

Cultural adaptation and validation of patient and observer scar assessment scale 3.0 for keloid scar assessment in Indonesian language

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pISSN: 0853-1773 • eISSN: 2252-8083
<https://doi.org/10.13181/mji.oi.268447>
Med J Indones. 2026;35:115–24

Received: September 30, 2025

Accepted: May 19, 2026

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ABSTRACT

BACKGROUND Keloid, a fibroproliferative skin disorder, requires accurate scar assessment. Comprehensive evaluation using a standardized instrument from both patient and observer perspectives is essential to capture its multidimensional impact. This study aimed to translate, culturally adapt, and validate the generic patient and observer scar assessment scale (POSAS) 3.0 into Indonesian for keloid assessment.

METHODS A cross-sectional design was adopted following the translation and cultural adaptation guidelines. The instrument was translated into Indonesian by certified translators and administered to 68 keloid patients and 62 dermatologists especially recruited from Pekanbaru and the surrounding areas. Content validity was assessed using the scale-level content validity index average (S-CVI/Ave), construct validity through exploratory factor analysis (EFA), internal consistency with Cronbach's alpha, test-retest reliability using the intraclass correlation coefficient (ICC), and external validity by correlating the observer scar assessment scale (OSAS) with the modified Vancouver scar scale (mVSS).

RESULTS The Indonesian version of the generic POSAS 3.0 demonstrated strong psychometric properties. The S-CVI/Ave was 0.97. The EFA revealed 3 factors for the patient scar assessment scale and two for the OSAS, explaining 71.25% and 73.1% of the variance, respectively. Cronbach's alpha was 0.79–0.90 and ICC was ≥ 0.83 . External validity was confirmed by a strong correlation with the mVSS (Spearman's rho = 0.82, $p < 0.001$).

CONCLUSIONS The Indonesian adaptation of the POSAS 3.0 is a valid and reliable tool for comprehensive keloid scar assessment. Future research should explore the responsiveness to therapeutic interventions.

KEYWORDS Indonesia, keloid, psychometrics, reproducibility of results, validation study

Keloids are fibroproliferative dermatoses resulting from an aberrant cellular reaction to injury.^{1–3} This disorder can have considerable physical and psychological effects, frequently resulting in discomfort, pain, pruritus, tenderness, contractures, and diminished self-esteem.⁴ Keloid evaluation is a crucial aspect of clinical practice, particularly in dermatology and plastic surgery, because it facilitates

the assessment of severity, provides suitable treatment approaches, and evaluates therapeutic results.

Current scar assessment scales for hypertrophic scars and keloids include the Vancouver scar scale (VSS), modified Vancouver scar scale (mVSS), visual analog scale, patient and observer scar assessment scale (POSAS), Manchester scar scale, and the Stony Brook scar evaluation scale. Although no gold standard

exists for scar evaluation, simple scale-based methods remain the ideal assessment tools.⁵ The VSS and mVSS are widely used, despite assessing only observer-rated parameters and lacking patient-reported outcomes.^{6,7} This limitation restricts their capacity to capture the multidimensional impact of keloids on the quality of life.

The generic POSAS 3.0 is a validated instrument developed to evaluate scars from both the patient's and observer's perspectives, thereby offering a more holistic understanding of scar quality. It is publicly accessible at <https://www.posas.nl/>. This version, released in 2022,⁸ is the most recent tool update. A key improvement over POSAS 2.0 is the simplification from a 10-point to a five-point response scale across all items, where higher scores indicate greater deviation from normal skin.⁸ Previous versions of the POSAS demonstrated strong validity, reliability, and comprehensiveness, making them a widely accepted tool in scar research.^{9–11}

Accurate linguistic translation and cultural adaptation are essential for implementing the generic POSAS 3.0 within the Indonesian context. The primary objectives of this study were to translate the POSAS 3.0 into Indonesian, perform the necessary cultural adaptations, and assess the validity and reliability of the translated version. Additionally, this study aimed to contribute to the development of a culturally relevant and inclusive measurement instrument applicable to public health practices in Indonesia.

