ORIGINAL ARTICLE

SIGNS-M: Psychometric Validation of a Malay Tool to Detect Infant Neglect

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ABSTRACT

Introduction: Child neglect is the most common form of child maltreatment, yet no validated Malay-language tool exists to identify early signs of neglect in infants. The Signs of Neglect in Infants Assessment Scale (SIGNS), developed by Arimoto and Tadaka in 2019, is a self-administered tool for community nurses to detect early neglect. This study aimed to translate and validate the Malay version of SIGN (SIGN-M). **Methods:** The SIGNS tool was translated into Malay via forward-backward translation and expert panel review. A cross-sectional psychometric study was then conducted among 98 community nurses in Malaysia. Psychometric evaluation included content and face validity, internal consistency, test–retest reliability, and construct validity. Exploratory factor analysis (EFA) was performed using Principal Component Analysis with Varimax rotation. **Results:** The SIGNS-M demonstrated good internal consistency (Cronbach's α = 0.94), higher compared to the original version (α = 0.82). Test-retest reliability showed moderate single measure ICC (0.49) and excellent average measure ICC (0.96). EFA supported a three-factor model; Lack of Basic Supervisory Care, Child Underdevelopment, and Lack of Emotional Behaviour which accounted for 74.9% of total variance. All items loaded >0.4 on their respective factors. **Conclusion:** The SIGNS-M is a reliable and valid tool for early identification of infant neglect in Malaysia. Its use may strengthen community-based child protection by enabling timely intervention and targeted support for at-risk families. Future studies should assess predictive validity and applicability across diverse settings.
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INTRODUCTION

Child neglect, defined as a caregiver's failure to provide a child's basic physical, emotional, educational, or protective needs, is the most common form of maltreatment worldwide (1). Global prevalence varies, with rates of physical and emotional neglect estimated at 16.3% and 18.4%, respectively (2). In the U.S., over 674,000 children were reported as victims of abuse and neglect in 2017, while in the UK, up to 16% of young adults reported experiences of neglect (3) In Southeast Asia, the data are limited, but it is reported that the prevalence ranges from 22% in Indonesia (4) to 38.9% in parts of Malaysia (5, 6).

Neglect can have long-term detrimental effects on children, including depression, substance abuse, suicidal behaviour, and high-risk sexual activity (7). In infants, the impact is particularly severe, disrupting critical developmental processes. Early prevention efforts are therefore essential, with community-based identification and support playing a vital role.

However, most existing assessment tools focus on assessing the risk and severity in known neglect cases, primarily for use by child protection services in Western countries. These tools are not designed for early detection or for identifying support needs in infants and caregivers. Furthermore, in Malaysia, there is a lack of validated, Malay-language tools to assess early signs of neglect in infants.

This study aims to translate and culturally adapt the Signs of Neglect in Infants Assessment Scale (SIGNS) into Malay language and to evaluate its psychometric properties for use by healthcare providers in early detection of infant neglect.

MATERIALS AND METHODS

Tool/ Instrument

Signs of Neglect in Infants Assessment Scale (SIGNS) was developed by Azusa Arimoto and Etsuko Tadaka

in 2019 (8). This is self-administered questionnaire for community nurses to assess signs of neglects of infants. It contains 14 items with three main domains that measure: lack of basic supervisory care, child underdevelopment and lack of emotional behaviour. The nurses need to rate signs of neglect that they see in a child based on 3 points Likert-scale (twice or more= 2, once =1 and never = 0).

All items were assessed using a 3-point scale, with scores ranging from 0 (not observed or reported), 1 (once observed neglect) and 2 (observed or reported on two or more occasions during routine practice). Higher scores reflected a greater number of indicators suggestive of neglect.

This relative new questionnaire has a very good internal consistency with Cronbach alpha of 0.82 and demonstrated good criterion validity, as evidenced by a positive correlation with the preexisting scale ($r = 0.335$, $p < .001$). The original SIGNS also demonstrated a robust three-factor structure reflecting key domains of infant neglect: basic supervisory care, child underdevelopment, and lack of emotional behaviour.

