

Status of newborn hearing screening program in India

Suman Kumar^{a,*}, Bijoyaa Mohapatra^b

^a Department of Speech Language Pathology, Ali Yavar Jung National Institute for the Hearing Handicapped, Eastern Regional Centre, B. T. Road, Bon Hooghly, Kolkata 700090, India

^b All India Institute of Speech & Hearing, Mysore, India

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ABSTRACT

Objectives: The present study is aimed at figuring out the status of new-born hearing screening program being conducted in India, estimate the use of different screening instruments used and tests practiced, study the role of various professionals involved and document the current practices of audiologists in the country.

Method: A questionnaire on “Newborn Hearing Screening Survey” was sent to 185 institutions (165 medical colleges and 20 Speech and hearing centers) all over India and the information gathered was subjected to appropriate analyses.

Results: On a 16.75% return rate of the questionnaire, almost half of the colleges have their annual birthing census more than 2000. The majority of sites (57.13%) report an average length of stay for a vaginal delivery to be more than 24 hours with 78.94% also reporting of a NICU of Level II/III type. Only 38.09% of the medical colleges have a universal Newborn Hearing screening program (NBHS) in comparison to 80% of the Speech and Hearing centers. Again 43.8% of the medical colleges who conduct NBHS program have an audiologist and majority of them work towards screening. Almost 63% of the speech and hearing centers use physiological tests like ABR, OAE or their combination to screen newborns. Both medical and speech and hearing organizations prefer that the audiologist inform and even give a written material regarding the results of the tests to the parents. Only 62.65% of the institutions refer less than 11% of their clients for further testing at the time of discharge. In 50% of the medical colleges the results of a test are reported to the parents and primary care physicians/doctors and in 37.5% of the speech and hearing centers the results are informed to the parents.

Conclusions: While keeping in mind the incidence of hearing impairment in the neonatal population of India, the results of this survey warrant the need for an urgent implementation of universal neonatal hearing screening in all the health care facilities in the country, at large.

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Hearing impairment is one of the commonest congenital disabilities in the world. Incidence of hearing impairment in a standardized population of neonates at risk and not at risk to develop hearing impairment ranges from 6 to 60 per 1000 neonates with an average of 4 per 1000 neonates [4]. Early detection and management of hearing loss is crucial for the developmental period for auditory, speech, and language acquisition of these neonates. Numerous studies demonstrate that early diagnosis and intervention before six months of age is effective in allowing children with congenital hearing loss to acquire age appropriate cognitive and spoken language skills. In recent years, the technology and expertise has developed to allow screening to detect hearing loss in newborn babies. Early detection will also lead to earlier fitting of advanced hearing

instruments combined with intensive services targeting communication development.

Hence, early intervention for permanent childhood hearing impairment (PCHI) has been shown to reduce the deleterious effects of impaired audition on language and cognitive and social skills of affected children. For identification of hearing impairment in newborns, universal neonatal hearing screening (UNHS) has been implemented in many parts of the Western world. Most of the neonatal facilities in the United States and European Union have enforced mandatory screening of all newborns.

As per WHO estimates in India, there are approximately 63 million people, who are suffering from significant auditory impairment; this places the estimated prevalence at 6.3% in Indian population. National Sample Survey Organization, an agency of government of India responsible for documentation of census in its 58th Round (2003) [6] estimated the population of persons with disability to be 18.49 million that equivalent to 1.8 percent of the total population of the country where 10 percent of this figure are likely to have hearing disability of moderate to

* Corresponding author. Tel.: +91 33 25310507x229; fax: +91 33 25311427.
E-mail address: sumank16@yahoo.com (S. Kumar).

profound degree. Moreover, this number is likely to go up if we add lower degree of hearing disability. Considering such estimates, still there seems to be a dearth of any large scale incidence studies among the neonates in the Indian context [3] and the documentation of the various newborn hearing screening programs being conducted in the country.

In this background the objectives of the study were to find out the procedures followed for UNHS with reference to the parameters adapted, tools used, professionals involved in India.

