

# BEST PRACTICE GUIDELINE

## IDENTIFICATION, ASSESSMENT, AND REFERRAL OF CHILDREN WITH HEARING IMPAIRMENTS IN THE NORTH WEST REGION OF CAMEROON

PREPARED BY

THE NWR BEST PRACTICES IN HEARING IMPAIRMENT AND REHABILITATION GROUP

BAMENDA COORDINATING CENTRE FOR STUDIES IN DISABILITY AND REHABILITATION  
BAMENDA, NORTH WEST REGION, CAMEROON

AND

INTERNATIONAL CENTRE FOR DISABILITY AND REHABILITATION  
UNIVERSITY OF TORONTO, CANADA

NOVEMBER 2013

# **Best Practice Guidelines for the identification, assessment, and appropriate referrals of children under 12 years of age with hearing impairments in the North West Region of Cameroon**

## **Contents**

Core Development Committee	3
Statement of Intent .....	3
Scope of these guidelines – What are these guidelines about? .....	4
Background .....	4
Methodology .....	5
Recommendations for the Identification of Children with possible Hearing Impairment .....	8
Recommendations for Assessment.....	10
Recommendations for Functional Assessment .....	11
Recommendations for Intervention and Rehabilitation .....	11
Benefits of Implementing the Guidelines.....	12
Evidence supporting the Recommendations .....	13
Appendix 1: Resolution World Health Assembly 48.9.....	16
Appendix 2: Description of assessment tools .....	17

## Core Development Committee

1. **Che Manasseh**, Head of the Integrated School for the Deaf, Mbingo Baptist Hospital, Cameroonian Baptist Convention Health Board, North West Region, Cameroon
2. **Pamela Ofon**, Sign language interpreter and Instructor at the Morningstar School, Akum
3. **Shirin Kiani**, (2011) Volunteer at the Bamenda Coordinating Centre for Studies in Disability and Rehabilitation (BCCSDR), North West Region, Cameroon
4. **Anjonga Emmanuel**, Administrative Assistant at the Bamenda Coordinating Centre for studies in Disability and Rehabilitation (BCCSDR), North West Region, Cameroon

### Thank you to:

Dr. Lynn Cockburn, International Centre for Disability and Rehabilitation, University of Toronto, for her guidance during this project.

Mr. Julius Wango, Bamenda Coordinating Centre for studies in Disability and Rehabilitation (BCCSDR)

### Expert reviewers: our gratitude to

Mr. Rex Banks, Canadian Hearing Society

Dr. Acha Evaristus, Mbingo Baptist Hospital

**Guidelines Status:** The first version of the guidelines was developed over 2009-2011 and drafts were disseminated in 2011 and 2012. These guidelines should be added to and developed further based on interest, need and availability of persons to do so.

**Source of Funding:** Funding for this project was provided to the BCCSDR by the Cameroon Baptist Convention Health Board SEEPD Program which is in turn funded by AUSAID through CBM Australia. The BCCSDR and ICDR-Cameroon financially supplemented the completion of guideline and the writing of through in-kind support.

## Statement of Intent

These guidelines are intended to **guide** health care and educational practices, services, and systems in the North West Region of Cameroon; the Best Practices group recognizes that human, financial, and system resource limitations can make it difficult to implement all of the recommendations in this document. However, these recommendations are presented as good practice benchmarks which all organizations and health systems should strive to meet. We have based the contents of the guideline on the best available evidence at the time of development *and* our understandings of the realities of practice in the region.

Additionally, this guideline can be used as a valuable tool and information source for educators, managers, administrators, and for anyone advocating for improved hearing services and for providers in similar settings.

Adherence to these guidelines may not ensure a successful outcome in every case. These guidelines should neither be seen as including all proper methods of care, nor do they exclude other acceptable methods of care.

For an individual patient, client, or student standards of medical, nursing, and rehabilitation care are determined on the basis of all clinical and related data available for that individual case and

are subject to change as knowledge advances and patterns of care evolve. Each health care provider is ultimately responsible for the management of his/her unique patient, in the light of the data presented by the patient and the diagnostic and treatment options available.

We hope that these guidelines will assist in the provision of the best possible services for infants and children who have experienced hearing impairments in the region, and will also encourage providers to continue to learn and grow in their professional practices.

---

## **Scope of these guidelines – What are these guidelines about?**

**Objective:** To document best practice recommendations in hearing impairment and deafness for initial identification, assessment (e.g. medical and functional), and referral to rehabilitation facilities. An important consideration is to correctly identify and distinguish children with hearing impairments only, and those with multiple disabilities including hearing impairment and intellectual disability simultaneously, for appropriate referrals.

**Rehabilitation Settings:** The guidelines are intended to be used in community based rehabilitation and education settings. They can also be used in other settings if deemed appropriate.

**Intended users of the guidelines:** This document is to provide direction for rehabilitation providers, school administrators and teachers, hospital administrators and doctors/nurses, community leaders, stakeholders, organizations.

