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Adaptation and validation of Intelligibility in Context Scale as a screening tool for Hong Kong preschoolers

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Abstract

Intelligibility in Context Scale (ICS) is a parent report questionnaire developed based on the Environmental and Personal domain of the International Classification of Functioning, Disability and Health— Children and Youth Version (ICF-CY) (World Health Organization, 2007) for assessing children's speech intelligibility (McLeod, Harrison, & McCormack, 2012). This study aimed to adapt ICS into Chinese, namely, ICS-C, and examine the psychometric properties of the adapted version when applying to Cantonese-speaking children. A secondary objective was to identify speech measures ICS-C was sensitive to. A total of 72 Cantonese-speaking preschoolers with (N = 39) and without speech sound disorders (SSD) (N = 33) were recruited. Native Cantonese-speaking parents completed ICS-C independently. Results demonstrated good internal consistency and test-retest reliability of ICS-C. Correlations with speech performance, and significant difference in ICS-C mean scores between the two groups supported validity of ICS-C. The optimal cutoff was estimated using Receiver Operative Characteristic (ROC) curve analysis, giving a sensitivity of .70 and specificity of .59. ICS-C mean scores showed positive correlation with PICC and negative correlation with frequency of atypical errors, both were moderate in strength. Given the satisfactory psychometric properties of ICS-C, it can be a valuable clinical tool for screening of SSD in preschoolers.

Traditional assessment of speech sound disorders (SSD) include direct evaluation by speech-language pathologists (SLPs) using standardized assessment tools or speech samples analysis. SLPs may calculate percentage of phoneme correct (PCC), size of phonetic inventory, and/or numbers and types of phonological patterns based on the speech samples and compare a child's performance against normative data of the language (McLeod, 2012). Then a clinical decision of whether the child needs intervention on his or her speech sound production can be made. According to the framework of International Classification of Functioning, Disability and Health— Children and Youth Version (ICF-CY) (World Health Organization, 2007), this traditional way of documenting children's speech production belongs to the domain of Body Structures and Function, which involves the physiological and psychological functions of one's body systems. Sometimes, it is also known as the Impairment level. The other two domains that describe the impact of a communication disorder on an individual includes Activity and Participation, as well as Environmental and Personal. The Activity level involves aspects of communication, learning, self-care and other activities of daily living, and the Participation level describes the degree that an individual experiences engagement or limitations in life situation expected for his or her age. The Environment and Personal domain refers to the facilitators, obstacles and people in the context involved (WHO, 2007).

In the area of SSD, speech intelligibility can be considered as an index at the Activity and Participation domain that indicates a child's capacity when engaging in conversation. Intelligibility reflects a relative and joint effort of a speaker and a listener (McLeod, 2004). From a speaker's perspective, age, articulatory ability, error consistency, language ability and speaking style would directly affect his or her speech intelligibility (Ferguson, 2004; McLeod, 2012). From a listener's perspective, acceptability towards a speaker, familiarity with the

speaker, language or dialect, as well as experience in listening to the child's speech also affect intelligibility (Beukelman & Yorkston, 1980; Flipsen, 1995; McGarr, 1983; Witzel, 1995). Other contextual factors which impact on intelligibility include discourse types and availability of physical cues in the situation (Platt, Andrews, Young, & Quinn, 1980; Hustad, 2012). Taken all these factors together, Flipsen (2006) suggested the general conversational intelligibility perceived by unfamiliar listeners for children at the ages of 1;00, 2;00, 3;00 and 4;00 are 25%, 50%, 75% and 100% respectively. Speech intelligibility in context can therefore be regarded as a holistic and ecologically valid index about how well a child conveys his or her message to listeners in a situation (WHO, 2007).

Parents are often the primary communication partners to children during early years. Therefore, they are able to identify their child's communication performance across a wide range of social contexts and are expected to provide the most valid description of a child's speech intelligibility (Hustad, 2012; WHO, 2007).

