



Translation and validation of the Intelligibility in Context Scale into Sinhala for adolescents in Sri Lanka with cleft lip and palate

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ABSTRACT

The Intelligibility in Context Scale (ICS) is a parent-report screening tool used to measure parents' perceptions of children's functional intelligibility. This tool has been translated into over 60 languages and found to have a good reliability and validity. The purpose of the current study was to translate the ICS into Sinhala (the ICS-SIN), the main language spoken by the Sinhalese people in Sri Lanka, and to validate it with both typically developing (TD) children and children with repaired cleft lip and/or palate (CLP). The translation process followed the forward-backward-forward method. A total of 88 parents of TD children and children with CLP aged 12–15 years old (TD $n = 50$, CLP $n = 38$) completed the ICS-SIN questionnaire. Parents of TD and CLP children reported their children's speech as most intelligible to parents and least intelligible to strangers. The ICS-SIN had high internal consistency for both groups (TD $\alpha = 0.87$, $p < 0.05$, CLP $\alpha = 0.97$, $p < 0.05$). The ICS-SIN total scores and item scores showed significant correlations, indicating a good construct validity. TD participant group's ICS-SIN average mean scores ($M = 4.88$, $SD = 0.29$) were significantly higher compared to the CLP ICS-SIN average mean scores ($M = 4.64$, $SD = 0.67$) and varied according to gender in both groups, suggesting good discriminant validity. The ICS-SIN has overall good psychometric properties. Therefore, this tool has the potential to be used as a valid parent-rating screening tool for clinical and research purposes in Sri Lanka.

ARTICLE HISTORY

Received 5 December 2021
Revised 29 July 2022
Accepted 22 August 2022

KEYWORDS

Sinhala; intelligibility;
adolescents; cleft lip and
palate

Introduction

A key issue for speakers with cleft lip and palate (CLP) is achieving speech that can be readily understood by others. Despite the fact that in most countries surgery to repair CLP early in life leads to intelligible speech, there remains a proportion of adolescents and adults who have difficulty making themselves understood. For example, a recent study conducted in Sweden showed that around 87% to 91% of 19-year-olds born with unilateral CLP report good intelligibility, leaving around 10% with ongoing intelligibility issues (Peterson et al., 2022). In the United Kingdom, Timmons et al. (2021) reported age-appropriate speech intelligibility in only 47% of 12-year-olds with CLP. In Italy, Rullo et al. (2009) reported normal intelligibility in 47.05% of five- to eight-year-olds with non-syndromic CLP. While the figures may vary across countries, it's clear that intelligibility remains an issue in a proportion of speakers with CLP. Moreover, intelligibility is a key surgical outcome for

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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CLP, and measurement of it across childhood is crucial in determining whether individuals with CLP require speech and language therapy or further surgical interventions (Sell, 2005).

There are various methods of measuring intelligibility in speakers with CLP. Perceptual evaluation is the most common method because the aim of interventions is to achieve speech that is perceptually accurate, and therefore has good face validity. Kuehn and Moller (2000) highlighted that perceptual judgements are practical, appropriate to use with young children, and not easily replaced with instrumental techniques. The gold standard approach, phonetic transcription, can be used to record a speaker's productions which can then be analysed to determine, for example, percentage consonants correct. This in turn is used to quantify either the degree of difficulty or any improvements in speech over time. However, despite this being the 'gold standard', reliability can be low (Sell & Sweeney, 2020) and approaches such as this may not represent a speaker's capacity to be comprehensible in context (Hashemi Hosseinabad et al., 2022).

There have therefore been calls for a more functional approach that measures outcomes that matter to patients and their families: that is, how well the speaker is understood by others. Examples of more functional approaches include ordinal and visual analogue scales (Bettens et al., 2018) and use of multiple listeners comparing speech to a hypothetical adult model (Roxburgh et al., 2016). The International Consortium for Health Outcomes details a list of suggested outcome measures for CLP (Apon et al., 2021). Among the set of suggested outcomes for measuring articulation and intelligibility is the Intelligibility in Context Scale (ICS; McLeod et al., 2012a).

The ICS is a subjective rating scale completed by parents or carers. It was developed by McLeod et al. (2012a) as a parent-report screening tool for English-speaking preschool children as a quick and easy way of measuring speech intelligibility with seven different communication partners (McLeod, 2020). It considers perceptions of a child's functional speech intelligibility with a range of communication partners differing in levels of authority and familiarity in real-life situations (Neumann et al., 2017). The ICS fits within the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY; World Health Organization, 2007). That is, in contrast to other measures of intelligibility that look mainly at speech production (body function within the ICF-CY) the ICS also looks at contextual factors (McLeod et al., 2012). The scale is relatively quick to complete, consisting of only seven items rated by parents or caregivers on a 5-point Likert scale. All seven questions must be answered, producing a maximum score of 35. An average score is then reported for the seven items, with a higher total score indicating a higher speech intelligibility rating (McLeod et al., 2012). Each item of the questionnaire focuses on relevant contexts identified in the ICF-CY such as support and relationships, immediate and extended family, friends, acquaintances, peers, colleagues, neighbours and community members, people in positions of authority and strangers (Pascoe & McLeod, 2016).

