The Brazilian Phrases in Noise Test (PINT Brazil)

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The goal of this study was to determine if the Phrases in Noise Test (PINT), which is recorded in English, could be adapted for the assessment of the hearing skills in children in the Brazilian population from the age of four-years old. The steps to adapt the PINT Brazilian Portuguese included translation of the stimuli, testing cultural equivalence (verify that children understand the stimuli), record the stimuli, adjust the stimuli for equal intelligibility, and create and validate the final test lists. To validate the test lists, the speech recognition of 10 children was evaluated.

Introduction

Brazil has a public policy structured on Hearing Health. The acquisition of technological aids is considered essential in the process of hearing rehabilitation for children and adults. Hearing technology may be obtained in the accredited Hearing Health Services and with the criteria indicated by the Unified Health System (UHS) at no cost for the population.

Children with hearing loss and hearing aids require even greater effort than their peers with normal hearing when listening in adverse acoustic conditions (especially in classrooms), and all school children exposed to noisy environments at an early age (Hicks & Tharpe, 2002). Since 2013, the last concession in the UHS in the Hearing Health area was the provision of an assistive device known as frequency modulation (FM) systems, which is a device that improves the signal-to-noise ratio at the listener's ear. This ordinance was considered a great achievement by hearing health providers because it enabled the use of FM systems by children and teenagers with hearing loss in the school environment. The FM system is beneficial to children with hearing aids (HA) and/or cochlear implants (CI) because children with hearing loss have significant difficulty hearing in noisy environments and because will allow the listener to be able to hear the speech at a higher intensity level than when not using it (Jacob & Queiroz- Zattoni, 2011; Thibodeau & Schaper, 2014; Mulla & McCraken, 2014; Thibodeau & Wallace, 2014; Atcherson, 2014; Saunders et al., 2014).

The American Academy of Audiology (AAA, 2008, 2011) developed clinical practice guidelines for assessing the benefit of remote microphone systems, such as an FM system. The guidelines recommend a behavioral verification procedure consisting of speech perception in noise measures (AAA, 2008, 2011). The guideline also supports that fact that the measurement of communicative and hearing abilities of children with hearing loss is critical for monitoring progress as part of their rehabilitative program.

In Brazil, there is no standardized test for assessing children's speech recognition in noise. The only tests with accompanied noise are appropriate only for adults and include the Brazilian Hearing in Noise Test - HINT/ Brazil (Bevilacqua et al., 2008) and the test Lista de Sentenças em Português- LSP (Costa, 1998) (Jacob et al., 2011).

Tests that are appropriate for children may be used only to assess speech recognition in quiet. These tests were adapted from standardized tests used internationally and include the Tacam - Test of Minimal Hearing Capacity, which was adapted for Brazilian Portuguese by Orlandi & Bevilacqua (1999) and adapted from Early Speech Perception Test - ESP (1990). It can be used for children up to 5 years of age and assesses closed-set speech perception through the use of toys that correspond to the test stimuli. Another test, the GASP - Procedure for the Evaluation of Children with Profound hearing loss, adapted by Bevilacqua &Tech (1996), examines the skills of hearing detection and discrimination, auditory recognition and understanding of words in a closed set. The List of Dissyllable Words, proposed by Delgado & Bevilacqua (1999), evaluates open set word recognition.

Schafer et al. (2012) affirm that the number of research studies on the speech perception in noise in young children is limited, which is likely related to the lack of speech-in-noise tests specific to the pediatric population. The authors explain that the Hearing In Noise Test Children - HINT-C (Nilsson et al., 1996) and Bamford-Kowal-Bench Speech-in-Noise test- BKB-SIN (Etymotic Research, 2004), which are tests not translated into Portuguese Brazilian, contain vocabulary levels that are equal to or exceed that of typical 5- or- 6-years-old child. Also, these tests may not be sensitive or efficient because they use fixed-signal levels, which result in ceiling and floor effects (0% or 100% correct) when the signal-to-noise ratio (SNR) is too easy or difficult for a particular child. Other examples of speech perception tests in noise are described in the literature and include the Listening in Spatialized Noise Test (LISN®) composed of 120 sentences (Cameron & Dillon, 2007) and Leuven Intelligibility Number Test (LINT) (Van Deun, Wieringen and Wouters, 2010).

