The Intelligibility in Context Scale: Validity and Reliability of a Subjective Rating Measure

Sharynne McLeod, Linda J. Harrison, and Jane McCormack

Purpose: To describe a new measure of functional intelligibility, the Intelligibility in Context Scale (ICS), and evaluate its validity, reliability, and sensitivity using 3 clinical measures of severity of speech sound disorder: (a) percentage of phonemes correct (PPC), (b) percentage of consonants correct (PCC), and (c) percentage of vowels correct (PVC).

Method: Speech skills of 120 preschool children (109 with parent-/teacher-identified concern about how they talked and made speech sounds and 11 with no identified concern) were assessed with the Diagnostic Evaluation of Articulation and Phonology (Dodd, Hua, Crosbie, Holm, & Ozanne, 2002). Parents completed the 7-item ICS, which rates the degree to which children’s speech is understood by different communication partners (parents, immediate family, extended family, friends, acquaintances, teachers, and strangers) on a 5-point scale.

Results: Parents’ ratings showed that most children were always (5) or usually (4) understood by parents, immediate family, and teachers, but only sometimes (3) by strangers. Factor analysis confirmed the internal consistency of the ICS items; therefore, ratings were averaged to form an overall intelligibility score. The ICS had high internal reliability (α = .93), sensitivity, and construct validity. Criterion validity was established through significant correlations between the ICS and PPC (r = .54), PCC (r = .54), and PVC (r = .36).

Conclusions: The ICS is a promising new measure of functional intelligibility. These data provide initial support for the ICS as an easily administered, valid, and reliable estimate of preschool children’s intelligibility when speaking with people of varying levels of familiarity and authority.

Key Words: speech sound disorder; intelligibility; assessment; International Classification of Functioning, Disability and Health (ICF-CY); children

Intelligible speech is an essential skill for full participation in society (Ruben, 2000). Factors affecting intelligibility of speech are twofold. First, intelligibility is influenced by production factors, such as the competence of the speaker and the nature of the spoken material (e.g., single words vs. connected speech; Gordan-Brannan & Hodson, 2000; McGarr, 1983). Second, intelligibility is influenced by contextual factors that affect the perception of speech, such as the amount of noise in the environment; presence of supporting visual cues; and listeners’ familiarity with the language, dialect, and speaker (Baudonck, Buekers, Gillebert, & Lierde, 2009; Flipsen, 1995; Rhebergen & Versfeld, 2005). When working with children with speech sound disorders (SSDs), speech-language pathologists (SLPs) have reported intelligibility to be a frequent consideration when determining presence of an SSD, need for intervention, and whether intervention goals have been accomplished (Baker, 2010; Mullen & Schooling, 2010; Williams, McLeod, & McCauley, 2010).

A number of procedures for the evaluation of children’s intelligibility are available. Kent, Miolo, and Bloedel (1994) provided a comprehensive review of 19 procedures, including a range of commercially available instruments. They categorized these into five groups: (a) procedures that emphasize phonetic contrast analyses (e.g., the Test of Children’s Speech Plus; Hodge & Daniels, 2007); (b) procedures that emphasize phonological analyses (e.g., the Hodson Assessment of Phonological Patterns, Third Edition; Hodson, 2004); (c) procedures that emphasize word identification (e.g., the Intelligibility Index; Shriberg, Austin, Lewis, McSweeny, & Wilson, 1997; see also Flipsen, 2006); (d) indexes of phonetic accuracy in continuous speech (e.g., percentage of consonants correct; Shriberg et al., 1997); and (e) procedures that rely on a scaling method (e.g., the Meaningful Use of
Speech Scale; Osberger, 1992). The first two groups typically require specifically developed (and often commercially available) stimuli and scoring equipment administered by SLPs. The next two can be completed during SLPs’ analysis of children’s speech samples. The fifth group can be administered both by SLPs and others. Most of the measures of intelligibility used by SLPs and outlined by Kent et al. (1994) focus on the children’s production factors and their intelligibility in the clinical context. Measures of intelligibility should also take into consideration contextual factors, including listener diversity in contexts other than the clinic. A new measure is needed that can supplement clinical measures of intelligibility and thus provide a more comprehensive picture of the impact of an SSD on a child’s intelligibility in daily life.