The ease with which the scale can be completed by parents/carers makes it an attractive clinical and research tool. Moreover, the original English language version was initially validated on 120 Australian English-speaking children aged 3;11 to 5;8 years and has high internal reliability ($\alpha = 0.93$), construct validity and sensitivity (McLeod et al., 2012), making it a robust tool for measuring functional intelligibility in a range of speech sound disorders. Subsequently, the ICS has been translated into over 60 languages by speech and language pathologists, phoneticians, linguists and accredited translators. There are 18 validation/norming studies of the ICS including 4235 children in 14 countries (Australia,

Croatia, Fiji, Germany, Hongkong SAR China, Italy, Korea, Jamaica, The Netherlands, New Zealand, Portugal, Slovenia, Sweden, Viet Nam) published to date (McLeod, 2021). Some of these validation studies included typical children only (Washington et al., 2017; Kim et al., 2016) and some SSD only (Lagerberg et al., 2019) and some with both TD and SSD (Ng et al., 2014, Kok and To, 2019; McLeod et al., 2012b; Neumann et al., 2017) aged from 1; 2 to 15 years; however, most studies focus on preschool-aged children.

The ICS has been used as an outcome measure in research on speech sound disorders (McLeod et al., 2017), including children with cleft lip and palate (Hashemi Hosseinabad et al., 2022; Seifert et al., 2021) and also in a study of adults who speak other languages than English (McLeod, 2020). Neumann et al. (2017), reported high internal reliability (mothers $\alpha = 0.918$, fathers $\alpha = 0.917$) and construct and criterion validity in the Italian language ICS validation of 364 typically developing children and 356 children with speech disorders aged 3;0 to 5;11. The Korean ICS validation (Lee, 2019) demonstrated high internal reliability ($\alpha = 0.945$), satisfactory test, retest reliability, and good construct validity. Furthermore, the Vietnamese ICS validation (Pham et al., 2017) results showed excellent internal reliability ($\alpha = 0.94$) and construct validity in children aged 2; 0–5; 11 years.

A recent paper using the ICS with three-year-old English-speaking children with CLP found that parents were able to understand their child most of the time, but strangers were less likely to find the child intelligible (Seifert et al., 2021). In this study mothers of 412 children with CLP completed the ICS and the average total score was 3.75 ('sometimes' to 'usually intelligible') of a possible five ('always intelligible'). Moreover, children with cleft lip only were more intelligible than children with any type of palatal cleft, who in turn were more intelligible than children with CLP associated with a syndrome. Hashemi Hosseinabad et al. (2022) investigated the clinical application of the ICS in 20 children aged four to 12 with CLP and velopharyngeal insufficiency (native speakers of American English) and findings supported the use of ICS in practice with CLP children. This study also highlighted the high correlation between ICS scores and articulation accuracy. The ICS, therefore, shows potential as a suitable tool for measuring intelligibility in CLP, both within research and clinical contexts.

The current study is a translation and validation of the ICS in Sinhala, the main language spoken in Sri Lanka. Sinhala is an Indo-Arya Language, written in the Sinhala script. It has around 16 million speakers, mostly concentrated in Sri Lanka. Speech and Language Therapy is a young profession in Sri Lanka, beginning only in 2000 and moving to a degree-level profession in 2008 (Wickenden et al., 2003). As a young profession, there are few validated questionnaires or standardised assessments for the evaluation of speech in Sinhala. To our knowledge, there is only one published assessment, the Common Token Test (COT), a measurement of speech perception in children with cochlear implants (Jeyaraman et al., 2016). There are also few single-word articulation or phonology assessments validated in Sinhala for different age groups. It is therefore clear that an easy-to-use parent/carer reported measure of intelligibility translated into Sinhala for use with speakers with CLP, and potentially other types of speech sound disorders would be a valuable addition for Speech and Language Therapists and researchers in Sri Lanka. Although the ICS was primarily designed for preschool-aged children, the current study focuses on older children with and without CLP for two reasons. Firstly, we assume that older children without speech disorders will show no difficulties with intelligibility, and secondly, the ICS has been used with children aged up to 15 years old so far and found to be an acceptable tool.

Aims

The aims of this study were as follows: 1. to translate the Intelligibility in Context Scale to Sinhala; 2. to determine both typically developing (TD) and repaired cleft lip and/or palate (CLP) ICS scores in Sinhala-speaking adolescents and 3. to determine the psychometric properties of the Sinhala Intelligibility in Context Scale.

Method

The original ICS English-language questionnaire (McLeod et al., 2012a) was translated into Sinhala (ICS-SIN) following standard translation and cross-cultural adaptation guidelines (the Forward – Backward – Forward method, Guillemin et al., 1993) and validated with adolescents with cleft lip and palate (CLP) and typically developing (TD). The study was conducted with approval from the Ethics committees at the University of Strathclyde, Glasgow and Lady Ridgeway Hospital for Children (LRH), Colombo, Sri Lanka.