Study Design, Sampling and Data Collection

The study comprised two phases: translation of the instrument into Malay language and subsequent cross-sectional validation to determine its psychometric properties (Fig. 1).

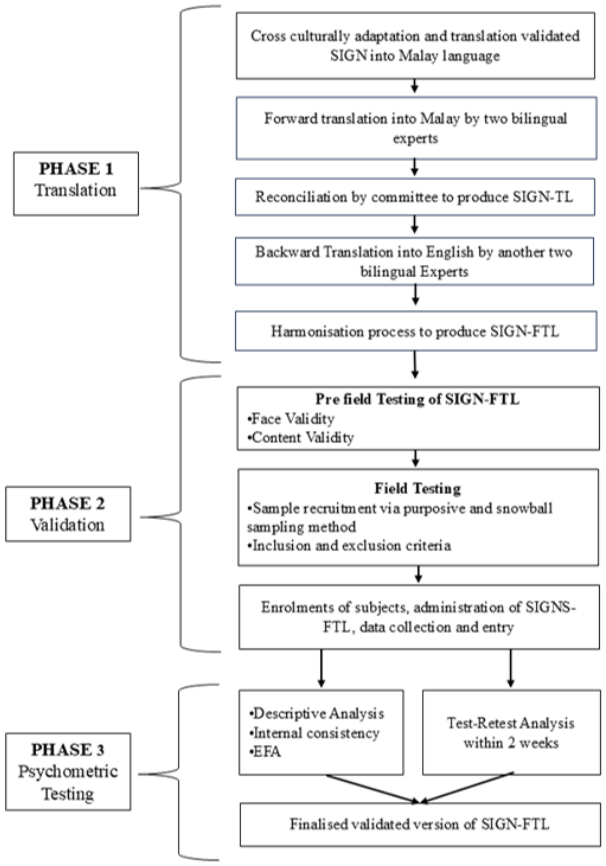

Figure 1: Flowchart of the study

Participants Recruitment

A total of 98 participants were recruited from government health clinics across Kota Bharu, Kelantan. The recruitment began with meeting with nurses' representatives of Kelantan State Health Department. During this session, the study's purpose, protocol, ethical considerations, and the importance of confidentiality and voluntary participation were thoroughly explained. Subsequently nurses representative from each local health clinic in Kota Bharu were identified and briefing was done to all representatives and nurses that fulfilled the inclusion criteria were enrolled in this study. The questionnaire was distributed via Google Forms, allowing for efficient and anonymous data collection using unique coding.

Data collection was conducted in two rounds over a two-week period. Twenty-eight voluntary participants completed the same questionnaire twice at a two-week interval. Each session lasted approximately 30 min, with on-site researchers available to address any concerns

Study Phase

Phase 1: Translation Phase

The translation process involves, three stages: Forward translation, backward translation and finally reconciliation. In forward translation, the original questionnaire which is English (SIGNS-SL) will be translated to Malay as the target language (SIGNS-TL). The translators are two bilingual experts, that consist of Paediatric Dentist and certified Malay translator. Following that, a committee will be formed that included the researchers and translators for the process of reconciliation, to compare and merge both forward translated SIGNS to become one forward translation version (SIGNS-PI-TL).

Next a backward translation was done by Senior English Teacher and a certified translator, from Malay to English to produce single backward translated version (SIGNS-BTL).

The final process, the reconciliation phase consists of 4 committee members including researcher and paediatricians who reviewed the backward translated and original translation items. These were compared to ensure that any ambiguities were removed, and finally to agree on the final version of SIGNS-M.

This version was used for content validity, face validity, construct validity, and subsequent psychometric testing. The language teacher and translator involved were certified and specialised in both Malay and English teaching, which ensured linguistic accuracy and proficiency.

Phase 2: Validation and Reliability of SIGNS-M

Content Validity

Content validity was conducted first involving 6 experts that involve 3 paediatric medical officers, 2 paediatricians and one psychologist. They must rate the relevance of questionnaire based on 4 Likert scale (1= not relevant until 4 = very relevant). Subsequently the data was analysed using Microsoft excel to obtain Scale Level Content Validity Index / Universal Agreement and Scale level Content Validity Index/ Average. The value of CVI is considered acceptable if the score is 0.83 (9).