1. Objectives of the study

The objectives of the study are to:

1. Figure out the status of new-born hearing screening program being conducted in India.
2. Estimate the use of different screening instruments used and tests practiced for the purpose of universal newborn hearing screening.
3. Study the role of various professionals and referral sources in the newborn hearing screening program.
4. Document the current practices of audiologists who provide services towards universal newborn hearing screening.

2. Method

2.1. Participants

A total of 185 institutions (165 medical colleges, 15 speech and hearing institutes and 5 private clinics for speech and hearing) distributed all over India were considered for the study. The medical colleges considered for participation were selected from the directory of colleges being governed by the Medical Council of India and the Speech and Hearing institutes were considered from the directory of Rehabilitation Council of India.

2.2. Tools

A questionnaire “Newborn Hearing Screening Survey” was designed (modified and adapted from National Centre for Hearing Assessment and Management, Utah University) [5] and given to 5 Audiologists who had 10 years of experience in the field of pediatric audiology. The questionnaire was rated based on 3 point Likert scale (0 - not relevant, 1 - relevant, 2 - very much relevant). Only items which was rated 2 were considered for the final questionnaire. The final questionnaire consists of 26 questions intended at gathering information on the various facts about the NBHS program being conducted at the institution/organization. The questions can be grouped under 6 categories:

1. Annual birthing status of the medical colleges.
2. Details of the newborn hearing screening program.
3. Methods/personnel/tests used for the screening procedure.
4. Reports of screening results to various groups.
5. Referral of sources post screening, and
6. Miscellaneous issues (such as funding, data management system).

2.3. Procedure

The questionnaire was simultaneously mailed and posted to the 185 institutions all over India between August 2007 and September 2007.

2.4. Statistical analysis

Statistical Package for social sciences (SPSS) version 10 was used and data was subjected to descriptive statistical measures.

3. Results

The results of the survey have been grouped under various sections which are discussed below.

• Section-I: number of surveys received

Table 1 provides number of surveys received from different types of institute. Out of the 185 institutions that the survey questionnaire was sent to, a total of 31 questionnaires were received back representing a 16.75% return rate. Out of the 30, 21 were received from medical colleges (MCs), 8 from speech and hearing institutions and 2 from private clinics. Henceforth the speech and hearing institutions and private clinics will be considered under one category speech and hearing centers (SHCs) (a total of 10 organizations).

• Section-II: characteristics of birthing programs (annual birthing census, average length of stay of newborns and presence of NICUs)

Out of the 21 medical colleges, 19 have the provision for birthing at their hospitals accounting for 90% of the total number of colleges those responded to the questionnaire.

Table 2 provides information concerning the medical college respondents' birthing status; reveal that almost half of the colleges have their annual birthing census more than 2000. The majority of sites ($n = 12$ sites (57.13%)) report an average length of stay for a vaginal delivery to be more than 24 h (between 24 and 48 h). The majority of sites ($n = 15$ sites (78.94%)) also report having a NICU of Level II/III type.

• Section-III: frequency of screening programs

As indicated in Table 3, only 38.09% of the medical colleges have a universal newborn hearing screening program (NBHS) in comparison to 80% of the speech and hearing centers conducting

Table 1
No. of surveys received.

Types of institutions	No. of colleges questionnaire was sent to	No. of colleges questionnaire was received from
Medical colleges	165	21 (12.72%)
Speech and hearing institutions	15	8 (53.3%)
Private clinics	5	2 (40.00%)
Total	185	31 (16.75%)

Table 2
Characteristics of birthing programs.

Characteristic	Percentage of sites Reporting characteristic ($n = 19$)
(a) Annual birthing census	
<1000	3 (15.78%)
1000–2000	5 (26.31%)
>2000	11 (57.89%)
(b) Average length of stay-delivered vaginally	
≤24 h	7 (33.33%)
>24 h	12 (57.13%)
No provision	2 (9.52%)
(c) Presence of NICU (level II/III)	15 (78.94%)

Table 3
Frequency of newborn hearing screening programs in various institutions.

Types of institutions	No. of colleges that responded	No. of colleges that have NBHS program	No. of colleges that do not have NBHS program
Medical colleges	21	8 (38.09%)	13 (61.90%)
Speech and hearing centers	10	8 (80%)	2 (20%)

Table 4
Frequency of NBHS program and association of audiologists in them.