Intelligibility will differ depending on whether the listener is a family member, a stranger, or an SLP (Baudonck et al., 2009; Flipsen, 1995; Kwiatkowski & Shriberg, 1992). As indicated above, the majority of intelligibility measures are designed to describe the intelligibility of a child in a clinic as understood by SLPs or listeners trained in phonetic transcription. For example, Flipsen (2006) described the Intelligibility Index as “the percentage of words in the entire sample that the transcriber could reliably understand” (p. 306). Flipsen indicated that typically developing 3-year-olds were 95% intelligible to a transcriber and that this increased to 97% by age 4. Within the clinical context, listeners who are experienced with disordered speech (e.g., speech produced by people with hearing loss, or those who use tracheoesophageal speech) tend to provide higher intelligibility ratings than those who are inexperienced (Doyl, Swift, & Haaf, 1989; McGarr, 1983), although this tendency has not been reported in every study (e.g., Menke, Ochsner, & Testut, 1983).

The impact of familiarity and experience on intelligibility can also be applied to the child’s context outside of the clinic. Parents have estimated that 2-year-old children were 50% intelligible to strangers, a number that increased to 75% by age 3 (Coplan & Gleason, 1988). Parental estimations of 2-year-olds’ intelligibility were also examined in a study of 1,127 typically developing children: “Children were mostly intelligible to their parents with 12.7% of parents finding their child difficult to understand and only 2.1% of parents reporting that they could rarely understand their child” (Roulstone, Loader, Northstone, Beveridge, & The ALSPAC Team, 2002, p. 264). To date, there are no validated measures to consider children’s intelligibility with a diversity of listeners (communication partners) in a range of environmental contexts. The purpose of this article is to report on the development and evaluation of a new measure of children’s intelligibility that relies on parents’ estimates of how well their child’s speech is understood in daily life by different communication partners: the Intelligibility in Context Scale (ICS).

Consideration of individuals within differing environmental contexts has been promoted within the International Classification of Functioning, Disability and Health: Children and Youth Version (ICF-CY; World Health Organization, 2007). The ICF-CY was developed as a holistic framework for describing health and well-being and has been recommended for use with children with SSDs (e.g., McLeod & McCormack, 2007; McLeod & Threats, 2008). The ICF-CY provides a framework for conceptualizing individuals’ Body Structures and Functions (e.g., articulation functions), the interrelationship between Activities and Participation (e.g., the ability to hold a conversation), and Environmental and Personal Factors. Intelligibility is influenced by two factors: (a) production factors (cf. Body Functions) and (b) contextual factors (cf. Environmental Factors). Previous research into intelligibility has focused on only the first of these factors; however, both are important when aiming to holistically document children’s intelligibility. The ICS was developed in accordance with the ICF-CY Environmental Factors to take account of the range of contexts/listeners and communication partners with whom children communicate. Specifically, the seven items of the ICS draw on the relevant contexts identified in Chapter 3 of the ICF-CY, “Support and Relationships”; “immediate family”; “extended family”; “friends”; “acquaintances, peers, colleagues, neighbors and community members”; “people in positions of authority . . . such as teachers”; and “strangers” (World Health Organization, 2007, p. 205).

This article is a report of the trial of the parent-rated ICS measure in a community sample of preschool children. The aim was to determine the validity and reliability of the ICS and to examine its specificity in relation to severity of SSDs assessed through traditional speech-language pathology measures.

