Reviews/Analyses

Practical screening priorities for hearing impairment among children in developing countries

F.M. Gell,¹ E. McC. White,² K. Newell,³ I. Mackenzie,⁴ A. Smith,⁵ S. Thompson,⁶ & J. Hatcher⁷

Routine screening for hearing impairment in childhood is now widespread in industrial countries, although there is considerable controversy over the most efficient techniques and procedures. In most developing countries, however, routine screening programmes for hearing impairment do not currently exist. The problems involved in implementing screening programmes in developing and industrial countries are very different, and in selecting screening procedures for a particular population the following factors have to be taken into consideration: the environmental test conditions; the availability of resources for equipment and the training of testers; the local attitudes towards disability; the level of hearing impairment that may cause handicaps; and the major types of pathology causing hearing impairment. We suggest that in developing countries children should be screened at school entry using a simple field audiometer and that the external ear be inspected for the presence of a discharge. There is an urgent need to develop reliable and simple screening procedures for infants and young children; where possible, all children should be screened for severe or significant hearing impairment before the age of 2 years. No screening should, however, be implemented until appropriate follow-up services are available.

Introduction

Childhood hearing impairment,⁸ even when mild, may have a detrimental effect upon linguistic and educational development, which can result in social and psychological problems for affected children and their families. The effects are most severe when there is a profound sensorineural hearing defect present from birth or early life, but even less severe conductive impairments that develop later in childhood can slow down the child’s linguistic and educational development (1). Poor educational performance has been observed in children with mild and transient conductive impairments, which are frequently associated with recurrent middle ear infection (2, 3). Since prompt appropriate therapy and supportive services can prevent many of the damaging effects of early hearing impairment, timely detection is essential to alert both parents and health care professionals to the need for appropriate action.

Routine screening of infants and preschool and school-age children is now widespread in industrial countries, and a considerable range of methods has been developed to detect hearing impairment in children and to assess its extent. If a possible hearing impairment is detected in this way, otoscopy and a

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⁸ The term “hearing impairment” is used here to encompass the entire continuum from a very mild impairment to profound deafness.

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full audiomteric examination normally follow, and referral may then be made to an appropriate specialist.

In developing countries the demands on health resources can be such that the detection of children with hearing impairments takes low priority (4), even though the prevalence of ear pathology and hearing impairment is higher than in industrial countries. Also, audiological services may be limited or nonexistent, and equipment for the routine screening of hearing impairment is rarely available. Informal enquiries suggest that where audiometers are provided, they tend to be expensive nonportable diagnostic instruments, which are rarely recalibrated. Markides has pointed out that these are often second-hand instruments donated by simple countries which are eager to dispose of out-of-date equipment in a “useful” way (5). Breakages are common, spare parts rarely provided, and since local maintenance and repair services are seldom available the costs in the long run can be very high. In addition, the equipment may be unsuitable for use in hot, humid, and dusty conditions, where air-conditioned testing areas may not be available.

In developing countries, audiometers are usually located in urban clinics or hospitals; rural clinics and school medical services are almost never equipped to screen for hearing impairment (4); and staff are rarely trained to use the instruments. Where appropriately skilled personnel and quiet testing areas are available, acceptable assessment and diagnostic services can be provided using relatively simple equipment: battery-powered audiometers and tympanometers can meet most of the criteria of referral. Such assessment, with diagnostic facilities for referral, and services for those found to have hearing difficulties, should clearly be available before the establishment of a screening programme is considered.

While the facilities for referral in developing countries may be similar to those used in industrial countries, it is more difficult for developing countries to adopt comparable screening procedures. Alternative methods are needed to accommodate the possibility of poor environmental test conditions, difficulties in maintaining equipment, minimal training of testers, the difficulty in reaching all members of the community, and poor compliance because many parents attach a low importance to hearing impairments.

Ideally, the planning and development of an appropriate audiology service should be preceded by epidemiological studies to determine the prevalence of hearing impairment. Such studies are feasible only when appropriate tools for the identification and assessment of hearing impairment are available, and if some referral and rehabilitative services can be provided for children identified to have such an impairment.

