

Editorial - Educational

National Neonatal Hearing Screening Program in Bahrain

Pankaj Sakhuja, MD, RCPCH, UOFT* Samya Al Doseri, CABB, CJBE, MSc Audio Vestibular** Kevin Dunne, MRCP, FRCP***

The moderate to profound (>40 dB) bilateral permanent childhood hearing impairment occurs in 1-2 per 1,000 babies¹. This number rises to 2-3 per 1,000 children in early infancy if mild (>25 dB) and unilateral hearing impairment is included².

Permanent childhood hearing impairment (PCHI) profoundly affects the quality of life of an individual and delays in its identification and treatment effects speech and language, social and emotional development and education and employment prospects³.

Wilson and Jungner (1968) suggested “screening is an admirable method of combating disease”. They proposed 10 criteria for deciding whether screening should be done for a particular condition and newborn hearing screening meets all, see table 1⁴.

Table 1: Criteria for Disease Screening by Wilson and Jungner (1968)⁴

1	The condition to be detected by screening should be an important health problem
2	There should be an accepted treatment for cases identified
3	Facilities for diagnosis and treatment should be available
4	There should be a recognizable latent or early symptomatic stage
5	There should be a suitable screening test
6	The test should be acceptable to the population
7	The natural history of the condition should be understood
8	There should be an agreed policy on whom to treat as patients
9	The cost of case-finding (including diagnosis and treatment of those diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole
10	Case-finding should be a continuing process and not a “once and for all” project

WHO (2010) recommends implementation of universal neonatal hearing screening and rehabilitation services in all countries and communities⁵.

* Consultant Neonatologist

** Consultant Audio Vestibular Medicine
In Charge of Audiology Unit
Department of ENT
Salmaniya Medical Complex

***Consultant

Head of Department
Department of Pediatric
King Hamad University Hospital
Kingdom of Bahrain
Email: pankaj.sakhuja@khuh.org.bh

Global Status of Newborn Hearing Screening

In some countries, newborn hearing screening program is very well-established. United Kingdom, Austria, Netherlands, the United States, Oman, Slovakia, and Poland screen 90% of their births; whereas Australia, Canada, Belgium, Ireland, Germany, Taiwan, Russia, Philippines, and Singapore screen about 30%-89% of their births^{4,5}.

Essential Components

Universal neonatal hearing screening program aims at the early detection and intervention through the use of an approved screening test, appropriate follow-up, counseling, parental education, public awareness and early intervention programs. It must involve a multidisciplinary team of individuals who have experience, knowledge and skills to look after the children with hearing impairment.

Hearing screening test is only one component of the universal hearing screening program. Automated auditory brainstem response (A-ABR) and Evoked Otoacoustic Emissions (OAE) are used in newborn hearing screening programs. Both could detect peripheral (conductive and sensory) hearing loss; ABR could also detect neural deafness. Babies admitted to NICU are high-risk population and may have a higher risk for neural deafness; therefore, it is strongly recommended that they should be screened with ABR. Many follow 2-step screening process, which includes OAEs followed by ABR in those who failed the first test. Though, the two tests have high sensitivity and specificity, few babies with hearing loss might be missed; therefore, follow-up and retest is necessary³. Screening protocols could be broadly classified in four different categories, see table 2.

Table 2: Advantages and Disadvantages of Hearing Protocols⁶

Protocol	Population	Primary Advantages	Limitations	Equipment	Costs
A: ABR only	NICU or WIN*	Lower fail rate than for OAEs only; will aid in detecting neural hearing loss	Misses some mild hearing loss (unless low stimulus level is used)	ABR	Disposable costs higher than for OAEs only; initial test time greater than OAEs only
B: OAEs only	WIN	Low disposable costs	Misses neural hearing loss low prevalence in WIN)	OAEs	Disposable and test time low; follow-up costs higher than for ABR due to high inpatient refer rate
C: Two Tier-OAEs with ABR rescreen only if OAE is failed	WIN	Lower fail rate than for OAEs only	Misses some mild hearing loss	ABR + OAEs	Disposable costs vary depending on OAEs fail rate; protocol balances high inpatient referral rate and cost of ABR
D: Two Technology-ABR and OAEs	NICU or WIN	Will aid in detecting neural hearing loss	Time and cost intensive compared to other protocols	ABR + OAEs	Disposable cost and test time higher than for one-technology test or two-tier tests

*WIN Well-infant Nursery

It is essential to highlight PCHI among healthcare professionals and the public. Education of parents is vital, and effective communication and collaboration with various health facilities in Bahrain (public hospitals, private hospitals, primary health centers and maternity hospitals)

is necessary. The most important is the support to the families with affected children and early intervention.