Participants

Fifty parents of typically developing (TD) children and 38 parents of children with repaired cleft lip and palate (CLP), ages ranging from 12 to 15 years completed the ICS-SIN questionnaire. The mean age of the TD group was 13.22 (SD = 0.86) and the CLP group was 14.16 (SD = 1.05). There were 31 males (62.0%) and 19 females (38.0%) children in the TD group and 13 males (34.2%) and 25 female (65.8%) children in the CLP group. Inclusion and exclusion criteria were applied. Children who speak Sinhala as their first language were included and children with long-lasting medical conditions who require daily medication and children with learning/cognitive difficulties were excluded from the study. According to teachers' reports, none of the TD children had been diagnosed with cognitive difficulties or other developmental disorders, and none used hearing amplification. In the TD group, 38 mothers (76.0%), nine fathers (18.0%) and three immediate family members (6.0%) such as brother, sister or grandmother completed the ICS-SIN questionnaire. In the CLP group, the ICS-SIN was completed by 28 mothers (56.0%), six fathers (12.0%) and four other immediate family members (8.0%) such as brothers, sisters or grandparents.

Procedure of translating ICS into Sinhala

Permission to translate the scale into Sinhala was obtained from the original author of the ICS, Sharynne McLeod. A systematic approach was taken in translating the ICS into Sinhala using the guidelines recommended by Guillemin et al. (1993), the protocol for translation and adaptation of instruments proposed by the World Health Organization (World Health Organization, 2007). The questionnaire was translated according to the forward-backwards-forward technique, as illustrated in Figure 1. This approach required three independent translators. In step 1, 'first forward translations', two translators, both bilingual qualified Speech and Language Therapists whose first language is Sinhala, translated the English ICS into Sinhala. These two translators worked independently, considering the entirety of the original, including instructions, design, and headers and footers. The translators followed the guidelines by Guillemin et al. (1993), WHO (see, Youhan et al., 2019

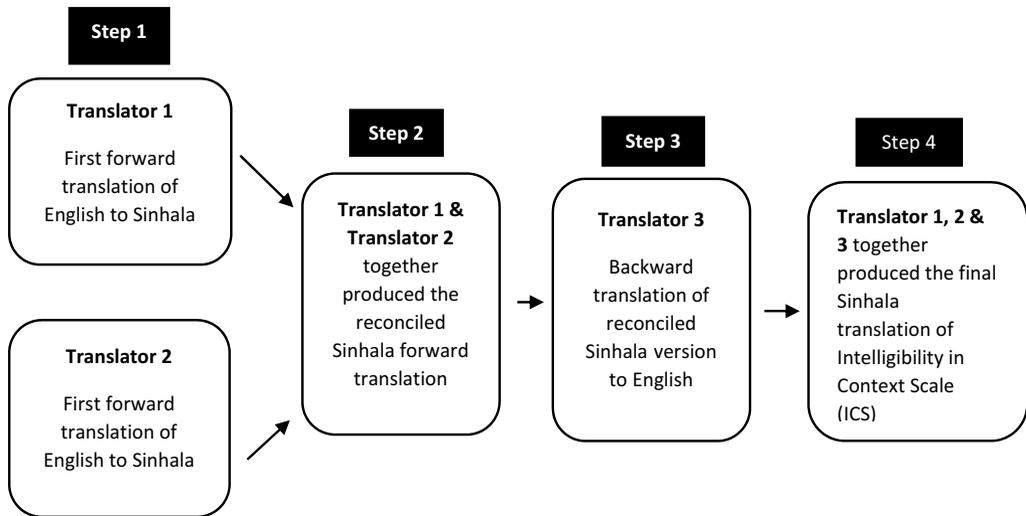


Figure 1. The translation process of the ICS-Sinhala.

for a description), and considered linguistic and cultural factors throughout the translation process, aiming to use acceptable language for a broad audience and ensure that the meaning and concepts behind the original scale were preserved in the translated versions.

In step 2- the ‘reconciliation step’, the two translators reviewed the two forward individual translations. Together they created a reconciled forward Sinhala translation, meeting all demands of linguistic and conceptual equivalence of the original English draft. Next, in step 3, a ‘backward translation’ was performed. The reconciled forward Sinhala translation was translated back into English by a third bilingual English – Sinhala Speech and Language Therapist (translator 3) who was blind to the original English version. This third translator’s first language was English.

Finally, in step 4- ‘final forward translation’ – as a committee, all three translators reviewed the forward and respective backward translations and looked for discrepancies with the original ICS. The differences were then discussed, and using structured techniques to find solutions, further alterations were made to the translations. The committee generated the final forward Sinhala translation of the ICS-SIN maintaining its conceptual equivalence, while ensuring the questions remained linguistically appropriate and understandable for a wide range of speakers. This final questionnaire was formatted according to the ICS standard format with guidance from the original author, and approval confirming completion of the translation process (aim 1) before undertaking piloting and validation (<https://www.csu.edu.au/research/multilingual-speech/ics>).