METHODS

This study employed a cross-sectional design aimed at translating and culturally adapting the generic POSAS 3.0 into Indonesian and evaluating the validity and reliability of the translated measurement tool. This design allowed for data collection from respondents at a single point in time, providing a clear snapshot of the instrument's effectiveness in the local context. The generic POSAS 3.0 comprises two independent scales, each preceded by an optional global rating item (item 0) that is scored separately and excluded from the total scale score: (1) The patient scar assessment scale (PSAS) with 16 core items assessing color, shine, surface relief, hardness, irregularity, hypersensitivity, numbness, pain, shooting sensation, burning sensation, itching, tingling sensation, tightness at rest, tightness during movement, fragility, and dryness; and (2) The observer

scar assessment scale (OSAS) with seven core items evaluating pigmentation, vascularization, surface level, surface texture (irregularity), pliability (hardness/firmness), adhesion to underlying tissue, and tension. Each item is scored on a five-point scale (1 = normal skin/no symptoms, 5 = worst scar/maximal symptoms). Higher scores indicated greater deviation from normal skin or more severe symptoms.⁸

The target population comprised patients diagnosed with keloids who attended Syafira General Hospital and several other hospitals in Pekanbaru. Data were collected between April 2024 and August 2024. Participants were selected using purposive sampling based on the following inclusion criteria: age ≥ 18 years, physician-confirmed diagnosis of keloids, and willingness to participate in the study. The exclusion criterion was a keloid duration of < 6 months. Recruitment was conducted directly by dermatologists, who identified eligible patients during clinical consultations and invited them to participate. Qualified participants were then asked to complete an online questionnaire. Based on the literature, the recommended sample size for factor analysis in questionnaire studies ranges between 50 and 1,000 participants, whereas the item-to-response ratio typically ranges between 1:3 and 1:20.^{12–14} The 1:3 ratio remains acceptable under practical constraints,¹³ as keloid cases are relatively uncommon in clinical practice. This ratio represents the minimum number of respondents required per questionnaire item to ensure stable factor solutions during exploratory factor analysis (EFA). In the context of the POSAS 3.0, a 1:3 ratio translates to a minimum of 48 respondents for the 16-item PSAS and 21 respondents for the seven-item OSAS. Therefore, the anticipated minimum sample size for this study was determined to be 50 participants per scale, or a 1:3 item-to-respondent ratio.

Data collection using the Indonesian version of the generic POSAS 3.0 was conducted via an online form distributed to keloid patients and dermatologists in Pekanbaru and the surrounding area. This translated version was subsequently used in a randomized clinical trial in Pekanbaru, as outlined in a previously published study protocol.¹⁵

Formal permission to use and translate the questionnaire was obtained from the POSAS team via email. The translation and cultural adaptation process of the generic Indonesian version of the POSAS 3.0 follows the guidelines proposed by Beaton et al,¹⁶

which included the following stages: translation (stage I), synthesis (stage II), back-translation (stage III), expert panel review (stage IV), and pre-testing (stage V). Following the pre-testing stage, the final version of the instrument was developed through the final revision process and tested for validity and reliability. The translation and adaptation processes involved dermatologists, certified translators, and language experts during the forward- and back-translation stages. The translators were certified by the Ministry of Law and Human Rights of the Republic of Indonesia and had more than 5 years of experience. The results of the translation process are as follows:

Stage I (translation)

The POSAS 3.0 was translated into Indonesian, resulting in two initial translations: translation 1 (T1) and translation 2 (T2).