This article first reviews the methods employed to screen for hearing impairment in industrial countries. Subsequently, some of the problems that are likely to be encountered if these methods are used in developing countries are identified, and possible methods of screening for hearing impairment that might be appropriate and realistic in such settings are outlined.

**Standardization of techniques and classifications**

Despite the widespread use of screening programmes to detect hearing impairment in industrial countries, there is no standard internationally accepted procedure for identification of the condition, nor a standard criterion for “failure” and referral. Even within a country standardization of procedures is rare, and a survey of screening procedures in each state of the USA revealed “a chaotic myriad of standards, regulations, guidelines, techniques, and recommendations” (6).

Classification of hearing impairment also varies widely, making comparisons of prevalences both within and between countries extremely difficult. In 1986, WHO prepared an international classification of hearing impairment, based on bilateral hearing performance tests rather than audiomteric measurements. Comparable audiometric values were also given. Some modifications were made to this classification in 1991 (see Table 1).c We recommend that all countries without access to audiomteric technology should adopt a similar performance-based system of classification.

**Screening procedures for infants and preschool children**

**Screening methods**

Many congenital hearing impairments are not identified, even in industrial countries, until a relatively late stage. For example, a study carried out in the United Kingdom in 1977, of children born in 1969, found that the average age when severe congenital deafness and hearing impairment: report of the Director-General. WHO unpublished document A39/14 (annex to document EB 79/10)

### Screening children for hearing impairments in developing countries

<table>
<thead>
<tr>
<th>Grade of impairment</th>
<th>Performance</th>
<th>Recommendations</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (&lt;25 dB)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>No (or very slight) hearing problems. Able to hear whispers</td>
<td>—</td>
<td>20 dB also recommended. People with 15–20 dB levels may experience hearing problems. Those with unilateral hearing losses may experience problems even if the better ear is normal</td>
</tr>
<tr>
<td>1 (26–40 dB)</td>
<td>Able to hear and repeat words spoken in normal voice at 1 metre</td>
<td>Counselling. Hearing-aids may be needed</td>
<td>Some difficulty in hearing, but can usually hear normal level of conversation</td>
</tr>
<tr>
<td>2 (41–60 dB)</td>
<td>Able to hear and repeat words using raised voice at 1 metre</td>
<td>Hearing-aids usually recommended</td>
<td>—</td>
</tr>
<tr>
<td>3 (61–80 dB)</td>
<td>Able to hear some words when shouted into better ear</td>
<td>Hearing-aids needed. If no hearing aids available, lip-reading and use of sign language should be taught</td>
<td>Discrepancies between pure tone thresholds and speech discrimination score should be noted</td>
</tr>
<tr>
<td>4 (&lt;81 dB)</td>
<td>Unable to hear and understand even a shouted voice</td>
<td>Hearing aids may help in understanding words. Additional rehabilitation needed. Lip-reading and sometimes use of sign language essential</td>
<td>Spoken speech distorted, the degree depending on the age at which hearing was lost</td>
</tr>
</tbody>
</table>


<sup>a</sup> Performance tests for speech discrimination levels should be carried out using hearing alone, i.e., without any visual clues.

<sup>b</sup> Figures in parentheses are the corresponding ISO audiometric values for the better ear, i.e., the averages of the results at 500, 1000, and 2000 Hz. Speech discrimination against a background of noise requires good high-frequency hearing. It is therefore recommended that epidemiological studies include testing and reporting of the hearing threshold at 4000 Hz.

Hearing defects were detected was 2.5–3 years (7). Also, a study carried out in 1982 reported that about 40% of hearing-impaired children in the United Kingdom were not detected at their first screening test (8). This situation is common in industrial countries and is likely to be worse in developing countries, where programmes for the early detection of hearing impairment are rare.

While programmes to screen the hearing of entire infant populations have met with limited success and enthusiasm (9), the importance of identifying those infants who are likely to develop defects as a result of exposure to perinatal or other hazards has been extensively documented (10–12). In 1982 the American Joint Committee on Infant Hearing suggested the following seven-item check-list to identify such at-risk children (13): a family history of childhood hearing impairment; congenital or perinatal infection; anatomic malformations involving the head or neck; birth weight <1500 g; hyperbilirubinaemia above the level which indicates the need for exchange transfusion; bacterial meningitis, especially with *Haemophilus influenzae*; and severe asphyxia. The value of such a register has been questioned, since 100% follow-up is impossible to achieve and a significant proportion of children with impaired hearing are not identifiable as being at risk (8, 14). However, there is general agreement that these registers remain a useful and basic guide for identification of some of the infants most at risk of hearing impairment (15).