**Method**

**Participants**

Participants were 120 four- to five-year-old children: 109 with a parent/teacher-identified concern about how they “talked and made speech sounds” (Glascoe, 2000) and 11 with no identified concern. There were more males ($n = 80, 66.7\%$) than females ($n = 40, 33.3\%$), a ratio that is typical for children with SSDs (Campbell et al., 2003). The children ranged in age from 47 to 68 months ($M = 55.6, SD = 5.1$). They resided in two (of the eight) Australian states/territories. New South Wales (NSW = 65, 54.2\%) and Victoria (VIC = 55, 45.8\%). Group comparisons using $t$ tests and chi-squares showed that there were no significant differences between the
identified and nonidentified groups for sex (identified males = 72, 66.1%; identified females = 37, 33.3%; nonidentified males = 8, 72.7%; nonidentified females = 3, 27.3%); age (identified M = 55.5, SD = 4.9; nonidentified M = 56.6, SD = 5.8); and state where they resided (identified NSW = 58, 53.2%; VIC = 51, 46.8%; nonidentified NSW = 7, 63.6%; VIC = 4, 36.4%).

None of the children had been diagnosed with cognitive difficulties or other developmental disorders. None of the children used hearing amplification devices or were diagnosed with persisting hearing loss; however, 21 (17.5%) were reported to have a history of hearing problems/ear infections. All children spoke English as their first language; in addition, 11 (9.2%) children were regularly spoken to in a language other than English, and five (4.2%) spoke a language other than English. Four children (3.3%) were identified as Indigenous Australians, which is similar to the national representation of Indigenous children ages 4 to 5 years (3.7%; Soloff, Lawrence, Mission, & Johnstone, 2006). Family socioeconomic status was based on the Australian Index of Relative Socioeconomic Advantage and Disadvantage (IRSAD; Australian Bureau of Statistics, 2008), which measures socioeconomic well-being along a continuum, from the most disadvantaged to the most advantaged areas. The index defines socioeconomic advantage (above the 30th percentile) and disadvantage (below the 30th percentile).

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Tools

ICS. The ICS was developed as a parent-rated measure of children’s intelligibility when speaking with people of varying levels of familiarity and authority: parents (themselves), immediate family, extended family, friends, acquaintances, teachers, and strangers. The 7-item ICS asks parents to think about their child’s speech intelligibility over the past month and identify the degree to which they (themselves) and the six other types of communication partners understood the study child on a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = usually, 5 = always; see Appendix).

Diagnostic Evaluation of Articulation and Phonology. Children’s speech skills in single words were assessed using the Phonology subtest from the Diagnostic Evaluation of Articulation and Phonology (DEAP; Dodd, Hua, Crosbie, Holm, & Ozanne, 2002). The DEAP Phonology subtest samples a broad range of phonemes (consonants, vowels, and consonant clusters) in a single word task, and this version provides normative data for British and Australian children. The children’s responses on the DEAP were used to generate three measures using the standard scoring procedure as outlined in the DEAP manual: (a) percentage of phonemes correct (PPC), (b) percentage of consonants correct (PCC), and (c) percentage of vowels correct (PVC).

Procedure

Participant recruitment. The 120 children were participants in Stage 2 of the Sound Effects Study, an Australian Research Council project investigating the prevalence, severity, and impact of speech sound disorder in early childhood (McLeod, Harrison, & McAllister, 2007–2009). In Stage 1 of the Sound Effects Study, 1,097 children from 33 preschools and child care centers in two Australian states were screened by parent and teacher report to identify those who were having difficulty talking and making speech sounds. During Stage 2, an in-depth speech-language pathology assessment was undertaken with 157 children, of whom 143 were identified by their parents or teachers as having difficulty “talking and making speech sounds” and 14 were not identified but were included to test for under- or over-identification (for more information about sampling and attrition, see McLeod, Harrison, McAllister, & McCormack, 2011). The present sample comprised the 120 children whose parents returned case history questionnaires that included the ICS (76.4% of participants in Stage 2 of the Sound Effects Study); of these, 109 had been identified by their parents or teachers as having difficulty talking and making speech sounds, and 11 were not identified.