Stage II (synthesis)

The two translations were compared to identify any differences that might alter the meaning or reflect only stylistic variations. A discussion among three dermatologists was conducted to review these differences. Overall, both translations were largely consistent and easily understandable. However, certain phrases required careful handling to avoid misinterpretation owing to literal translations. For instance, the phrase “unaffected skin” on the OSAS was translated not literally as “*kulit yang tidak terpengaruh*,” which may sound too direct, but rather as “*kulit normal di sekitarnya*.” Similarly, the term “shooting sensation” in the PSAS was initially translated as “*sensasi tembakan*,” which some laypersons might find difficult to understand because most people have never experienced such a sensation. To clarify, the additional words “*tertusuk dan tiba-tiba*” were added, although the original phrase was retained to allow the respondents to imagine the sensation themselves. Another example is the word “tight,” which was translated as “*kencang*,” but owing to its potential ambiguity in Indonesian (as it can also mean “fast”), the term “*ketarik*” was added to enhance clarity, as it is more familiar to the public. This resulted in a combined version called T12.

Stage III (back-translation)

Two English language teachers performed back-translation (BT) into English, resulting in BT1 and BT2.

The BT showed semantic equivalence with the original version without altering the intended meaning in Indonesian. For example, the word “firm” (original OSAS item no. 5) was rendered as “hard” and “rigid” in the BT. The terms “raised” or “sunken” (original PSAS item no. 3) became “concave” and “convex.” The word “hard” (original OSAS item no. 4) was translated back as “rigid.” The word “irregular” (original PSAS item no. 5) became “uneven” and “bumpy.” The term “fragile” (original PSAS item no. 15) was translated back as “brittle.” These BTs ensured that the meaning remained intact when returned to the source language. The English terms used in the generic POSAS 3.0 were generally simple and straightforward, allowing accurate translation into Indonesian without loss of meaning.

Stage IV (expert panel review)

An expert panel review was conducted among participating dermatologists, translators, and language experts. Based on their evaluation, the translation from stage II was deemed acceptable, as it preserved the original meaning of the items.

Stage V (pre-testing)

The pre-test phase consisted of 130 respondents: 68 patients and 62 dermatologists. The participants completed an online form of the translated POSAS (version 3.0). In addition to completing the questionnaire items, participants were asked to provide feedback on potential improvements.

For the PSAS, ≥90% of the respondents reported that the translated version was understandable. However, some patients expressed confusion regarding the interpretation of the sensations described in the questionnaire and suggested the inclusion of frequency indicators.

“Untuk item pertanyaan no 9, 10, dan 12 sedikit ada keraguan bagi saya untuk menjawabnya karena pertanyaan terlalu umum, mungkin perlu ditambahkan kata pernah mengalami, sering mengalami, atau selalu mengalami” (“I had a bit of doubt answering questions number 9, 10, and 12 because the questions were too general. Perhaps it would help to add words like “have experienced,” “often experience,” or “always experience.”)

“Ada sedikit keraguan, karena yang dirasakan hanya kadang-kadang saja” (“I felt a little unsure because the sensation only happens occasionally.”)

“Paham cuma mungkin bisa pilihannya bisa kadang-kadang, selalu. Terus bisa ditambahkan ukuran luka kira-kira berapa, dan ada berapa banyak keloid di tubuh” (“I understand, but maybe the options could include ‘sometimes’ or ‘always.’ Also, it might help to add a question about the approximate size of the scar and how many keloids are on the body.”).

These suggestions were likely owing to a lack of attention to the questionnaire instructions, which required patients to focus on a specific keloid and the sensations experienced within the past week rather than their overall or long-term experiences. Regarding the dermatologist version, nearly all participants indicated that the questionnaire was understandable. Some provided feedback:

“Memerlukan waktu yang cukup lama untuk memahami maksud tiap pertanyaan, mungkin dapat lebih disederhanakan bahasanya” (“It took quite some time to understand the meaning of each question; maybe the language could be made simpler.”) Unfortunately, no further clarification statement was provided regarding which specific wording could be simplified, as the language used appeared to be standard clinical terminology.

“Yang agak membingungkan mengenai tekstur permukaan bekas luka” (“There was some confusion regarding the description of the scar surface texture”). This may indicate insufficient attention to the definition provided in the questionnaire, in which texture refers to the surface condition of the scar and not whether it is shiny.