In industrial countries, it is recommended that routine screening be carried out in the first year of life, normally around 8 months of age, and again at 2.5–3 years of age, when the development of speech and articulation can also be reviewed (7). Behavioural response screening is used for both these tests. Children can also be examined between routine screening tests if there is any suspicion of hearing impairment (16, 17).
Many attempts have been made to develop behavioural methods of screening for hearing impairment in preschool children, but it is difficult to develop a satisfactory test that adheres to the basic principles of screening, particularly that the method should be simple, low-cost, and suitable for the rapid testing of large populations. A test that requires a voluntary response from a preschool child can be neither rapid nor simple, and is particularly difficult with 2–3-year-olds. The effectiveness of the tests depends largely on the skill of the tester in assessing a child’s developmental progress, in selecting and performing an appropriate test, and in correctly interpreting response behaviour in terms of hearing impairment. The first-year screening test for hearing impairment includes testing the infant’s hearing using the distraction technique and questioning the mother about the developmental status, communication abilities, and hearing behaviour of her infant. It is important that parental suspicions of hearing problems should never be disregarded, since they are valid indicators of the presence of hearing disorders (18).

The distraction test involves the production of an orienting response to “meaningful sounds” of different frequency ranges immediately after the child’s attention is distracted by a play activity. The test stimuli recommended at known decibel levels are the hum (<500 Hz), the consonant “s” (about 4000 Hz) and, if available, a high frequency rattle (>6000 Hz). The responses of the test subject are compared with those expected for a normally developed child of the same age using an auditory behaviour index (19, 20).

Although the current procedure for carrying out distraction testing appears to be fairly simple, it is beset with difficulties and potential hazards. Considerable skill and experience are required to select the appropriate test procedure for the infant’s developmental age group, since general development progresses rapidly during the first year of life (20). If inaccurate stimulus intensity and frequency levels are used, distraction techniques are poor, while if clues are given about the source and timing of the stimulus, high false-negative rates can occur. McCormick has suggested that insufficient training of health visitors, poor test technique, and the lack of sound-level meters may account for the low levels of detection of hearing impairment among young children in the United Kingdom (17).

In developing countries, staff training difficulties are likely to be considerable (21). Provision of equipment may be inadequate; quiet, distraction-free testing environments may be difficult to find; and health services that are overburdened and understaffed may not be able to allocate trained and skilled staff for the time necessary to ensure adequate quality of testing.

The 2–3-year-old age group is usually screened using a cooperative test, such as the verbal-auditory screening test in which the child is required to point to a picture representing a word that is spoken aloud (22). Children aged 3–4 years or more are screened using a performance test in which the child is trained by play-conditioning to manipulate objects in response to either speech or pure-tone stimuli.

Most behavioural tests are culture-specific in that they use stimulus sounds, test materials, types of response behaviour, and procedures that are familiar and appropriate to the culture in which they were developed. Cross-cultural studies on cognition have shown that test performance depends greatly on culture, level of formal education, and familiarity of test materials (23–25). In industrial countries the sounds used in the distraction test have included a spoon scraping a china cup, a sound that would be unfamiliar and therefore not “meaningful” to cultures that use gourds or calabashes as drinking utensils. Picture-pointing tests are only appropriate for children who are familiar with pictorial representations; for those who have had no access to books and pictures, real and familiar objects should be used instead. At a more fundamental level, the concept of “testing” and of conditioning a behavioural response may be quite alien to some societies.

The development of behavioural methods of testing hearing that are appropriate to the needs of different countries is urgently needed. While such tests are time-consuming and require an experienced, thoroughly trained and sensitive tester, they have the considerable advantage that they use inexpensive equipment.