**Target population:** Persons living with hearing impairments and deafness, from infants to school age.

**Age group:** Birth to 3 years; school age children (3-12 years). While the guideline is intended to be used with children up to age 12, the recommendations might also be used with older children.

**Disease (s) and/or condition(s):** All Hearing impairments and deafness

**Description of patients/clients not included:** People over 12 years of age.

**Clinical specialties:** CBR (Community Based Rehabilitation) workers, other health workers, speech therapists (visiting/students)

---

## **Background**

These guidelines are part of a larger initiative to improve services for people with disabilities and rehabilitation services in the North West Region of Cameroon.

Our working group chose the topic of identification and assessment in children in 2009, prior to knowing about the WHO Report on Neonatal and Infant Hearing Screening: Current issues and Guiding Principles for Action which was released in early 2011 (WHO, 2010). So we were delighted to see that the links between screening and rehabilitation which our group has made were also reflected in global efforts. For example, the following paragraphs are from the 2010 WHO report:

“Screening activities must also be placed in the broader context of rehabilitation approaches. Early detection and the provision of rehabilitation and support services are crucial aspects in preventing disability or mitigating its impact. The United Nations Convention on the Rights of Persons with Disabilities was adopted in May 2008 with Article 7 of this convention specifically addressing the rights of children with disabilities, and Article 26 emphasizing that habilitation and rehabilitation should be provided at the earliest stage.

All children have a right to treatment and to non-discrimination...There appears to be a growing consensus that linking screening with rehabilitation and support is key and should go beyond the health sector. However, it is unclear at present whether the provision of newborn and infant hearing screening without corresponding diagnostic, rehabilitation and other services and interventions already in place can be considered to be ethical or beneficial. On the one hand, it seems clear that screening alone is insufficient and potentially unethical, but it is also true that in some countries (for example, the United States) setting up screening programmes acted as a spur to the subsequent expansion of service provision.

Because many children do not come into contact with health services, outreach efforts will also be needed (for example, in schools). This is particularly the case for children with other disabilities.” (WHO, 2010, p. 9-10)

## Methodology

**Method used to collect evidence:** Evidence was collected using a search of the following electronic databases,

- ▲ Google Scholar (<http://scholar.google.co.uk/>)
- ▲ The CIRRIE database of International Rehabilitation Research (<http://cirrie.buffalo.edu/search/index.php>)
- ▲ National Guideline Clearing House (<http://www.guidelines.gov>)
- ▲ Guidelines International Network (<http://www.g-i-n.net>)
- ▲ Scottish Intercollegiate Guidelines Network New Zealand Guidelines Group (<http://www.nzgg.org.nz>)

Search words entered: best practices, hearing impairment, deafness, identification, assessment, Africa, Cameroon.

During the search, we identified a ‘clinical practice guideline’ on assessment and intervention for persons with hearing loss developed by health authorities in the USA, the New York State Department of Health. This document was used for occasional referencing but not as a core guideline for recommendations as it was designed for a high-income, high resource setting, not matching the available resources in Cameroon for screening equipment and human resources. As such, the guideline developed in this document puts together a variety of evidence from expert experience in Cameroon and from places comparable to Cameroon.

**Method used to select evidence:** To ensure evidence selected and reviewed related to the scope statement, a brief review of evidence’s abstract and discussion/conclusion was done to ensure content of the evidence related to identification, assessment, and/or referral to appropriate centres (e.g. educational, medical, rehabilitation). Another consideration for selection of appropriate evidence was to select articles relating to practice in Africa or similar contexts (e.g. Asia). Articles from developed

countries were reviewed but not selected for developing these guidelines as recommendations often did not match the Cameroonian context.

**Method used to assess the quality and strength of evidence:** Each piece of evidence was categorized according to the levels listed below. During the literature search, a variety of evidence with the highest strength was sought out, however, in reality, there seems to be a scarcity of rigorous literature (Level A or B) on the African context and practices for identifying and supporting persons with hearing impairments. Many of the articles deemed appropriate and included as part of these guidelines classified in Level C and D.

Level of evidence	Type of evidence
A	Strong recommendation. Evidence from randomized controlled trials or meta-analyses of randomized controlled trials. Desirable effects clearly outweigh undesirable effects, or vice versa.
B	Single randomized controlled trial or well-designed observational study with strong evidence; or well-designed cohort or case-control analytic study; or multiple time series or dramatic results of uncontrolled experiment.
C	At least one well-designed, nonexperimental descriptive study (e.g., comparative studies, correlation studies, case studies) or expert committee reports, opinions and/or experience of respected authorities, including consensus from development and/or reviewer groups.
D	Expert opinion, formal consensus

**Method for formulating recommendations:** A comparison table was developed using the format below to help determine appropriate recommendations to make. The idea of this table was to compare current practices identified in the North West Region as per the scope statement (e.g. identification, assessment, and referral to appropriate centres) to recommendations made in the literature on those areas, while ensure that levels of evidence of articles for each recommendation is noted and considered.