Another suggestion was to replace *“ketegangan”* with *“rasa tertarik/tertarik”*. *Rasa* refers to a sensation in English, which likely reflects a misunderstanding of the observer’s role as this sensation is self-reported by the patient and not assessed by the physician. Following discussions with other dermatologists, we concluded that the feedback did not significantly affect the overall quality of the translated version. Thus, the final translated version was established, which can be viewed on the website <https://www.posas.nl/>.

Following the final translation, the content validity was assessed using a content validity index (CVI). A questionnaire is considered to have good content validity if the item-level content validity index (I-CVI) is ≥ 0.78 , the scale-level content validity index (S-CVI) is ≥ 0.80 , and construct validity will be evaluated through EFA. Prior to conducting EFA, the suitability of the data

was evaluated using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity.¹⁷

Factor analysis was performed after confirming sampling adequacy with a KMO value exceeding the 0.60 threshold. Additionally, a statistically significant result from Bartlett’s test ($p < 0.05$) indicated that the correlation matrix is not an identity matrix and that sufficient relationships exist among the variables for EFA. Internal consistency was tested using Cronbach’s alpha, where a value of ≥ 0.70 is considered acceptable for good internal reliability.¹⁸

For test-retest reliability, the translated questionnaire was administered to the same respondents twice, with a 1-week interval for patients and a 3-day interval for dermatologists or observers. This ensured that the instrument produced consistent results over time, confirmed the accuracy of the translation, and supported the validity of the adapted version for the target population.¹⁹ The results were analyzed using intraclass correlation coefficient (ICC). External validity will be assessed using Pearson’s or Spearman’s correlation coefficients, depending on the distribution of the data after normalization, particularly when comparing score ranges that differ significantly. The mVSS,⁷ which is commonly used in Indonesia as a subjective scar assessment tool, was used. The mVSS is an observer-rated instrument adapted from the original VSS developed by Baryza and Baryza.⁶ It assesses four clinical scar characteristics (vascularity, pigmentation, pliability, and height) through visual inspection and manual palpation, with each domain scored relative to the adjacent unaffected skin (0 = normal). Unlike the original VSS, which yielded a maximum total score of 13, this modified version incorporates pigmentation into the overall assessment, resulting in a total score range of 0–14, with higher scores indicating greater scar severity.⁷

This study adhered to all applicable ethical guidelines. Ethical approval was obtained from the Medical and Research Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada – Dr. Sardjito General Hospital (Ref: KE/FK/0868/EC/2024). All participants will be required to provide informed consent prior to their participation, and all collected data will be kept confidential.

Table 1. Demographic and keloid characteristics of patients who completed the patient scar assessment scale (PSAS)

Category	Subcategory	Number of patients (N = 68)	Number of keloids (N = 78)
Sex	Female	39	-
	Male	29	-
Number of keloids	Single	50	-
	Multiple	18	-
Cause of keloid	Unknown cause	14	-
	Surgical wound	15	-
	Trauma/accident	24	-
	Post skin infection	15	-
Keloid location	Face	-	5
	Chest	-	27
	Extremities	-	28
	Other areas	-	26
Keloid duration	6 months–5 years	40	-
	5–10 years	13	-
	≥10 years	15	-

RESULTS

The research subjects who participated in this study consisted of approximately 68 patients with keloid who met the inclusion criteria and 62 dermatologists from Pekanbaru and other regions with more than 5 years of clinical experience. A sample size of 68 patients for the 16-item PSAS yielded an item-to-respondent ratio of 1:4.2, which is within the recommended range for factor analysis. The demographic and keloid characteristics of the 68 patients with keloid are summarized in Table 1. Most participants were female, with keloids predominantly located in the extremities and chest. A single keloid was the most common presentation, primarily resulting from trauma or injury, and a substantial proportion of the lesions persisted for more than 5 years. There were no missing data for any of the POSAS items. All respondents completed the questionnaire, ensuring data completeness and minimizing bias in the psychometric evaluation.

