MINISTRY OF HEALTH MALAYSIA

GUIDELINES FOR NEONATAL HEARING SCREENING

SEPTEMBER 2014

MEDICAL DEVELOPMENT DIVISION

SURGICAL AND EMERGENCY MEDICINE SERVICES UNIT

MEDICAL SERVICES DEVELOPMENT SECTION

This guideline was developed by the Surgical and Emergency Medical Services Unit, Medical Services Development Section of Medical Development Division, Ministry of Health and the Drafting Committee.

Published in September 2014

A catalogue record of this document is available from the Library and Resource

Unit, Institute for Medical Research, Ministry of Health; MOH/P/PAK/182.09 (GU)

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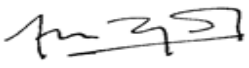
"Guidelines for Neonatal Hearing Screening" is a standard practical guideline intended to be used for all health practitioners who are involved in neonatal hearing screening program in Ministry of Health Malaysia.

The first edition of the Guidelines of High Risk Neonatal Hearing Screening was published on 2009 with the collaboration of all professional involved such as Audiologist, Pediatrician, Obstetrician, ENT Specialist, Speech Language Therapist and Nurses This guideline provides a unified standard of practice for newborn hearing screening program especially for the target group of high risk newborn. In line with the advancement and the availability of the technology, the increasing numbers of the Audiology services in the Ministry of Health Malaysia and the increasing awareness of the importance of universal newborn hearing screening amongst our health care provider then there is a need to update the current guideline. Hence this second edition guideline is developed in order to meet the need of the Ministry of Health hospital which successfully initiated universal newborn hearing screening program.

I would like to thank the committee on their efforts and painstaking task undertaken to come out with this edition. May we strive together towards early hearing detection and intervention for infants in Malaysia.

Thank you



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LIST OF ABBREVIATION

AABR	Automated Auditory Brainstem Response
ABR	Auditory Brainstem Response
B/O	Baby of
CI	Cochlea Implant
CMV	Cytomegalovirus
dBnHL	Decibel normal Hearing Level
DOB	Date of birth
DPOAE	Distortion Product Otoacoustic Emission
HRNHS	High Risk Newborn Hearing Screening
JCIH	Joint Committee on Infant Hearing
KPI	Key Performance Indicator
MOH	Ministry of Health
NICU	Neonatal Intensive Care Unit
NHS	Neonatal Hearing Screening
OAE	Otoacoustic Emission
ORL	Otorhinolaryngology
SCN	Special Care Nursery
TEOAE	Transient Evoked Otoacoustic Emission
UNHS	Universal Neonatal Hearing Screening

1. INTRODUCTION

Hearing loss is one of the most common major abnormalities present at birth and if undetected, will impair speech, language and cognitive development (Kemper & Downs, 2000; Cunningham & Cox, 2003) According to WHO (2009) around 0.5 to 5 in every 1000 neonates and infants have congenital hearing loss.

The critical period for language and speech development is generally within the first 3 years of life. Children who are identified with hearing loss between birth and 6 months of age and received immediate interventions have significantly higher cognitive, language and social development (Yoshinaga-Itano, 1995). Therefore, a neonatal hearing screening is the best mean to minimize the adverse effects of hearing loss.

Universal neonatal hearing screening (UNHS) program is the current standard practice in developed countries to detect hearing loss among children at the very early age. The purpose of UNHS is to detect hearing loss in newborn babies before 3 months of age and provide appropriate intervention no later than 6 months of age (Joint Committee on Infant Hearing, 1994)

In Malaysia, the high risk neonatal hearing screening program (HRNHS) has been introduced in the Ministry of Health (MOH) hospitals since 2001. In 2014, 30 hospitals implement HRNHS while 6 hospitals run UNHS program. It is estimated that more hospitals will follow suit in the near future.

This Guideline is intended to provide a standard protocol of neonatal hearing screening program in MOH hospitals. However, it is important to allow for adaptation of this Guideline into the local policy of individual institution based on the availability of local resources and technology.

2. DESCRIPTIONS

Automated Auditory Brainstem Response (AABR)

An automated test of hearing, and evaluate the nervous system response to sound

Hearing Screening

An objective screening method performed to identify infants who may have hearing loss and who need follow up or more in depth testing.

Hearing Screening Database

An information management system which is used to record hearing screening data.