Based on that, McLeod, Harrison, and McCormack (2012) developed a parent questionnaire called Intelligibility in Context Scale (ICS) to obtain parents' opinions about their child's speech intelligibility when talking to different communication partners, including the parents themselves, other immediate family members, extended family members, child's friends, child's teachers, acquaintances and strangers (see Appendix A). The ICS highlights the Environment and Personal domain in the ICF-CY model by enlisting the relevant communication partners for a holistic documentation of a child's speech intelligibility (WHO, 2007; McLeod et al., 2012). In the questionnaire, parents are requested to rate on how well their child's speech can be understood by different communication partners using a 5-point Likert scale. The whole questionnaire consists of seven questions and takes about 3 to 5 minutes to complete. A mean score can be computed as the average rating of these seven

items. In the validation study, McLeod et al. (2012) reported a moderate correlation between the ICS mean score and SSD severity measures percentage phoneme correct (PPC) (r = .54, p < .01), percentage consonant correct (PCC) (r = .54, p < .01) and percentage vowel correct (PVC) (r = .36, p < .01) in a group of preschool children with (N = 109) and without (N = 11) parent- or teacher-identified concern on their speech sound production ability. Moreover, significant difference in ICS mean scores between the typical and "concerned" groups was noted. This evidence further supported the potential clinical value of ICS for screening of SSD in young children.

The Present Study

The main aim of the present study was to adapt ICS to Cantonese population in Hong Kong. The adapted tool developed was called the Chinese version of ICS (ICS-C). A validation study was conducted to examine the psychometric properties of the adapted tool in Cantonese-speaking parents and children. In the validation study, the reliability of ICS-C was examined in terms of internal consistency of the items and test-retest reliability. Validity was examined in terms of (1) the correlations between speech performance of a child and the corresponding ICS-C mean score from his or her parent and (2) the difference between the ICS-C mean scores of children with and without SSD. For investigating the sensitivity and specificity of ICS-C, the best cutoff that can yield the best sensitivity and specificity was identified. A secondary objective of the present study was to investigate which speech dimension(s) ICS-C was more sensitive to, which in turn can provide a clear picture about the speech problems of children that can be identified by parents using the ICS-C.

Method

The current study consisted of two stages. Stage 1 was the adaptation of ICS into Chinese by taking into account the cultural features of Cantonese (Ferraro, 2002; WHO, 2012) and Stage 2 involved the administration of the ICS-C onto a group of native Cantonese-speaking parent-child dyads, in which children were diagnosed as having normal and disordered speech sound development.

Adaptation of ICS to ICS-C

ICS was translated to Chinese according to recommended standard of back translation and guidelines for cross-culture test adaptation (Brislin, 1980; Su & Parham, 2002; WHO, 2012). Forward translation was first conducted by a professional bilingual translator whose first language was Chinese. Back translation was independently carried out by a professional translation company. Corresponding modifications of ICS-C were done until there was no further enhancement to be made. The final version of the ICS-C in traditional Chinese characters can be accessed from http://www.csu.edu.au/research/multilingual-speech/ics (see Appendix B).

Participants

Parent-child dyads were recruited from four community kindergartens and nurseries in Hong Kong. Teachers were invited to assist in participant recruitment. Two groups of children were requested, the first group consisted of children being considered as having unclear speech or their parents showed concern for his or her speech development, and the other group consisted of children with typical speech ability. A total of 94 parent-child dyads were recruited with 46 boys and 48 girls as the child participants. Using teacher-identified concern instead of parent-identified concern for recruitment of children participants was an attempt to minimize bias sampling of only a group of parents with

concerns about their child's speech, who might give lower the ICS-C ratings, regardless of the actual diagnosis. Parents were allowed to fill out the ICS-C at home and return after completion. In addition to the ICS-C, parents were requested to provide background demographic information in a questionnaire (see Appendix C). Teachers assisted in distributing the ICS-C, demographic questionnaire and the consent form to parents and collecting the returned forms from parents. Two parents failed to return the questionnaire. The overall return rate of ICS-C among the 94 participating parents was 98%. Majority of the respondents of the ICS-C were parents (mothers:76%, fathers: 15%) and some were the child's relatives (8%).

Based on the demographic questionnaire, 20 parent-child dyads were excluded with 12 parents indicated their child had a diagnosis or concern of developmental disabilities such as autism spectrum disorders (ASD) and language delay, 7 parents pointed out that theirs and their child's first language was not Cantonese, 1 reported both diverse linguistic environment and relevant diagnosis. These were attempts to ensure the target population in the study was children were native Cantonese speakers with normally developing speech or SSD, and not comorbid with other communication problems; as well as parents whose first language was Cantonese so that they may not have affected perception on Cantonese speech (Best, 1995; Flege, 1995; Iverson & Kuhl, 1995).

