ORIGINAL ARTICLE

Evaluation of a bilingual questionnaire-based assessment on hearing in children with speech delay

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ABSTRACT

Introduction: To correlate the score obtained using a bilingual (Malay and English) 14 points questionnaire in the detection of hearing loss at the University of Malaya, Medical Centre (UMMC), Kuala Lumpur, Malaysia over a 9 month period.

Methods: This is a prospective instrument correlation study done on 93 children aged 1-4 years of age with speech and language delay for at least 3 months. Hearing status was confirmed using otoacoustic emissions, pure tone audiometry and brainstem evoked response (BSER). Hearing status was then compared to the 14-point questionnaire final scores and is statistically correlated.

Results: There were 26 patients, 15 males (58%) and 11(42%) females who were diagnosed to have hearing loss. The average age of presentation was 2.49 and conductive hearing loss accounted for about 74% of cases of hearing loss. The mean questionnaire score obtained through our patients was 3.83±1.987. Discriminant analysis suggests that a questionnaire score of above 4 was indicative that the child was suffering from hearing loss.

Conclusion: Our study suggests that the low-cost bilingual (Malay and English) questionnaire can be used to detect hearing loss in the Malaysian population and could potentially be useful in rural health centres to help detect hearing loss and to determine the urgency of referral to a tertiary health centre.

KEY WORDS:
Questionnaire, Hearing loss, Screening, Paediatrics , Speech delay

INTRODUCTION

Hearing loss in childhood has been linked with lifelong deficits in speech and language acquisition, poor academic performance, social maladjustments, and emotional difficulties with the critical period of speech and language development within the first four years of life. The prevalence of hearing loss in high risk children was reported to be approximately 0.42% in Malaysia,[1] while internationally, it is often cited to occur in about 6 per 1000 live births.[2] According to the World Health Organization, it is estimated that approximately 32 million children in the world are suffering with hearing disability and 60% of detected cases are potentially preventable.[3] Furthermore, the economic impact of hearing disability internationally, is significant as it accounts to approximately 750 billion dollars of loss annually.[3] Hence, the importance of early detection, prevention, timely intervention and education on hearing loss would not only benefit children with hearing loss, it is also cost efficient.

In response to the growing need to detect hearing loss early in the neonatal period, the Ministry of Health (MOH) Malaysia has devised the Guideline for Neonatal Hearing Screening in 2009, with the latest edition in 2014. The high-risk neonatal screening programme (HRNHS) has served to detect hearing loss in children with identifiable risk factors in developing hearing disabilities.[4] This serves as an effective method of screening children with high risk factors but neglects hearing loss in children with lower or no risk. Universal neonatal screening program (UNHS), which is the current standard of practice in developed countries, has gradually been implemented in several hospitals under the MOH. However, the detection of hearing loss may not be uniform in some areas of Malaysia particularly in rural areas as factors such as equipment and staff availability may be inadequate to detect hearing loss in children.

Hearing loss is usually detected using audiological testing, which includes otoacoustic emission (OAE), auditory brainstem response (ABR), pure tone audiometry (PTA) and tympanogram. These tests require trained personnel to perform and interpret the results. Questionnaire based studies have been identified as a cheap, quick and effective alternative to detect hearing loss, which require minimal training. However, the accuracy of questionnaires is often debatable.[5] A promising study was done by Sammeli et al. in Sao Paolo, Brazil suggesting a reliable questionnaire which correlates better with the detection of hearing loss in children aged 2 to 10 years of age.[6]

In this study, we assess the correlation of a bilingual questionnaire adapted from Sammeli et al.,[6] on the detection of hearing loss in children with speech delay in the University Malaya Medical Centre (UMMC).

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MATERIALS AND METHODS

Study population

This was a single-centre study conducted on children aged 1-4 years at the Department of Otorhinolaryngology, UMMC. Inclusion criteria were children that had been receiving treatment for age-appropriate speech and language delay for at least three months;. care givers which were able to read and understand the Malay and/or English language; and diagnosis of speech delay by either paediatricians, speech therapists or ENT surgeons using standardised developmental milestones. As all patients with speech delay were routinely referred to the audiology department for a hearing assessment, it was generally agreed that all participants in the study had speech delay prior to coming for a hearing assessment.

The exclusion criteria were children with dysmorphism or syndromes; having respiratory tract infection on the day of testing; having an implanted hearing device or aid, with cognitive defect; and neuromuscular disorder.