Hearing screening personnel

Any paramedic or nursing personnel, who had undergone a proper training in neonatal hearing screening program. The personnel should be knowledgeable about neonatal hearing screening protocol and technique.

High Risk Neonatal Hearing Screening (HRNHS)

A hearing screening performed on neonates who are born with high risk factors associated with congenital or acquired hearing loss.

High Risk Hearing Register

A list of factors that place a neonate or an infant at risk for hearing loss. (See Appendix 1).

Neonate

A baby from birth to four weeks of age.

One stage hearing screening

Involves only one method of hearing screening at any time; either OAE or AABR.

Otoacoustic Emission (OAE)

Automated hearing test which measure sounds emitted by normal, healthy inner ear. There are two types of OAE technologies: Transient Evoked Otoacoustic Emissions (TEOAE) and Distortion Product Otoacoustic Emissions (DPOAE).

Two stage screening

Involves two different method of hearing screening at any time of the screening program.

Universal Neonatal Hearing Screening (UNHS)

Hearing screening offered to all babies delivered in MOH hospital with UNHS program

3. OBJECTIVES OF THE MOH NHS PROGRAM

- To screen babies by 1 month of age
- To diagnose any hearing loss by 3 months of age.
- To provide appropriate intervention by 6 months of age.
- To facilitate early cochlear implantation in children.

4. ROLES AND RESPONSIBILITIES OF PROFESSIONALS

The NHS program involves a multi-disciplinary team of professionals. All team members must work together to ensure the success of the program. The roles and responsibilities of each team member should be well defined. The team members are:

- Hospital Director
- Otorhinolaryngologists
- Pediatricians;
- Obstetricians;
- Family Medicine Specialists
- Audiologists
- Speech Language Therapists
- Screening personnel / Paramedic
- Medical Social Officers

4.1 Hospital Director

4.1.1 An Advisor of the NHS program

4.1.2 To provide support in terms of :

- ❖ Manpower
  - o Screening Personnel (Staff Nurse, Assistant Medical Officer, Technician, certified health personnel)
  - o Audiologists
  - o Speech Language Therapist
  - o Health Care Assistant (*Pembantu Perawatan Kesihatan*)

- ❖ Materials
  - o Health education (e.g. brochures, pamphlets, posters, electronic Information about hearing screening and hearing development)
  - o Database for NHS program

- ❖ Equipment & consumables

- ❖ Space for hearing screening

4.2 Otorhinolaryngologist

4.2.1 To collaborate with other clinical disciplines in terms of comprehensive patient management.

4.2.2 To determine the aetiology of hearing loss, identifying related risk indicators for hearing loss, including syndromes that involve the head and neck, and evaluating and treating ear diseases.

4.2.3 To determine the appropriate choice of medical and/or surgical intervention.

4.2.4 To involve in the long-term monitoring and follow-up.

4.2.5 To provide information and participate in the assessment of candidacy for amplification, assistive listening devices, and surgical intervention

4.3 Paediatrician

4.3.1 To identify babies who are at high risk of hearing loss

4.3.2 To monitor the hearing and speech development of the baby at risk.

4.3.3 To ensure and support the continuum of audiological assessment and care.

4.3.4 To initiate referrals for further evaluation necessary to determine the presence and etiology of the hearing loss.

4.3.5 To determine any other associated medical conditions.

4.3.6 To ensure all newborns are screened prior to discharge.

4.4 Family Medicine Specialist / Primary Healthcare Personnel

4.4.1 To review medical and family history during antenatal visits for babies with risk indicators that requires referral for hearing screening.

4.4.2 To include hearing loss awareness in the maternal child health program.

4.4.3 To monitor the general health, development, and well-being of the infant.

4.4.4 To ensure and support the continuity of audiological assessment and care.

4.4.5 To initiate referrals for further evaluation necessary to determine the presence and aetiology of the hearing loss.