Because there are no speech-in-noise tests in Portuguese Brazilian, it is imperative to consider if an existing test can be adapted to allow for testing with wireless technology, such as FM systems. Schafer & Thibodeau (2006) developed and validated a list of phrases for preschoolers that involved body parts. The test results provide a sensitive estimate of a young child's speech-in-noise threshold; the test should not be negatively influenced by a child's receptive vocabulary level or by the child's intelligibility to the examiner. Schafer & Thibodeau (2006) used the Phrases in Noise Test (PINT) to determine the benefit of FM systems in young children with cochlear implants and detected significant improvements when the FM systems were in use relative to the cochlear implant alone. The motivation for the present study was to determine if the PINT could be adapted for the assessment of the hearing skills in children in the Brazilian population from the age of four-years old.

METHODS

This study was conducted in the Department of Speech-Language Pathology and Audiology of the School of Dentistry of Bauru Clinic at University de São Paulo (FOB/ USP). The study was approved by the University Research Ethics Committee.

Instrument and Procedures

The PINT test was developed originally for children with cochlear implants by Schafer (2005) and Schafer & Thibodeau (2006) and was reviewed and modified by Schafer et al. (2012). The goal of this test was to obtain speech-in-noise recognition thresholds of young children without the influence of variables related to the level of receptive vocabulary or intelligibility of speech produced by the child (i.e., articulation).

The PINT estimates 50% correct thresholds for phrases in the presence of ascending and descending levels of multiclassrom noise. It is comprised of 12 simple-order sentences related to the parts of the body and is recorded with a female voice. The intensity of the speech stimulus is fixed, and the noise is presented at varying intensities. These phrase stimuli were selected assuming that most children are familiar with parts of the body from a small age (Weaver et al., 1979). Noise was recorded in several real classrooms during independent work time and was, then, overlapped digitally using acoustic editing software. The noise samples were overlapped to reduce the peaks and valleys (i.e., silent periods) that occur in single-classroom noise samples. This type of noise was selected to simulate conditions experienced by most school-age children. Classroom noise is expected to be more challenging than other non-significant noises, such as steady-state, speech-shaped noise (Sperry et al., 1997).

Cross-Cultural Adaptation

We first made contact with the authors of the PINT test who authorized the translation and cultural adaptation of the PINT Test, into Brazilian Portuguese. The translation and the cross-cultural adaptation of the PINT (Schafer, 2005; Schafer & Thibodeau, 2006; Schafer et al., 2012) followed the stages recommended by Guillemin, Bombardier, and Beaton (1993).

The first step was to translate (forward) the original English language instrument into Portuguese. The original instrument was given to two English translators and interpreters, fluent in this language, who did not know each other and had no knowledge of the test. The purpose was to elaborate, individually and in confidentiality, the first Portuguese version. This procedure aimed at generating two independent translations of the test.

The group of revisers comprised two speech-language pathologists (Brazilian individuals who were fluent in English) who analyzed the two resulting documents, reduced the differences found in the translations, and adapted the text to the Brazilian culture. Thus, a new test named "PINT Brazil" was created. The phrases that were translated and adapted from the PINT test are provided in Table 1.

Table 1. Phrases translated and adapted for the Brazilian Portuguese

Phrases in English	Phrases in Portuguese
Hold his hand	Segure a mão
Brush his teeth	Escove os dentes
Touch his tongue	Toque a barriga
Wipe his mouth	Limpe a boca
Blow his nose	Aperte o nariz
Stomp his feet	Bata os pé
Comb his hair	Penteie o cabelo
Hide his face	Esconda o rosto
Find his shoe	Mostre o sapato
Pat his leg	Bata na perna
Move his arm	Mexa o braço
Pull his toes	Puxe o dedão do pé

For the revision of grammatical and idiomatic equivalence, a copy of the test was sent to two other translators who had the same linguistic and cultural characteristics of the translators used in the first stage. Without any knowledge of the original text, they produced the English counterpart of the new version of the instrument. The same group of revisers evaluated the two resulting versions, comparing them to the original in English.