Piloting

The final ICS-SIN questionnaire was piloted with parents of five typically developing Sinhala-speaking adolescents aged 12–15 years old; parents of two Sinhala-speaking adolescents with repaired cleft lip and palate aged 12–15 years old; and five Sinhala-speaking parents who have younger children to check the equivalence in source and final versions. These participants were chosen as a representative match with the ICS

study participant group and the general wider population. The probe technique was used to check face validity (by asking verbally) to confirm the questions were understandable. There were no changes made to the ICS-SIN questionnaire after piloting. The Speech and Language Therapists (SLTs) in the cleft clinic were consulted regarding the translation process and given the final ICS-SIN questionnaire. They were informed about the current evidence base for the use of the ICS in other languages with children with CLP and other speech sound disorders. The SLTs checked the appropriateness of the language of the translated version, listened to parents' feedback on how easy the ICS was to use further confirming clinical feasibility of the ICS-SIN questionnaire.

Validation

The scale was validated with typically developing adolescents and adolescents with repaired cleft lip and palate. In this study, the traditional approach of using a single-word articulation test to identify speech intelligibility difficulties was not employed due to lack of such tools in Sinhala. Hence, an older participant (12–15 years) typically developing group without underlying health conditions was included, with the assumption that typically developing children would be 100% intelligible by this age. Moreover, participants were chosen randomly from schools and clinics according to the inclusion and exclusion criteria to reduce sample bias. Furthermore, consideration was given to previous validity evidence of the ICS (McLeod, 2020) along with piloting the ICS-SIN before use in the study to account for any practical issues parents reported while administering the questionnaire.

Recruitment procedure and response rate

Participants were recruited from urban and non-urban mainstream schools in the western province of Sri Lanka. A study information leaflet, consent form and a translated copy of the ICS-SIN questionnaire were sent to the parents via the schools. CLP participants were recruited from the Lady Ridgeway Hospital for Children, Colombo, Sri Lanka. This children's hospital is one of the leading children's hospitals in Sri Lanka, where all specialised craniofacial treatments are provided. All children declared Sinhala as their primary language. The cleft-type for CLP participants was identified from medical notes. Fifty-four (27.0% response rate) parents of TD children returned completed ICS-SIN questionnaires within the response time of 7 days. Three questionnaires (5.5%) had to be excluded from the analysis because the parents did not respond to one or more items of the ICS-SIN. One further questionnaire was not included in the analysis after the respondent reported that Sinhala was not their first language. This left a total of 50 complete ICS-SIN questionnaires from TD children.

Parents of the children with CLP were invited to complete the questionnaire while waiting for clinics at the cleft department. Parents of children with CLP were asked to read the participant information sheet and sign the consent form before completing the questionnaire. All invited parents or carers of CLP children completed the questionnaires (100.0% response rate). Two questionnaires had to be excluded (5.0%) because parents or carers did not respond to all seven items on the scale. All respondents declared their first language as Sinhala. Consequently, 38 complete ICS-SIN questionnaires were included in the final analysis.

Analysis

Parents' responses to the ICS-SIN were entered into ExcelTM and subsequently converted into SPSS version 25. The frequency and percentage of responses for each of the seven items were calculated to determine TD and CLP ICS-SIN values in the sample (aim 2). The Kolmogorov Smirnov with Lilliefors test of normality was used to check the distribution of the data. The psychometric properties of the ICS-SIN (aim 3) were then evaluated. Item-by-item inter-correlations (non-parametric – Spearman's rho) and Cronbach's alpha test of internal reliability were conducted to determine the consistency of the seven items on the ICS-SIN. This study referred to the Field (2013) recommended thresholds to interpret correlations and Cronbach's alpha values. The original ICS questionnaire already has good face validity (McLeod, 2020). ICS-SIN face validity was determined by asking the respondents and SLTs verbally about the accuracy and whether the items are good enough to measure the issues that the items intend to. Construct validity of the ICS-SIN was checked using Spearman's correlations (two-tailed significance test) among the seven ICS-SIN item scores and the ICS-SIN total score in the whole group. Discriminant validity was assessed by comparing ICS-SIN total mean scores between the TD and CLP groups and comparing gender groups in both samples.

Results

Translation and cultural adaptations

The translation and adaptation process were conducted by Sinhala-English bilingual Speech and Language Therapists, who reported that it was culturally appropriate to use the original structure of the questionnaire. There were no changes applied to the ICS original English format: content only was translated into Sinhala. In Sinhala, 'acquaintances' could not be translated into a single word. Therefore, two Sinhala words were combined to provide an equivalent meaning. Similarly, there are two appropriate Sinhala words for 'strangers' that are in common usage, we therefore used one word and gave the alternative word in a footnote. For 'friends' we used the word in common usage, rather than the dictionary translation that is a formal version. After piloting, no further changes were made to the questionnaire, and the translating committee agreed that the ICS-SIN achieved cultural appropriateness while maintaining the purpose of the tool.

ICS-SIN ratings for typically developing children

The ratings for each of the seven questions for the TD group is presented in Table 1. In the TD group the most common rating for all communication partners was 'always': parents (96.0%), immediate family (92.0%), extended family (88.0%), friends (92.0%), acquaintances (88.0%), teachers (92.0%) and strangers (86.0%). A small number of parents of TD children reported that communication partners 'usually' or 'sometimes' understand their child. None of the parents of TD children rated their child as 'never' understood. Mean scores for the 50 TD participants showed that ratings were highest for parents, followed by other communication partners: parents ($M = 4.96$, $SD = 0.19$), immediate family members ($M = 4.92$, $SD = 0.27$), friends ($M = 4.92$, $SD = 0.27$), teachers ($M = 4.90$, $SD = 0.36$), extended members of the family ($M = 4.86$, $SD = 0.40$), acquaintances ($M = 4.84$, $SD = 0.46$),

Table 1. Parents' ratings for the ICS-SIN -Typically developing group (N = 50).