The PSAS and OSAS differ in terms of respondent characteristics, purpose, scale structure, and assessment approach; therefore, they should be analyzed separately. A validity analysis was conducted on the collected data. Content validity was evaluated by five dermatologists across all 25 items of the

generic POSAS 3.0 questionnaire, including the general assessment of keloids in item 0 for both the PSAS and OSAS. This is shown in Table 2. Each item is rated on a scale of one to four (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = highly relevant). The CVI was calculated for each item using the formula (Equation 1), where the number of raters indicating relevance (score 3 or 4) was divided by the total number of raters.

$$I - CVI_{(item-level\ CVI)} = \frac{\text{Number of experts who gave a score 3 or 4}}{\text{Total number of experts}} \quad (1)$$

The scale-level content validity index average (S-CVI/Ave) quantified the overall content validity of an instrument by calculating the mean of all I-CVI values (Equation 2).

$$S - CVI / Ave = \frac{\text{Sum of all } I - CVI \text{ values}}{\text{Total number of items}} \\ = \frac{24.2}{25} = 0.97 \quad (2)$$

The construct validity of the PSAS was evaluated using data from 68 patients with keloid who completed a 16-item Indonesian questionnaire. EFA assumptions were confirmed with a KMO value of 0.87 and Bartlett's test of sphericity $\chi^2 = 1,245.67$ (df = 120, $p < 0.001$), and the analysis using principal component analysis with varimax rotation extracted three factors based on eigenvalues >1 , accounting for 71.25% of the total variance (Table 3). The first factor, which encompassed the physical appearance of scars, explained 32.5% of the total variance. This factor included items related to the physical characteristics of scars, such as "warna" (color), "kilap" (shine), "timbul/cekung" (raised/sunken), "kekerasan" (hardness), and "ketidakrataan permukaan" (irregularity). The second factor, which covered pain/sensitivity sensations, explained 23.75% of the total variance. This factor included items related to pain or sensitivity sensations in scars, such as "rasa sakit" (pain), "gatal" (itching), "terbakar" (burning), and "kesemutan" (tingling). Finally, the third factor, which addressed tightness and dryness sensations, explained 15.0% of the total variance. This factor included items related to feelings of "ketarik" (tightness) both at rest and during movement, and "rasa kering" (dryness) in scars. The internal consistency was assessed using Cronbach's alpha. The overall Cronbach's alpha was 0.87.

An EFA of the OSAS was performed on data from 62 observers who rated the seven items. The KMO

Table 2. CVI of the generic POSAS 3.0

Item	The item of generic POSAS 3.0 in Indonesian	I-CVI (relevant and highly relevant)
The PSAS		
0	<i>Kepuasan secara umum</i>	1.0
1	<i>Perbedaan warna</i>	1.0
2	<i>Kilap</i>	1.0
3	<i>Bekas luka timbul atau cekung</i>	1.0
4	<i>Kekerasan</i>	1.0
5	<i>Ketidakrataan permukaan</i>	1.0
6	<i>Sensitivitas terhadap sentuhan</i>	0.8
7	<i>Kurang sensitif terhadap sentuhan (kebas)</i>	0.8
8	<i>Rasa sakit pada bekas luka</i>	1.0
9	<i>Sensasi tertusuk dan tiba-tiba/rasa tertembak</i>	0.8
10	<i>Sensasi terbakar</i>	0.8
11	<i>Rasa gatal</i>	1.0
12	<i>Sensasi kesemutan atau seperti tertusuk-tusuk jarum</i>	1.0
13	<i>Kencang/ketarik saat istirahat</i>	1.0
14	<i>Kencang/ketarik saat gerakan</i>	1.0
15	<i>Rapuh</i>	0.8
16	<i>Terasa kering jika tidak dilembabkan</i>	1.0
The OSAS		
0	<i>Kualitas bekas luka secara keseluruhan</i>	1.0
1	<i>Pigmentasi</i>	1.0
2	<i>Vaskularisasi</i>	1.0
3	<i>Tingkat permukaan</i>	1.0
4	<i>Tekstur permukaan</i>	1.0
5	<i>Kekerasan</i>	1.0
6	<i>Perlekatan</i>	1.0
7	<i>Ketegangan</i>	1.0