NBHS program	No. and percentage of sites reporting characteristic		
		Medical colleges (n=21)	Speech and hearing centers (n=10)
(a)Yes			
Do you have an audiologist?	Yes	7 (33.33%)	8 (80.0%)
	No	1 (4.76%)	–
(b)No			
Do you have an audiologist?	Yes	4 (19.04%)	2 (20.0%)
	No	9 (42.85%)	–

the program. All the 13 medical colleges and 2 speech and hearing centers that do not have NBHS program are interested in starting a NBHS program, and some have sought our help for the same.

Of all the medical colleges who conduct a NBHS program, only 33.3% of them have an audiologist and those that do not conduct a NBHS program, among them 42.85% do not have an audiologist as depicted in Table 4. Eighty percent of the Speech and hearing centers have an audiologist recruited either as a staff or for the purpose of newborn hearing screening and 20% of the centers although not conducting a NBHS program still have an audiologist recruited.

• Section-IV: characteristics of newborn hearing screening programs (personnel concerned with screening, manual data management systems and program funding)

As indicated in Table 5, the majority of the sites in both types of institutions (both n = 7, (87.15%)) use audiologists as the screeners

Table 5
Characteristics of newborn hearing screening programs.

Characteristic	No. and percentage of sites reporting characteristic	
	Medical colleges (n=8)	Speech and hearing centers (n=8)
(a) Personnel used for screening		
Audiologists	7 (87.5%)	7 (87.5%)
Doctors	1 (12.5%)	–
Nurses	–	1(12.5%)
(b) Manual data management systems	7 (87.5%)	5 (62.5%)
(c) Program funding		
No funding received	5 (62.5%)	4 (50%)
From the state health department	3 (37.5%)	1 (12.5%)
Others	–	3 (37.5%)

Table 6
Testing procedures used in the screening of newborns.

Characteristic	No. and percentage of sites reporting characteristic	
	Medical colleges	Speech and hearing centers
(a) Screen all infants before discharge using physiological tests (ABR, AABR, and/or OAE)	2 (25%)	5 (62.5%)
(b) Screen only infants with high risk factors before discharge using physiological tests (ABR, AABR, and/or OAE)	–	2 (25%)
(c) Noisestik, noisemakers and/or warblet on all infants before discharge	2 (25%)	–
(d) Others	4 (50%)	1 (12.5%)

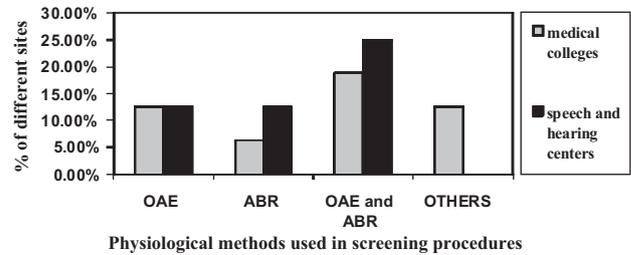


Fig. 1. Physiological methods used in screening procedures in different institutions.

in their programs, followed by doctors (in medical colleges) and nurses (in speech and hearing set-ups) with 12.5%. One medical college and 3 speech and hearing centers did not report on their data management system, suggesting that they do not have a systematic way of keeping track of the outcomes of their newborn hearing screening survey. More than half (62.5%) of the medical colleges do not receive any funds for their program. Almost half of the speech and hearing centers also receive no funds for their projects and 37.5% of the speech and hearing centers depend on service organizations, hospital auxiliaries and others for their funding.

• Section- V: audiological screening procedures

Table 6 shows the percentage of institutions of various categories using different testing procedures for screening purposes. More than half (62.5%) of the speech and hearing centers use physiological tests like ABR, OAE or their combination to screen newborns followed by 50% of the medical colleges using none of the physiological tests or behavioral methods for screening.

• Section-VI: technology used in screening procedures

Fig. 1 shows the technology protocols reported by sites with universal newborn hearing screening programs. The majority of sites (n = 7, 43.75%) report using OAEs in combination with ABR, followed by 4 sites using OAEs for screening purposes. Of sites using OAEs, 45.55%use transient evoked otoacoustic emissions (TEOAEs), 36.36%use distortion product otoacoustic emissions (DPOAEs) and18.18%use both TEOAEs and DPOAEs.

