ORIGINAL ARTICLE

HEARING LOSS ASSESSMENT: EVALUATING THE UHEAR TM AN IOS-BASED APPLICATION AS A SCREENING TOOL.

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ABSTRACT

Background: Disabling hearing loss is a major health issue all over the world. It is however found to be worse in the developing countries according to WHO. It is said that one in five Africans now operate smartphones which can be effectively use for hearing loss screening purposes. The purpose of the study is to evaluate the use of uHear™ an iOS-based application
 on iPhone as a hearing loss screening tool.

Methods: This is a prospective hospital base study carried out in ENT clinic between January 2014 and December 2015 after obtaining the hospital ethical committee approval. Consented adults that could operate iphone were recruited for the study by convenience sampling. Subjects had a conventional audiometric test after which they were made to complete the iPhone uHear™ test using the headphones supplied with the device in a quiet room. Hearing loss at frequencies of 250Hz–8000Hz were determined with a threshold of >40 dB considered as 'Failed screening' and a p-value of <0.05 was considered significant.

Results: Ninety eight ears of 49 patients were tested, males 26 and females 23 with male to female ratio of 1.1:1. There was a statistically significant difference between pure tone thresholds recorded with the iPhone and that of the audiometer at lower frequencies. However, there was no statistically significant difference between these thresholds recorded at higher frequencies.

Conclusion: The uHear™ 'app' on iPhone is effective in detecting high-frequency hearing loss, and can be use in hearing loss screening programmes.

KEY WORDS: uHear™, iPhone, hearing, screening, tool.

INTRODUCTION

Hearing loss is a major health burden all over the world. In Nigeria, a study carried out among school children in Lagos had shown that 13.9 percent of school children had hearing loss[1]. While in Ilorin North Central Nigeria, a study by Aremu et al, 2010 showed that 21% of elderly otological diseases are hearing loss related[2]. There are three types of hearing loss, conductive, sensorineural and mixed. A conductive hearing loss occurs in a situation in which there is a decrease in the transmitted sound through the canal and middle ear into the inner ear. While a sensorineural hearing loss is when the cochlear and auditory nerves are involved and mixed is when conductive hearing loss coexist with the sensorineural hearing loss in the same ear.

According to the World Health Organization statistics (WHO), hearing loss is affecting about 360 million people of the world population[3]. Stevens G et al found that the prevalence of child and adult hearing impairment was significantly higher in middle- and low-income countries than in high-income countries, demonstrating the global need for attention to hearing impairment[4, 5]. Risk factors for hearing impairment include noise exposure, alcoholism, family history, smoking, hypertension, use of ototoxic drugs, head injury, etc.[6]. Complications of hearing impairment include poor language development, poor speech development, poor education and social isolation[7]. Currently, hearing loss screening tools are few and scarce with most of them located in the urban centers There is the need for a cost effective and portable hearing screening tool in our environment. Smartphones are now being used by 85% of the world population and `it is said that 1 in 5 Africans owned at least one[8]. Its

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availability is therefore not a problem if accepted as a screening tool in Otolaryngology practice. Researchers started working on the use of uHear™ an iOS-based application after a Canadian company (Unitron) developed the software that can be downloaded freely into the iPhone[9].

METHODS

This was a prospective study carried out in ENT clinic of Federal Medical Centre, Lokoja between January 2014 and December 2015. Consented subjects who were able to operate the iphone were recruited for the study by convenience sampling method. All subjects had a formal audiometric test after which they were made to complete the iPhone uHear™ test using the headphones supplied with the device in a quiet room. Frequencies of 250–8000 Hz of participants were determined with a threshold of >40 dB considered as 'Failed screening'. Chi-test was performed to determine the p-value and a p-value of <0.05 was considered statistically significant.

RESULTS

Ninety eight ears of 49 patients were tested, males 26 and females 23 with male to female ratio of 1.1:1. Age range was 23-80 years with an age group mean of 41.22 years as shown in table1. There was a statistically significant difference between pure tone thresholds recorded with the iPhone and that of the audiometer at lower frequencies (p-value < 0.0001) as shown in table2. However, there was no statistically significant difference between thresholds recorded at higher frequencies (p-value = 0.8914) as shown in table3.

Table.1: Age Distribution of Subjects.

Age Group (years)	Number of Subjects	Frequency (%)
21-30	15	30.6
31-40	10	20.4
41-50	11	22.4
51-60	7	14.3
61-70	4	8.2
71-80	2	4.1
Total	49	100.00

*Mean group age=41.22years

Table.2: Frequency table showing average hearing threshold (dB) of 98 ears screened at lower frequencies

Hearing Threshold (dB)	Number of Ears Tested	
	iphone	Audiometer
<25	60	10
25-40	12	25
>40	26	63
Total	98	98

*P-value< 0.0001

Table.3 Frequency table showing average hearing threshold (dB) of 98 ears screened at higher frequencies

Hearing Threshold	Number of Ears Tested	
dB	iphone	Audiometer
<25	30	28
25-40	28	31
>40	40	39
Total	98	98

*P-Value=0.8914

DISCUSSION

Hearing screening programs are necessary for neonates, preschool age children, school children and adults to detect possible hearing loss on time and to allow for timely intervention as may be required by the individual. Besides this general group, it is mostly required to periodically screen individuals at risk of hearing loss such as diabetic patients, those with family history of hearing impairment, smokers, and those working in noisy environment.

Using the decibel (dB) scale, the World Health Organization graded the hearing loss into 4 categories as mild (26-40dB), moderate (41-60dB), severe (61-80dB) and profound (81dB and above) using the decibel scale. (http://www.who.int/features/-factfiles/deafness/facts/en/index2.html).

A disabling hearing loss is defined by the WHO as a hearing loss of greater than 40 dB in the better hearing ear in adults and greater than 30 dB in the better hearing ear in children. (http://www.who.int/pb-d/deafness/WHO_GE_HL.pdf ?ua=1)[10]. In this study there was a slight male preponderance which does not really matter as we were not comparing the disease in the two sexes. The mean group age was 41.22years which may suggest that there were more of young adults than the elderly ones in the study due possibly to the fact that most of the young adults could operate the iphone. In this study, disabling hearing loss in high-frequencies were detected by the screening method of using the uHear™ ''app'' on iphone and values obtained were comparable to those obtained using a conventional audiomenter. This is similar to the results obtained by other researchers using smartphones applications as hearing loss screening tool[11-15]. However, a preliminary study by a group of researchers in the Middle East has found that the uHear™ in any setting lacks specificity in the range of normal hearing and is highly unreliable in giving the exact hearing threshold in clinical settings[16].

CONCLUSION

The uHear™ application on iphone is effective in detecting high-frequency hearing impairment but

not so accurate for low-frequencies hearing loss. With further evaluation, the smartphone can be used effectively in hearing screening programs in both urban and rural areas.

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