A total of 22 parent-child dyads were excluded due to the above reasons or failure to return ICS-C. Among 72 preschoolers included in the study, there were 31 boys and 41 girls aged from 36 to 72 months old as shown in Table 1. Concerning the birth order, 28 of them was the first and only child, 17 was the first child among siblings, 18 was the younger of two, 3 was the middle child, 1 was the youngest of three and 5 parents did not respond to this question. Socioeconomic status (SES) was evaluated based on their domestic income with

reference to Hong Kong 2011 population census data (Census and Statistics Department, 2012). There were 11 children whose family income fell below 25th percentile (15%), 49 between 25th and 75th percentile (68%), 11 above 75th percentile (15%) and 1 did not respond to this question.

Among the parents completing the questionnaire, 15 received post-secondary education, 50 received up to secondary education and none have only primary school education.

Table 1

Demographic Information of Children Participants (N = 72)

	Age (month)		Boys	Girls	Total
Grade	*M*	(*SD*)	*N*	*N*	*N*
K1	41	(3.46)	16	11	27
K2	53	(2.82)	5	12	17
K3	66	(3.39)	10	18	28

Speech Measures

The reference standard to differentiate children with typical speech development and SSD was based on the child's performance in a standardized speech assessment, Hong Kong Cantonese Articulation Test (HKCAT) (Cheung, Ng, & To, 2006). That is, children who scored at or below -1.33 SD from the mean according to the normative data could be considered as having SSD. Since using the standard scores as severity measures would weigh all errors equally and would under-identify atypical children with articulatory errors and atypical phonological patterns, in addition to the standard scores, the presence of atypical speech errors was also taken into consideration (Preston & Edwards, 2010). In other words,

a child with SSD is defined as having (1) standard score of initial consonant, vowel and diphthong, or final consonant at or below -1.33 SD from the mean and (2) atypical speech errors as defined by phonological patterns or articulation errors in any segmental position exhibited by less than 5% of children at all age group in HKCAT normative data (Cheung et al., 2006).

To examine which speech dimensions ICS-C was more sensitive to, correlations between ICS-C mean score and the following measures were calculated: PPC, PICC, PV/VVC, PFCC, and frequency of atypical speech errors.

Procedure

Validation study. All the children were assessed using HKCAT (Cheung et al., 2006) by an investigator in a quiet room in their preschool centres. Speech samples were transcribed online together with audio recording using a Sony ICD-PX820 digital voice recorder. Both intrarater and interrater reliability of speech transcription in HKCAT were established by random and independent review of 10 participants' audio recordings with a total of 2,720 items. The item-by-item agreement for intrarater and interrater reliability were 98.3% and 95.7% respectively, indicating a highly reliability.

A copy of ICS-C, a demographic questionnaire and a consent form were distributed to each parent, and the returned forms were collected via the teachers. The investigator did not know which recruited group, typical or SSD, a child belonged to or their ICS-C ratings before speech assessment, while the parents did not know the result of the standardized speech assessment when they filled in the questionnaire. This can ensure that report bias was minimum. To measure the test-retest reliability of ICS-C, parents were invited to fill in the questionnaire again at least 2 weeks after the first one. A total of 21 questionnaires were returned.

Statistical Analysis

A series of statistical analyses were conducted to address the objectives. Data was analyzed using SPSS Version 19.0. To demonstrate reliability of ICS-C, inter-correlation coefficients of the seven items in ICS-C were calculated to indicate the internal consistency, while item-to-item agreement in ICS-C rating among the first and repeated measure was calculated for test-retest reliability. To demonstrate validity of ICS-C, correlations between ICS-C mean scores and children's actual speech performance, as well as difference in the ICS-C mean scores between the typical and SSD group were examined.

To determine the best cutoff that yielded satisfactory diagnostic accuracy, a Receiver Operating Characteristic (ROC) curve was drawn followed by cutoff adjustment. For the final objective, that is to investigate the speech dimensions (PPC, PICC, PV/VVC, PFCC and frequency of atypical errors) that were most sensitive to ICS-C ratings, correlations between these speech measures and ICS-C mean scores were calculated.

Results

Speech Performance

Using HKCAT norms for initial consonant, vowel and diphthong and final consonant, together with the existence of atypical speech errors as the gold standard, 72 children divided into (1) a typical group without concern of speech difficulties and (2) an SSD group. There were 39 children (54%) considered typical with mean age of 58 months (*SD* = 10.0) and 33 (46%) considered atypical with mean age of 48 months (*SD* = 11.5). Their speech performance in terms of different measures were summarized in Table 2.