Questionnaire

The questionnaire was adapted from the questionnaire from the Samelli at al., which is a 14-point questionnaire to identify and classify hearing loss based on specific cut-off points.[6] The English version of the validated Samelli at al.,[6] questionnaires was first translated to the Malay language by two independent native Malay speakers, and is translated back to English by two independent native English speakers (Figure 1). Parents or caretakers were given the questionnaires prior to the commencement of audiological examination. The parents or caretakers were first asked if risks of hearing loss were present and this was followed by the questionnaire scoring. The score from each question was then added up to give a final score. The score of the questionnaire were not review to the who is conducting the clinical and audiological evaluation.

Clinical and audiological evaluation

Participants who were diagnosed to have speech and language developmental delay based on age-appropriate developmental milestones by an attending paediatrician, otorhinolaryngologist or speech therapists following routine otoscopic examination were invited to participate in the survey.

Initial hearing screening was performed using the oticon otoread distortion product otoacoustic emission device (DPOAE). When hearing loss was suspected based on the DPOAE, the child was further evaluated using the intelligent hearing systems diagnostic ABR. Tympanometry was used to provide additional information for children with conductive hearing loss. Children who has reached an appropriate age and was reasonably co-operative, a pure tone audiometry was done in a sound proof room using standard audiometric techniques to obtain the hearing thresholds.

Statistical analysis

Statistical analysis was performed using SPSS version 21.0 for Mac. The logistic regression analysis was used to determine the association between the questionnaire score and clinical assessment of hearing loss. Distribution of score was compared between children with normal hearing and children with hearing loss. Further analysis was made between children with normal hearing, conductive hearing loss and sensorineural hearing loss. A Receiver operating characteristic (ROC) curve was constructed to determine the cut off value that would help determine if a child is likely to suffer from hearing loss. The level of statistical significance was determined to be <0.05.

RESULTS

In this study, 93 patients were enrolled into the study from January till September 2018. Twenty-six (28%) patients were diagnosed to have hearing loss and among them 15 (58%) were males and 11 (42%) were females. The average age of presentation was 2.49 years. The commonest encountered hearing loss was that of conductive hearing loss, which accounted for 74% of cases. The score of the questionnaire ranged from 0 to 10 over a total score of 14. The mean score was 3.83±1.987 (Table I) and the median score was 4.0.

Cut off scores to the bilingual questionnaire

The univariate logistic regression analysis was used to test the association between score and the clinical assessment of hearing loss. In the univariate analysis, the odds ratio was 1.877 (95%CI 1.379, 2.555) and the p value was <0.001 hence there was a significant association between the score and clinical assessment of deafness.

In ROC, the area under the curve was 0.770 (95%CI 0.647, 0.893). For a good trade-off between sensitivity and specificity, the ideal cut point was 4.5 (Figure 2). To obtain a confidence interval of 95%, the sensitivity of the bilingual questionnaire to detect hearing loss above the score of 4 was 65% and its specificity was 81% (p<0.05).

When comparing the cut-off point of conductive hearing loss and normal hearing versus sensorineural hearing loss, the area under the curve in ROC was 0.983 (95% CI 0.96,1.00). The ideal cut-off point for to detect sensorineural hearing loss was 6.5. To obtain a confidence interval of 95% for the cut-off of above 6.5 score, the sensitivity of 100% and the specificity of 42% was obtained (p<0.05).

