

## Statewide Infant Screening - Hearing (SWISH) Program

**Summary** The Guidelines of the Statewide Infant Screening - Hearing (SWISH) Program have been developed to encompass all protocols and procedures of the program. The document sets out guidelines for the SWISH program including screening protocols and referral pathways. In doing so, the guidelines describe roles and responsibilities of staff; equipment used; protocols for screening, coordination, audiological assessment and paediatric medical assessment.

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## NSW STATEWIDE INFANT SCREENING – HEARING (SWISH) PROGRAM

### PURPOSE

This document sets out guidelines for the SWISH program including screening protocols and referral pathways. In doing so, the guidelines describe roles and responsibilities of staff; equipment and protocols for screening, coordination, audiological assessment and paediatric medical assessment.

Technology is available to diagnose hearing problems in the neonatal period. Early identification and intervention are important, with research suggesting that intervention commencing by 6 months of age may result in optimal speech and language development and minimise the need for ongoing special education.

### KEY PRINCIPLES

The Guidelines outline the responsibilities each stage has in the hearing screening pathway.

Each Area Health Service (Area or AHS) has a SWISH Coordinator responsible for implementing and managing the screening program across all facilities in their Area. This model allows SWISH Coordinators flexibility to meet unique needs in their Area Health Service. SWISH Coordinators have adopted innovative approaches to ensure maximum screening capture such as service agreements with private hospitals and employing dedicated screeners to meet local needs (eg. Indigenous and Culturally and Linguistically Diverse (CALD) populations). (Chapter 2 & 3)

SWISH diagnostic audiology services are provided through the three tertiary paediatric hospitals which are the acute care hubs of the three paediatric services networks which cover the state (Greater Western, Northern and Greater Eastern and Southern). These hospitals are:

- The Children's Hospital at Westmead;
- John Hunter Children's Hospital, Newcastle; and
- Sydney Children's Hospital, Randwick.

Jim Patrick Audiology Centre is used as an overflow site for unilateral referrals in the Greater Western service network. Jim Patrick Audiology Centre is part of the Royal Institute of Deaf and Blind Children. (Chapter 4)

All referred newborns receive an audiological assessment. If a hearing loss is detected medical assessment and family support is available. A child who is diagnosed with hearing loss in the program could be referral to *Australian Hearing*, SWISH Hearing Support Services and other medical specialists. (Chapter 5)

If diagnosed as having hearing impairment, newborns are provided with options available for intervention services appropriate to the degree of hearing loss and specific diagnosis. Support is provided by the diagnosing Audiologist and SWISH Parent Support (Social Worker) in assisting parents to make the decisions. Parents are also consulted about early intervention, eg. hearing aids, cochlear implant and educational programs. (Chapter 6)

## USE OF THE GUIDELINE

The Guidelines of the Statewide Infant Screening – Hearing (SWISH) program are to be used by staff working specifically within the following roles of the NSW Statewide Infant Screening - Hearing program both in public and private sectors.

- Screening Staff (Chapters 2 and 3)
- Area Health Service SWISH Coordinators (Chapters 2 and 3)
- SWISH Diagnostic Audiologists (Chapter 4)
- SWISH Paediatricians (Chapter 5)
- SWISH Parent Support (Social Workers) (Chapter 6)

## REVISION HISTORY

Version	Approved by	Amendment notes
February 2010 (GL2010_002)	Deputy Director- General, Strategic Development	New document outlining the guidelines for the SWISH Program.

## ASSOCIATED DOCUMENTS

1. Statewide Infant Screening – Hearing (SWISH) Program - Guidelines

# **Guidelines**

## **Statewide Infant Screening – Hearing Program**

**2010**

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# 1. Introduction: Statewide Infant Screening – Hearing (SWISH) program

The NSW Statewide Infant Screening – Hearing (SWISH) program is an early hearing detection program for infants born or residing in New South Wales (NSW).

Early diagnosis and appropriate intervention for children with significant permanent hearing impairment can lead to significantly improved health, educational and social outcomes.

Significant permanent bilateral hearing loss has an incidence of 1 to 2 per 1,000 live births<sup>1 2 3</sup> (approximately 80 babies in NSW per year). Significant hearing loss is defined as being greater than 40dB in the better ear.

Hearing impairments can have varied aetiology including: perinatal infection; craniofacial abnormalities; syndromic aetiology; ototoxicity; hypoxia or auditory nerve damage and genetics.

The NSW Statewide Infant Screening - Hearing (SWISH) Program is aimed at identifying all babies born in NSW with significant permanent hearing loss by 3 months of age, and for those children to be able to access appropriate intervention with services outside of NSW Health by 6 months of age. Identification is achieved through offering universal hearing screening to all newborns.

This document sets out guidelines for the SWISH program including screening protocols and referral pathways. In doing so, the guidelines describe roles and responsibilities of staff; equipment and protocols for screening, coordination, audiological assessment and paediatric medical assessment.

Technology is available to diagnose hearing problems in the neonatal period. Early identification and intervention are important, with research suggesting that intervention commencing by 6 months of age may result in optimal speech and language development and minimise the need for ongoing special education.<sup>4 5 6</sup>

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<sup>1</sup> American Academy of Paediatrics: Task Force on Newborn and Infant Hearing (1999) Newborn and Infant Hearing Loss: Detection and Intervention. *Paediatrics*, 103 (2), 527.

<sup>2</sup> Smith, RJH, Bale Jr, JF, White, K R; (2001) Sensorineural hearing loss in children. *The Lancet*, 365, 88

<sup>3</sup> Thompson, D et al (2001) Universal Newborn Hearing Screening: Summary of Evidence. *The Journal of American Medical Association*, 286 (16) 2001-2010

<sup>4</sup> Fortnum, HM et al, (2001) Prevalence of permanent childhood hearing impairment in the United Kingdom and implications for universal neonatal hearing screening: questionnaire based ascertainment study. *British Medical Journal*, 323, 4

<sup>5</sup> Spivak, L and Sokol, H (2005) Beyond Newborn Screening: Early Diagnosis and Management of Hearing Loss in Infants. *Advances in Neonatal Care* , 5 (2) , 104-112

<sup>6</sup> Yoshinaga-Itano, C et al, (1998) Language of Early – and Later – identified Children with Hearing Loss *Pediatrics*, 102 (5), 1161 – 1171

Each Area Health Service (Area or AHS) have SWISH Coordinators who are responsible for implementing and managing the screening program across all facilities in their Area. This model allows SWISH Coordinators flexibility to meet unique needs in their Area Health Service. SWISH Coordinators have adopted innovative approaches to ensure maximum screening capture such as service agreements with private hospitals and employing dedicated screeners to meet local needs (eg. Indigenous and Culturally and Linguistically Diverse (CALD) populations).

SWISH diagnostic audiology services are provided through the three tertiary paediatric hospitals which are the acute care hubs of the three paediatric services networks which cover the state (Greater Western, Northern and Greater Eastern and Southern). These hospitals are:

- The Children's Hospital at Westmead;
- John Hunter Children's Hospital, Newcastle; and
- Sydney Children's Hospital, Randwick.