CVI=content validity index; I-CVI=item-level content validity index; OSAS=observer scar assessment scale; POSAS=patient and observer scar assessment scale; PSAS=patient scar assessment scale

value was 0.88, and Bartlett's test for sphericity was significant ($\chi^2 = 1,523.47$, $p < 0.001$). Principal axis factoring with varimax rotation extracted two factors based on eigenvalues > 1 (Table 4), accounting for 73.1% of the total variance. The first factor explained 46.3% of the variance and included "pigmentasi" (pigmentation), "vaskularisasi" (vascularization), "tekstur permukaan" (surface texture), and "kekerasan" (hardness). The second factor explained 26.8% of the variance and included "perlekatan" (adhesion), "ketegangan" (tension), and "tingkat permukaan" (surface level). The Cronbach's alpha was 0.85 for the total scale.

Test-retest reliability was assessed. For the PSAS, 47 of the 68 patients completed the assessments at 1-week intervals. The ICC for the 16 items ranged from 0.83–0.89 (mean ICC = 0.86; 95% confidence interval

[CI]: 0.76–0.92). For OSAS, 59 of the 62 dermatologists completed the assessments at a 3-day interval. The ICC for the seven items ranged from 0.83–0.89 (mean ICC = 0.86; 95% CI: 0.77–0.92).

The external validity of the OSAS was assessed by comparing its scores with those of the mVSS, using data from 59 dermatologists who evaluated the same keloid lesions using both instruments. Raw scores were normalized to a 0–1 scale (OSAS range: 7–35; mVSS: range 0–14) owing to different scoring systems. The Shapiro–Wilk test indicated a non-normal distribution of normalized scores ($p < 0.05$). The Spearman's rank correlation coefficient between the two scales was $\rho = 0.82$ (95% CI: 0.71–0.89, $p < 0.001$).

To demonstrate the clinical application of the Indonesian version of the generic POSAS 3.0, a

Table 3. Loading factor patient scar assessment scale (PSAS)

Item description (Indonesian)	Factor 1 (physical characteristics)	Factor 2 (pain/sensitivity sensations)	Factor 3 (tightness/dryness sensations)
<i>Perbedaan warna</i>	72	-	-
<i>Kilap</i>	69	-	-
<i>Timbul/cekung</i>	75	-	-
<i>Kekerasan</i>	71	-	-
<i>Ketidakrataan</i>	73	-	-
<i>Sensitivitas berlebih terhadap sentuhan</i>	-	82	-
<i>Kurang sensitif terhadap sentuhan</i>	-	78	-
<i>Rasa sakit</i>	-	81	-
<i>Sensasi tertusuk/tertembak</i>	-	76	-
<i>Sensasi terbakar</i>	-	74	-
<i>Rasa gatal</i>	-	79	-
<i>Sensasi kesemutan/tertusuk jarum</i>	-	77	-
<i>Rasa kencang/ketarik saat istirahat</i>	-	-	83
<i>Rasa kencang/ketarik saat bergerak</i>	-	-	81
<i>Kerapuhan bekas luka</i>	-	-	79
<i>Kekeringan bekas luka</i>	-	-	80

Table 4. Loading factor observer scar assessment scale (OSAS)

Item descriptions (Indonesian)	Factor 1 (texture and appearance)	Factor 2 (attachment and tension)
<i>Pigmentasi</i>	0.83	-
<i>Vaskularisasi</i>	0.81	-
<i>Tingkat permukaan</i>	0.78	-
<i>Tekstur permukaan</i>	0.71	0.47
<i>Kekerasan</i>	0.71	-
<i>Perlekatan</i>	-	0.87
<i>Ketegangan</i>	-	0.85

clinical illustration of keloid scar assessment using the Indonesian version of the generic POSAS 3.0 is presented in Figure 1. The inclusion of a 1-cm scale marker ensured an accurate size reference, and the image was captured with patient consent for research and publication purposes.