Fig. 2 shows the relationship between choice of technology and the presence of an audiologist on staff at the different set-ups. Nearly 11 (68.8%) sites using OAEs or OAEs in combination with ABRs have audiologists on staff. In contrast, only 1 of the institutions using ABR alone does not have an audiologist as staff. Hospitals without an audiologist usually conduct their screening programs, likely through their doctors or nurses.

It is evident from Fig. 3 that for annual birthing census, less than or more than 2000, use of physiological techniques count almost the same for both the groups indicating that the use of the techniques has been universally accepted by all the institutions despite the differences in birthing census.

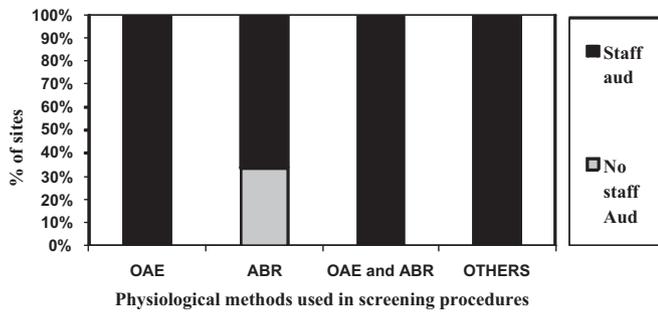


Fig. 2. Percentage of sites that use a particular technology (OAE, ABR or a combined ABR) that have an audiologist on staff or do not have an audiologist on staff.

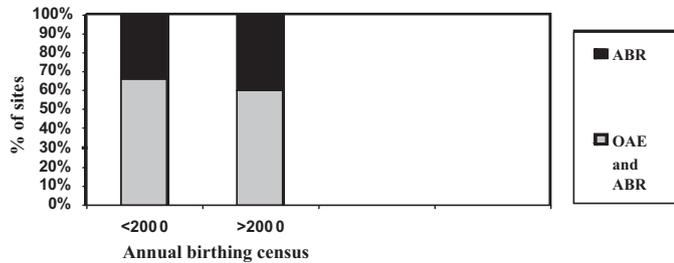


Fig. 3. Percentage of sites with small census (<2000) or large census (> 2000) that use ABRs and/or ABRs along with OAEs.

• Section-VII: test results and referral from a screening test

It is evident from Table 7 that in half (50%) of the medical colleges, both physicians and audiologists are responsible for intimating the “pass” result to the parents and again 50% of the speech and hearing set-ups prefer informing the parents about the result by an audiologist and simultaneously giving a written material concerning the same. For a “refer” result, almost 37.5% of the medical colleges seek audiologists help for the same and even give a written material to the parents for the same. Fifty percent of the speech and hearing centers prefer the audiologists in giving the “refer” result to the parents.

So, to sum up, both the type of institutions (medical and speech and hearing centers) prefer the audiologist informing parents and even giving a written material regarding the results to the parents. All the institutions (100%) agree to the recommendation of an outpatient re-screen if the results from the initial screen is a “refer”.

As indicated in Table 8, only 62.65% (n = 10) of the institutions refer less than 11% of their clients for further testing at the time of discharge, followed by 12.5% of the institutions referring almost 11–15% of their clients for further testing.

• Section-VIII: reporting of results from screening

It is evident from Table 9 that in 50% of the medical colleges the results of a test are reported to the parents and primary care physicians/doctors and in 37.5% of the speech and hearing set-ups

Table 7
Intimating parents about the result.

Process of intimating parents about a pass/refer result from the screening	“Pass”		“Refer”	
	MCs	SHCs	MCs	SHCs
(a) Audiologists informs parents	1 (12.5%)	3 (37.5%)	1 (12.5%)	4 (50%)
(b) Audiologists informs and parents are informed through written material	1 (12.5%)	4 (50%)	3 (37.5%)	2 (25%)
(c) Physician and audiologists informs parents	4 (50%)	–	2 (25%)	–
(d) Others	2 (25%)	–	3 (37.5%)	2 (25%)

Table 8

Percentage of infants referred for further testing at the time they are discharged from the hospital.