Equal variance of the two groups was not assumed in the Levene's Tests for all the speech measures. Mann-Whitney *U* tests were conducted to examine if the group differences were significant. Results showed that there were significant differences in PPC

(U = 115, p < .001, r = -.71), PICC (U = 233, p < .001, r = -.58), PV/VVC (U = 317, p < .001, r = -.55) and frequency of atypical errors (U = 19.5, p < .001, r = -.92) between the typical and SSD group, while no significant difference was found in PFCC (p = .018). Results indicated that the typical group performed significantly better than the SSD group in most of the speech dimensions.

Table 2

Speech Performance Scores of Children in the Typical and SSD Group (N = 72)

	Typical (N = 39)		SSD (N = 33)	
Speech measures	*M*	(*SD*)	*M*	(*SD*)
PPC	98.2	(2.33)	89.4	(8.53)
PICC	98.3	(3.88)	85.1	(16.12)
PV/VVC	99.8	(0.77)	96.8	(3.65)
PFCC	94.9	(4.94)	89.2	(11.30)
z-IC [a]	0.34	(0.40)	-0.44	(1.14)
z-V/VV [a]	0.28	(0.50)	-0.25	(1.11)
z-FC [a]	0.57	(0.59)	0.45	(0.85)
Atypical errors	0.0	(0.00)	3.3	(3.56)

Note. PPC = percentage phoneme correct; PCC = percentage consonants correct; PICC = percentage initial consonant correct; PV/VVC = percentage of vowel and diphthong correct; PFCC = percentage of final consonant correct; z-IC = standard score of initial consonant; z-V/VV = standard score of vowel and diphthong; z-FC = standard score of final consonant; Atypical errors = frequency of atypical error

[a] The lowest standard score available for reference was -3 SD from the mean

ICS-C Ratings

General pattern. Parental perception on preschoolers' speech intelligibility to different communication partners was listed in Table 3. Collapsing the two groups, most parents completing ICS-C reported they "always" (66.7%) understood their child's speech, which was the highest percentage among all the communication partners. None of the parents rated "rarely" (0.0%) or "never" (0.0%) for themselves or for the immediate family members. Teachers (52.8%), the child's friends (48.6%), acquaintances (45.8%) and strangers (44.4%) were mostly considered "usually" understood their child's speech. Mean score of all seven items showed that parents regarded themselves as understanding their child's speech best, followed by immediate family, with extended family similar to that of the child's teachers, followed by the child's friends, then acquaintances, and the least were strangers.

Table 3

Parent Ratings on Their Child's Intelligibility to Different Communication Partners (N = 72)

Ratings			Always	Usually	Sometimes	Rarely	Never
			5	4	3	2	1
Items	*M*	(*SD*)	%	%	%	%	%
Parent (self)	4.65	(0.51)	66.7	31.9	1.4	0.0	0.0
Immediate family	4.57	(0.53)	58.3	40.3	1.4	0.0	0.0
Extended family	4.39	(0.70)	50.0	40.3	8.3	1.4	0.0
Friends	4.29	(0.72)	41.7	48.6	6.9	2.8	0.0
Acquaintances	4.17	(0.80)	37.5	45.8	12.5	4.2	0.0
Teachers	4.36	(0.59)	41.7	52.8	5.6	0.0	0.0
Strangers	4.13	(0.82)	36.1	44.4	15.3	4.2	0.0

Inter-correlations of items in ICS-C. ICS-C mean scores of the seven items received by each child participant were calculated. Test of normality using Kolmogorov-Smirnov with Lilliefors was significant, suggesting normal distribution was not assumed. Spearman's *rho* correlations among the items ranged from moderate ($r_s(70) = .56$, $p < .001$) to strong ($r_s(70) = .89$, $p < .001$) (see Table 4). The results demonstrated an overall satisfactory internal consistency for ICS-C.

Table 4

Non-parametric Correlations among the seven ICS-C Items (N=72)

Items	Parent (self)	Immediate family	Extended family	Friends	Acquain-tances	Teachers
Immediate family	.79	-				
Extended family	.75	.80	-			
Friends	.64	.65	.82	-		
Acquaintances	.59	.71	.80	.88	-	
Teachers	.64	.63	.81	.80	.77	-
Strangers	.56	.68	.81	.82	.89	.87

Note. *** $p < .001$ (two-tailed) for all the above correlations

Test-retest reliability. Twenty one parent repeated ICS-C after at least a two-week interval. Item-to-item agreement was 71.4% among a total of 147 items, demonstrating a moderate test-retest reliability.