Jim Patrick Audiology Centre, North Rocks is used as an overflow site for unilateral referrals in the Greater Western service network. Jim Patrick Audiology Centre is part of the Royal Institute of Deaf and Blind Children.

All referred newborns receive an audiological assessment. If a hearing loss is detected medical assessment and family support is available. A child who is diagnosed with hearing loss in the program could be referred to *Australian Hearing*, SWISH Hearing Support Services and other medical specialists.

The SWISH Travel Assistance Scheme was established to reimburse parents for the cost of travel where they live more than 100km (one way) from one of the three tertiary diagnostic assessment centres listed above.

If diagnosed as having hearing impairment, newborns are referred to Australian Hearing, a Commonwealth funded hearing service, where they are provided with the different options available for intervention services appropriate to the degree of hearing loss and specific diagnosis. Referral to early intervention services is not undertaken by NSW Health.

Support throughout the diagnostic audiology process and during referral is provided by the diagnosing Audiologist and SWISH Parent Support (Social Worker) in assisting parents to make the decisions. The Parent Support (Social Worker) provides information to parents about early intervention, eg. hearing aids, cochlear implant and educational programs to assist in their decision making during this time.

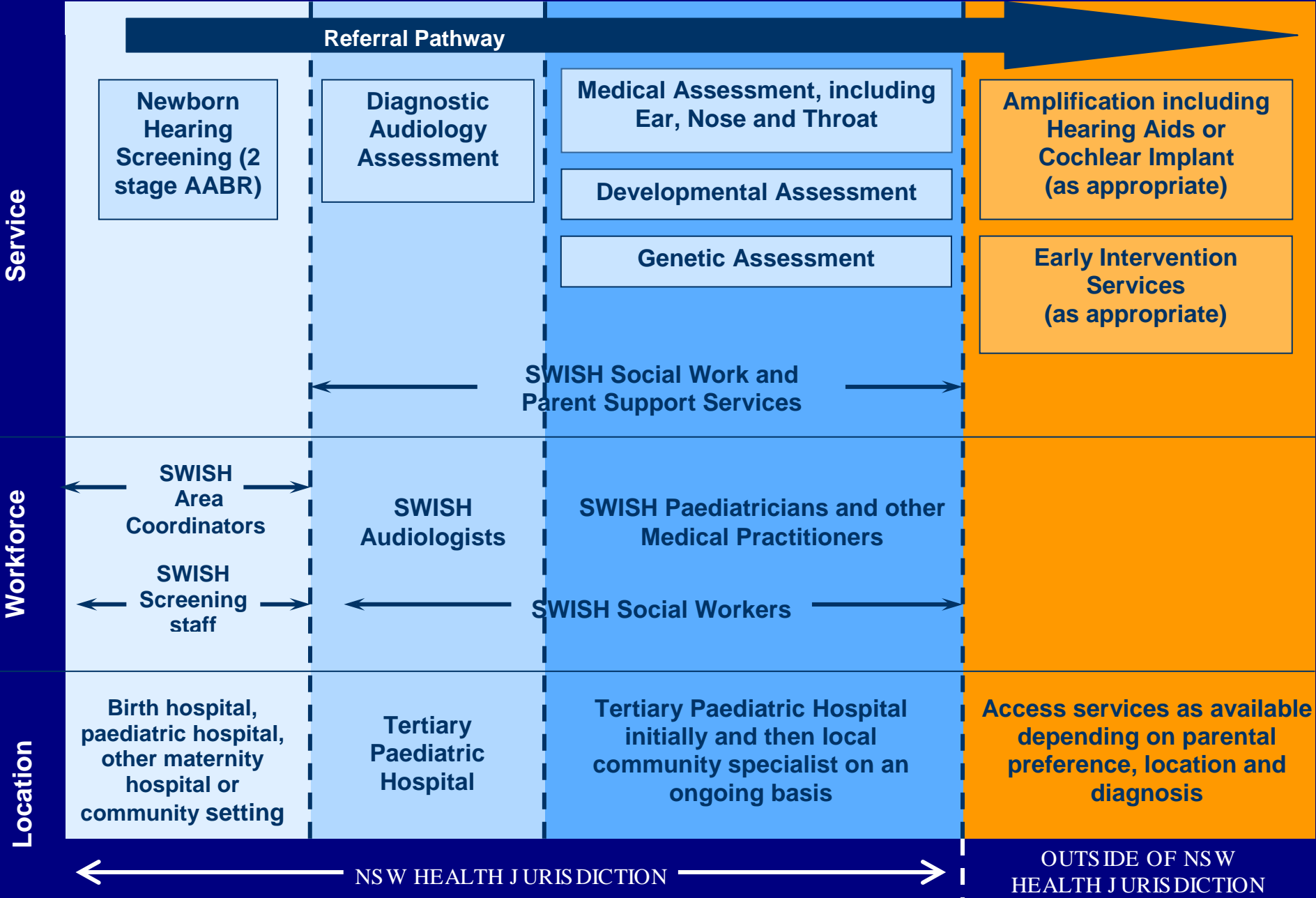
Figure 1 outlines the referral pathway in the SWISH program.

The program results in earlier diagnosis and treatment of hearing loss, which can lead to better outcomes for children and their families in terms of speech, language and social development.



# Statewide Infant Screening – Hearing (SWISH) Program

Figure 1



## 2. SWISH Personnel

The Statewide Infant Screening – Hearing (SWISH) program has a number of personnel specifically dedicated to performing tasks in the program, from screening to diagnosis and provision of support to parents.

### 2.1 Screening Staff

Newborn hearing screening is to be conducted by professionals who have received specialised training in newborn hearing screening and are competent with using the newborn hearing screening equipment

Area Health Services should have in place a quality process for assessing the ongoing competency of professionals conducting the hearing screening.

SWISH screeners are employed by each Area specifically to perform screening. Screeners may be referred to perform newborn hearing screening on infants either in maternity wards within hospitals, as outpatients in community health services or as home visits.

There are dedicated screeners that perform screening in large hospitals or places with high birth rates and part-time and casual screeners such as midwives, community health nurses and SWISH Coordinators who perform screening in smaller hospitals, community health centres, as outpatients or as a home visit.

SWISH screeners are responsible for the provision of infant hearing screening in various clinical settings that may include the postnatal ward, maternity unit or newborn care centre, delivery suite birth centre and outpatient clinic.

The SWISH screener performs an objective test with an Automated Auditory Brainstem Response (AABR) machine while the infant is resting or asleep. A waveform response of the infants' auditory pathway is generated when electrodes are placed on the infant's head and sound is introduced via ear tips or earphones. Waveforms of the result are generated and measured against a template to determine a pass or refer result. The current equipment used will perform this comparison automatically.