In this stage, cultural adaptation, the purpose was to establish a cultural equivalence between the English and Portuguese versions of the test. Cultural equivalence is achieved when at least 80% of the population understands the sentences. We tested a group of 10 children with normal hearing sensitivity, five boys and five girls with a mean age of seven years, who spoke Portuguese fluency, and 100% of them understood all the sentences.

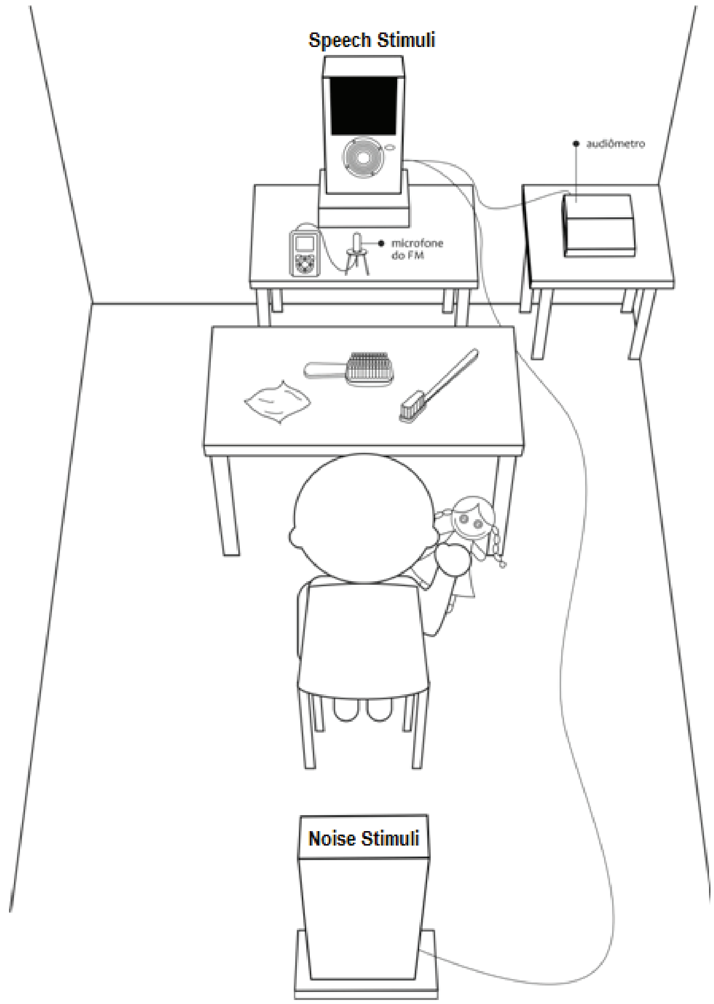
Participants

The participants included 10 children with normal hearing sensitivity (5 boys and 5 girls from 4 to 11 years, mean age 7 years old) and 10 adults with normal hearing sensitivity (6 female and 4 male from 19 to 25 years). The participants had Portuguese as a first language and no history of recurrent otitis media, middle ear surgery, use of ototoxic drugs, speech-language delays, and/or hearing difficulties. The following tests were conducted to confirm normal hearing: otoscopy, a pure tone hearing screening (500, 1000, 2000 and 4000 Hz) with a pass criterion of 25 dB HL at each frequency and in each ear, transient evoked otoacoustic emissions (Otoport Lite/ Otodynamics Ltd), tympanometry, and ipsilateral acoustic reflex (Titan/Interacoustics S/A).

Test Environment and Equipment

Testing was conducted in an acoustically-treated room in the Audiology Clinic (ANSI standards). The AC40 full two-channel audiometer (version 1.69 USA) was used to present the stimuli, and speech and noise stimuli were presented from two, head-level loudspeakers located at 0- and 180-degrees azimuth, respectively (i.e., S0/N180). Each speaker was located at a distance of one meter from the listener who was seated in a chair placed in the center of the room as shown in Figure 1.