Comparison Table

Current practices in vocational rehabilitation	Recommendations from Evidence	Author and Level of Evidence
1. Identification		
2. Assessment – Medical and Functional		
3. Referral to appropriate centers (e.g. medical/ rehabilitation and educational)		

From the findings of this table a discussion arose within each of the 3 areas of the scope statement. Recommendations were discussed in terms of feasibility within the local context within the short and long term, considering the existing and potential resources at hand and possibilities appropriate to the context. Based on this the first draft of the guidelines was developed.

**Method of guideline validation:** The first draft of the guidelines underwent further two-steps of

validation, expert and practitioner review.

1. Expert Review: Members of the group who developed these guidelines were experienced practitioners and leaders in the field of supporting children with hearing impairment in the North West Region of Cameroon. To further validate the recommendations formulated by these persons, experts were sought out who could further validate and confirm appropriateness of recommendations made. Experts were deemed person who had worked in the field of hearing impairment for at least a 5 year period, preferably who had produced written work (published and unpublished) in the area, who had possibly presented on the topic of hearing impairment at local conferences/seminars, and lastly who had received some type of education/formal learning on the area of hearing impairment to substantiate their knowledge base.

Feedback of experts were incorporated to improve the content of these guidelines to produce a second draft.

2. Practitioner review: To ensure the format used to present these guidelines is user friendly, a small group of practitioners in the area of hearing impairment were shown the first draft of these guidelines and asked for their input on how relevant, understandable and feasible these guidelines could be in their work. Recommendations were noted and included in the third draft.

## Recommendations for the Identification of Children with possible Hearing Impairment

**Identification:** Identification is the process of detecting a person who might have a hearing impairment. If the person is identified as possibly having a hearing impairment, they should then have a referral for full assessment.

- 1) **Targeted screening is cost effective but it has its limitations:** Targeted Screening is when all children in a high risk group are looked at, and is used with high risk infants (i.e. whose mothers had unhealthy pregnancies or who had difficult births). It is a cost saving method of tackling the issue, but it may not be the most effective way to get the majority of infants who are born with hearing impairments – about half of children with hearing impairments are not classified as high risk infants. [Olusanya et al. 2007, Level C; WHO, 2010]
- 2) **Targeted screening should be done for high risk infants:** For targeted screening, high-risk babies were identified as those whose mothers had unhealthy pregnancies (e.g. malaria, HIV/AIDS, rubella, syphilis, cytomegalovirus, herpes) and if the baby had a poor health condition after birth such as: bacterial meningitis, infections, HIV/AIDS, malaria, head injury, and facial abnormalities. [HPCSA 2007, Level C; WHO, 2010]
- 3) **Universal screening can be very informative:** Universal screening is when all children are looked at. It is more costly but can also provide valuable epidemiological information (i.e. trends on a disease/disability) for future planning purposes to see why (e.g. incidence, risk factors) and where hearing impairment rates are high. [Olusanya et al. 2007, Level C; WHO, 2010]
- 4) **Universal screening is more costly but more accurate in catching children who only have hearing loss and not multiple disabilities:** Universal screening is recommended and not to only screen high-risk babies, even in contexts with limited resources. The high-risk population (babies to mothers with difficult pregnancies and labour) only accounts for approximately 50% of infants with hearing loss, and this means that the children presenting only with hearing loss (not other disabilities), and who have the highest potential for success, are most likely to be missed if targeted screening is only done. [HPCSA 2007, Level C]
- 5) **It is feasible to train community health workers for screening:** Non-specialist screeners are recommended versus specialist screeners (audiologist, ear care specialist) so that a rapid spread of screening can happen, which is an important public health concern that has been unaddressed due to lack of manpower/personnel so far. [Olusanya et al. 2007, Level C]
- 6) **Community-based screening is important in areas where home births are common.** Hospital-based screening are needed in all countries, but in places where a high proportion of births occur outside the hospitals, community-based screening is essential as well. Community-based screening is often linked to visits to maternal and child clinics for routine immunization in the first 3 months of life. [Olusanya et al. 2007, Level C] Hospital-based screening for infants who are in poor health and have an extended stay in the hospital, the child should be screened when they are born and again before they leave the hospital. [HPCSA 2007, Level C]
- 7) **Community-based screening can be done mainly through immunization clinics:** Routine screening for hearing of infants attending BCG immunization clinics was feasible in Nigeria

and an efficient tracking and follow-up system is needed to improve return rates for second-stage screening and diagnostic evaluation. [Olusanya et al. 2008, Level C] Routine screening during 6-week immunizations in South Africa were also seen as a way to reach people when hospital-based screening was not possible. To implement screening in health clinics during infant immunization visits, the following recommendations are made: consider the technology used, the timing of screen within the first immunization visit at 6 weeks, coordination of follow-up screens with appropriate environments that are not noisy, availability of screening personnel, follow-up criteria, access to diagnostic evaluations, information management and quality control. [HPCSA 2007, Level C]