Correlations between ICS-C mean scores and HKCAT scores. Spearman's *rho* was used to compare ICS-C mean scores with various speech measures including PPC, PICC,

PV/VVC, PFCC and frequency of atypical errors as normal distribution was not assumed. ICS-C mean scores showed positive correlation with PICC and negative correlation with frequency of atypical errors. Both correlations were moderate in strength (see Table 5). Other speech measures including PPC, PV/VVC and PFCC did not show significant correlations with ICS-C mean scores.

Table 5

Non-parametric Correlations between ICS-C Mean Scores and HKCAT Scores (N=72)

Speech measures	r_s	*p*
PPC	.27	.02
PICC	.41	***
PV/VVC	-.06	.61
PFCC	-.08	.53
Atypical errors	-.41	***

Note. *** = $p < .001$

Comparison of ICS-C mean scores between groups. ICS-C mean scores of the two groups fulfilled the assumption of equal variances. Results of *t*-test showed significant difference in ICS-C mean scores between the typical ($M = 4.56$, $SD = 0.48$) and SSD group ($M = 4.14$, $SD = 0.65$) ($t(70) = 3.13$, $p < .01$, $d = 0.74$) suggesting that ICS-C can differentiate children with and without concern of SSD with a large effect size of 0.74.

Diagnostic accuracy of ICS-C. The optimal threshold value for sensitivity and specificity based on Euclidean distance was the coordinate point with sensitivity of .58 and specificity of .72 (see Figure 1). Given sensitivity and specificity level should be at least .70

to .80 to be regarded satisfactory (Glascoe & Dworkin, 2008), this cutoff identified in mathematical perspective is considered with a low level of sensitivity but with a satisfactory specificity level. Considering the potential use of ICS-C as a screening tool, a designated cutoff was therefore selected based on the principle that a satisfactory sensitivity level should be achieved for adequately identifying children with potential SSD. The adjusted cutoff yielded a satisfactory sensitivity level of .70 with a drop in specificity level to .59 as a tradeoff. ROC space in Table 6 showed the corresponding number of positive and negative cases using ICS-C. The corresponding cutoff ICS-C score for the adjusted pair of sensitivity and specificity was 4.29. That means, if the ICS-C score of 4.29 was used as the cutoff , the number of children identified as having SSD and having typical speech development is the closest to the actual diagnosis based on the standardized assessment. For the area under the ROC curve (AUC) which represents an overall accuracy, value of .69 using the ICS-C mean score indicated a borderline acceptability (Hosmer & Lemeshow, 2000).

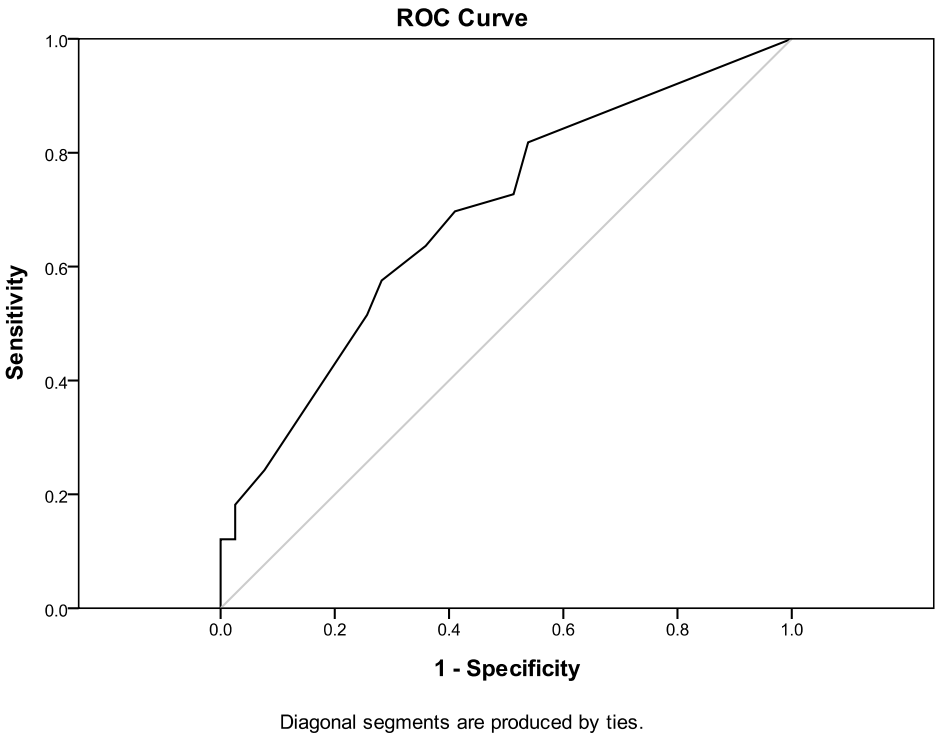

Figure 1. ROC curve using the ICS-C mean scores.