4.4.6 To monitor hearing and speech development of children at 6, 12, and 18 months of age.

4.4.7 To counsel parents/care provider regarding further management/therapy

4.5 Obstetrician

4.5.1 To provide prenatal counseling and antenatal identification of patients with risk factors.

4.5.2 To include hearing loss awareness in the maternal child health program.

4.5.3 To counsel parents of the affected babies regarding the importance to comply with further management plans

4.5.4 To ensure newborns are screened prior to discharge

4.6 Audiologist

4.6.1 To coordinate hearing screening program development, management, quality assessment and service.

4.6.2 To provide audiological diagnosis, treatment and management including appropriate referral and documentation.

4.6.3 To provide comprehensive audiological assessment to confirm the existence of the hearing loss.

4.6.4 To inform parents regarding the audiological results, impacts of hearing loss and the rehabilitation involved.

4.6.5 To evaluate the suitability for amplification, assistive listening devices and ensure prompt referral for early intervention programs.

4.6.6 To provide timely fitting and monitoring of amplification.

4.6.7 To ensure that hearing screening results are well-documented in *Buku Rekod Kesihatan Kanak-kanak (umur 0 – 6 tahun).*

4.6.8 To ensure the hearing screening data is updated daily into the Hearing Screening Database.

4.6.9 To submit a report of NHS program to the Audiology Technical Committee, MOH every 6 months.

4.6.10 To coordinate and facilitate parent support group activities.

4.6.11 To promote hearing and speech-language awareness to parents.

4.6.12 To provide communication options for families with hearing impaired children.

4.7 Speech Language Therapist

4.7.1 To provide information to parents about normal and abnormal speech and language development.

4.7.2 To administer ongoing formal and informal speech and language assessment and develop individualized therapy plans.

4.7.3 To guide and empower parents and families to facilitate their child's listening ability and language into all aspects of the child's life.

4.7.4 To coordinate and facilitate parent support group activities.

4.8 Screening Personnel

4.8.1 To conduct hearing screening on neonates.

4.8.2 To adhere to all protocols involved (Appendix Flowchart).

4.8.3 To provide documented hearing screening results to parents.

4.8.4 To record and update hearing screenings results in the Hearing Screening Database.

4.8.5 To provide parents with appropriate follow-up and resource information.

4.8.6 To consult audiologist in the preparation of supplies.

4.8.7 To schedule follow-up appointment for neonates who failed hearing screening.

4.8.8 To schedule appointment for neonates who missed the initial hearing screening

4.9 Medical Social Officer

4.9.1 To provide social and emotional supports to families with hearing impaired babies.

4.9.2 To serve as a liaison officer between parents and the related agencies for funding purposes.

5. FRAMEWORK OF HEARING SCREENING PROCEDURE

5.1 To implement the NHS program, the hospital shall take into consideration the following factors:

- The availability of screening devices, with a proper back up supply.
- Local policy and screening protocols
- Availability of qualified screening personnel;
- Appropriate screening facilities
- Follow-up referral criteria and referral pathways for follow-up;
- Availability of a computer system for information management;
- Proper data collection and reporting;
- Continuous Quality Improvement

5.2 Neonatal Hearing Screening Program

The NHS program in MOH hospital is divided into 2 types:

a) High Risk Neonatal Hearing Screening (HRNHS)
b) Universal Neonatal Hearing Screening (UNHS)

5.2.1 High Risk Neonatal Hearing Screening (HRNHS)

- Target population

  All neonates with high risk factors (as listed in Appendix 1)

- Method used:

  It involves a one stage AABR protocol.

First screening: AABR

Second screening (for those with "Refer" result in either ear): AABR

* Do not screen more than 2 times in each ear either at first or second screening.

Testing time :

√ Testing time takes about 15-20 minutes, (the time maybe longer if a baby is restless and does not include time for discussion and preparation before test).

- ✓ Testing should be done prior to hospital discharge.
- ✓ Testing should include: preparation of the baby, taking consent from parents, delivering information and giving results to parents.

- Pass/Refer criteria for AABR
  - Pass :
    - Reliable evoked responses present at 35 dBnHL on both ears.

- Refer :
    - No recordable responses at 35 dBnHL in any ear.

- Neonates condition

    - Babies should be in a stable condition without any medical equipment attached (i.e. with no life support, no nasal cannula and in open cot)

    - If the **corrected age** at the time of discharge for the preterm baby is more than 3 months, the baby should be referred directly to the audiologist for diagnostic hearing assessment.

    - Screening should be done while the baby is quiet an in a quiet room.

- Equipment

    - Screening equipment must be check daily and calibrated annually.

    - A documented user guide and trouble-shooting should be made available for each screening devices.

