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Commentary

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Newborn Hearing Screening and Early Intervention in Indian Context

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Joint committee on infant hearing: The Joint Committee on Infant Hearing was established in late 1969 and composed of Audiologists, Otolaryngologists, Paediatricians, mainly. It had people from American Speech and Language Hearing Association (ASHA), the then American Academy of Ophthalmology and Otolaryngology (AAOO) and American Academy of Paediatrics (AAP). Their pivotal roles were making standardized recommendations concerning the early identification of children with or at-risk for hearing loss and newborn hearing screening. Currently the Joint Committee is comprised of representatives from the American Academy of Paediatrics, the American Academy of Otolaryngology and Head and Neck Surgery, the American Speech Language Hearing Association, the American Academy of Audiology, the Council on Education of the Deaf, and Directors of Speech and Hearing Programs in State Health and Welfare Agencies [5].

Newborn hearing screening protocol (NHSP): It was proposed following the recommendation for universal hearing screening of newborns developed during the NIH consensus conference on early identification of hearing impairment in infants and young children. Therein the consensus supporting mass hearing screening was reached. The Rhode Island Hearing Assessment Project was the first major attempt at universal hearing screening of newborns and has been written about extensively (White and Behrens, 1993 and Vohr., *et al*. 1998). Based on two stage protocol using Oto-Acoustic Emissions as a hearing screening tool shortly after birth, followed by Auditory Brainstem Response procedure and the results were reported for more than 53,000 newborns. Different organisations tested using these protocols for upto five years duration before publishing their findings. Combined results showed overall failure rate of 4%, combined miss rate of 2.6% resulting in 6.6% of infants getting referred for out-patient follow-ups and as per Hayes (2000), the New York state project confirmed the necessity and demonstrated the feasibility of developing a complete Audiologic system of care of infants and newborns and further established a standard of care, benchmark of accountability for universal hearing screening program and its state-wide implementation [9,12,17].

Figure 1: OAE screening test.

Figure 2: ABR test.

Pre-requisites of a screening program:

1. Condition is sufficiently frequent in screened population
2. Condition gets serious or fatal if left without intervention
3. Condition must be preventable or treatable
4. Effective follow-up protocol is possible.

Goals of NHSP:

1. All infants below 1 month of age to be screened.
2. In case of no clear responses confirmatory Audiological and medical evaluation to be done at no letter than 3 months of age.
3. All hearing impaired infants to receive the intervention at no later than 6 months of age.

Goals of early detection of hearing loss (CDC, 2004).

S. No.	Goal	
1	All newborns will be screened for hearing loss before 1 month of age, preferably before hospital discharge	Hospitals will have a written protocol to ensure all births are screened, results are reported to the infant's parents and PCHP, and referred infants (4%) are referred for diagnostic evaluation. Demographic data will be collected for each infant and appropriate educational material provided to parents. States will reduce/eliminate financial barriers to screening and ensure screening of out-of-hospital births
2	All infants who screen positive will have a diagnostic audiologic evaluation before 3 months of age	States will develop audiologic diagnostic guidelines and maintain a list of qualified providers to ensure infants referred from screening receive a comprehensive audiologic evaluation before 3 months of age and are referred to appropriate services. States will provide appropriate education and/or training about diagnostic audiologic evaluation to parents, PCHPs, and audiologists
3	All infants identified with hearing loss will receive appropriate early intervention services before 6 months of age (medical, audiologic, and early intervention)	States will develop policies and resource guides to ensure all parents of children with hearing loss receive appropriate medical (including vision screening and genetic services), audiologic, and early intervention services (based on the communication mode chosen by the family). States will ensure that early intervention service providers are educated about issues related to infants and young children with hearing loss
4	All infants and children with late-onset or progressive hearing loss will be identified at the earliest possible time	Hospitals and others will report information about risk factors for hearing loss to the state, who will monitor the status of children with risk factors and provide appropriate follow-up services
5	All infants with hearing loss will have a medical home as defined by the American Academy of Paediatrics	A primary care provider who assists the family in obtaining appropriate services will be identified for all infants with confirmed hearing loss before 3 months of age. The state will provide unbiased education about issues related to hearing loss for parents and medical home providers
6	Every state will have an EHDI Tracking and Surveillance System that minimizes loss to follow-up	A computerized state wide tracking and reporting system will record information about screening results, risk factors, and follow-up for all births. The system will have appropriate safeguards, be linked to other relevant state data systems, and be accessible to authorized healthcare providers
7	Every state will have a system that monitors and evaluates the progress toward the EHDI goals and objectives	A systematic plan for monitoring and evaluation will be developed and implemented by an advisory committee to regularly collect data and provide feedback to families and ensure that infants and children with hearing loss receive appropriate services

Table 1

Figure 3: Protocol of newborn hearing screening program.