Figure 1. Application Scenario the PINT Brazil



Speech Stimuli

Speech stimuli were recorded by a female talker in an acoustically-treated studio. Afterwards, using acoustic editing software (Cool Edit Pro 2.1 and Pro Tools HDX 10.3.5), the phrases were adjusted to reduce the root mean square (RMS) intensity and duration across the sample to allow for reliable testing of speech-in-noise threshold. In the software, the time-stretching function, which modifies the number of pitch periods in the signal, was used to modify the duration of the phrases because the time-stretch function preserves the frequency of the signal. As a result, it was possible to increase or decrease the length of the sentences without modifying the signal frequency as shown in Table 2. Each phrase was adjusted to duration of 1.2 seconds to ensure that phrases could not be identified based on varying lengths.

Table 2. Translated Phrases, List of Objects used During Testing, and Initial Duration of Each Phrase Before They were Adjusted to 1.2 seconds

Phrases	List of objects	Duration (seconds)
01 – Segure a mão	--------	1.00
02 – Escove os dentes	Toothbrush	1.06
03 – Toque a barriga	---------	1.00
04 – Limpe a Boca	Face towel	1.00
05 – Aperte o Nariz	---------	1.09
06 – Bata os pés	--------	1.06
07 – Penteie o cabelo	Hair brush	1.04
08 – Esconda o rosto	-----------	1.20
09 – Mostre o sapato	----------	1.10
10 – Bata na perna	----------	1.09
11 – Mexa o braço	----------	1.20
12 – Puxe o dedão do pé	----------	1.15

Noise Stimulus

The noise used in this study was the noise stimuli used in the Fidêncio (2013) study, which was a recording of noise in four elementary-school classrooms during normal class period thru the use of a Sony portable digital recorder (Model ICD-BX800). Samples obtained in the four classrooms were edited using the aforementioned audio editing software to remove the amplitude modulation between the recordings (i.e., silent periods) while maintaining the spectral characteristics of noise. Samples from each classroom were merged into one, four-minute wave file. This waveform was, then, edited by using compression and expansion coefficient of 5:1 with a threshold of -15 dBFS to decrease the difference between the maximum and minimum RMS in the whole sample.

This final noise sample was a duration of 3.2 seconds with a difference of 1.2 dB between the maximum and the minimum RMS, -9.7 and -10.9 dB, respectively, in a 50msec time window (Pro Tools HDX 10.3.5). According to Schafer (2005), it is necessary to manipulate the noise to generate a consistent noise, necessary for measuring speech recognition thresholds. Large intensity variations may cause an increase in performance variability within the experimental conditions.

Intensity-Adjustment procedures

A procedure to adjust the intensity of the speech and noise was conducted to ensure equal intelligibility of the phrases; procedures used mirrored the methodology used by Schafer et al. (2012). The edited speech and noise stimuli were recorded on a CD and presented to the 10 adults with normal hearing sensitivity to determine an ascending threshold for each phrase while noise was presented at 60 dBA. An ascending-intensity-scaling process was used for this procedure. The mean difference between the mean threshold for each phrases was subtracted from the mean threshold for all phrases combined. This resulted in the final level presentation level:

Mean threshold of each phrase - Mean threshold of all phrases = Final level of presentation of the Phrases.

Following the scaling process, the examiners excluded two phrases, "Esconda o rosto" (Hide the face) and "Puxe o dedão do pé" (Pull the big toe) because the mean thresholds were +3-dB higher than the remaining phrases. The mean differences of the remaining phrases ranged from -2.9 and 2.1 dB relative to the mean for all phrases combined (Table 3). Therefore, the final version of the PINT Brazil test has 10 phrases with an 8-second inter-stimulus interval that are presented at a fixed intensity (60 dB SPL). The multiclassroom noise ranges in intensity from 45 to 72 dB SPL in 3 dB step sizes.

Table 3. Calculation of the final level of presentation of sentences

Phrases	Final Level of presentation
01 – Segure a mão	2.1
02 – Escove os dentes	- 1.3
03 – Toque a barriga	- 0.3
04 – Limpe a Boca	- 1.3
05 – Aperte o Nariz	- 1.0
06 – Bata os pés	- 0.1
07 – Penteie o cabelo	- 1.5
08 – Esconda o rosto	3.1
09 – Mostre o sapato	- 2.9
10 – Bata na perna	- 2,6
11 – Mexa o braço	- 2.0
12 – Puxe o dedão do pé	7.3