Community-based screening programmes

Routine testing of hearing should ideally form part of general developmental screening procedures. In industrial countries, the health visitors who screen for hearing impairment in the home are normally nurses trained in developmental paediatrics; however, in developing countries, health workers with sufficient training and experience to perform developmental screening tests are likely to be employed in hospitals and clinics rather than in the community. Their expertise is, nevertheless, needed to test children with a suspected hearing impairment or those in a “high-risk” group who can be brought to a clinic or hospital. The routine screening of children’s hearing in the community is therefore undertaken by the primary health care workers, who often receive only minimal training and have a multitude of other duties to perform.

Helander et al. have produced a manual on community-based rehabilitation for use by primary health
Screening children for hearing impairments in developing countries

care workers, which describes a procedure of screening for hearing impairment using distraction and speech tests (26). This is the first real attempt to develop screening methods for use in developing countries, but the methods advocated are crude and involve the use of nonfrequency-specific home-made rattles and hand-clapping. Werner has produced a similar manual with a smaller number of more accurate but simpler tests that can be used by families themselves (27); however, this approach indicates that distraction testing can be performed by one person when, for the best results, teamwork is essential.

WHO recommends that primary health care workers should be trained to perform these screening tests routinely on all children in the community. The first screening test should be carried out on children before 2 years of age and the second just before school age. Children with discharging ears or with the clinical signs and symptoms of hearing problems (e.g., earache, vertigo, or tinnitus) and infants or children considered to be “at-risk” (e.g., where a parent or sibling is deaf, or following certain severe infections) should also be tested.

In most developing countries the number of home births is high and “at-risk” children are seldom identified soon after birth. In addition, it is rarely possible for infant development to be monitored by skilled health professionals. Parents and primary health care workers must therefore be responsible for identifying, as early as possible, children with impaired hearing. McCormick’s simple checklist of behavioural indicators of hearing impairment in the first year of life (17) is a useful guide for use by both parents and health visitors in the United Kingdom and (apart from reference to the noise of a vacuum cleaner, which could be easily modified to a more appropriate sound) could also be of value in developing countries (see Table 2).

It is stressed that routine screening of the hearing of infants and young children should not be implemented unless a referral programme and realistic and appropriate methods of assessment are available, and until adequate follow-up care and support can be provided. Children who fail the first screening test, infants who are considered to be “at-risk”, and any child with a suspected hearing impairment should be referred to an appropriate health centre for examination and further assessment.

Further assessment of infants and young children

In the assessment of hearing impairment in infants and young children in industrial countries, distra-
Table 2: Can your baby hear you?*

Here is a checklist of some of the general signs you can look for in your baby's first year: Please tick if response present

* Shortly after birth
  Your baby should be startled by a sudden loud noise such as a hand clap or a door slamming and should blink or open his eyes widely to such sounds.

* By 1 month
  Your baby should be beginning to notice sudden prolonged sounds like the noise of a vacuum cleaner and he should pause and listen to them when they begin.

* By 4 months
  He should quieten or smile to the sound of your voice even when he cannot see you. He may also turn his head or eyes towards you if you come up from behind and speak to him from the side.

* By 7 months
  He should turn immediately to your voice across the room or to very quiet noises made on each side if he is not too occupied with other things.

* By 9 months
  He should listen attentively to familiar everyday sounds and search for very quiet sounds made out of sight. He should also show pleasure in babbling loudly and tunefully.

* By 12 months
  He should show some response to his own name and to other familiar words. He may also respond when you say 'no' and 'bye bye' even when he cannot see any accompanying gesture.

* Your health visitor will perform a routine hearing screening test on your baby between seven and nine months of age and will be able to help and advise you at any time before or after this test if you are concerned about your baby and his development. If you suspect that your baby is not hearing normally, either because you cannot answer yes to the items above or for some other reason, then seek advice from your health visitor.


Otitis media in its various forms is common in children under 7 years of age and may cause both transient and permanent hearing impairment. Chronic suppurative otitis media (CSOM) is often ignored by parents, although high prevalences of this condition have frequently been reported among populations of American Indians, Aborigines, and Maoris (34, 35), as well as in developing countries (36–38). This contrasts with the situation in industrial countries, where noninfective, allergic and acute infective diseases of the middle ear are the predominant causes of aural pathology (39). Children with chronic otitis media may either be unable to express the nature of the problem or be unaware of the associated mild-to-moderate hearing impairment. Consequently their condition often goes unnoticed by both health care professionals and parents.