Face Validity

Face Validity was conducted among paediatric nurses in Hospital Pakar Universiti Sains Malaysia. Ten nurses were selected randomly from all paediatric wards in Hospital Pakar USM. They were given briefing regarding the research and rated the comprehensibility from 1 to 4 (1= not clear until 4 =very clear). The data were then calculated to get Face Validity Index by averaging these values. It was conducted face-to-face among the staff nurses to allow immediate clarification especially given the scale's sensitive nature. The accepted value for FVI is 0.8 (10)

Validity of SIGNS-M

Construct Validity

This study was carried out at local health clinics in Kota Bharu, Kelantan. The inclusion criteria were nurses who had attended courses on child neglect or had experience managing child neglect cases, nurses with more than five years of working experience, and nurses who had encountered child abuse cases involving children under one-year-old. Nurses employed in the private sector were excluded.

The largest sample needed was to determine the construct validity of the SIGNS-M scale using exploratory factor analysis (EFA). By using a sample to variable (14 items in the SIGNS-M scale tool) ratio (SVR) of 6:1, a minimum of sample of 98 were required, including a 10% drop out rate (11).

Reliability and Stability Testing

The reliability of the SIGNS-M was assessed using Cronbach's alpha to measure internal consistency. Stability over time was evaluated using the Intraclass Correlation Coefficients (ICC). Twenty-eight participants repeated the questionnaire after two weeks

Data Analysis

The data were analysed by using IBM Statistical Packages for Social Sciences (SPSS) version 27.0. Descriptive statistics were used to summarise the socio-demographic characteristics of the participants, where the numerical data were presented as mean (SD) based on their normality distribution, while categorical data presented as frequency (percentage).

The psychometric analysis properties were analysed by using EFA for Construct Validity while for reliability Cronbach's Alpha and ICC were used.

Construct validity of the SIGNS-M was assessed through EFA. Sampling adequacy was evaluated using the Kaiser-Meyer-Olkin (KMO) test, with values above 0.6 indicating suitability for factor analysis. Bartlett's test of sphericity was deemed significant when the p-value was less than 0.05, suggesting adequate correlations among the items. Principal axis factoring with Varimax rotation was then performed, retaining factors with eigenvalues greater than 1. Items were considered acceptable if their factor loadings exceeded 0.4 (12).

The items in the SIGNS-M indicated a high internal consistency if the total alpha value was more than 0.6 (13-15). Stability of the scale was assessed using ICC, which evaluates the level of agreement between repeated measurements. The ICC and its 95% confidence interval were calculated using a two-way mixed-effects model with absolute agreement and single-measure analysis. Based on established benchmarks, ICC values below 0.50 indicate poor reliability, values from 0.50 to 0.75 indicate moderate reliability, 0.75 to 0.90 suggest good reliability, and values above 0.90 reflect excellent reliability (16).

Ethical Clearance

Permission to translate and validate was approved by publisher SAGE Journal. The study protocol was approved by the Human and Research Ethics Committee Universiti Sains Malaysia Ethics Committee (USM/JEPeM/KK/24060545) as well as National Medical Research and Ethics Committee (NMRR ID-24-02575-HON (IIR). Consent of the participants obtained following a detailed briefing.

RESULTS

Translation Process, Face Validity and Content Validity

Translation and Harmonization Process

The translation process followed a rigorous protocol involving forward translation, backward translation, and harmonisation to ensure linguistic and cultural appropriateness (17). Initially, the instrument was translated from English to Malay by bilingual experts (forward translation). A separate team then translated the Malay version back into English (backward translation) to check for consistency and conceptual equivalence. Discrepancies were reviewed and resolved through a harmonisation process involving both translation teams and subject matter experts.