5.2.2 Universal Neonatal Hearing Screening (UNHS)

- Target population
    - All newborns delivered in the respective hospital prior to hospital discharge.

- Method used:

  It involves a one or two stage screening protocol. The current practice recommends one stage screening protocol with AABR. However, for hospital with lack of AABR equipment, two stage screening protocols can be applied.

a) One stage screening protocol :

   First screening : AABR

   Second screening (for those with “Refer” result in either ear) : AABR

b) Two stage protocol

   First screening : DPOAE

   Second screening (for those with “Refer” result in either ear): AABR

   * Do not screen more than 2 times in each ear either at first or second screening.

- Pass/Refer criteria for DPOAE

  Pass criteria : The difference between distortion product and noise floor amplitudes is more than 6dB at 4 out of 6 frequencies.

  Refer criteria : No emission in any of the frequency bands

6. TRAINING FOR SCREENING PERSONNEL

6.1 The trainer

- ✓ Audiologist in each hospital

6.2 The trainee can be

- ✓ Paramedic/Nursing Personnel/ Audiologist

6.3 The components of training program include:

6.3.1 Introduction of neonatal hearing screening
6.3.2 Basics of OAE and AABR testing
6.3.3 In the use of screening devices
6.3.4 Trouble shooting of faulty equipment
6.3.5 Handling of the neonate during the test
6.3.6 Infection control and hand hygiene
6.3.7 Appropriate environment, place and time to run the screening
6.3.8 Result interpretation
6.3.9 Feedbacks to parents and caregivers
6.3.10 Practical sessions
6.3.11 Documentation

6.4 The training program constitutes:

i. Theory
ii. Practical: perform screening test under supervision of Audiologist for minimum 50 neonates for one month period.
iii. Log book: The trainees need to maintain record of cases performed.
iv. Monitoring by Audiologist for a minimum of 1 month prior to credentialing.

7. MANAGEMENT

7.1 When there is a PASS RESULT

7.1.1 Using OAE

- ✓ The neonate's hearing is adequate for normal speech and language development. **However it will not detect cases of Auditory Neuropathy Spectrum Disorder.**

- ✓ Ongoing monitoring and evaluation is needed and should be done by Family Health Physician or Medical Officer in hospitals and Health Clinics.

7.1.2 Using AABR

- ✓ The neonate's hearing is adequate for normal speech and language development.

- ✓ Ongoing monitoring and evaluation is needed and should be done by Family Health Physician or Medical Officer in hospitals and Health Clinics.

7.2 When there is a REFER RESULT:

- ✓ The neonate needs further audiological evaluation to determine whether the neonate's hearing status is adequate for normal speech and language development.

- ✓ The **"Refer"** result of the screening is shared with the family before discharge, and appointment for further evaluation is scheduled by the Screening Personnel and/or Audiologist.

7.3 When there is a MISSED SCREEN:

- ✓ The babies will undergo screening in Audiology Clinic / Hearing Screening Centre within 3 – 4 weeks after discharge.

7.4 Surveillance and screening in the primary healthcare facility

- ✓ For all babies, regular surveillance of developmental milestones, auditory skill, parental concerns and speech and language development should be performed in the primary healthcare facility.

- ✓ Babies who do not follow normal development milestone or for whom there is a concern on hearing or language development should be referred for speech-language evaluation and/or audiology assessment.

8. EVALUATION PROGRAM AND MONITORING

8.1 All screening data should be entered and updated into the Hearing Screening Database on daily basis.

8.2 Program coordinator (audiologist) from each hospital should evaluate the program every month based on the quality indicators.

8.3 Screening Program at each hospital should conduct Continuous Quality Improvement meeting, involving all committee members, at least every 6 months.

8.4 Performance of hearing screening program should be presented yearly at the national hearing screening committee.

8.5 The Quality Indicators for neonatal hearing screening program are :

8.5.1 The coverage rate of neonates screened

$$\textbf{For UNHS: } \frac{\textbf{Total neonates screened}}{\textbf{Total live birth}} \times 100\%$$

$$\textbf{For High Risk: } \frac{\textbf{Total neonates screened}}{\textbf{Total NICU discharge}} \times 100\%$$

8.5.2 Percentage of neonates screened before one months of age.

8.5.3 Percentage of neonates who do not pass the initial hearing screening.

8.5.4 Percentage of neonates who failed initial hearing screening and return for follow up screening.

8.5.5 Percentage of neonates who do not pass the follow up screening and referred for audiological and medical evaluation.