- 8) **It is important to sensitize families for early identification and seeking help versus delayed identification:** In the absence of universal and targeted screening, the mean age of identification of hearing impairment in children in developing countries is 5.5 years, that is when their parents bring them into the hospital for screening. Parental awareness and sensitization on hearing disability and the value of early detection and intervention needs to be strengthened. Parents have a prime role in the surveillance of their children's possible hearing impairments and reporting of it. [Omondi et al. 20087, Level C] Often, suspicion for hearing loss does not happen in parents until the child demonstrates delays in speech and language (usually at approximately 2 years of age). [NYSDH 2007, Level C]
- 9) **Parents need to be aware of hearing loss and of services to address the issue:** Most parents are aware of their children's hearing limitations, they detect them late and their level of service demand is still low. Prioritizing issues of access to and utilization of the care facilities and poverty alleviation can help parental awareness for early intervention. [Omondi et al. 20087, Level C; WHO, 2010]
- 10) **Goal: community screening before 4 months of age:** The goal should be to have all children screened at immunization clinics before 4 months of age at the latest. To achieve this goal, education of mothers and caregivers regarding the importance of returning for follow-up appointments, the effect of late-identified hearing loss, and the benefits of early identification and intervention must be done. [HPCSA 2007, Level C]
- 11) **Monitor children with one-sided hearing loss:** It is important to keep on monitoring children who have unilateral (one sided/ear) hearing loss. These children often develop bilateral hearing loss later on in their childhood and must not be forgotten, they must be monitored regularly, such as every 6 months. [HPCSA 2007, Level C]
- 12) **Be sensitive to sharing screening results with families:** Parents of children receiving screening need to be treated with sensitivity, they expect that their children will be born healthy and it is a happy event for them; and so, it is good to speak to parents about this screening before the baby is born during antenatal clinics. Parents need to be educated on the benefits and risks of screening, and their consent for screening received beforehand. Consent can be received as part of routine neonatal examinations and when OAE or AABR equipment is used, screening is painless and quick to do usually. [Olusanya et al. 2007, Level C]
- 13) **Family has a right to confidentiality:** The family has the right to confidentiality of all screening, assessment and intervention so the infant and family information should be carefully handled and not accessible by members of the public. [HPCSA 2007, Level C]
- 14) **Families want to know the results, and should be informed of the results:** A survey in Nigeria reported that mothers had a positive attitude towards early detection of hearing loss and being informed if their child had an impairment. [HPCSA 2007, Level C; WHO, 2010]
- 15) **Objective screening tools are recommended over subjective tools and will be better to identify children with mild and moderate hearing loss.** High tech versus low tech identification: OAE (Oto-acoustic Emissions) and AABR (Automated Auditory Brainstem

response) are two pieces of equipment that are recommended as objective measure of hearing loss, and are more accurate than subjective tools (i.e. clapping, rattles behind a child's head to see a response). Subjective screening methods have been misleading and only identified children with severe to profound hearing loss and not those with mild/moderate hearing loss. See Annex for pictures and more information on this equipment. [Olusanya et al. 2007, Level C] OAE and AABR have shown to be accurate 95% of the time and are the most reliable method. [HPCSA 2007, Level C]

- 16) **Subjective screening is better than no screening.** If objective screening tools are not available, children should still be assessed by trained practitioners through the other methods and the use of parental reports of their observations including the child's response to sound from birth till time of intervention. .

## Recommendations for Assessment

- 17) **Decentralize screening and centralize assessment/diagnosis:** Following the community screening, to help diagnose and confirm hearing loss, it is recommended to have one diagnostic centre in the region to serve several hospitals that only conduct screening. This system has successfully been implemented in China and has been cost-effective. This approach needs to balance the risk of poor follow-up rates. [Olusanya et al. 2007, Level C]
- 18) **Aim for 70% return rates of families:** The audiologist managing the hospital assessment and confirmation of hearing loss after the initial identification, should make efforts to follow-up on a minimum of 95% of infants referred from the initial screen. It is expected that if 70% of families and their children return for follow-up that that is ideal. Successful follow-up is influenced by various factors such as lack of adequate demographic information, changes in addresses or contact details, access to facilities and personal constraints such as poverty. [HPCSA 2007, Level C]
- 19) **Diagnosis and assessment has many components and should be done by someone specifically trained.** Diagnosing the type and degree of the loss should be done by someone with experience in diagnosing infant hearing loss.
- 20) As much as possible, audiologic assessments of young infants and children should provide ear-specific estimates of the type, degree, and configuration of the hearing loss. Components of assessment include:
- i. family history
  - ii. physical examination
  - iii. laboratory test if required and available
  - iv. radiologic screening
  - v. middle ear functioning
  - vi. acoustic reflex
  - vii. infant or child's behavioral and startle response to sound and sudden noise. Tools could be whistle, music, gong, voice, keys, bell.
  - viii. parental report of communication style, including progress of vocalizations . [HPCSA 2007, Level C; Expert opinion]
  - ix. electrophysiologic measure using AABR (see Appendix; not currently available in NWR)
  - x. diagnostic OAE (See Appendix; not currently available in NWR) (Plans are underway for this to be available as of March 2014 in Mbingo Baptist Hospital)