DISCUSSION

The translation and cultural adaptation of the generic POSAS 3.0 to Indonesian represent a significant advancement in the comprehensive assessment of keloid scars in the Indonesian healthcare context.

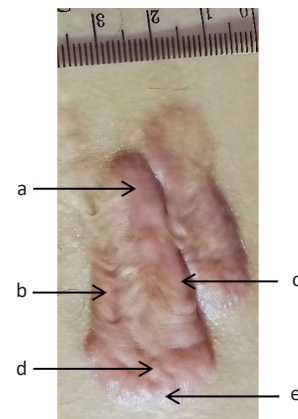


Figure 1. Clinical illustration of keloid scar assessment using the Indonesian version of the generic POSAS 3.0. (a and b) Color (item 1-PSAS, items 1 and 2 OSAS); (c) level (item 3-PSAS, item 3-OSAS); (d) irregularity (item 5-PSAS, item 4-OSAS); (e) shine (item 2-PSAS). OSAS=observer scar assessment scale; POSAS=patient and observer scar assessment scale; PSAS=patient scar assessment scale

This study demonstrated that the translated version exhibits strong psychometric properties, including high content validity, sound construct validity, excellent internal consistency, robust test-retest reliability, and good external validity. These findings are consistent with those of other validated versions of the POSAS, such as the Portuguese version,¹⁹ reinforcing its cross-cultural applicability and utility as a reliable scar assessment tool.

An S-CVI of 0.97 indicated that the items are highly relevant and adequately represent the underlying constructs of keloid assessment. This supports the instrument's ability to capture patient-reported symptoms and clinician-observed scarring. The EFA confirmed a three-factor structure for the PSAS, specifically physical appearance, pain/sensitivity sensations, and tightness/dryness sensations, which accounted for 71.25% of the total variance, surpassing the practical threshold of 60% that is often considered adequate in the social sciences.²⁰ Similarly, the OSAS demonstrated a two-factor structure comprising scar texture and appearance, and scar attachment and tension, which collectively explained 73.1% of the total variance. This structure aligns with the clinical distinction between visual-tactile evaluation and mechanical-functional scar assessment, thereby providing a robust framework for future research and clinical applications.

The instrument demonstrated excellent internal consistency, with Cronbach's alpha values ranging from 0.79 to 0.90 across scales and factors. These values indicate that each factor exhibited good-to-excellent reliability, suggesting that the instrument can be used consistently to measure aspects relevant to scars. Overall, the high levels of internal consistency across all factors provided strong evidence of the instrument's reliability and robustness in capturing the intended constructs related to scarring experiences.

Test-retest reliability was also excellent, with ICC values ≥ 0.83 for all items in both the PSAS and OSAS, indicating high temporal stability. For the PSAS, only 69% of the participants completed both the initial and retest assessments. The primary reasons for nonresponse in the retest phase were lost contact, limited internet access, and scheduling conflicts. All 16 PSAS items demonstrated excellent stability. For the OSAS, around 95% of the observers participated in both assessments. Three experts were unable to complete the retest, likely because of time constraints. All seven OSAS items showed excellent mean ICC values, confirming their reliability and stability in clinical evaluations over time. The high ICC values and narrow CIs for both scales demonstrate that the Indonesian version of POSAS 3.0 produces consistent and reproducible results across repeated administrations, thereby supporting its use in longitudinal studies and routine

clinical practice. External validity was supported by a strong correlation between the OSAS and the mVSS, confirming its convergent validity with an established observer-rated tool. This indicated a high degree of agreement between the two instruments in assessing scar severity, thus supporting the external validity of the Indonesian version of the OSAS. These findings demonstrate that the OSAS produces results consistent with those of an established clinical assessment tool, reinforcing its validity for use in observer-based scar evaluations within the Indonesian context.