The screeners responsibilities are outlined below:

- Promote a professional, welcoming and caring environment endorsing a family centred approach to care
- Ensure patients and families retain their dignity, privacy and individuality at all times
- Set-up of equipment at commencement of shift. Ensure equipment is functioning. Ensure that there are adequate cleaning materials for equipment, consumables, maintain supplies of stationery and other information resources
- Identify babies for screening
- Liaise effectively with parents, team members and other health care professionals
- Obtain parental consent for the procedure (verbal or written consent) and relevant medical history from the parent

- Conduct the hearing screen
- Conduct the hearing screening of newborns within the Maternity Unit, Special Care Nursery, Neonatal Intensive Care Unit, Newborn Nursery Outpatient Department, Home Visit or Community Health Centre
- Adhere to hospital infection control guidelines
- Be sensitive to parent's responses, supportive and give accurate and standardised information about the screening process, which complies with the standards and procedures, outlined in the Area Standards Manual, and including providing specific SWISH information brochures
- Report babies for follow-up to the SWISH Area Coordinator
- Documentation of results in the medical record and Personal Health Record. Comply with standard protocols and data collection policies.
- Record clinical and screening information in the equipment database and complete statistical documentation
- Maintain up-to-date knowledge of procedures and policies relevant to the position
- Maintain the confidentiality of the babies and their families at all times
- Ensure the safety and security of equipment at all times and report any problems to the SWISH Area Coordinator
- Explanation of screening results to the parent
- Maintenance and care of equipment
- Advising the SWISH Area Coordinator of any issues, incidents, problems or concerns that arise during the screening session.

## **2.2 SWISH Area Coordinator**

SWISH Area Coordinators are AHS staff that oversee the screeners and refer infants who do not pass the two-stage AABR screening to diagnostic audiology. The SWISH Area Coordinators also provide support to parents during and after the screen.

The SWISH Area Coordinator is responsible for:

- Acting as a local contact for the NSW SWISH program
- Ensuring that all babies from within the AHS have been offered a hearing screening
- Following up newborns who have not received newborn hearing screening
- Arranging referral for audiological follow up for newborns who require audiological assessment following newborn hearing screening
- Providing support to parents in the period between newborn hearing screening and audiological assessment
- Maintaining newborn hearing screening performance indicators of the SWISH program
- Maintaining competency standards of screening staff
- Informing relevant professionals of the outcome of the screening process
- Communicating data related to the SWISH newborn hearing screening program as required
- Data collection and management and reporting
- Utilise the SWISH Budget providing resources effectively within the Area

Responsibilities outlined in Job Description:

- Recruitment, orientate and train hearing screening staff
- Training, development and performance management of hearing screeners
- Day to day management of screening staff and the screening program, training, development, ongoing education and evaluation including the hearing screening roster for each site
- Key contribution to local policy and guideline development within the program in conjunction with relevant hospital management and clinicians within the Area
- Maintain data base and develop tracking mechanisms for those babies who missed screening and those babies who require onward referral and management in accordance with Area Program guidelines
- Develop the systems for screening all babies who were born in hospital and follow up those babies not screened in hospital
- Provide screening services as required
- Develop local processes and ensure that families and babies who require diagnostic follow-up access audiological services in a timely manner
- Provide support to families, and in consultation with families play a major role in networking them to relevant pre and post diagnostic services
- Facilitate an intersectoral approach in offering options to families in conjunction with the Families NSW program
- Act as a resource person to families and health professionals on hearing health issues
- Maintain strong links with general practitioners, medical specialists, early intervention and coordination services including Australian Hearing and other government and non-government organisations
- Provide specialist education and information to hospital and community health staff
- Provide data on the results of screening to the local Area and to the Department of Health
- Implement quality improvement processes at the Area level
- Promote and advocate on behalf of the SWISH Program within the Area
- Maintain equipment standards including calibration of the screening units

### **2.2.1 SWISH Area Coordinator responsibilities between newborn hearing screening and diagnostic audiological assessment**

The period between the completion of newborn hearing screening and attendance at diagnostic audiology can be a stressful time for some parents. Some parents require minimal support during this period, whilst others will require intensive and ongoing support. SWISH Area Coordinators should assess the level of support required by each family taking into account:

- socioeconomic resources
- extra familial support systems
- special needs of parents, including disability, drug and alcohol and mental health issues

- cultural and linguistic factors
- distance and isolation of the family
- individual family's circumstances eg. number and ages of other children
- family history of hearing problems

SWISH Area Coordinators shall offer ongoing support to families throughout the period between newborn hearing screening and audiological assessment dependent upon the needs of individual families. This support may include:

- referral to appropriate counselling and support services, eg. SWISH audiologists or SWISH parent support services (Social Workers)
- referral to appropriate AHS based services
- arrangement of travel or accommodation
- assistance with access to SWISH travel assistance funds
- providing additional information regarding hearing loss or services
- maintaining regular contact with the family to monitor anxiety levels

SWISH Area Coordinators should inform parents that they are able to contact them at any time during the period between newborn hearing screening and audiological assessment if they require additional information or support.

The SWISH Area Coordinator shall inform the SWISH Audiologist at the time of making the referral for the infant to have diagnostic audiology, if the family may require ongoing support during the period between newborn hearing screening and audiological assessment.

### **2.3 SWISH Audiologist**

The SWISH Audiologists perform diagnostic testing on infants that have been referred from the two-stage screening process. The SWISH Audiologist provides incidental support to parents during and after the diagnostic process.

SWISH Audiologists are responsible for:

- Acting as an audiological contact for the NSW SWISH program
- Ensuring that all babies referred for diagnostic audiology assessment following SWISH newborn hearing screening receive audiological assessment
- Conducting diagnostic audiological assessment of SWISH infants
- Arranging referral to appropriate services for infants identified by audiological assessment as requiring further referral
- Providing support and referral options to parents in the period between newborn hearing screening and audiological assessment
- Providing support and referral options to parents in the period between audiological assessment and accessing early intervention services
- Maintaining diagnostic audiology performance indicators for the SWISH program
- Informing relevant professionals of the outcome of the diagnostic audiology process. Relevant professionals include the Paediatrician, General Practitioner, Medical Specialists, SWISH Coordinator, Hearing Support Services, Australian Hearing and the Early Childhood Centre
- Communicating data related to the audiology program as required

### **2.3.1 SWISH Audiologist responsibilities between referral from SWISH Coordinator and performing diagnostic assessment**

In this transition period the SWISH Area Coordinator and the SWISH Audiologist at the location where the referral is being made must be in contact with each other and present a coordinated support system for families.

During the initial contact with the parents the SWISH Area Coordinator is to organise the referral to diagnostic audiology. The SWISH Audiologist provides the parents with an appointment time and information regarding the diagnostic audiology processes.

The SWISH Audiologists should provide a referral to the SWISH parent support service (Social Worker).

SWISH Audiologists should inform parents that they are able to contact them at any time during the period between newborn hearing screening and audiological assessment if they require additional information or support.

