Original Article

Screening of Vision and Hearing in Primary School Children

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Abstract

Background: Hearing and sight are two basic senses in terms of education and profession. The World Health Organization (WHO) estimates that 15 million children worldwide suffer from uncorrected refractive disorders and another 275 million people are handicapped due to compromised hearing. In Indonesia, screening primary school children for hearing and vision is not part of the free public health-care system. Knowledge of the status of a child's hearing and vision may help secure the child's education and future profession. **Materials and Methods:** In five primary schools in a poor urban neighborhood in Yogyakarta, Indonesia, we screened pupils from class 1 to 6, for vision and hearing handicaps, following the WHO's definitions of handicap. On location in the primary schools, we screened vision using a Snellen chart and hearing using distortion product otoacoustic emission (DPOAE). Those with vision below 6/18 were referred to an ophthalmologist and pupils with hearing below 30 decibels at 0.5, 1, 2, and 4 kilohertz were referred to an ear nose and throat (ENT) specialist for final testing. **Results:** Totally, 775 pupils were vision screened and 777 pupils were hearing screened. We found that 2% were disabled by sight and 6% by hearing. **Conclusion:** Lost without proper education, these pupils can, with simple recommendations, have access to education. We recommend that Indonesia start screening its primary school pupils for hearing and vision to secure the country's future productivity and socioeconomic development.

Keywords: Children, hearing, senses, sight, vision

Introduction

Hearing and sight are two of our most basic senses especially in terms of education and profession. Being unable to see or hear normally may compromise our professional and social future and disable us from obtaining an education.[1-4]

The World Health Organization (WHO) estimates that worldwide, around 15 million children aged below 15 are handicapped by vision due to uncorrected refractive disorders![5] The WHO estimated that in 2004, 275 million people were handicapped because of compromised hearing and 80% of these people lived in low- and middle-income countries.[6] Recently published results show that between 2 and 8% people have visual problems[7-10] and around 6% have hearing disabilities in countries with limited public health-care systems.[11,12]

In many low- and middle-income countries, the testing of children's senses is not part of the country's free primary health-care system. As a result, children with compromised sight or hearing may be poorly equipped for the challenges of life. Even though expenses for glasses and hearing aids may be challenging and for many, impossible to cover, the knowledge of any existing handicap is important to help these children have access to an education.

This knowledge may also help to minimize the use of costly private practitioners in the search for an explanation for the child's poor performance in school.

This cross-sectional study was carried out in affiliation with the Centre for Bioethics and Medical Humanities (CBMH), Gadjah Mada University, Yogyakarta, Indonesia which is a partner in the research program "Health Systems Reform and Ethics: Private Practitioners in Poor Urban Neighbourhoods in India, Indonesia and Thailand" (HSRE). The main objective of HSRE is to help reforms in the sector of private practitioners to protect patients against iatrogenic adverse events.[13]

Therefore the aim of the study was to detect and register the current status of hearing and sight disabilities among poor

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urban primary school children in Indonesia, using a thoroughly tested, cheap, and easy method that could be reproduced on a large scale. In testing our method, we also illustrate some of the organizational challenges related to screening for hearing and vision that must be faced before any country can implement a screening program for hearing and sight.

Materials and Methods

Screening was done in five public primary schools[1] with a total of 813 pupils from grade 1 to 6. The five schools were the schools in the four neighborhoods that were part of the Indonesian HSRE study. Approximately 1,000 families live there and the four neighborhoods were selected by HSRE due to their status as poor and urban.[14]

Indonesia has about 240 million inhabitants;[15] we desired results with 95% confidence level and a confidence interval of 4. Calculation showed that we needed to test a minimum of 600 pupils.

All parents were informed of the study one week prior to our visit with a letter including a return slip to express their allowance or denial of the pupil to be enrolled in the study. Informed consent was received from all parents. Furthermore, all the schools were visited prior to our study and the headmasters granted permission. All tests were paid for by the research unit leaving no expense to the participating pupils. After the study ended, the research unit made applications for private funding of glasses and hearing aids for needy pupils.