Sentence Lists

Once the intelligibility was verified, six lists of sentences were created with the 10 phrases; each phrase was repeated twice per list in a pseudorandomized manner. In each list of the PINT Brazil, phrases were presented (60 dBSPL). The intensity of the noise increased automatically (recorded on CD) in 3-dB steps for each phrase for the 10 consecutive steps of the descending side, and decreased in 3-dB steps for each phrase for the 10 consecutive steps of the ascending side. This descending and ascending stimuli correspond to the two sides of the score sheet where the examiner notes the accuracy of the response as shown in the same in Figure 2. Each list of the PINT Brazil that was presented had an average duration of three minutes, and participants completed a total of 4 lists.

Figure 2. Sample scoring form for the PINT Brazil

PINT
Brasil

NOME: ______

IDADE: ______ RESPONSÁVEL: ______

DATA: ___/___/___

DISPOSITIVO: ______ FM: ______

D.A: ______

RESULTADOS: (+6)+ (-3) / 2 = +1,5dBSR

LISTA 4 - FALA 0°/ RUIDO 180°

Nº	S/R	FRASES	RESPOSTA	Nº	S/R	FRASES	RESPOSTA
1	+15	Bata os pés	+	11	-12	Toque a barriga	-
2	+12	Penteie o cabelo	+	12	-9	Aperte o nariz	-
3	+9	Bata na perna	+	13	-6	Mostre o sapato	-
4	+6	Segure a mão	+	14	-3	Mexa o braço	+
5	+3	Toque a barriga	-	15	0	Penteie o cabelo	+
6	0	Limpe a boca	-	16	+3	Segure a mão	+
7	-3	Mostre o sapato	-	17	+6	Bata os pés	
8	-6	Mexa o braço	-	18	+9	Limpe a boca	
9	-9	Escove os dentes	-	19	+12	Escove os dentes	
10	-12	Aperte o nariz	-	20	+15	Bata na perna	

Santos, L.G. Phrases in noise test (PINT): Adaptação cultural para o Português Brasileiro e aplicabilidade na avaliação do Sistema de Frequencia Modulada (FM) [dissertação] Bauru (SP): Faculdade de Odontologia de Bauru, Universidade de São Paulo; 2015.

FOB USP

Verification and validity of the lists

In order to verify and examine whether there was equal intelligibility and the possibility of a learning effect for children, 10 children with normal hearing sensitivity were tested. Three male children opted to complete the test by pointing to their own body parts.

Before starting the tests, children were familiarized with the test phrases by being shown how to act out each phrase with a doll. Children were allowed to verbally repeat the sentence and demonstrate the phrases on the doll (e.g., Segure a mão) or just demonstrate with the doll and no verbal response. Afterwards, each randomly-selected list (with no repeats) of sentences were presented through the loudspeakers in the following conditions: (a) one list in quiet, (b) one list at a +15 dB SNR and (c) two randomized lists of the PINT test with prerecorded SNRs. The purpose of the first two conditions was to ensure that the child could demonstrate 100% correct understanding of the phrases when presented in quiet and at a +15 dB SNR. Next, children completed the actual test conditions, which included two lists of PINT in the S0/N180 condition. Children were asked to act out what was heard with the doll.

Scoring rules were determined in previous studies, and this scoring technique is expected to yield 50% correct speech-in-noise thresholds (Schafer, 2005; Schafer &Thibodeau, 2006). As shown in the sample score sheet in Figure 2, the test was suspended when the child obtained three consecutive correct answers of the ascending side of the answer sheet. The threshold in dB SNR was determined by the mean of the following scores: (1) descending side: the last correct answer followed by two incorrect answers (indicated with a circle) and (2) ascending side: the first correct answer followed by two other consecutive correct answers. If the child did not present three consecutive correct answers, the value of +15 dB SNR was considered as the threshold on the ascending side of the scoring form. In the case of 100% correct answers for all tested phrases, the threshold was recorded as -12 dB SNR. A hypothetical speech-recognition score sheet is presented in Figure 2 with a "+" symbol to represent correct responses and a "-" symbol to represent incorrect responses. The child in this example had a threshold of +1.5 dB SNR.