#### **SWISH parent support staff (Social Workers)**

SWISH parent support staff (Social Workers) provide support to parents in the time during the diagnostic process and following confirmation of hearing impairment.

SWISH parent support staff (Social Workers) are responsible for:

- Acting as parent support contact for the NSW SWISH program in AHS
- Ensuring that all babies referred for parent support services receive these services
- Providing parent support services to families of SWISH infants at any stage during the pathway from screening to intervention
- Arranging referral to appropriate services for infants identified as requiring further referral
- Maintaining SWISH parent support performance indicators for the SWISH program

### **2.4 SWISH Paediatricians**

Paediatricians work within the SWISH program to provide medical assessment to infants who have been diagnosed with a hearing loss in the SWISH program. The medical assessment usually includes a genetic assessment.

SWISH Paediatricians are responsible for:

- Acting as a paediatric medical contact for the NSW SWISH program
- Ensuring that all babies receive paediatric medical assessment when referred following SWISH audiological assessment
- Conducting paediatric medical assessment of SWISH infants
- Arranging referral to appropriate services for infants identified by medical assessment as requiring further referral
- Informing relevant professionals of the outcome of the paediatric medical assessment process

- Communicating data related to the paediatric medical assessment to the Department of Health as required

## **2.5 SWISH Hearing Clinics**

SWISH Audiologists, parent support (Social Workers) and Paediatricians work within the Hearing Clinics at each of the diagnostic hospitals. These clinics provide a framework for the diagnosis, support and medical assessment of infants with confirmed hearing impairment.

These clinics are called:

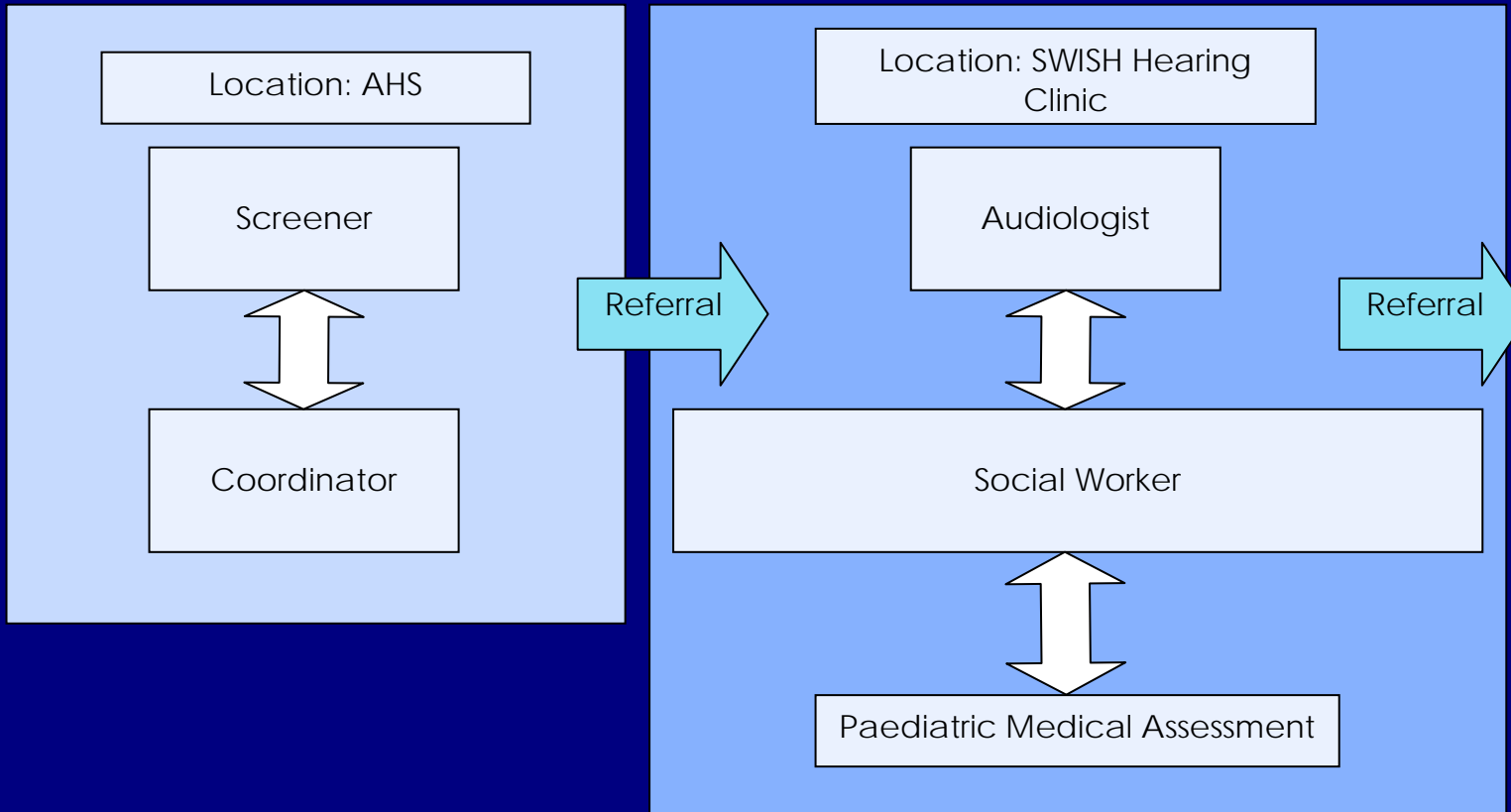
- Hearing Assessment Centre, Sydney Children's Hospital
- The Deafness Centre, The Children's Hospital at Westmead
- Baby Hearing Clinic, John Hunter Hospital

Figure 2 describes the SWISH Support Pathway.

Each Area Health Service should develop and implement checklists for their screeners and SWISH Area Coordinators to follow. This ensures that the correct protocol has been followed for each screen. A template for a screener checklist and a SWISH Area Coordinator checklist is located at Appendix 2.

# SWISH Support Pathway

Figure 2



**Outside of NSW Health Jurisdiction**

Australian Hearing Early Intervention

**Amplification**

Screeners	Coordinators	Referral	Audiologist	Social Worker	Paediatric
Screeners provide support to parents during the process of screening. They liaise with the SWISH Area Coordinator. Screeners provide literature as appropriate, eg Screening Pamphlets.	Area SWISH Coordinators continue providing support and explain the results further to parents. SWISH Area Coordinators can refer patients to public Social Workers (other than specific SWISH Social Workers.)	When an infant is referred to diagnostic audiology it is the role of the SWISH Area Coordinator to liaise with the SWISH Social Workers and Audiologist to ensure that the parents and children are well supported in their journey.	The Audiologist provides support and guidance before, during and after the diagnostic audiological assessment.	SWISH Social Workers are concerned with the emotional well-being of families before, during and after diagnosis. SWISH Social Workers also work with Area Coordinators to support families in the difficult time between referral and diagnosis.	SWISH Paediatric Medical assessment occurs at the Tertiary Paediatric Hospital. This service works in conjunction with the SWISH Social Workers and Audiologists to provide support to the parents and children.