Participant assessment. Each of the children participated in comprehensive communication assessments conducted by a qualified SLP in a quiet room in their preschool or child care center. Children were accompanied by a familiar adult, usually a parent. Assessments lasted approximately 1 to 1.5 hr and took place over the course of one to two sessions, depending on the child’s concentration during the tasks. With the assent of the children and consent of their adult guardians, assessments were audio-recorded using a Sony MP3 digital recorder (ICD-UX80) using the built-in microphone placed approximately 15 to 20 cm from the child’s mouth. Each child completed the Phonology subtest of the DEAP as well as a range of other assessments of language, oromusculature, hearing, stuttering, and voice. The SLP transcribed the children’s responses to the DEAP online and then relistened to the assessments within 24 hr of the session to check transcription.

Reliability of transcription on the DEAP. Point-to-point agreement (consonants and vowels) was calculated
for broad phonetic transcription of each word on the DEAP Phonology subtest. To determine intrarater reliability, the SLP who assessed each child retranscribed the DEAP Phonology subtest for 11 children within 6 months of the assessment. Intrarater reliability on 2,427 phonemes was high (M = 93.16%, range: 83.26–97.73). Similarly, intrarater reliability between two SLPs was determined for transcription of the words on the DEAP Phonology subtest for an additional 11 children. The SLPs independently transcribed the child’s speech online and then independently checked their transcription afterward via audio-recording. The intrarater reliability on 2,514 phonemes was also high (M = 92.57%, range: 88.26–97.39), indicating an acceptable level of reliability for transcription.

Parent estimation of intelligibility. Parents were requested to complete the questionnaire containing the ICS during or after their child’s assessment. Follow-up letters were sent to parents who did not return the questionnaire within 1 month of the assessment and again within 2 months.

Data Analysis

Parent responses to the ICS and measures of speech severity (PPC, PCC, PVC) were entered into SPSS Version 17.0.2. The validity and reliability of the ICS were analyzed by using descriptive statistics to determine the frequency of responses for each item, item-by-item intercorrelations (nonparametric) and a Cronbach’s alpha test of internal reliability to determine the coherence of the seven items, factor analysis to justify the formation of an overall scale of parent-rated intelligibility in differing contexts, and correlation analyses to examine the correspondence between the ICS score and clinical measures of speech severity. Specificity of the ICS was tested with an analysis of variance that compared measures of speech severity. Specificity of the ICS was determined for transcription of the words on the DEAP Phonology subtest. To determine intrarater reliability on 2,514 phonemes was also high (M = 92.57%, range: 88.26–97.39), indicating an acceptable level of reliability for transcription.

Results

ICS

Descriptive statistics. Parents’ ratings for each of the seven communication partners are presented in Table 1. The distributions in column 3 show that parents completing the questionnaire were more likely to report that they “always” (39.2%) understand their child compared with other groups: immediate family (25.4%), extended family (15.3%), the child’s friends (15.1%), acquaintances (11.8%), the child’s teacher (17.1%), and strangers (10.0%). The most common rating for all communication partners was “usually” (column 4): parent (56.7%), immediate family (62.7%), extended family (57.6%), the child’s friends (59.7%), acquaintances (46.9%), the child’s teacher (70.1%), and strangers (41.7%). Strangers were rated as equally likely to “sometimes” understand the child (41.7%). Parents gave few ratings of their child being understood “rarely” (column 6), but when this rating was given it was most likely to be for strangers (6.7%) or acquaintances (5.0%). Average ratings (means and standard deviations) were calculated for the degree of intelligibility for each communication partner (column 2). Mean scores for the sample of 120 children showed that parents’ ratings differed by communication partners, being highest for themselves (M = 4.36); similar for immediate family and teachers (Ms = 4.14 and 4.04); and lowest for extended family (M = 3.86), acquaintances (M = 3.87), and strangers (M = 3.55).

Internal consistency and construct validity of the ICS. Bivariate nonparametric correlation analyses (Spearman’s rho) for the 7-item ICS showed moderate to high correlations (ranging from r = .48 to r = .86, ps < .01) between the items (see Table 2). Moderate correlations were noted between the child’s parent and the child’s friends (r = .48), other acquaintances (r = .48), and strangers (r = .54). High correlations were observed between ratings for strangers and other acquaintances (r = .86) and ratings for teachers and friends (r = .79).