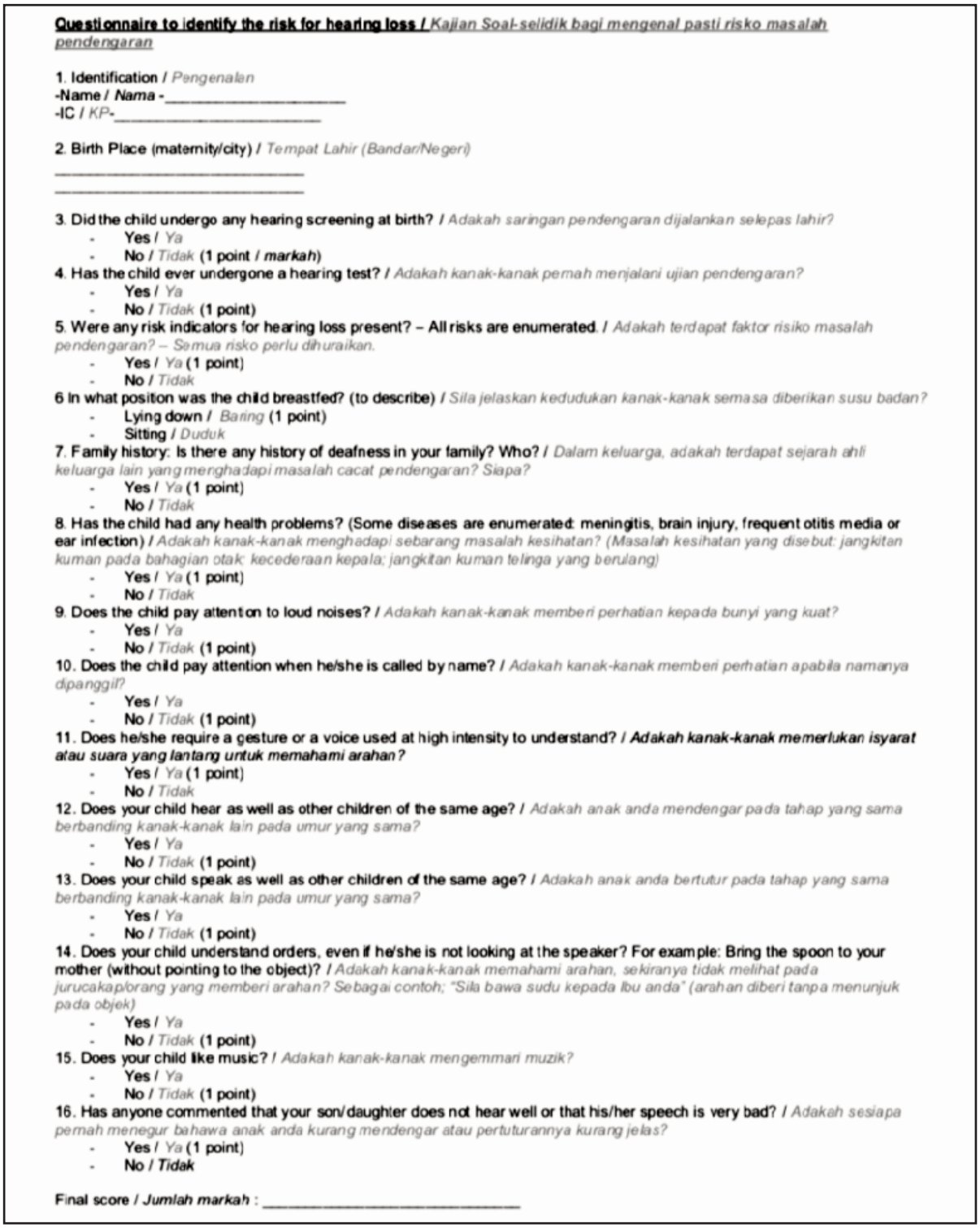
Hence, discriminant analysis had revealed that the cut-off values had revealed that based on the questionnaire had suggested that a score of above 4.0 was suggestive of some form of hearing loss present as suggested by Samelli et al.6

DISCUSSION

Hearing plays an important role in the growth of children as it not only affects its physical and mental development, it also has an important role in social interaction with their parents, siblings and peer. Hearing loss in children should therefore, be detected as early as possible to ensure early intervention. Many methods have been implemented to detect paediatric hearing loss such as the Universal Newborn Hearing Screening (UNHS). The UNHS in developing countries such as Malaysia however faces many challenges including lack of manpower, insufficient support services, low public awareness, limited funding and equipment to perform

Table I: Table showing the summary of cases seen during data collection and scored obtained during screening questionnaire. Hearing was categorized based on the better hearing ear

	Frequency(n)	Percent	Mean score	Standard deviation
Normal hearing	67	72.0	3.24	1.44
Conductive hearing loss	19	20.4	4.42	2.04
Sensorineural hearing loss	7	7.5	7.86	1.22
Total	93	100	3.86	1.99



Questionnaire to identify the risk for hearing loss / *Kajian Soal-selidik bagi mengenal pasti risko masalah pendengaran*

1. Identification / *Pengenalan*
-Name / *Nama* -_____
-IC / *KP*-_____

2. Birth Place (maternity/city) / *Tempat Lahir (Bandar/Negeri)*
_____
_____

3. Did the child undergo any hearing screening at birth? / *Adakah saringan pendengaran dijalankan selepas lahir?*
- Yes / *Ya*
- No / *Tidak* (1 point / *markah*)

4. Has the child ever undergone a hearing test? / *Adakah kanak-kanak pernah menjalani ujian pendengaran?*
- Yes / *Ya*
- No / *Tidak* (1 point)

5. Were any risk indicators for hearing loss present? – All risks are enumerated. / *Adakah terdapat faktor risiko masalah pendengaran? – Semua risko perlu dihuraikan.*
- Yes / *Ya* (1 point)
- No / *Tidak*