## Recommendations for Functional Assessment

- 21) **Early assessment leading to intervention is important:** Early intervention for infants and young children with hearing loss has shown to positively develop thinking skills and overall better child development than if no intervention was given to child with hearing loss. Thinking, language, and speech skills develop best at very early stages in our lives, and for children with hearing loss it is the same and they must not be neglected. [HPCSA 2007, Level C]
- 22) **Evaluate all abilities of the child not just hearing:** A language evaluation, including oral, manual, and visual mechanisms and cognitive abilities should be performed for infants and young children with hearing loss. [HPCSA 2007, Level C]
- 23) **Functional assessment includes thinking/behavioral, communication and physical skills:** Three areas where a child can be assessed are: thinking/behavioral/social (reasoning/thinking, attention, social interaction in class), communication (expressive, receptive), and physical (visions, hands/arms/legs, balance, overall health). Usually children who are deaf have more difficulty in other functional skills, especially communication and thinking/social/behavioral. They should be assessed for difficulty and helped to overcome them where possible. [Karchmer & Allen 1999, Level C]

## Recommendations for Intervention and Rehabilitation

- 24) **Consider barriers in transportation costs:** Factors such as transportation costs, parental convenience, and anxiety may contribute to a high default rate for follow-up. [Olusanya et al. 2007, Level C]
- 25) **Parents of children screened 3 months of age or older have a higher follow up rate:** Parents of children with severe-to-profound hearing loss are sometimes more cooperative when requested to attend follow-up appointments if their babies were tested later than 3 months of age as they may have already begun to suspect the child's hearing difficulty. [Olusanya et al. 2007, Level C]
- 26) **Professionals can increase follow-up of families by having clear communication and good tracking of families:** Sometimes poor return rates are due to decreased tracking system or poor communication between health professionals and the parents. Some programmes have demonstrated increasing efficiency after implementing improved tracking systems and increasing awareness of hearing loss amongst healthcare professionals and families. [Olusanya et al. 2007, Level C; WHO, 2010]
- 27) **Intervention at 6 months:** It is recommended that children with hearing loss receive medical intervention around 6 months. Although we recognize that this might be unavailable or difficult in some areas of the region, it is a goal to strive for. [HPCSA 2007, Level C]
- 28) **Early intervention should include families:** The primary members of the early intervention team are the family as they spend the most time with the baby and they should support the child, learning his/her communication style, social skills, emotional well-being and positive self-esteem. [HPCSA 2007, Level C; WHO, 2010]
- 29) **Families should be coached on how to support their child:** Programs should be in place to coach families on how to support the healthy development of their child with a hearing loss and try to introduce the family to positive deaf adult role models. Community workers who may do early intervention work will support parents on socio-emotional, language and thinking skills development of their children. [Storbeck & Calvert-Evans 2008, Level C]
- 30) **Start small and scale up:** For public health projects, such as early intervention and

rehabilitation of hearing loss, small projects can be started, success assessed, and then they can be scaled up as the resources are more available. [HPCSA 2007, Level C]

## **Benefits of Implementing the Guidelines**

These guidelines aim to develop standard and quality practices within the North West Region in identification, assessment and referrals of persons, especially infants and children, with hearing impairments across different contexts (e.g. rural and remote, semi-urban and urban).

There are many potential benefits of following these guidelines: practitioners and institutions will improve the effectiveness, relevance, and outcomes of their work; they will maximally identify, appropriate assess and refer children with hearing impairments, based on their own work and the work and lessons learned by colleagues in similar contexts.

Please provide feedback to the project team so that the guidelines can continue to be refined.