Statistical Analysis

The paired t-test was used to examine list equivalency or the possibility for a learning effect between the lists of the PINT Brazil test. A confidence interval of 95% was adopted. The Pearson Correlation was also used to examine the relationship between PINT performance and the age of the children with normal hearing sensitivity as well as between the PINT Brazil and another test that yields 50% of the thresholds in noise (i.e., HINT/ Brazil, Jacob et al., 2011). On the HINT/Brazil the dB SNR was determined by averaging performance across two lists.

RESULTS

Verification of the PINT Brazil Lists

The PINT Brazil was used to test 10 children with normal hearing sensitivity. On the practice lists, all children were able to repeat the phrases in quiet and at a +15 SNR with 100% accuracy. When comparing the results on the two conditions with the PINT Brazil, there was no significant difference, suggesting no learning effect or measureable difference in performance between lists, $t(9)=1.63$, $p = 0.13$ (Table 4). The average PINT Brazil threshold (i.e., between the two lists) was not correlated with age, $r(10) = -0.1$, $p= .77$.

Table 4. Individual results on the two PINT Brazil lists

Children	List 1 (dBSR)	List 2 (dBSR)	Average SNR	SD (dB)
1	- 4.5	- 7.5	-6.0	2.1
2	- 4.5	- 9.0	- 6.75	3.2
3	- 6.0	- 3.0	- 4.5	2.1
4	- 6.0	- 7.5	-6.75	1.1
5	- 6.0	- 3.0	-4.5	2.1
6	- 4.5	- 6.0	-5.25	1.1
7	- 7.5	- 7.5	- 7.5	0
8	- 6.0	- 6.0	- 6.0	0
9	- 4.5	- 12.0	- 8.25	5.3
10	+ 1.5	- 10.5	- 4.5	8.3
Average	-4.8	-7.2	-6.0	2.5
SD	2.4	2.9	1.3	2.6

When comparing the adult results to those from Schafer (2005) for the intensity-adjustment procedures, the variability between data sets is comparable. For 10 adults in the Schafer study, the variability of 4.4 to 1.8 dB is similar to that of the PINT Brazil study showing 4.9 to 2.0 dB of variation (Table 5).

Table 5. Comparative studies with PINT Schafer (2005) and this study (PINT Brazil) of Signal-to-Noise Ratio (SNR) Performance, Ascending-Phrase Procedure

Phrase	Average SNR PINT – Schafer (2005)	Average SNR PINT Brazil	SD (dB) PINT - Schafer (2005)	SD (dB) PINT Brazil
Hold his Hand	--	-1.4	--	4.4
Brush his teeth	-12.4	-4.8	2.5	2.1
Touch his tongue	-9.6	-3.8	1.8	2.0
Wipe his mouth	-11.0	-4.8	2.2	4.0
Blow his nose	-14.1	-4.5	3.8	3.2
Stomp his feet	-9.1	-3.6	2.2	3.5
Comb his hair	-12.0	-5	3.7	4.9
Hide his face	-12.3	--	2.9	--
Find his shoe	--	-6.4	--	3.6
Bend his leg	-13.0	-6.1	2.7	2.3
Move his arm	--	-5.5	--	3.9
Pull his toes	-13.3	--	4.4	--
Scratch his chin	-9.4	--	1.8	--

Validity of the PINT Brazil lists

The data from the 10 children with normal hearing sensitivity supports the presence of convergent validity, which is the similarity to another measure (Pasquali, 2007; Schafer et al., 2012). To examine this, data from the present study were compared to the data from a HINT/ Brazil condition. No significant difference was found in the results (t(29)=0.25, p=0.80). It is worth noting that, despite being two distinct normal hearing populations (the population in this study and the population in the study by Jacob et al. (2011), the outcomes were similar.

DISCUSSION

The purpose of this study was to develop a test of speech perception in noise for children from the age of four years through the translation and cross-cultural adaptation of the PINT. The recording of the phrases of the PINT Brazil was carried out by a female talker because studies demonstrate that the speech of this gender is significantly clearer than the speech of a male (Bryne et al., 1994; Bradlow & Bent, 2002; Bradlow et al.,2003).