Age referred for further testing at the time they are discharged from the hospital	Medical colleges	Speech and hearing centers	Total
(a) Between 11% and 15%	2	0	2 (12.5%)
(b) Between 16% and 20%	0	4	4 (25%)
(c) <11% or >20%	6	4	10 (62.65%)

Table 9

Reporting screening results.

Report screening results to	No. and percentage of sites reporting characteristic		Total
	Medical colleges (n = 8)	Speech and hearing set-ups (n = 8)	
(a) Parents	1	3	4 (25%)
(b) Primary care physicians	2	1	3 (18.75%)
(c) Parents and primary care physicians	4	–	4 (25%)
(d) Others	1	4	5 (31.25%)

Table 10

Personnel who refers for diagnostic evaluation following “screening/personnel responsible for assuring whether diagnostic evaluation is done.

Personnels	“Referral by”		“Assured by”	
	MCs	SHCs	MCs	SHCs
(a) Nurse staff	–	1 (12.5%)	–	–
(b) Physician/ Doctors	2 (25%)	1 (12.5%)	1 (12.5%)	–
(c) Audiologists	1 (12.5%)	4 (50%)	4 (50%)	8 (100%)
(d) Physician and audiologists	3 (37.5%)	2 (25%)	3 (37.5%)	–
(d) Others	2 (25%)	–	–	–

the results are informed to the parents may be due to the fact that they do not have a doctor in their set-up and work independently.

As indicated in Table 10, around 37.5% of the medical colleges prefer both the physician and audiologist in referring the newborn for a diagnostic evaluation following screening while 50% of the speech and hearing centers prefer the audiologists only. In 50% of the medical colleges audiologists ensures regarding the diagnostic process being conducted or not, whereas in all (100%) the medical colleges both physician and audiologists are concerned in the process of ensuring.

• Section-IX: identification/monitoring of infants at risk of hearing loss and providing information to families regarding various options for obtaining diagnostic audiological services

Fig. 4 indicated that 20% of the medical colleges refer for audiological monitoring while 20% of the speech and hearing centers provide parents with information regarding progressive hearing loss and at the same time refer for audiological monitoring. Only 12.5% of the various institutions make use of High risk

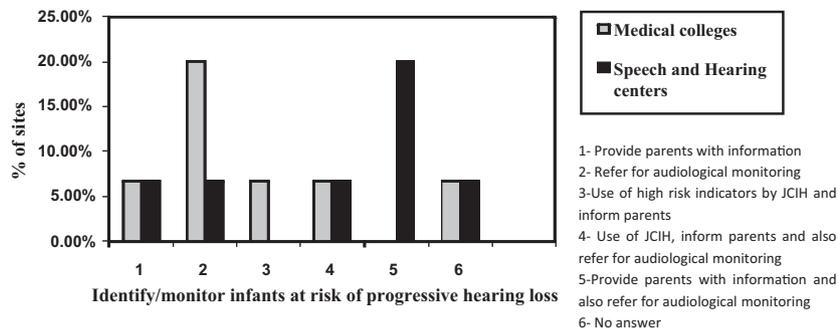


Fig. 4. Procedure followed by institutions in identifying/monitoring infants at risk for progressive hearing loss.

Table 11

Information provided to families regarding their options for obtaining diagnostic audiological services.

Information provided	No. and percentage of sites reporting characteristic	
	MCS	SHCs
(a) Family is informed about audiological services available	2 (12.5%)	3 (18.8%)
(b) Family is given a referral list of a subset of audiologists in the community	2 (12.5%)	1 (6.3%)
(c) Family given information about public health/state supported audiology services	2 (12.5%)	–
(d) Family informed about audiological services available within the hospital and about the public health/ state supported audiology services	–	2 (12.5%)
(e) Others	2 (12.5%)	2 (12.5%)

indicators established by the Joint Committee on Infant Hearing. In 60% of the institutions, the audiologists monitor the outcomes of a diagnostic referral.

It is evident in Table 11, around 31% of the various institutions provide information to the family about the audiological services available within their hospital followed by 18.8% of the institutions providing family with a subset of audiologists in the community. Around 25% of the institutions provide information to the family about their audiological services and simultaneously about the Public Health audiology services and regarding the subset of audiologists in the community.