**El & Amplification**

Early Intervention and Amplification services (such as device fitting and management and habilitation) are outside of the SWISH program.



## 3. Screening

### 3.1 Overview

The screening service of the program involves the offering of screening to all newborns in NSW using 2-stage Automated Auditory Brainstem Response (AABR) technology. 2-stage AABR testing means that if a refer result is obtained for the initial screen a second screen is performed to confirm the results. If newborns do not pass the second stage of hearing screening they are referred for diagnostic audiological assessment.

Parent/carer brochures describing the SWISH program are available in English and 20 other community languages, in both paper form and via the NSW Health website.

The screen is to be conducted:

1. by a competently trained screener
2. on a well (medically stable) infant between birth and one month old (corrected age)<sup>7</sup>, however, screening can be conducted up to three months (corrected age) if screening can not be done on the infant before one month. Manufacturers' guidelines state that screening can be undertaken up until 6 months age on the machines.
3. as determined by medical condition. For example, an infant with jaundice can not be screened until the condition has resolved, and in consultation with a Paediatrician.

The screen should be conducted using physiological assessment technology in accordance with the equipment manufacturer's instructions. For more information regarding selecting babies for screening please see Appendix 1.

Equipment used within the SWISH program is to be procured under specific contracts that have been approved by the NSW Department of Health.

### 3.2 Screening Pathway

This section describes the screening pathway through the SWISH program.

SWISH screening is a two-stage screening program using automated auditory brainstem response (AABR) technology. This means that if the initial screen returns a "refer" result, a second screen is performed to validate the initial result. This second screen must be performed more than 24 hours (next day) or thereafter the initial screen.

Two pathways have been developed due to NICU babies having a higher risk of auditory neuropathy or other neurological problems that are more likely to be picked up by AABR.

The estimated prevalence of, severe or profound bilateral permanent hearing loss is:

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<sup>7</sup> "Corrected age" refers to the age an infant born prematurely would be if born on the determined due date.

- 1-2 per 1000 (well babies)<sup>3 4 5</sup>
- Increased in those with risk factors for hearing loss
- 10-20 times higher in the NICU population (1-2 per 100 newborns in NICU)<sup>8</sup>

### 3.3 Selecting babies for Newborn Hearing Screening using AABR Technology

The Joint Committee on Infant Hearing, (2007) Year 2007 Position Statement: Principles and Guidelines of Early Hearing Detection and Intervention Programs states that:

1. All infants should have access to hearing screening using a physiologic measure at no later than 1 month of age (corrected).
2. All infants who do not pass the initial hearing screening and the subsequent rescreening should have appropriate audiological and medical evaluations to confirm the presence of hearing loss at no later than 3 months of age.
3. All infants with confirmed permanent hearing loss should receive early intervention services as soon as possible after diagnosis but at no later than 6 months of age. A simplified, single point of entry into an intervention system that is appropriate for children with hearing loss is optimal.<sup>9</sup>

Not all babies are suitable for newborn hearing screening using AABR technology. Exclusion criteria for the use of AABR technology on newborns are developed by the manufacturers of the AABR equipment. Area Health Services (Areas) should ensure that they follow the manufacturers' exclusion criteria.

International benchmarks for universal screening programs state that infants can be screened up until one month of age (corrected). NSW Policy is that screening should occur up to one month (corrected) age however infants can be screened up until three months of age if they are not well enough until this time. The manufacturers' guidelines state that infants can be screened with their machines until six months of age.

Babies with the following adverse conditions are at very high risk of hearing impairment:

- Atresia (absence of ear canal) or microtia (incomplete or underdeveloped pinna) – these provide an indication of hearing loss of some degree
- Bacterial or Viral Meningitis (confirmed or suspected)<sup>10 11</sup>

<sup>8</sup> Thompson, D et al (2001) Universal Newborn Hearing Screening: summary of evidence. *The Journal of the American Medical Association*, 286(16), 2001

<sup>9</sup> Joint Committee on Infant Hearing, (2007) Year 2007 Position Statement: Principles and Guidelines of Early Hearing Detection and Intervention Programs, *Paediatrics*, 120 (4), 900 - 901

<sup>10</sup> Richardson, M P et al (1997) Hearing Loss during bacterial meningitis. *Archives of Disease in Childhood*, 76 (2), 134 - 138

Babies with these conditions are not appropriate for screening and should be referred directly for early audiological assessment by the treating paediatrician.

There are also situations where AABR screening may be considered inappropriate, for example when an infant has severe jaundice or has a skin condition. In cases such as this, screening should be undertaken when the condition has resolved or the infant should be referred to diagnostic audiology for assessment.

There are also a number of risk factors for late onset or progressive deafness. For these cases the parents should be aware of the potential risk that their infant will develop hearing loss and consult with their paediatrician or general practitioner for testing at a later stage.

Refer to Appendix 1 for Principles for Selection of Babies for Newborn Hearing Screening using AABR.

### **3.4 Informing parents and guardians about the SWISH screening**

Parents should initially be informed about the SWISH program and newborn hearing screening during pregnancy as a part of antenatal care. Parents should be provided with the written information regarding the screening, for example the pamphlet “Why does my baby need a hearing check?” (Appendix 3).

The information should be discussed with parents or guardians either in a group situation, such as antenatal classes or on a one on one basis.

Directly prior to conducting the newborn hearing screening, screening staff must verbally inform the parents regarding the newborn hearing screening process, and ensure that they have received written information regarding the newborn hearing screening.

### **3.5 Consent**

Prior to conducting the newborn hearing screen, screening staff must verify that parents have received written and verbal information regarding the screen, that they understand what will happen during the screening and that they consent to their newborn being screened. A template screener checklist (Appendix 2) has been developed to ensure that the received consent is recorded appropriately.

Parents may refuse to provide consent for their newborn’s hearing screening. Area Health Services should devise a protocol for parental refusal of newborn hearing screening for their baby. It should include parents being properly informed about the screen and its importance, and an offer of the option of contacting the Coordinator of the SWISH program to answer any questions

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<sup>11</sup> Fact Sheet: “Meningitis and Hearing Loss” Deafness Research UK.  
<http://www.deafnessresearch.org.uk/factsheets/meningitis-and-hearing-loss.pdf> Accessed 24 March 2009

they may have regarding the screening or should they change their mind in the near future.

Parents who refuse the screen should be made aware of the expected normal hearing milestones (printed on the reverse of the “Why does my baby need a hearing check?” brochure) and advised of the appropriate professional to contact if they have concerns about their baby’s hearing in the future.

Cases of non-consent must be documented and signed by the parent in the baby’s medical file. Refusals should also be documented in the newborn’s Personal Health Record.

A template refusal letter and form for the parents or guardians of the baby has been developed and is located at Appendix 4.

### **3.6 Timing of the newborn hearing screening test**

Newborn hearing screening should optimally be conducted in the first days of life in the maternity unit. If this is not possible, then newborn hearing screening should be performed in the first few weeks of life. International benchmarks indicate that newborn hearing screening should be completed within the first month of term birth.