Figure 3: Schematic representation of Guidelines issued based on NHSP.

		Screening Methods		
Infants to be screened	**Targeted by:** Geographical subset	Questionnaire completed by family	Behavioural	Physiological
	NICU Babies			
	Babies with risk factors			
	Population based			

Table 2: Hearing Screening options recommended by WHO (2010).

Need of newborn hearing screening protocol (NHSP): It readily helps in early identification of hearing loss which if left untreated could have an effect on the child's cognitive, speech and language development. Delay in identifying hearing anomalies could lead to different challenges such as communicative, social, psycho-social, behavioural as well as educational [3,4,15].

Recognizing the fact that different approaches might be needed in different circumstances, the WHO report (2010) emphasized that all Newborn Hearing Screening programs should have [1,2]:

1. Clearly stated goals with well-specified roles and responsibilities for the people involved
2. A clearly designated person who is responsible for the program
3. Hands-on training for people who will be doing the screening
4. Regular monitoring to ensure that the protocol is being correctly implemented
5. Specific procedures about how to inform parents about the screening results
6. Recording and reporting of information about the screening for each child in a health record
7. A documented protocol based on local circumstances.

It is also important to remember that successful NHSP have been implemented in many countries in many different ways. Despite the variety of circumstances in which they operated (WHO, 2010).

The targeted hearing loss for screening programs is permanent bilateral or unilateral, sensori-neural or conductive hearing loss, averaging 30 to 40 dB or more in the frequency region important for speech recognition, approximately ranging from 500 to 4000 Hz [6,8].

Audiological test(s) for newborn hearing screening protocol (NHSP): Generally, two non-invasive recordings of physiologic activities are conducted for newborn hearing screening i.e.:

1. **Oto-acoustic emissions (OAE):** In this procedure a probe is placed in ear canal that passes a series of click sounds passing through outer, middle and inner ear to the cochlea and then receives response via same pathway in reverse order with the help of transmitter and receiver components of the probes. OAE responses are generated within the cochlea by the outer hair cells, and therefore OAE evaluation will not detect neural or retro-cochlear dysfunction. Mostly Distortion Product OAE is carried out for hearing screening in which results are indicated as "PASS" or "FAIL" for individual ear [9,14].

2. **Auditory brainstem response (ABR) or brainstem evoked response audiometry (BERA):** If the infant fails in OAE screening even after 3 months of age then ABR is recommended at the earliest. It reflects activity of entire Central Auditory Pathway and will also indicate the site of lesion (if any) by electrophysiological methods. Final findings depend on the wave morphology, absolute and inter-peak latencies EEG activity etc [10,11].

The efficiency of a hearing screening technique can be expressed by the sensitivity and specificity. Sensitivity should be nearly 100% whereas specificity should be low i.e. many normal hearing infants are referred for further audiological evaluation. These false positive screening results cause unnecessary distress.

After a failed hearing screening the infant has to undergo extensive audiological as well as medical evaluation to ascertain the hearing status. According to JCIH (2000) the audiological tests must include developmentally appropriate behavioural and physiological measures [13,18,19].

Hearing Loss Identification: If the results of hearing screening give a confirmation of hearing loss then they have to be offered detailed Audiological assessment and intervention, parents and/or caregivers might need counselling and educational support so that proper aural habilitation could be planned at the earliest. At the targeted 8 month follow-up babies are screened via Visual Reinforcement Audiometry (VRA) if the screening data is incomplete or they have any other syndromic features [7,16].

Need of hearing screening: If the congenital hearing impairment is left unattended then it will lead to poor development of socialisation, limited to poor vocabulary poor speech, language and academic development, low self esteem, isolation, poor mental health [6].

Newborn hearing screening in India: In India the newborn hearing screening is followed though at lesser than required scale but still the protocol followed is standard 2 step screening protocol issued by JCIH. If the detailed Audiological evaluation indicates stand-alone or syndromic hearing loss then proper medical and Audiological intervention is planned and administered with the help of concerned professionals [12].

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