Vision test

The pupils were screened using a Snellen chart, following the standard guidelines.[16] Cutoff levels according to the definitions of visual impairment issued by the WHO were used: A child is considered nondisabled by sight, if he/she can read line 6/18 or smaller on the chart.[17] Those unable to do so were referred to an ophthalmologist for full examination and final determination of their vision.

Hearing test

The pupils received a hearing test using distortion product otoacoustic emission (DPOAE) bilaterally, with an Otoreaden Screening Meter.[18] Those whose screening was abnormal were referred to an ear nose and throat (ENT) specialist for full examination and final determination of their hearing ability.

The cutoff level for hearing impairment was set at 30 decibels at 0.5, 1, 2, and 4 kilohertz following the WHO standards for hearing disability.[19]

Results

The schools comprised 813 pupils from classes 1 to 6. Gender was equally distributed.

Demographic profile is depicted in Table 1.
Flow chart given in Figure 1 depicts the outcome of this study.

We managed to screen 95% of the pupils and finally 2% were determined as disabled by vision and 6% disabled by hearing, following the WHO guidelines.

In the vision group, we had a referral rate of 6% to a specialist; of these, 38% were handicapped by vision and 75% needed glasses. When tested by the ophthalmologist, 60% of those not handicapped by vision were in need of glasses to obtain perfect vision, that is, 6/6. All in all, we detected 4% in need of glasses.

In the hearing group, the referral rate to a specialist was 16% and of these 43% was handicapped by hearing. After removal of cerumen and foreign bodies, all the others had normal hearing apart from the two with an ongoing infection.

Discussion

In this study, 2% pupils were disabled by vision which is similar to other comparable reports.[8-10] In our study, we considered pupils defined handicapped as per WHO guideline but optimally, every pupil with less than normal vision should get opportunity to correct it.

In this study, we referred all pupils with a screened vision less than 6/18 directly to an ophthalmologist but to reduce costs of a screening program and to minimize the burden on the country's ophthalmologists, referral can be done to an optician.

C.E. Basch found that uncorrected vision leads to poor education; therefore, the optimal solution for pupils with less than normal sight is glasses.[20] However help can be provided by other methods as well. [Table 2].

We found that 6% of the children were in need of a hearing aid, which is similar to other comparable countries.[9,10] Of the 6% with hearing loss, some might be reversible. We did not do a follow-up to test this and it could impact the final result, which is a limitation to the study.

Distortion product otoacoustic emissions (DPOAE) is usually used to test hearing in neonates and not school children, but Kruger *et al.*[21] also tested school children, finding a false-positive rate of 4%. Of the 115 pupils tested by the ENT specialist, 63 had normal hearing but this was after the intervention of removing foreign bodies and cerumen. The exact false-positive rate is therefore not known.

T. Most has reported that poor hearing leads to poor education. For the 50 pupils with hearing disability in our study, education inevitably was affected.[22] The optimal solution is a hearing aid but this is costly. Even without hearing aid, the pupils can be helped; Table 3 shows recommendations applicable immediately.