Question	M	SD	Range	Always %	Usually %	Sometime %	Rarely %	Never %
1. Do you understand your child?	4.96	(0.19)	4–5	96.0	4.0	0.0	0.0	0.0
2. Do immediate members of your family understand your child?	4.92	(0.27)	4–5	92.0	8.0	0.0	0.0	0.0
3. Do extended members of your family understand your child?	4.83	(0.40)	3–5	88.0	10.0	2.0	0.0	0.0
4. Do your child's friends understand your child?	4.92	(0.27)	4–5	92.0	8.0	0.0	0.0	0.0
5. Do other acquaintances understand	4.84	(0.46)	3–5	88.0	8.0	4.0	0.0	0.0
6. Do your child's teachers understand your child?	4.90	(0.36)	3–5	92.0	6.0	2.0	0.0	0.0
7. Do strangers understand your child?	4.80	(0.57)	2–5	86.0	10.0	2.0	2.0	0.0
Average total score (maximum = 35)	34.20	(2.03)	26–35					
Average total score (maximum = 5)	4.88	4.88						

strangers ($M = 4.80$, $SD = 0.57$). Therefore, parents rated themselves as understanding their child's speech the best (96.0%) ($M = 4.96$, $SD = 0.19$) and strangers the least (86%) ($M = 4.80$, $SD = 0.57$).

ICS-SIN ratings for children with CLP

As shown in Table 2, parents of the children with CLP rated that they understood their child's speech the best, (84.2%) 'always' and (15.8%) 'usually'. None of the parents rated they 'sometimes', 'rarely', or 'never' understood their child's speech. For children with CLP, the most common rating for all social communication partners was 'always': parents (84.2%), immediate family (76.3%), extended family (68.4%), friends (78.9%), acquaintances (68.4%), teachers (78.9%) and strangers (63.2%). Mean scores for the 38 participants with CLP showed that ratings were also highest in parents ($M = 4.84$, $SD = 0.37$), followed by teachers ($M = 4.71$, $SD = 0.65$), immediate family members ($M = 4.68$, $SD = 0.66$), friends ($M = 4.66$, $SD = 0.81$), extended members of the family ($M = 4.55$, $SD = 0.82$), acquaintances ($M = 4.55$, $SD = 0.82$) and strangers ($M = 4.47$, $SD = 0.89$). Parental perceptions of their children's intelligibility in different communication situations reflect that communication partners understood children's speech 'always' or 'usually'. Moreover, only a small number of parents reported that immediate family, extended family, friends, acquaintances, and strangers 'rarely' or 'never' (2.6%) understand their child.

Table 2. Parents' ratings for the ICS-SIN – Cleft lip and/or palate group (N = 38).

Question	M	SD	Range	Always %	Usually %	Sometime %	Rarely %	Never %
1. Do you understand your child?	4.84	(0.37)	4–5	84.2	15.8	0.0	0.0	0.0
2. Do immediate members of your family understand your child?	4.68	(0.66)	2–5	76.3	18.4	2.6	2.6	0.0
3. Do extended members of your family understand your child?	4.55	(0.82)	1–5	68.4	23.7	5.3	0.0	2.6
4. Do your child's friends understand your child?	4.66	(0.81)	1–5	78.9	13.2	5.3	0.0	2.6
5. Do other acquaintances understand your child?	4.55	(0.82)	1–5	68.4	23.7	5.3	0.0	2.6
6. Do your child's teachers understand your child?	4.71	(0.65)	2–5	78.9	15.8	2.6	2.6	0.0
7. Do strangers understand your child?	4.47	(0.89)	1–5	63.2	28.9	2.6	2.6	2.6
Average total score (maximum = 35)	32.55	(4.7)	12–35					
Average total score (maximum = 5)	4.64	(0.67)						

Internal consistency and correlations between items of ICS-SIN

Item correlation (TD)

The ICS-SIN mean scores of the seven items for each participant were calculated. The Kolmogorov-Smirnov with Lilliefors test of normality was significant, indicating normal distribution was not assumed. Bivariate non-parametric correlation analysis (Spearman's Rank Order) was calculated to determine the relationship between individual items on the scale. Correlations between the seven items and average mean scores are illustrated in Table 3. All inter-correlations between the subscales showed moderate-to-high correlations (Field, 2013) ranging from $r = 0.344$ to 0.901 and were significant ($p < 0.05$). While most correlations were moderate ($0.34-0.69$), high correlations ($r > 0.7$) were observed between ratings for extended family members and strangers ($r = 0.9$) and friends and acquaintances ($r = 0.81$).

Internal consistency (TD)

The Internal consistency for each scale of the ICS-SIN completed by parents of TD children ($N = 50$) was measured using Cronbach's alpha. The correlations were significant ($p < 0.05$), Cronbach's alpha was found to achieve a high level ($\alpha = 0.875$). The results for inter-correlations showed good internal consistency in responses to the items of the scale. This finding suggests that the ICS-SIN is an appropriate tool for measuring speech intelligibility within typically developing adolescents.