Education of medical and allied health professionals who provide healthcare to children plays a vital role in identification and recruitment of the infants. They would be able to provide appropriate support and assistance if they have been well-educated^{2,5,7}.

Professionals should be educated on the importance of early identification of hearing loss, the benefits of treating hearing loss, newborn hearing screening procedures which include making prompt referrals in the presence of risk factors, promoting family awareness about hearing loss, encouraging family compliance and providing support for families and providing information to the parents regarding the purpose and nature of the screening and what the results would mean and how they would be used.

Public and parent awareness is equally important if not more. Achieving public awareness would require printed materials, websites, newspapers, training of healthcare providers, radio and television announcements and the use of social media. It is important that all public awareness information be culturally appropriate and in a simple to understand language. Parental education may be initiated at antenatal visits using verbal and written information that explains the purpose and process of screening. Parents' information material must include description and reason of the screening process⁵.

Collaboration with both private and public health facilities plays a pivotal role in the effective implementation of a national neonatal hearing screening program. There should be one central organization that plays a lead role in the genesis and management of the hearing program. It would be responsible for the supervision, quality assurance of the program with all follow-up audiology services and early intervention. It would form an evidence-based standardized screening protocol, provide training support for the screeners and collaborate with the other health facilities to ensure consistency. It would track children needing follow-up, assure timely and appropriate follow-up services and early intervention services for infants diagnosed with hearing loss. It would be responsible for forming a national evaluation strategy, collect data, monitor the performance of the program and give performance feedbacks to the health facilities on a yearly basis. It would also conduct an epidemiological analysis of the data for planning, research and quality assurance purposes.

Parents may experience great anxiety during confirmation of their baby's hearing loss and beyond. This could impact on the developing parent-child relationship and could become a matter of concern. This impact may be minimized by providing them with a good quality, relevant, unbiased information in an easy to understand language. In these circumstances, a family support workers may assist them.

The delivery of services and the manner in which they are delivered should be family-centered. There should be a rapid and effective follow-up and consistent use of adequate parental education and information. Continuity and coordination of support is important to ensure that parents and families understand the information they are receiving and the processes involved.

Parents must be supported and involved in making informed decisions about early intervention for their child³.

An early intervention program needs to be initiated as soon as possible before children become delayed in their language development. The medical, educational and audiological intervention along with good quality follow-up rehabilitation services is essential to achieve the desired benefits and have a significant impact on the developmental outcomes for hearing-impaired children⁸⁻¹⁰.

National Evaluation Strategy and Quality Control

An integral successful screening program is the establishment of systems for coordinating, monitoring and evaluating screening pathway to ensure quality control at every stage. It is vital to monitor and evaluate standards, development of certain national performance indicators based on the aims, objectives and international standards for universal neonatal screening. A standardized dataset of national neonatal hearing screening and a separate database of those identified having hearing loss is essential for a comprehensive evaluation strategy.

The objective of the evaluation is to identify the deficiencies and the strengths of various components of the program, to further enhance the practices and administrative processes to improve the outcome of hearing in children⁴.

Why a National Approach to Neonatal Hearing Screening in Bahrain?

A total of 20,000 births were reported according to 2013 statistics in Bahrain¹¹. Approximately 20-40 babies are born with bilateral PCHI in Bahrain, which increases to 40-60 children each year if unilateral moderate to profound PCHI is included.

The effects of hearing impairment may be devastating not only to the child but also to the family. Evidence demonstrates that infants who are diagnosed and receive early intervention before six months of age have improved expressive and receptive language scores, better mental health and future employment prospects. They score 20 to 40 percentile points higher on school-related measures (language, social adjustment and behavior) compared with late diagnosis and intervention^{3,12}.

