira, J., Kaizer, U. A. O., Bramante, C. M., Apolinario, P. P., ... & Melo Lima, M. H. (2025). Factors associations and with health-related quality of life in individuals with diabetic foot ulcers: Cross-sectional study. *Journal of Wound Management*, 26(1), 22-28. <https://doi.org/10.35279/jowm2025.26.01.07>
- Pouwer, F., Mizokami-Stout, K., Reeves, N. D., Pop-Busui, R., Tesfaye, S., Boulton, A. J., & Vileikyte, L. (2024). Psychosocial care for people with diabetic neuropathy: time for action. *Diabetes Care*, 47(1), 17-25. <https://doi.org/10.2337/dci23-0033>
- Raju, B. N., Mateti, U. V., Mohan, R., D'Souza, C., Shastry, C. S., & D'Souza, N. (2022). Transcultural adaptation of the Malayalam version of the diabetic foot ulcer scale-short form. *Clinical Epidemiology and Global Health*, 18, 101190. <https://doi.org/10.1016/j.cegh.2022.101190>

- Russo, S., Landi, S., & Simoni, S. (2025). Cost-effectiveness analysis for managing diabetic foot ulcer (DFU) in USA: Platelet-rich plasma (PRP) vs standard of care (SoC). *ClinicoEconomics and Outcomes Research*, 157-169. <https://doi.org/10.2147/CEOR.S496616>
- Rusu, A., Roman, G., Stancu, B., & Bala, C. (2025). The Burden of Diabetic Foot Ulcers on Hospital Admissions and Costs in Romania. *Journal of Clinical Medicine*, 14(4), 1248. <https://doi.org/10.3390/jcm14041248>
- Sobol, E., Macioch, T., Krakowiecki, A., Mrozkiewicz-Rakowska, B., Kasprowicz, M., & Hermanowski, T. R. (2015). Translation and validation of the polish diabetic foot ulcer scale-short form (DFS-SF). *Value in Health*, 18(7), A615-A616. <https://doi.org/10.1016/j.jval.2015.09.2143>
- Steptoe, A., Deaton, A., & Stone, A. A. (2015). Subjective wellbeing, health, and ageing. *The Lancet*, 385(9968), 640-648. [https://doi.org/10.1016/S0140-6736\(13\)61489-0](https://doi.org/10.1016/S0140-6736(13)61489-0)
- Swaminathan, N., Awuah, W. A., Bharadwaj, H. R., Roy, S., Ferreira, T., Adebuseye, F. T., ... & Papadakis, M. (2024). Early intervention and care for diabetic foot ulcers in low and middle income countries: Addressing challenges and exploring future strategies: A narrative review. *Health Science Reports*, 7(5), e2075. <https://doi.org/10.1002/hsr2.2075>
- Van Leeuwen, K. M., Van Loon, M. S., Van Nes, F. A., Bosmans, J. E., De Vet, H. C., Ket, J. C., ... & Ostelo, R. W. (2019). What does quality of life mean to older adults? A thematic synthesis. *PloS One*, 14(3), e0213263. <https://doi.org/10.1371/journal.pone.0213263>
- World Health Organization (WHO). (2012). WHOQOL User Manual Programme on Mental Health Division of *Mental Health and Prevention of Substance Abuse World Health Organization*. <https://iris.who.int/handle/10665/77932#sthash.jCXbuNFW.dpuf>
- Yunir, E., Hidayah, C. D., Harimurti, K., & Kshanti, I. A. M. (2022). Three years survival and factor predicting amputation or mortality in patients with high risk for diabetic foot ulcer in Fatmawati General Hospital, Jakarta. *Journal of Primary Care & Community Health*, 13, 21501319211063707. <https://doi.org/10.1177/21501319211063707>
- Zhang, P., Lu, J., Jing, Y., Tang, S., Zhu, D., & Bi, Y. (2017). Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. *Annals of Medicine*, 49(2), 106-116. <https://doi.org/10.1080/07853890.2016.1231932>