8.5.6 Percentage of neonates who return for follow up services (either audiological or medical evaluation).

8.5.7 Percentage of babies who complete diagnostic audiological evaluation by 3 month of age.

8.5.8 Percentage of babies who receive intervention by 6 months of age. (e.g. hearing aid fitting, medical intervention and speech therapy).

8.5.9 Percentage of families who refuse initial hearing screening.

8.5.10 Percentage of babies who missed the initial hearing screening

8.5.11 Age of the babies when intervention is undertaken (e.g. hearing aid fitting, medical intervention and speech therapy).

8.6 Benchmarks for Neonatal Hearing Screening program based on (JCIH, 2007)

8.6.1 Percentage of neonates underwent hearing screening should be ≥ 95% by one month of age.

8.6.2 Percentage of neonates who return for follow up services (either audiological or medical evaluation) should be ≥ 70%.

8.6.3 Refer rate for follow-up following failure in hearing screening should ≤ 4%.

8.6.4 Percentage of babies who failed hearing screening and complete comprehensive audiological evaluation by three month of age should be 90%

APPENDIX 1

RISK FACTORS FOR HEARING LOSS (0– 28 days)

RISK INDICATORS ASSOCIATED WITH PERMANENT CONGENITAL, DELAYED-ONSET, OR PROGRESSIVE HEARING LOSS IN CHILDHOOD

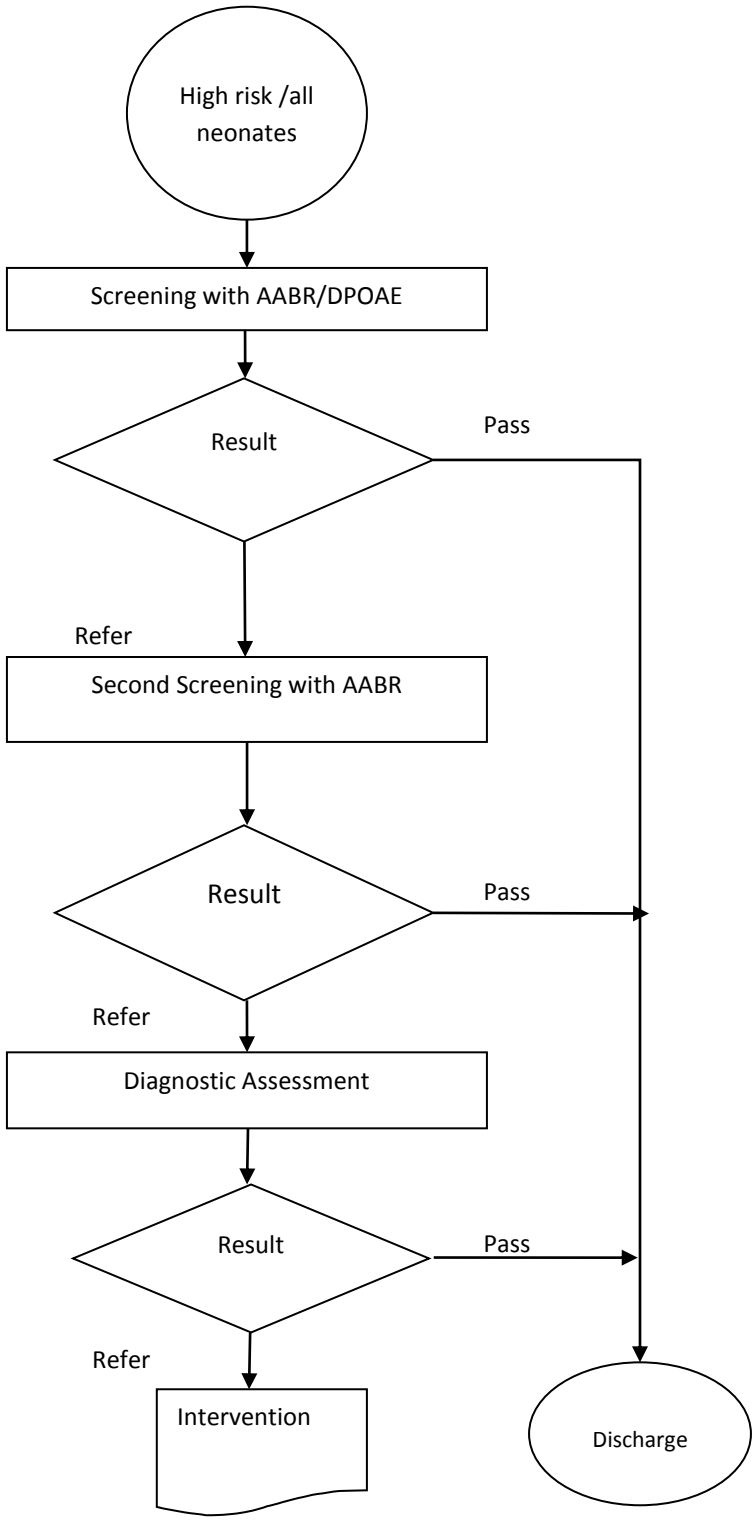
1. Family history of hereditary childhood sensorineural hearing loss
2. In-utero infection, such as cytomegalovirus, rubella, syphilis, herpes and toxoplasmosis
3. Craniofacial anomalies including those with morphological abnormalities of the pinna and ear canal
4. Birth weight less than 1,500 grams (1.5 kg)
5. Hyperbilirubinemia at a serum level requiring exchange transfusion
6. Ototoxic medications, including but not limited to the amino glycosides, used in multiple courses or in combination with loop diuretics
7. Bacterial meningitis
8. APGAR scores of 0 – 4 at 1 minute or 0 – 6 at 5 minutes
9. Mechanical ventilation.
10. Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss
11. **Any NICU stay for > 2 days (American Academy of Paediatrics, JCIH 2007)**