4. Discussions

Although the response from the institutions is not adequate, but basing on the results of the survey some representative conclusions can be drawn about the status and procedures of the NBHS program held in India. Almost half of the medical colleges have an annual birthing census more than 2000 (mostly 5000–6000) which is extremely high in comparison to the annual census of births in the States which is mostly less than 300 in most of the primary health centers [1]. More than half of the medical colleges (57.13%) allow an average length of stay of the infants for more than 24 h in NICU of levels II/III (78.94%). Of all the institutions conducting newborn hearing screening programs 43.75% of them use ABR along with OAE for the purpose of screening. A cross tab analysis of average length of stay of infants in the NICU and the physiological methods (OAE and ABR) used for screening these infants reveal a 37.5% of the total infants undergoing OAE and ABR screening test simultaneously. This is in accordance with the 'JCIH (2007) [2] position statement updates' which recommend that NICU infants admitted for more than 5 days are necessarily to have auditory brainstem response (ABR) included as part of their screening along with the primary physiological test OAE.

Eighty percent of the speech and hearing set-ups conduct a new-born hearing screening program while only 38.09% of the medical colleges conduct the program. Hence, it can be concluded that the rate of hearing screening programs in infants has not taken

up good hold in the various medical set-ups in India as yet. In such cases intervention programs cannot be implemented.

Fifty percent of the institutions have an audiologist as a staff or for the purpose of the newborn hearing screening program. But an increased number of the audiologists can be recruited in the hospitals to ensure an effective and smooth conduct of the newborn hearing screenings and also in the diagnosis and intervention purposes of the hearing impaired instead of appointing nurses, anganwadi workers (for screening purposes) or doctors for the same. A discrete job distribution should be maintained and the concerned professional should be recruited for the purpose.

Successful systems for universal newborn hearing screening will depend on data management systems that include specific-fields of information (e.g., no. of babies screened, no. of babies referred, no. of babies returning for follow-up) that are reported to state-agencies, department of health. Furthermore, a systematic means of reporting infants who are referred from screening may assist in successfully connecting infants and their families from screening process to diagnostic process.

Funding of screening programs should be undertaken by various government and non-government organizations for ensuring the smooth and effective administration of such programs all over the country at primary, secondary and tertiary levels.

Finally, it is important to acknowledge that the results presented here are limited by the fact that they are based on reports from a few number of organizations and may not hold true for all the medical and nonmedical organizations of India.

5. Conclusions

Late identification of hearing loss presents a significant public health concern. However, without screening, children with hearing loss are usually not identified until 2 years of age, which results in significant delays in speech, language, social, cognitive and emotional development. In contrast, early identification and intervention prior to 6 months of age has a significant positive impact on development

A high incidence of hearing impairment of 5.60 per 1000 in a standardized neonatal population of at risk and not at risk warrants

the urgent implementation of universal hearing screening of all the neonates in India [3]. Early identification is the first step in ensuring successful outcomes for children who are deaf/ or hard of hearing. The Joint Committee on Infant Hearing (JCIH) endorses early detection of and intervention for infants with hearing loss. The goal of early hearing detection and intervention (EHDI) is to maximize linguistic competence and literacy development for children who are deaf or hard of hearing. Without appropriate opportunities to learn language, these children will fall behind their hearing peers in communication, cognition, reading, and social-emotional development. Such delays may result in lower educational and employment levels in adulthood. To maximize the outcome for infants who are deaf or hard of hearing, the hearing of all infants should be screened at no later than 1 month of age. Separate protocols are recommended for NICU and well-infant nurseries. NICU infants admitted for more than 5 days are to have auditory brainstem response (ABR) included as part of their screening so that neural hearing loss will not be missed.

The result of the survey which requested information regarding services offered and populations served provided a baseline on the status of Universal newborn hearing screening program in India.

A committee run by the central government would prove effective in keeping a track of the hearing screening programs already existing and the programs that are newly undertaken in various hospitals. Moreover, hearing screening programs can be collaborated with screening programs of varied fields (communicative diseases, ophthalmology, etc.) intending towards a team-approach and time-saving issues.