The period of hospitalisation provides the optimal opportunity for conducting the hearing screening. If the baby is discharged prior to the newborn hearing screening process being completed, the Area should have a protocol in place for conducting outpatient newborn hearing screening for these babies.

### **3.7 Conducting the Screen**

Parents should also be advised of the possible outcomes of the newborn hearing screening, and the implications of these outcomes.

The hearing screening should be conducted in both an acoustically and electrically quiet area, in order to achieve optimal screening results.

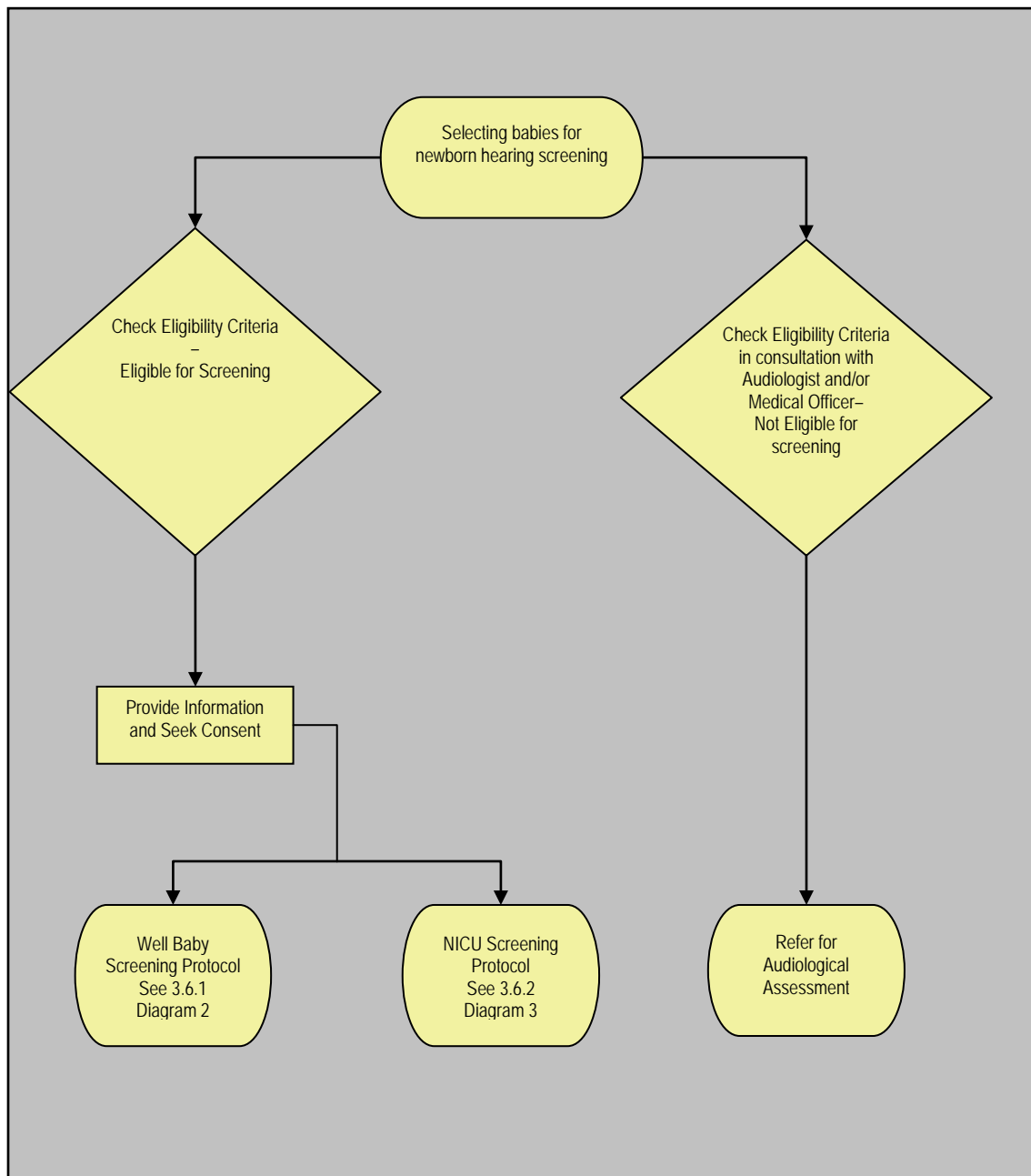
Consumables used when performing hearing screening are designed to be single use items. Items should not be reused.

When entering patient data into newborn hearing screening units it is essential that all relevant information is completed for each newborn.

### **3.8 Screening Pathway Overview**

This is the pathway that all infants born or residing in NSW are to take. It provides the pathway for infants’ eligibility, the consideration of risk factors in determining which screening pathway, either Well-baby or NICU, should be taken.