Table 1. Parent ratings for the 7-item Intelligibility in Context Scale (ICS; N = 120).

<table>
<thead>
<tr>
<th>Question</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>Valid cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you understand your child?</td>
<td>4.36</td>
<td>0.54</td>
<td>47</td>
<td>39.2</td>
<td>69</td>
<td>57.5</td>
<td>4</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>2. Do immediate members of your family understand your child?</td>
<td>4.14</td>
<td>0.60</td>
<td>30</td>
<td>25.4</td>
<td>74</td>
<td>62.7</td>
<td>14</td>
<td>11.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>118</td>
</tr>
<tr>
<td>3. Do extended members of your family understand your child?</td>
<td>3.86</td>
<td>0.68</td>
<td>18</td>
<td>15.3</td>
<td>68</td>
<td>57.6</td>
<td>30</td>
<td>25.4</td>
<td>2</td>
<td>1.7</td>
<td>0</td>
<td>0</td>
<td>118</td>
</tr>
<tr>
<td>4. Do your child’s friends understand your child?</td>
<td>3.87</td>
<td>0.68</td>
<td>18</td>
<td>15.1</td>
<td>71</td>
<td>59.7</td>
<td>27</td>
<td>22.7</td>
<td>3</td>
<td>2.5</td>
<td>0</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>5. Do other acquaintances understand your child?</td>
<td>3.68</td>
<td>0.75</td>
<td>14</td>
<td>11.8</td>
<td>59</td>
<td>49.6</td>
<td>40</td>
<td>33.6</td>
<td>6</td>
<td>5.0</td>
<td>0</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>6. Do your child’s teachers understand your child?</td>
<td>4.04</td>
<td>0.55</td>
<td>20</td>
<td>17.1</td>
<td>82</td>
<td>70.1</td>
<td>15</td>
<td>12.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>117</td>
</tr>
<tr>
<td>7. Do strangers understand your child?</td>
<td>3.55</td>
<td>0.77</td>
<td>12</td>
<td>10.0</td>
<td>50</td>
<td>41.7</td>
<td>50</td>
<td>41.7</td>
<td>8</td>
<td>6.7</td>
<td>0</td>
<td>0</td>
<td>120</td>
</tr>
</tbody>
</table>
The moderate to high intercorrelations between the individual test items demonstrate the construct validity of the ICS.

Exploratory factor analysis and a test of internal reliability were used to examine the suitability of creating an overall measure of intelligibility from the seven ICS items. Principal component analysis (PCA) was selected as an appropriate test for the population, as represented by a community sample of 109 four- to five-year-olds identified as having difficulty talking and making speech sounds and 11 nonidentified peers. A PCA identifies linear components within the data and indicates how each item contributes to these components. The PCA results revealed a single component (eigenvalue = 4.90) that accounted for 69.93% of the common variance, with item communalities for all seven items ranging from 0.806 to 0.518 (average communality = 0.699). Internal reliability of the ICS was tested by using Cronbach’s alpha and was found to achieve a very high level ($\alpha = .93$). Therefore, the seven items were averaged to form an overall mean score for the ICS with a possible range of 1.00 (low intelligibility) to 5.00 (high intelligibility).

Scale characteristics and psychometrics of the ICS. The purpose of the ICS is to provide an estimate of functional intelligibility for children with communication difficulty. The ICS was tested on the sample of 109 four- to five-year-old Australian children who had been identified with concern regarding how they talk and make speech sounds in order to examine scale characteristics, including normality of distribution. The mean score for these children was 3.85, $SD = 0.49$, minimum score = 2.57, maximum score = 5.00, and assumed equal weighting of the seven items. The distribution of scores (see Figure 1) met a number of criteria for normality: Most (68.8%) of the scores fell between 3.44 and 4.00; statistics for skewness (−0.045) and kurtosis (0.193) were close to zero, indicating a minimal deviation from normality. However, formal tests of deviation from a comparable normal distribution were significant at or below $p = .05$, suggesting that the distribution was not normal (Kolmogorov–Smirnov (with Lilliefors significance correction) $D(109) = .12$, $p < .001$, Shapiro–Wilk statistic = .98, $p = .05$. Note that the Shapiro–Wilk test, which has more power to detect differences from normality, was only just significant.) Field (2009) warned that in large samples (N > 100) “these tests can be significant when scores are only slightly different from a normal distribution; therefore they should be interpreted in conjunction with histograms, P–P or Q–Q plots, and the values of skew and kurtosis” (p. 148). The normal Q–Q plot, which plots the observed values of the data set against what would be expected in a normal distribution (expected values), shows reasonably good alignment with normality (see Figure 2).