Item correlation (CLP)

The ICS-SIN mean scores of the seven items were calculated. The test of normality using Kolmogorov-Smirnov with Lilliefors was significant, indicating normal distribution was not assumed. Bivariate non-parametric correlation analysis (Spearman's Rank Order) was calculated to determine the relationship between individual items on the scale. Correlations between the seven items and average mean scores are illustrated in Table 4. All inter-correlations between the subscales showed moderate-to-high correlations ranging from $r = 0.603$ to 0.910 and were significant ($p < 0.05$). While most correlations were high ($r > 0.70$), moderate correlations were observed between ratings for parents and strangers ($r = 0.6$), parents and extended family and acquaintances ($r = 0.65$)

Table 3. Spearman's rank-order correlations between the seven items and average mean score on ICS-SIN – Typically developing group ($N = 50$).

Item	Parent	Immediate family	Extended family	Friends	Acquaintances	Teachers	Strangers	Average Mean
Parent		0.69	0.54	0.69	0.56	0.70	0.48	0.50
Immediate Family	0.69		0.55	0.45	0.57	0.73	0.72	0.67
Extended family	0.54	0.55		0.55	0.64	0.34	0.90	0.82
Child's friends	0.69	0.45	0.55		0.81	0.46	0.49	0.66
Acquaintances	0.56	0.57	0.64	0.81		0.57	0.75	0.83
Teachers	0.70	0.73	0.34	0.46	0.57		0.52	0.65
Strangers	0.48	0.72	0.90	0.49	0.75	0.52		0.89
Average Mean	0.50	0.67	0.82	0.66	0.83	0.65	0.89	

Table 4. Spearman's rank-order correlations between the seven items and average mean score on ICS-SIN – Cleft lip and/or Palate group ($N = 38$).

	Parent	Immediate family	Extended family	friends	Acquaintances	Teachers	Strangers	Average Mean
Parent		0.79	0.65	0.66	0.65	0.85	0.63	0.67
Immediate Family	0.79		0.84	0.67	0.84	0.80	0.77	0.83
Extended family	0.65	0.84		0.69	0.89	0.80	0.91	0.93
Child's friends	0.66	0.67	0.69		0.80	0.86	0.74	0.80
Acquaintances	0.65	0.84	0.89	0.80		0.80	0.91	0.94
Teachers	0.85	0.80	0.80	0.86	0.80		0.73	0.80
Strangers	0.60	0.77	0.91	0.74	0.91	0.73		0.98
Average Mean	0.67	0.83	0.93	0.80	0.94	0.80	0.98	

Internal consistency (CLP)

The internal consistency for each scale of the ICS-SIN for children with CLP ($N = 38$) was measured using Cronbach's alpha. The correlations were significant ($p < 0.05$), Cronbach's alpha was found to achieve a very high level ($\alpha = 0.97$). The results for inter-correlations showed high internal consistency in responses to the items of the scale. This finding further supports that the ICS-SIN is an appropriate tool for measuring speech intelligibility within adolescents with Cleft Lip and Palate.

Validity of the ICS-SIN

Construct validity

The construct validity of the ICS-SIN was evaluated using Spearman's correlations (two-tailed significance test) among the seven ICS-SIN item scores and the ICS-SIN total score in the total group (Total $N = 88$). Scores ranged between $r = 0.61$ to 0.95 , as shown in Table 5. All correlations were highly significant ($p < 0.05$) when the two groups were assessed independently.

Discriminant validity

The mean average scores of the ICS-SIN questionnaires were compared between groups. The ICS-SIN total average mean scores of both samples were not normally distributed, evidenced by the significant ($p < 0.05$) normality test results. A Mann-Whitney U -test was therefore used to compare the total average mean scores of these two speaker groups. There was

Table 5. Spearman correlation r between the ICS-SIN total score and the seven ICS-SIN items.

ICS-SIN item	TD ($N = 50$)	CLP ($N = 38$)
Parent	0.507	0.670
Immediate family	0.675	0.833
Extended family	0.821	0.934
Friends	0.664	0.804
Acquaintances	0.831	0.945
Teachers	0.654	0.802
Strangers	0.893	0.984

ICS-SIN – Intelligibility in Context Scale – Sinhala, TD – Typically Developing.

CLP – Cleft Lip and Palate.