6 In what positon was the child breastfed? (to describe) / *Sila jelaskan kedudukan kanak-kanak semasa diberikan susu badan?*
- Lying down / *Baring* (1 point)
- Sitting / *Duduk*

7. Family history: Is there any history of deafness in your family? Who? / *Dalam keluarga, adakah terdapat sejarah ahli keluarga lain yang menghadapi masalah cacat pendengaran? Siapa?*
- Yes / *Ya* (1 point)
- No / *Tidak*

8. Has the child had any health problems? (Some diseases are enumerated: meningitis, brain injury, frequent otitis media or ear infection) / *Adakah kanak-kanak menghadapi sebarang masalah kesihatan? (Masalah kesihatan yang disebut: jangkitan kuman pada bahagian otak: kecederaan kepala; jangkitan kuman telinga yang berulang)*
- Yes / *Ya* (1 point)
- No / *Tidak*

9. Does the child pay attention to loud noises? / *Adakah kanak-kanak memberi perhatian kepada bunyi yang kuat?*
- Yes / *Ya*
- No / *Tidak* (1 point)

10. Does the child pay attention when he/she is called by name? / *Adakah kanak-kanak memberi perhatian apabila namanya dipanggil?*
- Yes / *Ya*
- No / *Tidak* (1 point)

11. Does he/she require a gesture or a voice used at high intensity to understand? / *Adakah kanak-kanak memerlukan isyarat atau suara yang lantang untuk memahami arahan?*
- Yes / *Ya* (1 point)
- No / *Tidak*

12. Does your child hear as well as other children of the same age? / *Adakah anak anda mendengar pada tahap yang sama berbanding kanak-kanak lain pada umur yang sama?*
- Yes / *Ya*
- No / *Tidak* (1 point)

13. Does your child speak as well as other children of the same age? / *Adakah anak anda bertutur pada tahap yang sama berbanding kanak-kanak lain pada umur yang sama?*
- Yes / *Ya*
- No / *Tidak* (1 point)

14. Does your child understand orders, even if he/she is not looking at the speaker? For example: Bring the spoon to your mother (without pointing to the object)? / *Adakah kanak-kanak memahami arahan, sekiranya tidak melihat pada jurucakap/orang yang memberi arahan? Sebagai contoh; "Sila bawa sudu kepada Ibu anda" (arahan diberi tanpa menunjuk pada objek)*
- Yes / *Ya*
- No / *Tidak* (1 point)

15. Does your child like music? / *Adakah kanak-kanak mengemmari muzik?*
- Yes / *Ya*
- No / *Tidak* (1 point)

16. Has anyone commented that your son/daughter does not hear well or that his/her speech is very bad? / *Adakah sesiapa pernah menegur bahawa anak anda kurang mendengar atau pertuturannya kurang jelas?*
- Yes / *Ya* (1 point)
- No / *Tidak*

Final score / *Jumlah markah* : _____

Fig. 1: Bilingual Questionnaire used for screening of hearing loss.