Figure 1. Distribution of children’s mean scores ($n = 109$) on the Intelligibility in Context Scale (range: 1 [never understand] to 5 [always understand]).

![Figure 1](image-url)
Assessed Severity (PPC, PCC, PVC)

The total sample of 120 children achieved an average PPC of 80.49 (SD = 10.32, range: 52.30–99.50), an average PCC of 71.65 (SD = 14.48, range: 32.60–100.00), and an average PVC of 96.18 (SD = 4.36, range: 79.50–100.00). Distributions were normal for the PPC and PCC (skewness statistics = −0.55 and −0.81, respectively). Distributions were strongly negatively skewed for the PVC (skewness statistics = −2.76). This was likely due to ceiling effects, because most of the participants produced vowels correctly. The PPC and PVC scores for the 11 children who were not identified by their parents as having difficulty talking and making speech sounds (see Table 3) were almost identical to the scores reported by Dodd, Holm, Hua, and Crosbie (2003) for 291 typically developing children ages 4;0 through 5;5 tested on the same single word measure.

Comparisons Between ICS Ratings and Assessed Severity

Specificity of ICS ratings and assessed severity. The ability of the ICS to effectively discriminate the intelligibility of children’s speech was assessed by comparing ICS scores for the group of children who were identified by parents and/or teachers as having difficulty talking and making speech sounds and the group of children who were not identified. The results presented in Table 3 show a significant difference in the ICS mean scores for the two groups, as demonstrated by the nonoverlap of their 95% confidence intervals, the t test statistics, and effect sizes (Cohen’s d). The results showed that the ICS scores were significantly lower for the identified group (M = 3.85) than the nonidentified group (M = 4.69), t(118) = −5.35, p < .001, Cohen’s d = −1.66. Significant differences were also noted for each of the other clinical measures of severity: PPC, M = 79.27 versus M = 92.61, t(118) = −4.39, p < .001, Cohen’s d = −1.64; PCC, M = 69.88 versus M = 89.15, t(118) = −4.54, p < .001, Cohen’s d = −1.67; PVC, M = 95.92 versus M = 98.84, t(40.56) = −4.95,1 p < .001, Cohen’s d = −0.88. These findings indicate that the ICS measure is effective in discriminating children who have and have not been identified as having difficulty talking and making speech sounds.

Criterion validity of the ICS. Criterion validity establishes the degree of overlap between the test and other standard speech sampling tools that measure the same or similar abilities (Gay, 1985; Messick, 1993). In this case, the selected criterion measures were well-established and valid measures of speech severity (Dodd et al., 2002; Shriberg et al., 1997). Bivariate correlation analyses showed that the ICS was positively correlated with PPC (r = .54, p < .01), PCC (r = .54, p < .01), and PVC (r = .36, p < .01). These moderate correlation coefficients provide evidence that speech severity is linked with parental ratings of how well their children’s speech is understood by themselves and others.

Discussion

Intelligibility is frequently considered during SLP assessment in the clinical context and may be used to assist with intervention planning and to evaluate intervention outcomes. Most measures of intelligibility focus on production factors. However, intelligibility combines both production and contextual factors. In this study, intelligibility in context was measured using the 7-item ICS, a subjective 5-item Likert response scale to rate children’s intelligibility with different communication partners. Parent responses revealed that children may be understood to different degrees, depending on their communication partner, demonstrating the influence of the environmental context on intelligibility. Parents reported that their children were most likely to be intelligible to people with whom they regularly communicated (e.g., parents, immediate family, and teachers) and less likely to be intelligible to those with whom they were less familiar (e.g., strangers and other acquaintances).