Table 6

ROC Space of Outcome Prediction using ICS-C

		Reference standard		Total
		+	-	
ICS-C (Prediction value)	+	23	16	39
	-	16	23	33
Total		33	39	

Note. "+" = SSD or failed in ICS-C; "-" = typical or passed in ICS-C

Discussion

The main objective of the study was to adapt ICS into Chinese to identify preschoolers with SSD. Psychometric properties of ICS-C were evaluated. Reliability was investigated in terms of internal consistency and test-retest reliability. Evidence of validity was appraised based on the correlations between ICS-C mean scores and speech performance, and also the significant difference between ICS-C mean scores of children with and without SSD. The secondary objective was to identify speech measures that ICS-C was more sensitive to.

Generally, parents completing the ICS-C mostly reported themselves "always" or "usually" understood their child's speech despite a group of children were considered having SSD, and had many speech errors as shown in the low HKCAT standard scores with presence of more atypical speech errors. There appeared to be a ceiling effect in the self-rating item. Parent ratings on how well their child could be understood by strangers was rated with the lowest mean score among the seven items but most of the parents thought strangers could at least "usually" understand their child's speech. Though parent ratings appeared to be conservative and skewed to the higher value, there was a significant difference between the

self-rating item and that concerning strangers. It implies that most parents found their child's speech intelligible but when they were guided to compare their child's communication performance with reference to other communication partners in various social contexts, discrepancy could be observed. Parents were aware that strangers may find it difficult to understand their child's speech even though they themselves had no problem understanding their child. This highlighted the importance of considering the Environment and Personal domain in the ICF-CY model for a holistic evaluation of a child's communication performance (WHO, 2007; McLeod et al., 2012). Speech intelligibility was clearly affected by different communication partners.

Psychometric Properties of ICS-C

Reliability. Internal consistency was demonstrated in the moderate to strong correlations among the seven items of ICS-C. The correlation values were similar to the original ICS reported by McLeod et al. (2012), in which moderate to high correlations were also shown. The correlation between the first and second time that parents filling in the questionnaire indicated that ICS-C had a moderate test-retest reliability. In summary, ICS-C demonstrated satisfactory reliability.

Validity. The moderately strong correlations between ICS-C mean scores and speech performance, as well as the significant difference in ICS-C mean scores between the typical and SSD group supported validity of ICS-C in capturing children's actual speech performance. The results imply that parent perception towards their children's speech performance can represent the child's speech ability. In other words, ICS-C was able to differentiate children with typical from children with SSD, suggesting its clinical value.

Diagnostic accuracy. The best cutoff point using ICS-C mean scores was estimated using ROC curve analyses followed by adjustment. The adjusted cutoff identified yielded a

satisfactory sensitivity level of .70 and a lower specificity level of .59 (Glascoe & Dworkin, 2008), which means that ICS-C is more ready to identify children with SSD but is too stringent that it may over-identify some typical children as having speech concern. Given the purpose of screening as to identify cases that might require a more detailed diagnostic assessment, the ICS-C cutoff with acceptable sensitivity rate can be selected despite compromised specificity.

Speech measures sensitive to ICS-C. Among various speech measures including PPC, PICC, PV/VVC, PFCC, and frequency of atypical errors, only PICC and frequency of atypical errors showed significant correlations with ICS-C mean scores. This means children whose errors were in initial consonants or were atypical in nature tended to be more easily identified by parents. This was coherent with Byers' (1973) finding that initial consonant was more intelligible to listeners given the same vowel environment at monosyllabic level, suggesting errors in initial consonant would compromise speech intelligibility in a greater extend. Therefore, lower PICC was easier to be picked up by parents and was reflected in ICS-C. Also, the relationship between atypical phonological errors and lower speech intelligibility (Feldman & Messick, 2008) explained why children with more atypical errors tended to be rated with lower speech intelligibility.