## Evidence supporting the Recommendations

- Karchmer M.; Allen T. (1999) The functional assessment of deaf and hard of hearing students. *American Annals of the Deaf* 144:68–77 (Level C) [Karchmer & Allen 1999, Level C]
- New York State Department of Health (2007) Clinical Practice Guideline: The Guideline Technical Report. Hearing Loss, Assessment and Intervention for Young Children (Age 0-3 Years). Division of family health, bureau of early intervention (Level C) [NYSDH 2007, Level C]
- Olusanya, B.O., Swanepoel, D., Chapchap, M.J.; Castillo, S., Habib, H., Mukari, S.Z., Martinez, N.V., Lin, H., & McPherson, B. (2007) [Progress towards early detection services for infants with hearing loss in developing countries](#). *BMC health services research*, 7:14. (Level C) [Olusanya et al. 2007, Level C]
- Olusanya, B.O., Wirz, S.L., Luxon, L.M. (2008) [Community-based infant hearing screening for early detection of permanent hearing loss in Lagos, Nigeria: a cross-sectional study](#). *Bulletin of the World Health Organization* 2008; 86(12): 956-63. (Level C) [Olusanya et al. 2008, Level C]
- Omondi, D., Ogot C., Otieno, S., & Macharia, I. (2007) Parental awareness of hearing impairment in their school-going children and healthcare seeking behaviour in Kisumu district, Kenya. [International Journal of Pediatric Otorhinolaryngology](#) 71(71):415-23. (Level C) [Omondi et al. 2007, Level C]
- Professional board for speech, language and hearing professions (2007) Early Detection and intervention programmes in South Africa, Position Statement Year 2007. Accessed on-line March 31, 2011 at [http://www.ehdi.co.za/UserFiles/File/EHDI%20position%20statement%20\(HPCSA%202007\).pdf](http://www.ehdi.co.za/UserFiles/File/EHDI%20position%20statement%20(HPCSA%202007).pdf) (Level C) [HPCSA 2007, Level C]
- Storbeck, C., Calvert-Evans, J. (2008). Towards Integrated Practices in Early Detection of and Intervention for Deaf and Hard of Hearing Children, *American Annals of the Deaf* 153(3):314-321. (Level C) [Storbeck & Calvert-Evans 2008, Level C]
- World Health Organization. Neonatal and infant hearing screening. Current issues and guiding principles for action. Outcome of a WHO informal consultation held at WHO head-quarters, Geneva, Switzerland, 9-10 November, 2009. Geneva; WHO. 2010.

## Bibliography

- Arnold, C. L., Davis, T. C., Humiston, S. G., Bocchini, J. A., Jr., Bass, P. F., III, Bocchini, A. et al. (2006). Infant hearing screening: stakeholder recommendations for parent-centered communication. *Pediatrics*.117(5 Pt 2):S341-54.
- Cavalcanti, H. G. & Guerra, R. O. (2012). The role of maternal socioeconomic factors in the commitment to universal newborn hearing screening in the Northeastern region of Brazil. *International Journal of Pediatric Otorhinolaryngology*.
- Chiabi, A., Tchokoteu, P. F., Toupouri, A., Mbeng, T. B., & Wefuan, J. (2004). The clinical spectrum of severe malaria in children in the east provincial hospital of Bertoua, Cameroon. *Bulletin de la Societe de Pathologie Exotique*.97(4):239-43.
- Eiserman, W., & Shisler, L. (2010). Identifying Hearing Loss in Young Children: Technology Replaces the Bell. *Zero to Three Journal*, 30, No.5, 24-28.

- Eiserman, W., Hartel, D., Shisler, L., Buhrmann, J., White, K., & Foust, T. (2008). Using otoacoustic emissions to screen for hearing loss in early childhood care settings. *International Journal of Pediatric Otorhinolaryngology*, 72, pp 475-482.
- Eiserman, W., Shisler, L., & Foust, T. (2008). Hearing screening in Early Childcare Settings. *The ASHA Leader*. November 4, 2008.
- Friderichs, N., Swanepoel, D., & Hall, J. W., III (2012). Efficacy of a community-based infant hearing screening program utilizing existing clinic personnel in Western Cape, South Africa. *International Journal of Pediatric Otorhinolaryngology*.76(4):552-9.
- Mathur, N. N. & Dhawan, R. (2007). An alternative strategy for universal infant hearing screening in tertiary hospitals with a high delivery rate, within a developing country, using transient evoked oto-acoustic emissions and brainstem evoked response audiometry. *Journal of Laryngology & Otology*.121(7):639-43.
- McCaslin, D. (2013). Infant hearing screening and the role of new technologies. *Journal of the American Academy of Audiology*.24(1):4.
- Olusanya, B. O. & Akinyemi, O. O. (2009). Community-based infant hearing screening in a developing country: parental uptake of follow-up services. *BMC Public Health*.9:66.
- Olusanya, B. O. & Roberts, A. A. (2006). Physician education on infant hearing loss in a developing country. *Pediatric Rehabilitation*.9(4):373-7, -Dec.
- Olusanya, B. O. (2011). Highlights of the new WHO Report on Newborn and Infant Hearing Screening and implications for developing countries. *International Journal of Pediatric Otorhinolaryngology*.75(6):745-8.
- Olusanya, B. O. (2011). Making targeted screening for infant hearing loss an effective option in less developed countries. [Review]. *International Journal of Pediatric Otorhinolaryngology*.75(3):316-21.
- Olusanya, B. O., Ebuehi, O. M., & Somefun, A. O. (2009). Universal infant hearing screening programme in a community with predominant non-hospital births: a three-year experience. *Journal of Epidemiology & Community Health*.63(6):481-7.
- Olusanya, B. O., Eletu, O. B., Odusote, O., Somefun, A. O., & Olude, O. (2006). Early detection of infant hearing loss: current experiences of health professionals in a developing country. *Acta Paediatrica*.95(10):1300-2.
- Olusanya, B. O., Somefun, A. O., & Swanepoel, d. W. (2008). The need for standardization of methods for worldwide infant hearing screening: a systematic review. [Review] [46 refs]. *Laryngoscope*.118(10):1830-6.
- Olusanya, B., McPherson, B., Swanepoel, d. W., Shrivastav, R., & Chapchap, M. (2006). Globalization of infant hearing screening: the next challenge before JCIH? *Journal of the American Academy of Audiology*.17(4):293-5; discussion 295-6.
- Olusanya, B., Somefun, A., Eletu, O., Olude, O., & Odusote, O. (2006). Health professionals' readiness for infant hearing screening in Lagos, Nigeria. *East African Medical Journal*.83(2):113-5.
- Swanepoel, D. & Almec, N. (2008). Maternal views on infant hearing loss and early intervention in a South African community. *International Journal of Audiology*.47 Suppl 1:S44-8.
- Swanepoel, d. W. & Hall, J. W., III (2010). A systematic review of telehealth applications in