The test arrangement for the PINT Brazil was designed to simulate a classroom setting where it is assumed that the teacher, the main sound source, stays primarily in the front of the class, and the competitive noise of the classroom is more intense at the side and behind the student. (AAA, 2008, 2011). This test arrangement is similar to those used in previous studies on the assessment of speech perception in noise that used the position S0/N180 and verified a significant improvement of the speech perception compared to the condition S0/N0 (Mok et al., 2010; Van Deun et al., 2010; Jacob et al., 2012; Vicent et al., 2012).

It is worth mentioning that the PINT (Schafer, 2005, Schafer & Thibodeau, 2006) originally was designed to present the speech signal at a 0-degree azimuth and the noise located at 135-degree and 225-degree azimuth relative to the child. However, in 2012, Schafer et al. altered the location of the loudspeakers to S0/N90 and S0/N180. According to the authors, the S0/N180 test position was used to simulate a common arrangement in the classroom with the teacher at the front of the classroom and children behind. This condition was also used to minimize the number of necessary test conditions for children given their short attention times. The two conditions with spatial separation (± 90-degree noise) were used to address the differences between the ears and could be used in the child's actual classroom, in future studies, in the clinic. However, the S0/N180 loudspeaker arrangement will be most appropriate for future research or clinical testing with children using unilateral or bilateral hearing aids with directional microphones, unilateral or bilateral cochlear implants with directional microphones, and FM systems.

The phrase stimuli for the original PINT (Schafer, 2005) were related to body parts and contained five syllables. To translate into Brazilian Portuguese, it was not possible for the sentences to have the same number of syllables because of the differences between the languages, but the results at Table 5 shows no difference in scores.

Verification and Validity of the Pint Brazil lists

When examining list equivalency or the possibility of a learning effect, no learning effect was found. That is, no significant difference was found between the lists, which is similar to findings in other studies (Schafer, 2005; Schafer& Thibodeau, 2006, Schafer et al., 2012). These results are likely due to the familiarity of the stimuli and the practice lists that were completing before the test conditions on the PINT Brazil. It is important to note that there was the risk of children correctly responding to a stimulus by only hearing one of the words of the phrase. However, the children were oriented to listen, understand, and repeat the whole phrase before performing the proposed action. This active response likely engages higher cognitive learning, auditory memory and understanding when compared to other tests that only require the child to repeat what they heard. These types of activities are common is schools in which children are constantly encouraged to follow the teacher´s instructions (Schafer et al., 2012).

Based on the Pearson Correlation results, there was no observable influence of age on the performance of the PINT Brazil lists in the S0/N180 condition, which is similar to results found in other studies that assessed speech perception in noise (Cameron & Dillon, 2007; Garadat & Litovsky, 2007; Nishi et al., 2010). However, these results do not support findings by Schafer et al. (2012), in which younger children (three and four years old) obtained a lower performance compared to older children (from the age of five years) and to adults in both the S0/N180 and S0/N0 test conditions. Similar to Schafer et al., Jacob et al. (2011) found age differences in a S0/N0 condition in three to five-year-old children relative to older children.

In summary, the PINT Brazil can be easily administered by audiologists; it has a relatively short duration; and it requires needs only a two channel audiometer, loudspeakers, dolls and low cost accessories. The use of classroom noise over multi-talker babble or other noises also adds ecological validity to the stimuli because children are asked to listen in classrooms a large portion of their lives. Other tests, such as the HINT/ Brazil (Bevilacqua et al., 2008), are not adapted for children, and few caring centers can purchase the HINT/Brazil due to the high cost and limited availability.

A limitation of the test is that is possible that the participant could identify a particular stimulus by just hearing one word and that, because of this, the test may overestimate speech perception in noise (i.e., the children may perform worse in real environments). It is also important to acknowledge that this study included a relatively small number of participants. Future research should replicate the findings of this study with a larger sample as well as children with hearing loss while using their various technologies (i.e., hearing aids alone; hearing aids with FM system). However, the results of this study provide initial data to which children with hearing loss can be compared. Poorer performance of children with hearing loss would indicate the need for classroom accommodations or a FM system.

Conclusion

The PINT was translated, adapted and validated into Brazilian Portuguese and named PINT Brazil. The results indicate that this test is efficient and sensitive for evaluating speech perception in noise in children, from the age of four years.

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