In conclusion, the above findings indicated that ICS-C was able to met several features of a good screening test, including having a satisfactory sensitivity (70%) to identify children at risk of SSD (Glascoe & Dworkin, 2008), a low cost as it involves parents only and no professionals, a short administration time of 5 minutes, and easy scoring. Moreover, simple calculation to obtain a mean score for comparison with the given cutoff allows getting the screening result immediately after questionnaire collection.

However, there are some cautions when using ICS-C in clinic. Firstly, children and parents with diverse linguistic background were not included in the study. In addition, children with medical diagnosis of intellectual impairment, ASD or diagnosis of language delay were also excluded. There was no evidence that ICS-C can be validly applied on these groups of parent-child dyads. Therefore, language background of a parent and a child, as well as the medical case history of the child should be taken before comparing with the ICS-C cutoff score.

Further Studies

Given that ICS-C can be a potential screening tool for Cantonese-speaking preschoolers in a large scale population screening, further validation study with larger sample of Cantonese-speaking parent-child dyads can be carried out. This could facilitate early identification of children with SSD to ensure better access of a detailed speech assessment and timely intervention. Factors that may affect ICS-C accuracy can also be investigated to determine the condition of ICS during application. For example, education level of parents and duration of daily parent-child interaction time, and whether mothers and fathers would rate differently using ICS-C with an maternal advantage of perceived intelligibility as reflected by Flipsen (1995). This may provide evidence for a more effective use of parent ratings in clinic setting. In addition, ICS-C ratings and speech measures of parent-child dyads with linguistically and culturally diverse background can be examined. For example, ICS-C ratings between parents of a child, one being native Cantonese speaker and one non-native, can be compared. This can reflect the influence of the first language on Cantonese perception on ICS-C ratings (Best, 1995; Flege, 1995; Iverson & Kuhl, 1995) would be prominent when using ICS-C. Similarly, ICS-C ratings of children who is simultaneously multilingual, with comparable use of Cantonese and other language or dialect

in daily life, or those who learn Cantonese as their second language can be obtained to see if the influence on Cantonese production (Flege, Frieda, & Nozawa, 1997) would be reflected in ICS-C by native Cantonese-speaking parents. Moreover, ICS-C ratings on preschoolers with a wider range of causes of SSD or with other communication problems such as language delay, ASD, or with comorbid situations could be investigate, to see if parents would be distracted to rate on other aspects of communication for the same items using ICS-C. This can identify whether parents with previous knowledge of relevant diagnosis would give significantly lower scores on ICS-C items than parents whose children are without concern or diagnosis, even if their child is considered typical in speech development and is highly intelligible. This could verify if ICS-C could be validly applied for this group of parent-child dyads with concern of other or comorbid communication disorders.

As the finding emphasized the importance of taking into account the Environment and Personal domain in the ICF-CY model for assessing a child's speech intelligibility, similar study can be done to investigate validity of ratings by various communication partners or caregivers other than parents (WHO, 2007; McLeod et al., 2012). Teacher report questionnaires, for example, have been involved in screening for a range of developmental problems in preschoolers (Dowdy, Chin, & Quirk, 2013; Bedore, Pena, Joyner, & Macken, 2010).

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Appendix A

Intelligibility in Context Scale (ICS)

Intelligibility in Context Scale (ICS)

(McLeod, Harrison, & McCormack, 2012)

Child's name:_____

Child's date of birth:_____Male/Female:_____

Language(s) spoken:_____

Current date: _____Child's age:_____

Person completing the ICS:_____

Relationship to child:_____

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.

	Always	Usually	Sometimes	Rarely	Never
1. Do **you** understand your child[1]?	5	4	3	2	1
2. Do **immediate members of your family** understand your child?	5	4	3	2	1
3. Do **extended members of your family** understand your child?	5	4	3	2	1
4. Do your **child's friends** understand your child?	5	4	3	2	1
5. Do other **acquaintances** understand your child?	5	4	3	2	1
6. Do your **child's teachers** understand your child?	5	4	3	2	1
7. Do **strangers**[2] understand your child?	5	4	3	2	1
TOTAL SCORE =	/35				
AVERAGE TOTAL SCORE =	**/5**				

[1] This measure may be able to be adapted for adults' speech, by substituting *child* with *spouse*.
[2] The term *strangers* may be changed to *unfamiliar people*

Further information: McLeod, S., Harrison, L. J., & McCormack, J. (2012). The Intelligibility in Context Scale: Validity and reliability of a subjective rating measure. *Journal of Speech, Language, and Hearing Research, 55*(2), 648-656. http://jslhr.asha.org/cgi/content/abstract/55/2/648