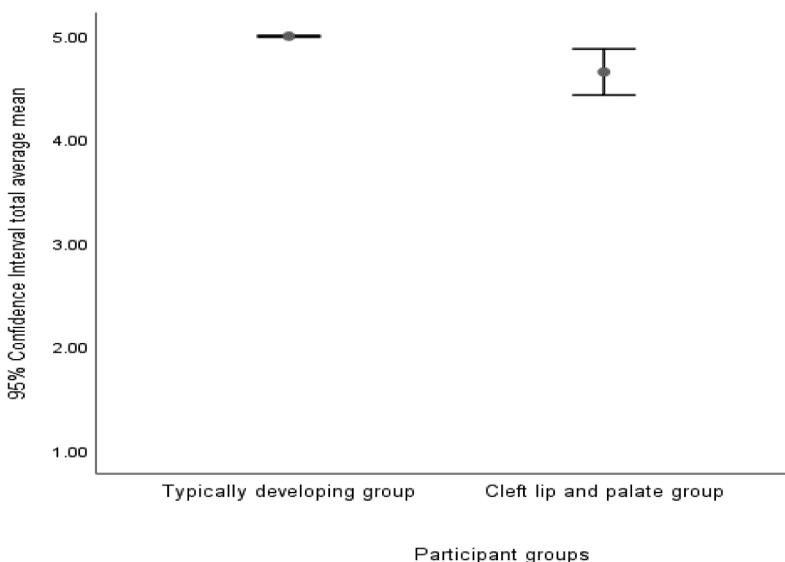


Figure 2. Intelligibility in Context Scale – Sinhala – average mean differences between the two groups.

a significant difference between the TD ($M = 4.88$, $SD = 0.29$) and CLP ($M = 4.64$, $SD = 0.67$) groups (Figure 2). The parents of the children with CLP reported significantly lower speech intelligibility compared to the parents of TD children ($U = 758$, $p = 0.037$) for each of the seven communication partners. Further, the results of the two groups were entered into an online effect size calculator and Hedges' g was calculated as the sample sizes were not equal in the groups. Hedges' g was 0.488, which is a moderate effect size (Cohen, 1988).

The mean scores of the ICS-SIN were compared by age and sex for both participant groups. Child's sex information was collected via parent reports. The Spearman's rho test results revealed that there was no significant correlation between the ICS – SIN mean scores in the CLP group and the age of the child ($r = 0.17$, $p = 0.30$). Similarly, in the TD group, the Spearman's rho test results revealed that there was no significant correlation between the ICS – SIN mean scores (TD) and the age of the child ($r = 0.11$, $p = 0.43$). There was a difference found between ICS-SIN mean scores (CLP) and the sex of the children [females ($N = 25$) $M = 4.53$, $SD = 0.80$] [males ($N = 13$) $M = 4.86$, $SD = 0.23$] in this participant group, Males with CLP rated slightly higher than females with CLP. There was also a difference between TD ICS-SIN mean scores and sex [females ($N = 19$) $M = 4.96$, $SD = 0.11$] [males ($N = 31$) $M = 4.83$, $SD = 0.35$]; however, converse to the CLP findings, TD females were rated slightly higher than TD males.

Discussion

This study aimed to translate the ICS English-language questionnaire into Sinhala and to validate the questionnaire on both typically developing adolescents and adolescents with cleft lip and palate living in Sri Lanka. With minimal adaptations, ICS-SIN achieved cultural appropriateness while maintaining the purpose of the tool. Pascoe and McLeod (2016) also emphasised the importance of ensuring the translated versions of the ICS convey the

original intent of the tool as much as possible, while achieving cultural relevance. ICS has been translated to over 60 languages, is available in languages that do not have standardised assessments and is considered a ‘user-friendly’ tool (McLeod, 2020).

Pilot data for the ICS-SIN

The mean ICS-SIN score for our TD children was 4.88 (SD = 0.29), which is consistent with findings from Sprunt and Marella (2018) who reported mean scores within the range of 4 to 5 for 257 TD children aged 5–15. In the current study, the TD mean value is within this range. However, it is slightly higher than values reported for other international studies of typically developing children, many of which report results from much younger children than those in our sample. For example, ICS-Fiji (Mean age = 9.7, SD = 4.4), $M = 4.5 (0.6)$, ICS-Fiji-English, $M = 4.5 (0.5)$; Hopf et al., 2017). It is widely accepted that speech intelligibility continues to develop as children grow, and Kok and To (2019) highlighted significantly higher scores in older children in their study using ICS-Traditional Chinese. The current study included only TD children aged between 12–15-year-olds, hence a higher intelligibility mean score than younger TD children was expected.

In terms of ratings on the new ICS-SIN, our results suggest that most TD children were understood ‘always’ by all communication partners. However, a small number of parents rated ‘usually’ or ‘sometimes’ mainly for strangers, acquaintances, and extended family. In summary, TD children were most intelligible to their parents (96.0%), followed by immediate family members (92.0%), friends (92.0%), teachers (92.0%), extended family (88.0%), acquaintances (88.0%) and strangers (86.0%). McLeod et al. (2015) describe the same trend in data, albeit with lower overall scores in younger children. Our findings were explored in detail as we expected TD participants would rate intelligible for all communication partners as they have normal speech development. From this we noted low intelligibility with all communication partners in one participant due to voice concerns and in two participants where there are language issues related to their bilingual social context.

The children with CLP had lower scores in the ICS-SIN than the typically developing children ($M = 4.64$, SD = 0.67). Seifert et al. (2021) provide comparison data on the ICS for a sample of 412, three-year-old English-speaking children born with any cleft type. The mean average ICS score of their total sample was 3.75 (SD = 0.76), suggesting intelligibility in children with CLP likely increases with age, similar to typically developing children. In addition, Hashemi Hosseinabad et al. (2022) also reported lower ICS mean scores in children aged 4–12 years (mean age = 6.97) with velopharyngeal insufficiency. Moreover in a recent study by McLeod (2020) summarising the use of ICS across 18 international studies, 10 studies reported higher ICS mean scores for typical children compared to children with speech sound disorders, again highlighting the trend of reduced intelligibility in atypical children more generally. McLeod (2020) highlighted those higher total scores were reported by children identified with typical speech than children with atypical speech in cross-cultural validation studies.