Children who have bilateral chronic otitis media may suffer 1–2 years’ educational retardation with significant delays in speech and language acquisition, even though their hearing impairments are rarely >45 dB (40). Paradise has concluded that early episodes of otitis media cause developmental impairments only if residual hearing impairment results (41), but others workers have documented language learning problems caused by even transient hearing impairments at an early age (42, 43). There is evidence to indicate that a mild hearing impairment (10–15 dB) may be sufficient to impair the acquisition of language skills by young children and may lead to educational retardation (44). In industrial countries, it is now considered important to identify such mild and transient hearing impairments as early as possible.

There is considerable controversy in industrial countries over the most appropriate and cost-effective methods of screening school-age children for hearing impairment. Screening audiometry, using either pure-tone or speech stimuli, is the most widely used method of identifying individuals with a possible hearing impairment, but the screening level generally used (around 25 dB HTL) does not reliably identify the mild hearing impairments associated with serous otitis media. Over the last 20 years
increasing concern about the effects of middle ear disease, particularly in North America, has focused interest on the detection of fluid in the middle ear using tympanometry (45–47).

**Tympanometry**

Tympanometry is a quick,客观, and reliable means of identifying the patency of the tympanic membrane or the presence of fluid in the middle ear; it requires minimal cooperation from the child. However, tympanometry may result in over-referrals, and consequently unnecessary follow-up costs (48), while the currently available equipment is neither rugged nor low cost, and the results can be difficult to interpret.

The technique has been used as a screening procedure for populations with a high prevalence of serous otitis media (otitis media with effusion). Where CSOM is a greater problem than serous otitis media, as appears to be the case in many developing countries, accurate tympanometry may not be possible since it can be difficult to obtain a good seal between the ear canal and the measuring probe if the ear is full of discharge. CSOM can best be diagnosed by examining for the presence of a purulent discharge, using otoscopy to identify a perforation of the tympanic membrane.

We suggest that for populations where CSOM is likely to be a major problem, inspection of the ear for a purulent discharge is the most effective form of screening. Where the priority is the identification of moderate-to-severe impairments, pure-tone audiometry is undoubtedly the most suitable screening tool.

**Audiometric screening**

The most commonly used form of audiometric screening for school-age children in industrial countries is pure-tone air conduction audiometry. The American Speech and Hearing Association recommend use of a limited frequency test, manually administered to individuals, as a rapid and efficient means of screening children as young as 3 years of age (49). Simple, portable, pure-tone screening audiometers are generally used for this purpose.

Opinion differs widely about which frequencies should be used in audiometric screening. The most commonly used are probably 500, 1000, 2000, 4000, and 6000 Hz. Although 500 Hz is an important speech frequency, it is often omitted since it is easily masked by ambient noise, while 6000 Hz tends to produce a high false-positive rate (50). Ballantyne & Martin recommend that 500, 1000, 2000, and 4000 Hz are probably enough for testing primary schoolchildren (51).

The pass/fail criterion for screening must be selected with regard to both availability of treatment and rehabilitation services, as well as to the degree of impairment considered to be a handicap. Consideration should be given to whether the objective is to identify only “disabling” impairment or all impairment over a specified intensity and frequency range, and whether the criterion for failure is based on the audiometrically better or worse ear. Haggard et al. state that in the predominantly sensorineural impairments of adults the disability is generally determined by the better ear, while speech testing indicates that overall disability in children may be more closely related to the situation in the worse ear (52).

A range of intensity levels are currently used for screening in industrial countries; most commonly, 20 dB HTL at 1000 Hz and 2000 Hz, and 25 dB HTL at 4000 Hz to compensate for the 4000 Hz “dip” that can be caused by noise-induced hearing impairment. Hearing impairment of this extent may be of little practical significance in a developing country, and for many individuals who are identified treatment may not be available (3). Screening at 30 dB HTL may be more appropriate for practical reasons because of the higher levels of background noise and because children with this level of hearing impairment need special attention at school, even if they do not necessarily require a hearing aid. Alternatively, screening at 50 dB HTL would exclude such children, and the smallest hearing impairments detected at this level would indicate the need for a hearing aid in the absence of chronic discharge (D. N. Brooks, personal communication, 1985).