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Appendix B

Intelligibility in Context Scale-Chinese (ICS-C)

語境說話清晰度量表

Intelligibility in Context Scale (ICS): Traditional Chinese

(McLeod, Harrison, & McCormack, 2012)

香港大學 杜潔森、吳綺雯譯 2012

Translated by: Carol K. S. To, Ph.D. & Kaylor Ng, The University of Hong Kong, HKSAR China, 2012

兒童姓名:_____

兒童出生日期:_____性別: 男/女:_____

會說的語言:_____

填表日期: _____兒童年齡:_____

填表人:_____

與兒童關係:_____

下列問題是關於不同人對孩子說話的理解程度。回答問題時請認真想想孩子在過去一個月中的說話情況。每題請圈一個數字。

	總是	通常	有時候	很少	從不
1. **您**能明白孩子的說話嗎[1]？	5	4	3	2	1
2. 孩子的**家庭成員**能明白他/她的說話嗎？	5	4	3	2	1
3. 孩子的**其他親戚**能明白他/她的說話嗎？	5	4	3	2	1
4. 孩子的**朋友**能明白他/她的說話嗎？	5	4	3	2	1
5. **其他認識而不熟識孩子的人**能明白他/她的說話嗎？	5	4	3	2	1
6. 孩子的**老師**能明白他/她的說話嗎？	5	4	3	2	1
7. **陌生人**[2]能明白孩子的說話嗎？	5	4	3	2	1
總分=	/35				
平均分=	**/5**				

[1]此量表適用於成人的言語，將孩子轉為配偶即可。

[2]此條中"陌生人"可換為"不認識的人"。

McLeod, S., Harrison, L. J., & McCormack, J. (2012). The Intelligibility in Context Scale: Validity and reliability of a subjective rating measure. *Journal of Speech, Language, and Hearing Research, 55*(2), 648-656. http://jslhr.asha.org/cgi/content/abstract/55/2/648

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Appendix C

Demographic information questionnaire

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Division of Speech & Hearing Sciences
Faculty of Education
The University of Hong Kong

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以家長問卷作為香港學前兒童語音障礙識別工具

基本資料

*** 請由同一人填寫以下問卷以及「語境說話清晰度量表」，所有個人資料均會保密。謝謝!**

填卷日期： _____年_____月_____日

填卷人與幼兒之關係:： 母子 / 母女 / 父子 / 父女 / 其他:

填卷人的母語： ☐廣東話 ☐普通話 ☐英語 ☐其他: _____

填卷人與兒童平均每天互動時數： 約_____小時

請填上答案或在適當的空格上填上√號:

1. 幼兒共有多少個兄弟姊妹？ _____個（不包括幼兒自己）
   幼兒排行第_____

2. 幼兒主要由誰人照顧? ☐父/母 ☐(外)祖父/母 ☐傭人 ☐其他: _____

3. 幼兒與各家中成員所用的語言或方言 (可選超過一項)
   a. 父 ☐廣東話 ☐普通話 ☐英語 ☐其他: _____
   b. 母 ☐廣東話 ☐普通話 ☐英語 ☐其他: _____
   b. (外)祖父母 ☐廣東話 ☐普通話 ☐英語 ☐其他: _____
   c. 兄弟姐妹 ☐廣東話 ☐普通話 ☐英語 ☐其他: _____
   d. 傭人 (如適用) ☐廣東話 ☐普通話 ☐英語 ☐其他: _____

4. 幼兒曾否被診斷有以下障礙? ☐否
   ☐是 (☐聽力障礙 ☐語言發展遲緩 ☐智力障礙 ☐自閉症 ☐其他: _____)

5. 幼兒曾否接受言語治療、物理治療、職業治療或其他治療? ☐否
   ☐是 (☐言語治療 ☐物理治療 ☐職業治療 ☐其他: _____)

6. 幼兒家庭成員是否有言語障礙? ☐否
   ☐是 (成員是: _____ 其障礙是:_____)

7. 幼兒父親教育程度 ☐小學或以下 ☐中學 ☐專上、大學或以上

8. 幼兒母親教育程度 ☐小學或以下 ☐中學 ☐專上、大學或以上

9. 家庭總入息 ☐一萬元以下 ☐一萬至四萬元 ☐四萬元以上

問卷完，請交回機構負責人。 謝謝！