During harmonisation, item number 2- originally phrased as "Caregiver gives the child inappropriate

clothes for the season or weather"- was modified to "Caregiver gives the child inappropriate clothes." This change was made to reflect Malaysia's tropical climate, which does not experience four distinct seasons, thereby enhancing the cultural relevance and clarity of the item. Other items were kept as they were appropriate and culturally adapted.

Content Validity and Face Validity

Content validity index of SIGNS-M shows good overall index with score more than 0.8. The item-level content validity index is 0.83 or 1.00, the universal agreement index (S-CVI/UA) was 0.86, and the average index (S-CVI/Ave) was 0.97. Thus, all items in the SIGNS-M scale demonstrated a satisfactory level of content validity (Table I).

Similarly with Face Validity index also shows high overall index. The item-level Face Validity index ranges from 0.9 to 1.00, the universal agreement index (S-FVI/UA) 0.78 while the average index is (S-FVI/Ave) is 0.97. This shows that the translated questionnaire is suitable for Malay speaking community (Table II).

Table I: Content Validity Index

	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Experts in Agreements	I-CVI	UA
Item 1	1	1	1	1	1	1	6	1	1
Item 2	0	1	1	1	1	1	5	0.83	0
Item 3	1	1	1	1	1	1	6	1	1
Item 4	1	1	1	1	1	1	6	1	1
Item 5	1	1	1	1	1	1	6	1	1
Item 6	1	1	1	1	1	1	6	1	1
Item 7	1	1	1	1	1	1	6	1	1
Item 8	1	1	1	1	1	1	6	1	1
Item 9	1	1	1	1	1	1	6	1	1
Item 10	1	1	1	1	1	1	6	1	1
Item 11	1	1	1	1	1	1	6	1	1
Item 12	1	1	1	1	1	1	6	1	1
Item 13	1	1	1	1	1	1	6	1	1
Item 14	1	1	0	1	1	1	5	0.83	0
							S-CVI /Ave	0.97	
							S-CVI /UA		0.86
Proportion Prevalence	0.93	1	0.93	1	1	1		0.97	

Psychometric Testing of SIGNS-M

Respondent and Infants with Signs of Neglect Characteristics

A total of 98 nurses involved in this study. The mean age of the nurses is 44.40 (SD 4.240) and mean working

Table II: Face Validity Index

	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	Rater 8	Rater 9	Rater 10	Experts In Agreements	I-CVI	UA
Item 1	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 2	1	1	1	1	1	1	0	1	1	1	9	0.9	0
Item 3	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 4	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 5	1	1	1	1	1	1	1	1	1	0	9	0.9	0
Item 6	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 7	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 8	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 9	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 10	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 11	1	1	1	1	1	1	1	1	1	0	9	0.9	0
Item 12	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 13	1	1	1	1	1	1	1	1	1	1	10	1	1
Item 14	1	1	1	1	1	1	1	1	1	1	10	1	1
											S-FVI/Ave	0.97	
											S-FVI/UA		0.78
Proportion Prevalence	1	1	1	1	1	1	0.93	1	1	0.86		0.97	

as a nurse is 19.64 years (SD 4.401). All of them are Malay and female.

Responses of Each Items

Among the 3 domains assessed by the SIGNS, the "Lack of Basic Supervisory Care" domain showed the highest frequency of observed neglect-related behaviours. Over 70% of respondents reported unclean household conditions (71.4%) and cluttered environments (77.6%). Additionally, more than half observed signs such as dirty clothing (62.2%), inappropriate clothes (50.0%), infrequent bathing (54.1%), and hazardous objects within the infant's reach (48.0%).

In the "Child Underdevelopment" domain, the most frequently reported indicators were inadequate nutrition (71.4%) and skipped feeding or breastfeeding (60.2%). Signs of dehydration (46.9%) and poor weight gain (42.8%) were also noted, though with slightly lower frequencies compared to the first domain.

The "Lack of Emotional Behaviour" domain showed relatively lower but still notable rates: failure to comfort a crying infant (57.1%), limited cuddling (52.0%), infrequent verbal interaction (47.9%), and poor eye contact (38.8%).