Knight’s review of currently available speech testing materials in non-European languages cites work on the development of such materials in Arabic, Cantonese, and several Indian and African languages (53). However, while speech audiometry has been used in childhood screening programmes (44), it is not generally employed for this purpose because of its complexity and the need for highly skilled personnel. The variation in the overall intensity of spoken words and their frequency-specific intensity patterns make them less easy to calibrate than pure-tone stimuli (52). Furthermore, since all speech frequencies give overtones of several frequencies, a child with a sharp high-frequency “dip” may not be identified if screened with speech stimuli (54). Speech audiometry is therefore more appropriate and useful for assessing the extent of hearing disability, particularly with preschool children who will not respond to pure tones.

**Combined screening methods**

Various combined screening methods have been suggested, particularly for situations where a high level
of ambient noise precludes the use of low frequency tones in audiometry. Suggestions have been made about combining tympanometry with a pure-tone test using five frequencies (55), with a single high frequency tone (56), or with a single warble tone at 3000 Hz (57). However, use of a combination of techniques increases the complexity and time taken to perform the tests.

Other methods which have been combined with audiometry, such as otoscopy or tuning-fork testing, require the skill and insight of an experienced examiner and these methods may not be effective for mass screening by less experienced individuals (58). WHO recommends a minimum of 3 years' formal training in otoscopy for community health workers and health professionals.  

**Screening audiometry in developing countries**

In most developing countries, routine audiometric screening is not performed in schools since staff and the appropriate equipment are not available. Clinics in major towns may be equipped with expensive, complicated, diagnostic audiometers, but it may be difficult to obtain spare parts or to service them, they require highly trained operators, and they are in any case too bulky and delicate to be transported to schools. Screening surveys in developing countries have therefore generally used simpler, portable screening audiometers (59, 60); nevertheless, even these instruments are relatively costly, and in field studies in India and Swaziland we have found them unsuitable for use in rough terrain if much travelling is involved.

Simple, low-cost, robust screening audiometers are needed for routine use in schools, clinics and field surveys, and in 1985 WHO requested that research be carried out into developing such an audiometer. In response, the Liverpool Field Audiometer was produced. This is a hand-held, battery-powered field audiometer with a single earphone that emits warble tones of 500, 1000, 2000, and 4000 Hz at intensities of 30, 50, or 80 dB HTL (Fig. 1). It has been used successfully in the field in the United Kingdom, India, and Swaziland (Fig. 2). The results of screening tests using the field audiometer agree well with those obtained using full audiometric testing in trials with children in the Nottingham Children’s Hearing Assessment Centre.

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1 See footnote b, p. 646.
2 The Liverpool Field Audiometer was designed and manufactured by MEG Instrumentation, Sheffield, England, to a specification developed in conjunction with the Liverpool Hearing Impairment Research Group.
The field audiometer is suitable for use not only as a screening tool in developing countries but can also perform several useful functions in industrial countries. For example, it could be useful in supplementing impedance testing with a high-frequency tone, in the testing of difficult children who cannot be examined using conventional headphones, and for use by non-specialists, such as general practitioners, speech therapists or teachers, where a simple check of hearing is needed to justify referral to an audiologist or otologist.

**Further assessment of school-age children**

School-age children who fail a screening test should be referred for otoscopic examination and a full audiometric assessment to determine the type and extent of their hearing impairment. In developing countries such referrals are normally made to hospitals or special hearing clinics. In district hospitals, there should ideally be small sound-proofed booths for audiological assessment, but with ingenuity a satisfactorily quiet area can be found in most hospitals.

**Conclusions**

If internationally standardized procedures for the identification and classification of hearing impairment are to be developed, an exchange of ideas and cooperation between countries is needed. Agreement on such procedures would facilitate both the planning and development of audiological services and comparisons of the prevalence of hearing impairment in different populations.

Routine screening programmes should only be implemented where there are adequate referral services. These services include diagnosis and assessment, production and fitting of ear moulds and hearing-aids, with follow-up and maintenance services and rehabilitation programmes, including educational support. In such situations, routine screening for hearing impairment should be performed at school entry and, where possible, before the age of 2 years. If it is not feasible to screen whole populations of young children, attempts should be made to screen those children considered to be “at-risk” of hearing impairment.