- audiology. [Review] [44 refs]. *Telemedicine Journal & E-Health*.16(2):181-200.
- Swanepoel, d. W. & Hall, J. W., III (2010). A systematic review of telehealth applications in audiology. [Review] [44 refs]. *Telemedicine Journal & E-Health*.16(2):181-200.
- Swanepoel, d. W. (2009). Early detection of infant hearing loss in South Africa. *South African Medical Journal.Suid-Afrikaanse Tydskrif Vir Geneeskunde*.99(3):158-9.
- Swanepoel, d. W. (2009). Early detection of infant hearing loss in South Africa. *South African Medical Journal.Suid-Afrikaanse Tydskrif Vir Geneeskunde*.99(3):158-9.
- Swanepoel, d. W. (2009). Early detection of infant hearing loss in South Africa. *South African Medical Journal.Suid-Afrikaanse Tydskrif Vir Geneeskunde*.99(3):158-9.
- Swanepoel, d. W., Clark, J. L., Koekemoer, D., Hall, J. W., III, Krumm, M., Ferrari, D. V. et al. (2010). Telehealth in audiology: the need and potential to reach underserved communities. *International Journal of Audiology*.49(3):195-202.
- Swanepoel, d. W., Clark, J. L., Koekemoer, D., Hall, J. W., III, Krumm, M., Ferrari, D. V. et al. (2010). Telehealth in audiology: the need and potential to reach underserved communities. *International Journal of Audiology*.49(3):195-202.
- Swanepoel, d. W., Louw, B., & Hugo, R. (2007). A novel service delivery model for infant hearing screening in developing countries. *International Journal of Audiology*.46(6):321-7.
- Swanepoel, d. W., Mngemane, S., Molemong, S., Mkwanazi, H., & Tutshini, S. (2010). Hearing assessment-reliability, accuracy, and efficiency of automated audiometry. *Telemedicine Journal & E-Health*.16(5):557-63.
- Swanepoel, d. W., Mngemane, S., Molemong, S., Mkwanazi, H., & Tutshini, S. (2010). Hearing assessment-reliability, accuracy, and efficiency of automated audiometry. *Telemedicine Journal & E-Health*.16(5):557-63.
- Swanepoel, d. W., Olusanya, B. O., & Mars, M. (2010). Hearing health-care delivery in sub-Saharan Africa--a role for tele-audiology. *Journal of Telemedicine & Telecare*.16(2):53-6.
- Swanepoel, d. W., Olusanya, B. O., & Mars, M. (2010). Hearing health-care delivery in sub-Saharan Africa--a role for tele-audiology. *Journal of Telemedicine & Telecare*.16(2):53-6.
- Trotta, L., Iacona, E., Primignani, P., Castorina, P., Radaelli, C., Del, B. L. et al. (2011). GJB2 and MTRNR1 contributions in children with hearing impairment from Northern Cameroon. *International Journal of Audiology*.50(2):133-8.
- van der, S. T. & Pottas, L. (2008). Infant hearing loss in South Africa: age of intervention and parental needs for support. *International Journal of Audiology*.47 Suppl 1:S30-5.
- Watkin, P. & Baldwin, M. (2012). The longitudinal follow up of a universal neonatal hearing screen: The implications for confirming deafness in childhood. *International Journal of Audiology*, 51, 519-528.
- Wiener-Vacher, S. R., Obeid, R., & bou-Elew, M. (2012). Vestibular impairment after bacterial meningitis delays infant posturo-motor development. *Journal of Pediatrics*.161(2):246-51.e1.