Nevertheless, in our sample, the CLP average ICS-SIN mean was notably higher than those reported in McLeod’s (2020) summary. This is likely because our sample included an older age range than the children included in other ICS studies. Moreover, in the current study, we excluded participants with syndromes that are known to impact speech, language, and cognitive development. In terms of the ratings across individual ICS-SIN items, the

trend in the CLP group was similar to that of the TD group. These children were most intelligible to their parents (84.2%), followed by teachers (78.9%), friends (78.9%), immediate family (76.3%), extended family (68.4%), and acquaintances (68.4%) and strangers (63.2%). A similar trend of most intelligible to mothers and least intelligible to strangers was also reported by Seifert et al. (2021) in CLP children using English as their first language and Hashemi Hosseinabad et al. (2022) in CLP children with velopharyngeal insufficiency using American English.

Psychometric properties of the Sinhala Intelligibility in Context Scale

This study's results support that the ICS-SIN is an appropriate, valid, parent report screening tool to assess speech intelligibility of Sinhala-speaking children in Sri Lanka. The scale had high internal reliability between items ($\alpha = 0.87$) and moderate-to-high correlations between items, ranging from $\rho = 0.344$ to 0.901 ($p < 0.05$) for both the TD group and for the CLP group ($\alpha = 0.97$) ($\rho = 0.603$ to 0.910 , $p < 0.05$). To assess the consistency of results across items, internal consistency/reliability was examined in 10 published studies to date and found to be very high ($\alpha = 0.91$ – 0.98) (McLeod, 2020). Our study results are in line with those of previous findings, and the internal consistency of ICS-SIN was recorded within this range for the CLP group. However, we found a slightly lower Cronbach's alpha value for the TD group, although this was still at an acceptable level. Similarly, we found slightly lower values than those reported by Hopf et al. (2017) and Lagerberg et al. (2021) who included participants up to 10 years of age. These results are likely to be related to the age range of the children in the current study.

We also examined construct validity of the ICS-SIN. Correlations among the seven ICS-SIN item scores and the total score were found to be highly significant, showing an excellent construct validity of the ICS-SIN. This is in line with most previous ICS validation studies which reported 'moderate to high correlations' for construct validity (McLeod, 2020; Neumann et al., 2017; Pham et al., 2017).

Limitations and future research

This study was part of a larger study investigating quality-of-life of adolescents with repaired CLP in Sri Lanka. Therefore, the ICS-SIN was tested using a subset of participants and the age range was not typical of other studies validating different language versions of the ICS McLeod's (2020) summary. Moreover, the sample size of the current study was lower than previous studies and the sample was recruited from one province of Sri Lanka only. Furthermore, this study did not include objective measurements due to the lack of standardised tests in Sri Lanka, nor did it gather demographic information of the participants in order to carry out a comprehensive data analysis. Therefore, although the results support the appropriateness of using ICS-SIN in clinical settings, they should be considered as a preliminary validation of the ICS-SIN. Future studies using the ICS-SIN with younger children and children with a wider range of speech sound disorders is necessary. Hence, a future study of reliability and validity of the ICS-SIN including test-retest reliability is highly recommended with a broader age range. The TD participants were recruited from the Western province of Sri Lanka, covering urban and rural areas, nevertheless, they do not represent a full island-wide sample. The CLP participants were recruited from a leading hospital in the capital, which provides a specialised service to most parts of the country,

however this service is not available in other general hospitals in the country and may not reflect speech intelligibility outcomes in all children with CLP born in Sri Lanka. Finally, it would be helpful to record all caregivers' perspectives on their child's intelligibility using the ICS-SIN to determine whether, for example, fathers rate their child's speech intelligibility differently to mothers due to the father-led working, and mother-led childcare culture in Sri Lanka (Kailasapathy & Metz, 2012) which tends to favour higher mother-child interaction.

Conclusion

The study provides the first translation and validation of the ICS into Sinhala. Our pilot validation study results were consistent with that of other studies in that both the typically developing children and children with repaired CLP followed similar trends in terms of being more readily understood by family, friends, and those they interact with most often. The ICS-SIN was shown to have a good internal consistency, discriminant and construct validity for both the TD and CLP adolescent groups. Hence, the ICS-SIN can be considered an appropriate parent-report screening measure that can be used to describe children and adolescents' intelligibility with different communication partners.

Acknowledgments

The authors wish to thank the speech and language therapists involved in the translation process; school principals and teachers who helped to recruit the typically developing children; and parents and children who participated in this project. We wish to extend our special acknowledgement to Dr. Romesh Gunasekera and Dr. Malka Jayathilaka for facilitating the recruitment of young people with cleft lip and palate.

Ethics statement

The study protocol and ethics applications were approved by the ethics committees of University of Strathclyde, Glasgow, United Kingdom and Lady Ridgeway Hospital for Children, Colombo, Sri Lanka.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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