The problems that arise in the behavioural testing of infants and young children in industrial countries are likely to be more pronounced in developing countries, where fewer resources for equipment and trained personnel are available, and where environmental testing conditions may be less favourable. Also, the traditionally used procedures for the behavioural screening of hearing impairment have been developed in industrial countries and may be inappropriate for some non-Western cultures. Research into the development of simple, low-cost and reliable techniques for the early identification of hearing impairment is urgently needed.

Chronic suppurative otitis media appears to be the most common cause of mild-to-moderate hearing impairment in children in developing countries. Tympanometry is not the most effective technique of identifying this condition, which is best diagnosed by the presence of a purulent discharge, using otoscopy if possible. For the detection of moderate-to-severe hearing impairment, audiometry is still the most suitable screening procedure: a simple, robust and low-cost field audiometer has recently been developed for this purpose.

**Acknowledgement**

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**Résumé**

**Priorités pratiques pour le dépistage des déficits auditifs chez l’enfant dans les pays en développement**

Un déficit auditif chez l’enfant peut compromettre son développement linguistique et intellectuel et être à l’origine de problèmes sociaux et psychologiques. Une détection précoce est donc essentielle pour avertir les parents et les professionnels de la santé de la nécessité d’instituer un traitement et de mettre en place des services de soutien capables d’éviter bien des effets néfastes d’un tel déficit. Des services d’orientation adéquats devraient être établis avant la mise en place d’un programme de dépistage, ces services pouvant être analogues à ceux qui existent dans les pays industrialisés; toutefois, d’autres méthodes de dépistage devront être adoptées dans les pays en développement en raison des circonstances et des conditions propres à ces pays.

Dans les pays industrialisés, le dépistage des déficits auditifs chez les nourrissons et les enfants d’âge préscolaire s’appuie sur l’exploitation de registres d’enfants “à risque” et sur les méthodes suivantes: épreuve de distraction pour les bébés de moins d’un an; audiométrie vocale pour le groupe des 2 à 3 ans; et tests de performance entre 3 et 4 ans. Toutes ces méthodes demandent du temps et un personnel expérimenté et compétent. La mise au point de tests adaptés aux
différentes cultures et aux différents environnements des pays en développement doit être une priorité. Ces tests doivent pouvoir être utilisés par les parents et les agents de soins de santé primaires.

Un dépistage systématique chez tous les enfants d’âge scolaire est également souhaitable. Dans les pays industrialisés, on utilise à cette fin les techniques suivantes, individuellement ou en association: audiométrie tonale en conduction aérienne; audiométrie vocale; tympanométrie; emploi du diapason. Etant donné que l’otite moyenne chronique suppurée est beaucoup plus fréquente dans les pays en développement que l’otite moyenne séreuse, la tympanométrie n’est pas particulièrement indiquée et il est préférable de rechercher la présence d’un écoulement purulent ou de pratiquer une otoscopie pour vérifier s’il n’y a pas perforation du tympan. Les examens audiométriques de routine sont rarement pratiqués dans les pays en développement en raison du manque de matériel et de personnel spécialisé. Un audiomètre simple serait également très utile pour les tests de dépistage et le Liverpool Field Audiometer a été mis au point pour répondre à ce besoin. Cet audiomètre de terrain portatif fonctionnant sur piles émet des sons modulés à 500, 1000, 2000 et 4000 Hz et à des intensités variables (30, 50 et 80 dB HTL). Il a été utilisé avec succès au Royaume-Uni, en Inde et au Swaziland.

Des recherches doivent être entreprises d’urgence sur les méthodes de dépistage applicable aux bébés et aux enfants d’âge préscolaire dans les pays en développement. Chez les enfants d’âge scolaire, la plupart des déficits auditifs légers à modérés que l’on observe dans ces pays sont dus à une otite moyenne chronique suppurée pour laquelle le meilleur test de dépistage consiste à vérifier la présence d’un écoulement purulent et, si possible, à pratiquer en même temps une otoscopie. La recherche des déficits auditifs modérés à graves doit être effectuée par audiométrie et le Liverpool Field Audiometer a été conçu à cet effet.

References
Screening children for hearing impairments in developing countries