## Appendix 1: Resolution World Health Assembly 48.9

The Forty-eighth World Health Assembly

Recalling resolution WHA38.19 on prevention of hearing impairment and deafness, and WHA42.28 on disability prevention and rehabilitation;

Concerned at the growing problem of largely preventable hearing impairment in the world, where at present 120 million people are estimated to have disabling hearing difficulties;

Recognizing that severe hearing impairment in children constitutes a particularly serious obstacle to optimal development and education, including language acquisition, and that hearing difficulties leading to communication problems are a major subject of concern in the elderly and thus one of growing worldwide importance in view of the aging of populations;

Aware of the significant public health aspects of avoidable hearing loss, related to causes such as congenital disorders and infectious diseases, as well as use of ototoxic drugs and exposure to excessive noise;

Noting the persistent inadequacy of resources for hearing impairment prevention, despite the increasing commitment of international nongovernmental organizations,

### 1. URGES Member States:

- (1) to prepare national plans for the prevention and control of major causes of avoidable hearing loss, and for early detection in babies, toddlers, and children, as well as in the elderly, within the framework of primary health care;
- (2) to take advantage of existing guidelines and regulations or to introduce appropriate legislation for the proper management of particularly important causes of deafness and hearing impairment, such as otitis media, use of ototoxic drugs and harmful exposure to noise, including noise in the work environment and loud music;
- (3) to ensure the highest possible coverage of childhood immunization against the target diseases of the Expanded Programme on Immunization and against mumps, rubella and (meningococcal) meningitis whenever possible;
- (4) to consider the setting-up of mechanisms for collaboration with nongovernmental or other organizations for support to, and coordination of, action to prevent hearing impairment at country level, including the detection of hereditary factors, by genetic counselling;
- (5) to ensure appropriate public information and education for hearing protection and conservation in particularly vulnerable or exposed population groups;

### 2. REQUESTS the Director-General:

- (1) to further technical cooperation in the prevention of hearing impairments, including the development of appropriate technical guidelines;
- (2) to cooperate with countries in the assessment of hearing loss as a public health problem;
- (3) to support, to the extent that resources are available, the planning, implementation, monitoring and evaluation of measures in countries to prevent hearing impairment;
- (4) to develop further collaboration and coordination with nongovernmental and other interested organizations and institutions;
- (5) to promote and support, to the extent feasible, applied and operations research for the optimal prevention and treatment of major causes of hearing impairment;
- (6) to mobilize extrabudgetary resources to strengthen technical cooperation in hearing impairment prevention, including possible support from organizations concerned;
- (7) to keep the Executive Board and the Health Assembly informed of progress, as appropriate.

WHO (1995) Available from [http://www.who.int/pbd/publications/wha\\_eb/wha48\\_9/en/](http://www.who.int/pbd/publications/wha_eb/wha48_9/en/) Hbk Res., Vol. III (3rd ed.), 1.16.15 (Twelfth plenary meeting, 12 May 1995 – Committee A, second report)

## Appendix 2: Description of assessment tools

An ABR (auditory brainstem response), or an OAE (otoacoustic emissions testing) hearing test can be done when a baby is born or a child is very young. Neither test indicates whether a child is definitely deaf or hard of hearing. In many countries, these types of tests are intended only to determine whether further, more accurate hearing testing is needed.

### **OAE (Otoacoustic Emissions)**

An otoacoustic emission (OAE) is a sound which comes from within the inner ear. Studies have shown that OAEs disappear after the inner ear has been damaged, so OAEs can be used as a measure of inner ear health.

Broadly speaking, there are two types of otoacoustic emissions: spontaneous otoacoustic emissions (SOAEs), which can occur without external stimulation, and evoked otoacoustic emissions (EOAEs), which require an evoking stimulus. Otoacoustic emissions are clinically important because they are the basis of a simple, non-invasive, test for hearing defects in infants and children who are too young to cooperate in conventional hearing tests.

This is an objective screening tool used for hearing loss, which is accurate, quick and does not hurt the baby at all. They cost about 3000\$ USD.

(adapted from [http://en.wikipedia.org/wiki/Otoacoustic\\_emission](http://en.wikipedia.org/wiki/Otoacoustic_emission) )

### **AABR (Automated Auditory Brainstem response)**

This is another objective screening tool used for hearing loss, which is accurate, quick and does not hurt the baby at all. They cost about 8000\$ USD.

From [http://www.ndcs.org.uk/family\\_support/audiology/newborn\\_hearing\\_screening/#contentblock3](http://www.ndcs.org.uk/family_support/audiology/newborn_hearing_screening/#contentblock3)

“The AABR screening test works by recording brain activity in response to sounds. Sound travels through the outer ear as vibrations. When it reaches the cochlea it is converted into an electrical signal. This travels along the nerve of hearing to the brain where it is processed into recognizable sounds.

The AABR test does this by playing a series of clicking sounds through headphones that cover the baby’s ears. Three small sensors are placed on the baby’s head and connected to the computer equipment. If the hearing system is working normally then the computer will report strong responses. If there is no strong response then the computer will report that a referral [*for more assessment*] should be made.”