**Diagram 1**

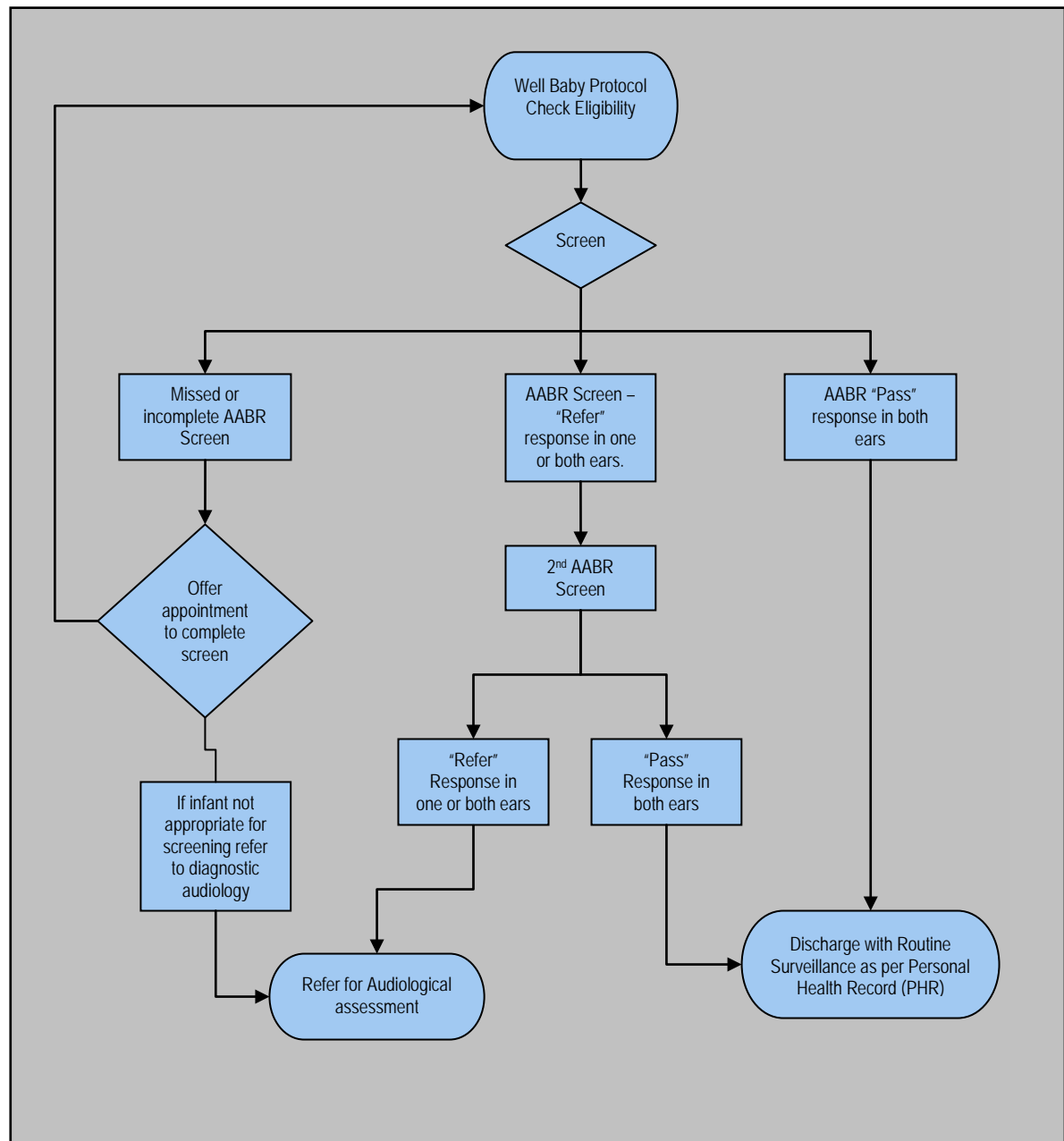


### 3.8.1 Well Baby Protocol

This protocol covers screening for well babies or infants who have not been resident in the neonatal intensive care unit (NICU) for more than 48 hours continuously.

The protocol covers well baby screening in hospital and community based services.

**Diagram 2**



**Scope:**

- This pathway covers screening for hearing impairment in newborn babies in "transitional care" or who have not been resident in the

neonatal intensive care unit (NICU) for more than 48 hours continuously

- The pathway covers both well baby screening in hospital and community based services

Out of scope:

- Babies resident in the NICU for more than 48 hours continuously should be screened using the NICU protocol

Hospital based services:

- Screening is usually carried out by screeners specifically employed to carry out hearing screening, technical assistants, as well as midwives, nurses and community health workers
- Ideally complete screening prior to discharge from hospital
- If the process is not completed in hospital an outpatient appointment or clinic appointment or home visit is required to complete the process
- Aim is to complete screening by age four weeks (one month)
- Screening should not be performed on babies less than gestational age 34 weeks

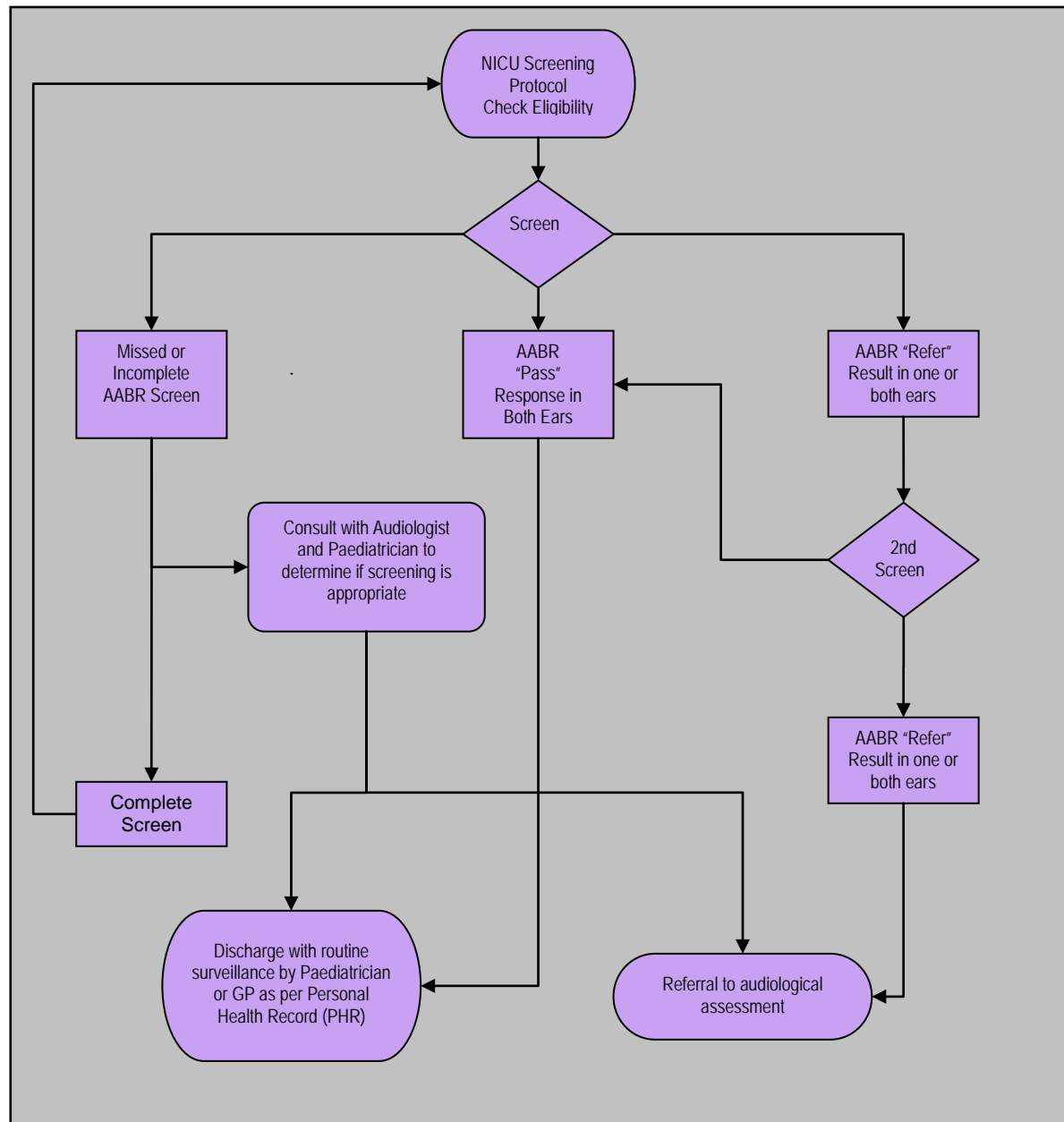
Community based services:

- Screening is usually carried out by a trained technical assistant, midwife, nurse or community health worker

### 3.8.2 NICU Protocol

Infants who are admitted to Neonatal Intensive Care Units (NICU) are at a higher risk of moderate, severe, or profound hearing impairment (1-2 per 100 newborns). Screeners are to consult with the infants Paediatrician regarding any decision making on the screening and ongoing surveillance.