1The t statistic is reported for unequal variances for the PVC, as per the results of the Levene’s test.
Table 3. Mean scores for the ICS, percentage of phonemes correct (PPC), percentage of consonants correct (PCC), and percentage of vowels correct (PVC) for children whose parents were and were not concerned about their speech sound production.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Children With Identified Concern About With Speech Sound Production (n = 109)</th>
<th>Children With No Identified Concern About Speech Sound Production (n = 11)b</th>
<th>Comparison</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>95% CI</td>
<td>M</td>
</tr>
<tr>
<td>ICS</td>
<td>3.85</td>
<td>0.50</td>
<td>[3.74, 3.94]</td>
<td>4.69</td>
</tr>
<tr>
<td>PPC</td>
<td>79.27</td>
<td>9.88</td>
<td>[77.17, 81.04]</td>
<td>92.61</td>
</tr>
<tr>
<td>PCC</td>
<td>69.88</td>
<td>13.77</td>
<td>[66.93, 72.30]</td>
<td>89.15</td>
</tr>
<tr>
<td>PVC</td>
<td>95.92</td>
<td>4.48</td>
<td>[95.04, 96.81]</td>
<td>98.83</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval.
a$t(40.56) = -4.95; \text{t} \text{ statistic for equal variance was not assumed}, \text{Levene’s } F = 5.98, p = .01$. bPCC and PVC scores were almost identical to scores reported by Dodd et al. (2003) for 291 typically developing children aged 4;0–5;5 who were tested on the same single-word measure.

Factor analysis and tests of inter-item consistency of the ICS items confirmed that the ICS is an internally reliable measure of the construct of functional intelligibility. Comparisons using the overall mean score for the measure showed that the ICS was able to discriminate children who were identified by their parents and/or teachers as having concerns about how they talked and made speech sounds from children who were not so identified. Future studies should examine the use of the ICS with a larger cohort of typically developing children and consider differences between mothers’ and fathers’ responses. Additionally, criterion validity of the ICS was examined through establishing moderate correlations with traditional measures of severity (viz., PPC, PCC, and PVC). These measures of severity were based on broad transcription of single words. Findings may be different if based on narrow transcription of conversational speech (Shriberg et al., 1997). Additional research could also examine the construct validity of the ICS by determining correlations with other intelligibility measures.

Intelligible speech has been described as the “functional common denominator of verbal behaviour” (Kent et al., 1994, p. 81); however, the functionality of measures of intelligibility may be limited if researchers and professionals do not consider the range of contexts in which children communicate and the potentially different degrees of intelligibility in those contexts. Most measures of intelligibility categorize speech on the basis of SLPs’ measurements within the clinical context. Although these measures are valid, they can be enhanced by considering the communicative contexts of children’s everyday life. The ICS determines children’s intelligibility in context with seven communicative partners identified in the ICF-CY and can be used alongside measures of speech severity and other production factors that influence intelligibility, to provide an additional holistic measurement of intelligibility. The present study provides support for the validity, reliability, and sensitivity of the ICS for use with Australian preschool children; however, future research should be undertaken with a larger sample of children comprising a wider range of ages and severity of SSD.

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References


**Appendix.** Intelligibility in Context Scale (ICS).

The following questions are about how much of your child’s speech is understood by different people. Please think about your child’s speech over the past month when answering each question. Circle one number for each question.

<table>
<thead>
<tr>
<th>Question</th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. Do immediate members of your family understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3. Do extended members of your family understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4. Do your child’s friends understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Do other acquaintances understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6. Do your child’s teachers understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7. Do strangers(^a) understand your child?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

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\(^a\)This measure may be able to be adapted for adults’ speech by substituting child with spouse. \(^b\)The term strangers may be changed to unfamiliar people.
The Intelligibility in Context Scale: Validity and Reliability of a Subjective Rating Measure

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