Although Pekanbaru is ethnically diverse and consists of Malay, Javanese, and Minangkabau populations, the use of *Bahasa Indonesia* as the official national language ensured a shared linguistic framework among all participants. This facilitated a consistent interpretation of the questionnaire items and minimized the risk of cultural or linguistic bias during the validation process. However, further evaluation of regions with dominant local languages is recommended to confirm the broader cross-cultural applicability.

During the translation and pre-testing phases, some challenges emerged, particularly in translating sensory descriptors such as "shooting sensation" or "tightness," which required conceptual rather than literal adaptation. Participant feedback indicated occasional uncertainty, often owing to insufficient attention being paid to the timeframe specified in the instructions (i.e., symptoms in the past week). To address this, we ensured that the respondents were explicitly instructed to focus on the symptoms experienced within the week before completing the questionnaire. Furthermore, we bolded and underlined the relevant instruction phrases in the Indonesian version of the POSAS template.

To further enhance measurement accuracy in future applications, it is recommended that both patients and observers receive brief standardized instructions prior to questionnaire administration. For clinicians, a short training module for the use of the OSAS may improve inter-rater reliability and reduce variability in clinical scoring. Such measures would strengthen the instrument's validity and ensure consistent application across diverse clinical settings.

Figure 1 shows the key observable and patient-reported features assessed using this scale, demonstrating its multidimensional capacity

to capture both clinician-observed and patient-experienced scar characteristics. For the OSAS, visual features corresponded to factor 1 (scar texture and appearance), which includes “*pigmentasi*” (item 1), “*vaskularisasi*” (item 2), “*tingkat permukaan*” (item 3), and “*tekstur permukaan*” (item 4). Similarly, for the PSAS, the image reflected factor 1 (physical characteristics of the scar), encompassing “*warna*” (item 1), “*kilap*” (item 2), “*timbul/cekung*” (item 3), and “*ketidakrataan*” (item 5). These items represent the patient’s visual and tactile perception of the scar, which aligns with clinical findings and enhances the holistic evaluation of scar appearance. The integration of these items into a single clinical image underscores the instrument’s ability to bridge observer and patient perspectives, reinforcing the construct validity of the Indonesian version of the POSAS 3.0.

This study had some limitations. First, the sample size, while adequate for factor analysis, was relatively small (68 patients and 62 dermatologists) and drawn from a specific region, which may have limited the generalizability of the findings. Second, external validity was assessed only for the OSAS by comparison with the mVSS, a subjective observer-based tool. Although this comparison is methodologically sound, it did not evaluate the full POSAS system, which fully captures the multidimensionality of scar assessments by integrating both patient-reported outcomes (PSAS) and clinician-reported observations (OSAS). Future research should include larger and more diverse populations and evaluate the responsiveness of the instrument to therapeutic interventions.

In conclusion, this study successfully translated and culturally adapted the generic POSAS 3.0 into Indonesian and demonstrated its validity and reliability in assessing keloid scars in the Indonesian population. The translated instrument retains the psychometric robustness of the original version and offers a comprehensive and reliable tool for evaluating patient-reported and clinically observed scar characteristics. The findings support the use of the Indonesian version of the generic POSAS 3.0 in both research and clinical settings, contributing to more accurate and culturally sensitive scar assessments. Future studies should explore its application in larger and more diverse populations and evaluate its responsiveness to therapeutic interventions, further solidifying its role as a

cornerstone of keloid management and scar research in Indonesia.

Conflict of Interest

The authors affirm no conflict of interest in this study.

Acknowledgment

The authors would like to express their sincere gratitude to the POSAS team for their valuable contributions to this work. We especially acknowledge Prof. Dr. Paul van Zuijlen, Dr. Adinda Mieras, and Dr. Anouk Pijpe for their guidance, expertise, and ongoing support throughout the process. Their efforts in developing and maintaining the POSAS system have been instrumental in enabling patient-reported outcome assessments worldwide.

Funding Sources

None.

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