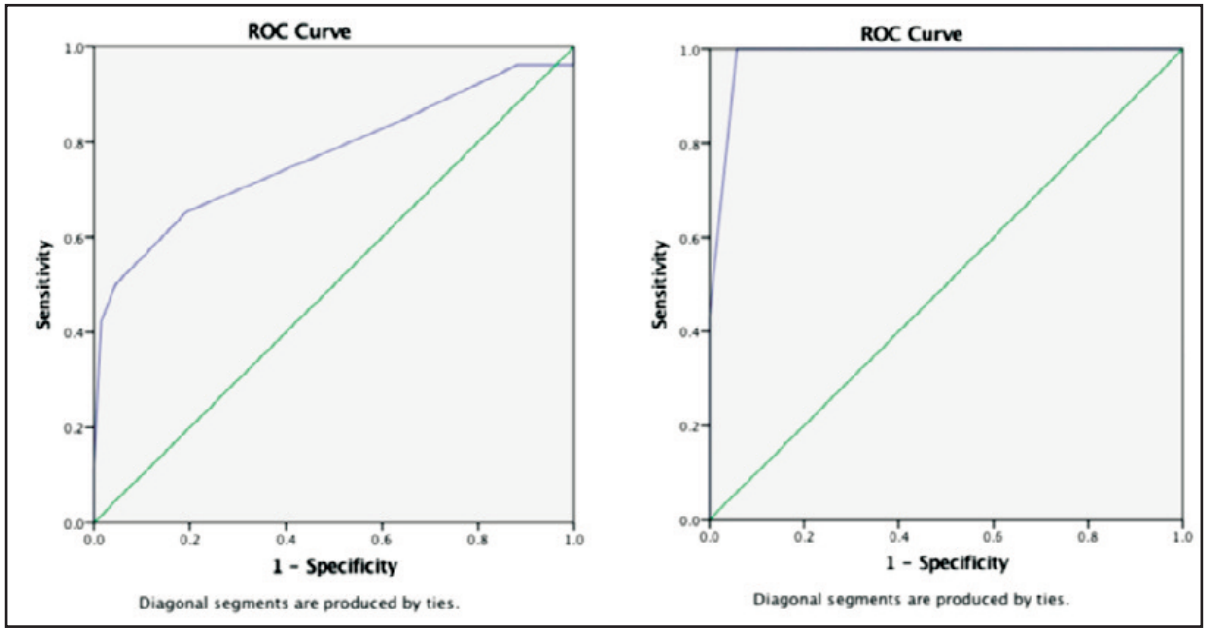


Fig. 2: ROC curve showing relationship of questionnaire score and hearing loss (Left) showing the area under the curve in ROC of 0.770. The relationship of questionnaire score and sensorineural hearing loss is seen in the right figure showing area under the curve in ROC of 0.983.

the hearing screening.[7] These shortages are even more apparent especially in the rural areas of Malaysia where resources are limited. Asma et al.,[8] in their UNHS study of more than 13,000 babies over three years noted a coverage rate of 85.9%. However, the same study also shows a high dropout rate of 15.2-35% for ENT follow up in the three years of the study and an even higher dropout rate of 30.8-62.5% for the audiological follow up for babies with impaired hearing levels. The parents' lack of understanding on the importance of continuous follow up could be a reason for the high defaulter rates. A recent study shows that about 22.5% of Malaysian health care professionals were not aware of the UNHS program in Malaysia.[9] These factors could explain the reason why some children with hearing loss were not screened at birth or missed during the new born screening and the impairment in hearing were only detected later in their life.

Therefore, a simpler method is needed to screen for hearing loss in children. There are many available questionnaires which help in detecting and screening children for hearing loss.[10,11] Our parental-based validated questionnaire, which is based on the questionnaire from Samelli AG et al.,[6] aiming to detect hearing loss in children ages 1 to 4, can be used as an adjunct to assist in the screening for hearing loss in children who were missed during the new born screening. The questionnaire is in English and Malay. The bilingual questionnaire contains a series of questions for the parents about to the hearing of children which is simple and easy to understand. The questionnaire takes only a few minutes to answer. Our results showed that a score of four and above warrants an early referral for an audiological assessment. These results are comparable to that of Samelli AG et al.,[6] where a score of more than four, points to a hearing impairment.

The cut off score to differentiate conductive hearing loss and sensorineural hearing loss is seven in our study. This is similar to the study by Simelli et al, as the cut-off between conductive and sensorineural hearing loss was a score of above seven. A larger sample size will be more helpful in accurately determining the cut-off point between conductive and sensorineural hearing loss.

This questionnaire is very relevant in Malaysia where resources are limited as mentioned above, and the parents and the patient may stay very far form a medical centre that is equipped with an audiology unit. These questionnaires can be easily distributed to health care professionals working in the front line such as district clinics, general practitioner clinics and maternal and child health clinics where the children are being followed up.

The limitation of this study is that the sample size is relatively small. A larger sample size will give a better picture of the cut off score for urgent referral and on any potential risk factors. The low number of patients with sensorineural hearing loss seems to indicate that either patients with sensorineural hearing loss may have been detected earlier by other screening methods or that this questionnaire is not sensitive enough to identify children with sensorineural hearing loss. As this is a study to correlate questionnaire score to results of hearing screening rather than diagnosis of hearing loss, more sensitive tests like auditory brainstem reflex (ABR) were not done in some cases as subjective assessments like audiometry are usually adequate to diagnosis hearing loss in these age groups.

CONCLUSION

Our study shows that the bilingual questionnaire is probably useful at detecting hearing loss in children at 1-4 years of age when the bilingual version was used (Malay and English). The authors would like to advocate for larger scale studies for better sensitivity and specificity in order to validate the use in clinical practice.

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ETHICAL APPROVAL

This study was approved by the UMMC Ethics Committee (201818-5942). Written consent had been obtained from the participants prior to the onset of the survey.

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CONFLICTS OF INTEREST

None.

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