Congenital bilateral hearing impairment may also put a significant economic burden on the society and newborn hearing screening could be cost-saving^{3,13,14}. Approximately 50% of hearing impairment at birth is without a risk factor¹². Monitoring childhood hearing as part of the child health surveillance program is critical to discover late onset and progressive permanent childhood hearing impairment.

The main objective of the newborn hearing screening is to identify newborns with hearing loss and also the newborns with medical conditions that causes late-onset hearing loss. These infants need continuous monitoring⁶. The national neonatal hearing screening program will support these requirements, followed by appropriate management and habilitation.

There is a need for neonatal hearing screening and early management of hearing loss in Bahrain based on child health perspective, cost effectiveness, best medical practice, and the obligation to fulfill the international established criteria for screening. A national approach will screen all babies in Bahrain for hearing impairment to maximize the early detection and provide early intervention where necessary to minimize the effects of deafness.

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REFERENCES

1. Fortnum HM. Epidemiology of Permanent Childhood Hearing Impairment: Implications for Neonatal Hearing Screening. *Audiological Medicine* 2003; 1(3):155-64.
2. Hyde ML. Newborn Hearing Screening Programs: Overview. *J Otolaryngol* 2005; 34 Suppl 2:S70-8.
3. American Academy of Pediatrics. Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. *Pediatrics* 2007; 120(4):898-921.
4. NCHAM. The NCHAM Book: A Resource Guide for Early Hearing Detection and Intervention. White KR. The Evolution of EHDI: From Concept to Standard of Care. Available at: http://infanthearing.org/ehdi-ebook/2015_ebook/1b-Chapter1EvolutionEHDI2015.pdf. Accessed on 14.5.2015.
5. WHO. Newborn and Infant Hearing Screening. Current Issues and Guiding Principles for Action, 2010. Available at: http://www.who.int/blindness/publications/Newborn_and_Infant_Hearing_Screening_Report.pdf. Accessed on 14.5.2015.
6. American Speech-Language-Hearing Association. Expert Panel Recommendations on Newborn Hearing Screening. Available at: <http://www.asha.org/Topics/Expert-Panel-Recommendations-on-Newborn-Hearing-Screening/#6>. Accessed on 14.5.2015.
7. National Institute on Deafness and Other Communication Disorders. When a Newborn Doesn't Pass the Hearing Screening: How Medical and Other Health Professionals can Help Increase the Number of Infants who Return for a Follow-Up Evaluation. Bethesda, 2003: 10. Available at: http://www.idph.state.ia.us/iaehdi/common/pdf/when_newborn_doesnt_pass.pdf. Accessed on 14.5.2015.
8. NCHAM. The NCHAM Book: A Resource Guide for Early Hearing Detection and Intervention. Marilyn Sass-Lehrer. Early Intervention for Children Birth to 3: Families, Communities, & Communication Available at: http://infanthearing.org/ehdi-ebook/2015_ebook/22-Chapter22EarlyIntervention2015.pdf. Accessed on 14.5.2015.
9. Yoshinaga-Itano C. Early Intervention after Universal Neonatal Hearing Screening: Impact on Outcomes. *Ment Retard Dev Disabil Res Rev* 2003; 9(4):252-66.
10. Wake M, Poulakis Z, Hughes EK, et al. Hearing Impairment: A Population Study of Age at Diagnosis, Severity, and Language Outcomes at 7-8 Years. *Arch Dis Child* 2005; 90(3):238-44.
11. Vital statistics 2013 report. Ministry of Health, Kingdom of Bahrain. Available at: http://www.moh.gov.bh/PDF/Publications/statistics/HS2013/PDF/Chapters/vital%20statistics_2013.pdf. Accessed on 14.5.2015.

12. Patel H, Feldman M. Universal Newborn Hearing Screening. *Paediatr Child Health* 2011; 16(5):301-5.
13. Colgan S, Gold L, Wirth K, et al. The Cost-Effectiveness of Universal Newborn Screening for Bilateral Permanent Congenital Hearing Impairment: Systematic Review. *Acad Pediatr* 2012; 12(3):171-80.
14. Schroeder L, Petrou S, Kennedy C, et al. The Economic Costs of Congenital Bilateral Permanent Childhood Hearing Impairment. *Pediatrics* 2006; 117(4):1101-12.