Hence, there is an urgent need to incorporate universal neonatal hearing screening in all the neonatal health care facilities in India. While considering the facts like infrastructure limitations of our country where basic needs are in shortage, there is a need to employ cost-effective behavioral observation methods using calibrated noise making toys to screen all new-borns. At the same time, private institutions may use the Otoacoustic emission technology to screen hearing impairment, for example, an automated screener can be used by the pediatrician and if the infant fails the screen twice then referral to the audiologist can be considered. In this way a provision to administer hearing screening in all the infants born in India can be implemented and effectiveness of the newborn hearing screening program be monitored thereof.

Appendix A

NEWBORN HEARING SCREENING SURVEY

Demographic Information

1. Hospital/Birthing Center: _____
 Contact Person: _____
 Title of Contact Person: _____
 Address: _____
 City: _____ State: _____ Pin: _____
 Phone Number, including area code: (____) _____ extension: _____
 Fax Number, including area code: (____) _____
 Email Address: _____

2. Do you birth babies at your hospital?

Yes
 No

3. What was your birthing census in 2006?

_____ babies were born in our facility in 2006.

4. What types of nurseries are available in your hospital/center?

Level I (well-baby care)
 Level II (Neonatal Intensive Care Unit, NICU)
 Level III (NICCU)

5. What is the average length of stay for infants who were delivered vaginally? (Check one)

12 hours
 24 hours
 48 hours
 other, please describe _____

6. Does your hospital have an audiologist (Bachelor/Master degree/PhD) on staff?

Yes
 No

7. Does your hospital have a newborn hearing screening program?

Yes. **Please continue**
 No. *Thank you for your cooperation (Pl complete Q. no. 8).*

8. If your hospital does not currently have a newborn hearing screening program, are you interested in starting a newborn hearing screening program?

Yes
 No

9. Audiologist on staff of hospital and/or affiliated with Newborn Hearing Screening Program

No. audiologist is on staff or affiliated with our program.

Name of Audiologist: _____

Title of Audiologist _____

Address: _____

City _____ State _____ Zip _____

Phone Number, including area code: (____) _____ extension _____

Fax Number, including area code: (____) _____

Email Address: _____

Please note the abbreviations used in the remainder of this survey:

OAE: Otoacoustic Emissions

TEOAE: Transient Evoked Otoacoustic Emissions

DPOAE: Distortion Product Otoacoustic Emissions

AABR: Automated Auditory Brainstem Response

ABR: Auditory Brainstem Response

10. What methods of newborn hearing screening does your hospital/center use before discharge? Check all that apply.

Screening deferred to outpatient setting.
 High Risk Register using a questionnaire on all infants *before discharge*
 High Risk Register using a questionnaire on NICU infants only *before discharge*
 Screen all infants *before discharge* using physiological test (ABR, AABR, and/or OAE)
 Screen only infants with high risk factors *before discharge* with physiological test (ABR, AABR, and/or OAE).
 Screen NICU infants only with physiologic test (ABR, AABR, and/or OAE) *before discharge*

Noisestik, noisemakers and/or warblet on all infants *before discharge*

Noisestik, noisemakers and/or warblet on NICU only *before discharge*

Noisestik, noisemakers and/or warblet on HRR only *before discharge*

11. If you screen using a physiologic-based technology, which procedure(s) do you use on all babies you screen? Check all that apply.

OAEs Indicate type(s) of OAEs used: TEOAE DPOAE

AABR

ABR

other, please specify _____

12. What personnel does your hospital use for screening? Check all that apply.

Nurses

Technicians

Doctors

Audiologists

other, please specify _____

13. How is consent for screening obtained from parents? Check all that apply.

Consent is implied as part of routine neonatal admission

Verbal permission is obtained.

Written information provided for parent but no specific consent is obtained.

Verbal information is provided for parent but no specific consent is obtained.

Written permission is obtained.

14. Check all of the following that apply to your screening program:

Screening is a standing order from all physicians

Screening is not a uniform standing order: some physicians order screening for some babies

15. How are parents informed about a "pass" result from the screening? Please check all that apply.

Screening personnel inform parents.

Physician informs parents.

Audiologist informs parents.

Parents are informed verbally before hospital discharge.