These findings suggest that the lack of basic supervisory care was the most reported concern, followed by indicators of underdevelopment and emotional neglect

Construct Validity

Construct validity of the Malay version of the SIGNS was examined by using EFA with Varimax rotation (Table III). Sampling adequacy was confirmed with a KMO value of 0.91 exceeding the recommended threshold of 0.6 indicating that the data were suitable for factor analysis. Bartlett's test of sphericity was significant ($p < 0.001$), suggesting sufficient correlations among the items to proceed with factor extraction.

The EFA revealed a three-factor solution, aligning with the theoretical structure of the original SIGNS. These three factors accounted for 74.9% of the total variance. Items loaded onto the following factors:
Factor 1: Lack of Basic Supervisory Care
Factor 2: Lack of emotional behaviour
Factor 3: Child underdevelopment

All items showed factor loadings above 0.4, supporting their inclusion within each respective domain. No items were removed. The factor structure replicated that of the original version, indicating that the scale retains its conceptual integrity following translation and cultural adaptation.

Internal Consistency

The internal consistency of the Malay version of the Signs of Neglect in Infants Assessment Scale (SIGNS) was evaluated using Cronbach's alpha (Table IV). The overall scale demonstrated excellent reliability, with a Cronbach's alpha of 0.94.

Table III: Items, factor loadings and domains of the SIGNS-M scale

Item no	Items	Rotated Factor Loadings		
		Factor 1 Lack of Basic Supervisory care	Factor 2 Lack of emotional behaviour	Factor 3 Child under-development
Q2	*Caregiver gives inappropriate clothes for children*	0.832		
Q1	*Caregiver dresses the child in dirty clothes*	0.788		
Q4	*Caregiver does not keep the house clean, with trash remaining in the house and stains left uncleaned*	0.765		
Q3	*Care giver does not bathe the child regularly*	0.764		
Q5	*Caregiver does not organize, leaving the house cluttered with many things*	0.757		
Q6	*Caregiver places dangerous objects within the child's reach*	0.650		
Q11	*Caregiver avoids eye contact with the child*		0.798	
Q12	*Caregiver rarely speaks to or praises the child*		0.785	
Q14	*Caregiver does not engage much in intimate connection with the child such as cuddling*		0.763	
Q13	*Caregiver does not comfort the child when the child is crying*		0.713	
Q7	*Child shows signs of poor weight gain*			0.806
Q10	*Caregiver does not fulfil the child's nutritional requirements*			0.686
Q9	*Caregiver skips breast-feeding times required to meet the child's nutritional requirements*			0.675
Q8	*Child shows signs of dehydration*			0.565
	Eigenvalues	8.147	1.447	0.892
	% of Variances	29.028	25.206	20.666

Subscale reliability coefficients were also acceptable: 0.91 for Lack of Basic Supervisory Care, 0.87 for Child Underdevelopment, and 0.90 for Lack of Emotional Behaviour. These values indicate that the items within each domain are measuring a consistent construct and are suitable for continued use in clinical and community settings.

Test- Retest Stability Using Intraclass Correlation Coefficient (ICC)

Test-retest reliability of the Malay version of the Signs of Neglect in Infants Assessment Scale (SIGNS) was assessed using the ICC, calculated via a two-way mixed-

Table IV: Internal consistency reliability of SIGNS-M scale and original version of SIGNS

Factors	Items	Cronbach Alpha SIGNS- M	Cronbach Alpha Original SIGNS
Total		0.94	0.82
Lack of Basic Supervisory Care	6	0.919	0.85
Child Underdevelopment	4	0.877	0.81
Lack of Emotional Behaviour	4	0.906	0.87

effects model with absolute agreement (Table V and VI). The items score ranges from 0.48 to 0.82 indicating moderate to high reliability. The single measure ICC was 0.49 (95% CI: 0.31-0.65), indicating moderate reliability when the scale is used by a single rater. In contrast, the average measure ICC was 0.96 (95% CI: 0.91-0.98), reflecting excellent reliability when used by multiple raters or over repeated assessments.

These results suggest that while individual ratings may vary slightly, the scale yields highly consistent results when applied across raters or time points, supporting its stability and suitability for community-based screening of early signs of infant neglect.