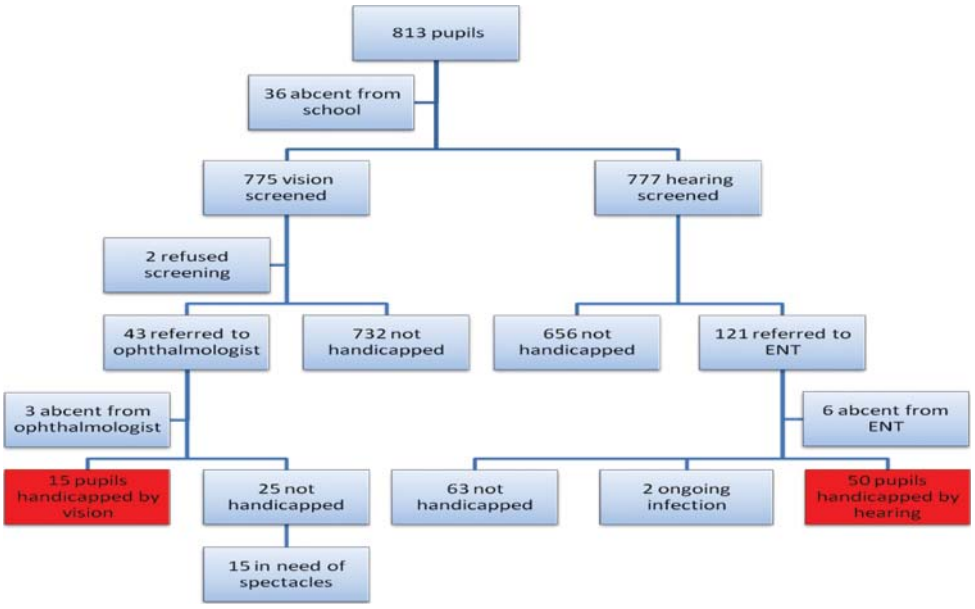

Figure 1: Flowchart depicting outcome of the result

An important aspect of identifying pupils with handicaps is to minimize the expenses the family incurs on private practitioners in its search for an explanation to the child's poor performance in school. Instead, the family can focus on helping the child overcome its handicap. Also the knowledge of a handicap enables applications to private foundations for funding of aids.

We recommend that middle- and low-income countries like Indonesia start screening its primary school pupils for hearing and vision to secure the country's future productivity and socioeconomic development. With a growing economy and a growing need for well-educated employees, this is the time to act if the future's need is to be secured.

Our method was simple and cheap at the screening level and used sophisticated equipment only at the follow-up level. The low number of dropouts in our research shows that screening in primary schools will secure a high percentage of participation.

The vision screening method should be improved using a Snellen chart with a background light instead of those used by us, which had no light from behind. The recommended chart is more expensive but we expect it will result in fewer referrals making it cost beneficial.

We are not sure that the hearing screening using the DPOAE is in fact the best solution for a nationwide-screening program. This needs to be tested further before advice can be made. Alternatively, simple tympanometry could be made by assistants trained in this, who could then visit schools once a year and test all pupils at class 2 level. This setup will probably decrease the referral rate.

Generally the false-positive rate was in the higher side in this study but as both the primary and secondary testing is noninvasive and non traumatic a high false-positive rate might be be acceptable. The problem, however, is the expense in secondary testing

Table 1: Demographic profile of the subjects

Age	Number	%
12 to 15	112	14
9 to 11	343	42
6 to 8	238	29
Unknown	120	15
Total	813	100
Vision and hearing status		
Wearing glasses	8	1
Wearing hearing aid	0	0
Vision tested before	100	12
Hearing tested before	79	10
Total	187	23

Table 2: Vision problem: Possible solutions

The child should
Be seated close to the blackboard.
Have light from behind to see the blackboard clearly.
Have assistance and extra time to copy from the blackboard.

Table 3: Hearing problem: Possible solutions

The child should be seated close to the teacher.
There should be light from behind to observe the teacher's lips while he/she is speaking.
The child should be spoken to clearly.
Unnecessary noise in the classroom must be reduced.
If a tape recorder is used, make sure the quality of the sound is good enough.
The teacher should be conscious of the extra effort expended by the disabled child just to follow the class.

that must be covered by either the health-care system or the families, both of which are with limited resources. This requires a setup designed to improve the high false positive rate. This will probably also result in a greater public backup to the program. The consequences of a high false-negative rate is not acceptable, as retesting can be done easily.

With so many pupils affected by poor hearing or sight, primary care physicians are bound to encounter children complaining primarily about headache and tiredness, but also other symptoms that can be related to many diseases. A test of vision and hearing of these patients may reveal the reason for their symptoms as related to uncorrected poor vision or hearing. In-house testing of hearing and vision is easily done as outlined in this paper and most importantly, it is nontraumatic for the child.

The results of this study shed useful information on screening two basic senses among primary school pupils in low- and middle-income countries and can help secure an education and future for those unfortunate pupils with poor sight or vision.

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