Parents are informed through written material before hospital discharge.

Parents are not informed of a test "pass" result.

16. How are parents informed about a referral? Please check all that apply.

Screening personnel inform parents.

Physician informs parents.

Audiologist informs parents.

- ___ Parents are informed verbally before hospital discharge.
 ___ Parents are informed through written material before hospital discharge.
 ___ Parents are not informed about a referral.

17. When an infant refers from the screen, do you recommend the baby return for an outpatient re-screen?

- ___ Yes
 ___ No

18. What type of hospital based data management system(s) do you use? Check all that apply.

- ___ We use a manual data management system.
 ___ Other, please specify _____

19. To which of the following individuals/agencies do you report screening results? Check all that apply.

- ___ Parents
 ___ Primary Care Physicians
 ___ Early Intervention Services in Rehabilitation Centers
 ___ other, please describe _____

20. Who refers the family for a diagnostic evaluation following the "screening" process? Check all that apply.

- ___ Nursery Staff
 ___ Physician
 ___ Audiologist
 ___ Coordinator of Newborn Hearing Screening Program
 ___ Other, please describe _____

21. Who is responsible for assuring that an infant who is referred from screening receives a diagnostic evaluation? Check all that apply.

- ___ Nursery Staff
 ___ Physician
 ___ Audiologist
 ___ Other, please describe _____

22. How do you identify/ monitor infants at risk for progressive hearing loss? Please check all that apply.

- ___ No comments
 ___ We do not identify infants at risk for progressive hearing loss.
 ___ High risk indicators established by the Joint Committee on Infant Hearing/our own hospital
 ___ Provide parents with information regarding progressive hearing loss
 ___ Refer for audiological monitoring
 ___ Other, please describe _____

23. For babies referred from screening, what information do you provide families regarding their options for obtaining diagnostic audiological services? Check all that apply.

- ___ No comments
 ___ No specific information is given regarding diagnostic audiological services.
 ___ Family is informed about audiological services available within our hospital.
 ___ Family is given a referral list consisting of all audiologists in the community.

- ___ Family is given a referral list consisting of a subset of audiologists in the community.
 ___ Family is given information about Public Health/ State supported audiology services.
 ___ Other, please describe _____

24. Who monitors the outcomes of diagnostic referrals? Please check all that apply.

- ___ Outcomes are not monitored at this time
 ___ Outcomes are monitored by a hospital-based system.
 ___ Outcomes are monitored by an audiologist.

25. Please check all of the following that apply to outside funding used to support your program.

- ___ We do not receive outside funding.
 ___ We receive outside funding from service organizations.
 ___ We receive outside funding from hospital auxiliaries.
 ___ We receive outside funding from the State Health Department.
 ___ Other: _____

26. If you have a universal newborn hearing screening program, what percentage of infants are referred for further testing at the time they are discharged from the hospital?

- ___ 1% or less
 ___ between 2% and 3%
 ___ between 4% and 5%
 ___ between 6% and 10%
 ___ between 11% and 15%
 ___ between 16% and 20%
 ___ greater than 20%

References

- [1] K.H. Arehart, C. Yoshinaga-Itano, V. Thomson, S.A. Gabbard, A.S. Brown, State of the States: the status of universal hearing screening, assessment and intervention systems in 16 states, *Am. J. Audiol.* 7 (1998) 1–14.
- [2] Joint Committee on Infant Hearing, Year 2007 position statement: principles and guidelines for early hearing detection and intervention programs, *Pediatrics* 106 (2007) 798–817.
- [3] P. Nagapoornima, A. Ramesh, Srilakshmi, S. Rao, P.L. Patricia, M. Gore, M. dominic, Swarnekha, Universal hearing screening, *Ind. J. Pediat.* 74 (6) (2007) 7–11.
- [4] J.L. Northern, M.P. Downs, *Hearing in Children*, 4th ed., Williams & Wilkins, Baltimore, MD, 1994.
- [5] <http://www.infanthearing.org/impguide/appendices.html>.
- [6] National Sample Survey Organization. Disabled Persons in India, NSS 58th Round (July–December 2002), Ministry of Statistics and Programme Implementation, Govt. of India, 2003.