Table V: Intraclass correlation coefficient of all items in SIGNS-M

Items	Intraclass correlation (ICC)	95% CI	
		Lower bound	Upper bound
Lack of Basic Supervisory Care			
Q1	0.623	0.255	0.832
Q2	0.757	0.481	0.896
Q3	0.799	0.557	0.916
Q4	0.704	0.386	0.872
Q5	0.612	0.235	0.827
Q6	0.658	0.310	0.850
Child Underdevelopment			
Q7	0.483	0.090	0.753
Q8	0.591	0.210	0.815
Q9	0.422	0.013	0.722
Q10	0.541	0.138	0.790
Lack of Emotional Behaviour			
Q11	0.745	0.456	0.891
Q12	0.820	0.602	0.925
Q13	0.755	0.486	0.894
Q14	0.639	0.289	0.839

DISCUSSION

This study aimed to develop a culturally sensitive and psychometrically sound tool for identifying signs of infant neglect in Malaysia. Infant neglect is often underrecognized due to the absence of standardized instruments that reflect local cultural contexts. To address this, the Signs of Neglect in Infant Assessment Scale (SIGN), originally developed by Arimoto and Tadaka, was translated and adapted into Malay—resulting in the SIGNS-M, the first validated version for use in Malaysia. The translation process followed established forward–backward protocols, with expert panel review ensuring semantic and conceptual accuracy (17). Minor cultural modifications were made to improve contextual relevance, such as revising Item 2 to reflect Malaysia's tropical climate. The final 14-item scale demonstrated strong clarity and accessibility, reflected in a 100% response rate from healthcare providers.

Face and content validity were supported by satisfactory FVI and CVI scores. Exploratory Factor Analysis (EFA) revealed a three-factor structure consistent with the original SIGN scale, accounting for 74.9% of total variance. These factors were interpreted as: lack of basic supervisory care, emotional neglect behaviours, and child underdevelopment. According to Hair et al. (18), for a sample size of approximately 100, factor loadings of 0.50–0.60 are considered statistically meaningful. In this study (n = 98), all items demonstrated loadings between 0.60 and 0.80, exceeding the recommended threshold. No cross-loadings were observed, and all items loaded cleanly onto a single factor, supporting the structural integrity and construct validity of the SIGNS-M.

Reliability analysis showed excellent internal consistency, with a total Cronbach's alpha of 0.94 and domain-specific alphas ranging from 0.87 to 0.91. While high alpha values indicate strong reliability, Streiner cautions that values above 0.90 may suggest item redundancy rather than true homogeneity. Future refinement could include item-level analysis to identify overlapping items and enhance the scale's parsimony (19).

Test-retest reliability was assessed using intraclass correlation coefficients (ICC). Item-level ICCs ranged from 0.42 to 0.82, indicating moderate to good reliability. The single-measure ICC was 0.49, while the average-measure ICC reached 0.96, suggesting excellent reliability in team-based settings—consistent with collaborative practices in Malaysian maternal and

Table VI: Intraclass Correlation Coefficient by using Single Measures and Average Measures

		95% Confidence Interval		F Test with True Value 0			
	Intraclass Correlation	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	**.494[a]**	**.351**	**.681**	**31.007**	**19**	**513**	**.000**
Average Measures	**.965[c]**	**.938**	**.984**	**31.007**	**19**	**513**	**.000**

child health services.

While the psychometric properties of the instrument used in this study were found to be acceptable within the Kota Bharu sample, caution is warranted when generalizing findings to other Malaysian populations (20). Previous studies have shown that cultural, regional, and demographic factors can influence scale performance and factor structures (21-23). Thus further study involving larger sample size and more ethnic group involvement is warranted.

CONCLUSION

The validated Malay version of the SIGNS offers a practical and culturally appropriate tool for community health nurses and front-line healthcare workers to detect early signs of infant neglect. By facilitating earlier identification and referral, it has the potential to reduce long-term adverse outcomes through timely intervention, education, and family support. This aligns with national child protection goals and complements ongoing public health strategies aimed at early childhood development.

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