Detail information on late onset hearing loss can be obtained from JCIH website guidelines, (**http://pediatrics.aappublications.org/content/120/4/898.full.html**)

RISK FACTORS FOR CHILDREN 28 DAYS-24 MONTHS

APPENDIX 2

FLOWCHART FOR NEONATAL HEARING SCREENING



APPENDIX 3

SUGGESTED WORK PROCESS OF NEONATAL HEARING SCREENING

1. The Screening personnel enter neonate's information in Hearing Screening Database.
2. Inform the parents/caregivers about hearing screening process.
3. Screening personnel prepares the hearing screening equipment.
4. Prepare neonate for the hearing screening procedure. Mothers may be with their baby during the procedure.
5. Screening process is done according to Appendix 2 and Appendix 3.
6. Screening personnel informs and provide results in written form to Parents /caregivers.
7. Records all results obtained in the Hearing Screening Database.
8. For babies with refer result, appointment date for audiological diagnostic assessment will be given to the parents. Appointment date should be within 1 month, or no later than 3 months of age.
9. Audiological diagnostic assessment will be done in audiology clinic by appointment.
10. For babies with normal hearing and those babies with high risk factors associated with late- onset, progressive, or fluctuating hearing loss; ; hearing and speech development monitoring should be done in primary health care facilities during immunization follow-ups.
11. For babies with confirmed hearing loss; further audiological, speech and medical intervention should be given as soon as possible.
12. For transferred cases, the Medical Officer of the primary unit shall take note and refer them to the preferred hospital for further medical evaluation and /or audiological diagnostic assessment.

APPENDIX 4

NEONATAL HEARING SCREENING FORM

B/O: _____ IC/passport(M): _____

DOB: _____ PhoneNo.: _____

Risk factors		Risk Factors	
Family history*		Parental Concern*	
Mechanical Ventilation		Ototoxic medication	
Hyperbilirubinemia*		In-utero Infection(CMV*)	
Cranio facial anomalies		Associated Syndrome*	
Neurodegenerative disorders		Bacterial Meningitis*	
Head trauma		APGAR scores of 0–4at1 minute or 0–6 at 5 minutes	
Very low birth weight(<1.5kg)		NICU stay > 2 days	
		No identifiable risk factor	

*Risk indicators that are marked with an asterisk are of greater concern for delayed-onset hearing loss. Please refer to audiologist after screening

Signature

Name of Screening Personnel

_____

Parents consent :YES/ NO

AABR/OAE testing:

	PASS	REFER
Right Ear	☐	☐
Left Ear	☐	☐

Name and signature:
Date:_____

- carbonized and standardized (2copies)

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