Diagram 3



Scope:

- This pathway covers neonatal intensive care (NICU) protocol for hearing impairment in newborn babies



In hospital based services, screening in NICU is performed by one of the trained hearing screeners, technical assistants, as well as, midwives, or NICU nurses

Timing:

- Ideally complete screening as close to discharge as possible while the baby is in hospital
- Wherever possible, baby should be well and any major medical or drug treatment completed
- If the process is not completed in hospital, an outpatient or clinic appointment or home visit is required to complete the process, usually within one visit
- Aim to complete screening by 44 weeks gestational age (4 weeks corrected age)
- Screening should not be performed on babies less than 34 weeks gestational age

### 3.9 Hearing screen results

Newborn hearing screening results are available immediately following the conclusion of the screen. Parents should be informed of the result.

After each screen the screener explains the results of the screens to parents, and specifies if it was a pass, a unilateral (one ear) or bilateral (both ears) refer, an inconsistent or an incomplete result.

#### **Results of AABR Screen:**

Three types of response are usually achieved

- AABR “pass” response obtained in both ears
- AABR test performed and “refer” response obtained in one or both ears.
- Inconsistent screening result from both screens (ie left pass/right refer, left refer/right pass)
- Screen is missed or incomplete

An inconsistent screening result occurs when the first screen returns a result and the second screen reverses or changes that result. For example the first screen can return a refer result in one ear (left refer, right pass) and when the infant is screened again the results are reversed (left pass, right refer). Results for both ears are to be recorded, even though this may be a referral for one or both ears.

SWISH policy for missed and incomplete screens is that:

- Babies under age 3 months (corrected age) should be offered an appointment to complete the screen from whichever stage AABR had been previously reached
- Babies over 3 months should be considered for referral to audiology at an appropriate age
- In the event of parental or professional concern, diagnostic assessment should be considered.

If a second screening is required according to the SWISH program protocol the parents should be informed of the refer result and be given the brochure “Why does my baby need a repeat hearing screen?” (Appendix 3).

The *2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs* states that “for re-screening, a complete screening on both ears is recommended, even if only 1 ear failed the initial screening.”<sup>12</sup>

If the second screen is also a refer result, the newborn requires audiological follow up. The screener should provide the family with the brochure “Why does my baby need a diagnostic assessment?” (Appendix 3) and then inform

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<sup>12</sup> Joint Committee on Infant Hearing, (2007) Year 2007 Position Statement: Principles and Guidelines of Early Hearing Detection and Intervention Programs, *Paediatrics*, Vol. 120, No. 4, p898

the SWISH Area Coordinator so that the process for obtaining a diagnostic assessment can begin.

Referral should be made immediately upon receiving the results and the appointment should be within three weeks of completing the screen.

The possible causes of the infant not passing newborn hearing screening should be clearly explained to the parents. The SWISH Area coordinator should also clearly explain the process that will be followed in order to fully assess the hearing status of the infant.

Attached at Appendix 5 is a protocol for the explanation of results to parents/carers of infants screened within the program.

### **3.10 Follow up/Referral**

The SWISH Area Coordinator has responsibility for organising audiological follow up for newborns identified by screening as requiring further investigation. This audiological follow up should be through one of the Child Health Network tertiary paediatric hospital audiological units (or other specialist paediatric audiological service). The referral is to be made by the SWISH Area Coordinator, in conjunction with a General Practitioner or Medical Specialist, not independently of them.

If a baby is referred unilaterally (in one ear), the SWISH Area Coordinator must ensure that the baby is referred to one of the three diagnostic audiology centres. There is anecdotal evidence that a small number of infants who are referred unilaterally for diagnostic assessment are identified with bilateral hearing loss.

The SWISH Area Coordinator will liaise with the newborn's General Practitioner and Paediatrician to inform them of the referral. The newborn's Early Childhood Health Centre should also be informed of the referral.

#### **Babies that have passed screening**

When screening is completed and the infant has passed, no further follow-up is formally required but services should be responsive to any parental, professional concern about hearing and able to offer appointment for audiological assessment at any age.

Routine surveillance:

- Some babies may develop problems which may affect hearing after the screen or other risk factors may come to light – such babies should be referred for assessment at any stage to audiology for an age appropriate assessment
- Bacterial meningitis and temporal bone fracture:
  - If these conditions occur at any point in infancy or childhood after the screen, then, on recovery, immediate referral should

be made to audiology for an age appropriate audiological assessment within 4 weeks of discharge from hospital

Parental or professional concern:

- Parental concern about an infants hearing or development of auditory or vocal behaviour should always be taken seriously
- All professionals who may be in contact with a child should feel able to refer to audiology if there is parental concern, or if they themselves are concerned

These children should be offered a hearing assessment as soon as possible carried out by an appropriately trained team

### 3.11 Documentation

The completion and results of the SWISH newborn hearing screening must be documented in both the baby’s medical file and in their Personal Health Record. A copy of the form, as it appears in the baby’s Personal Health Record is located below.



#### Statewide Infant Screening – Hearing (SWISH)

To be completed by the screener.

<b>Area Health Service</b>		
Screened at (place)		
Screened on (date & time)		
Screened by		
Screener's name (print)		
Screener's signature		
<b>Outcome</b>		
Pass	<input type="checkbox"/> Left	<input type="checkbox"/> Right
Repeat screen required	<input type="checkbox"/> Left	<input type="checkbox"/> Right
Repeat screen outcome	<b>L</b> pass / refer	<b>R</b> pass / refer
Refer to Audiologist	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Area Coordinator tel.		

Figure 5 Personal Health Record Form

### **3.12 Data Collection and Management**

The purpose of data collection and management is to facilitate better planning and management of the service, follow-up potential screening errors and to provide data for evaluation and monitoring.

Areas are required to collect monthly data related to the SWISH newborn hearing screening program. This data should be used to monitor the performance of the program at an AHS and statewide level. The data should also be used in the day to day operation of the program to ensure that all babies are offered newborn hearing screening services, and are referred to diagnostic audiology services within the required timeframes.

Areas should develop appropriate data collection and management systems which allow for easy extraction of information whilst maintaining the relevant electronic information privacy policies. All data collected by the SWISH program should be securely managed both for the integrity of the data and for the privacy of the individuals involved.

Areas are required to report the data from their SWISH newborn hearing screening programs on a monthly and ongoing basis to the Department of Health for collation of the statewide data. All data submitted to the Department of Health should be de-identified, numerical and consistent with the data reporting requirements.

### **3.13 Management of babies with risk factors**

At the time of newborn hearing screening, a thorough history should be taken, including identifying if the newborn has risk factors for late onset or progressive hearing loss.

Newborns identified as having risk factors for late onset or progressive hearing loss should receive ongoing management of their hearing status. Area Health Services should develop policies and procedures for managing newborns with identified risk factors for progressive and late onset hearing loss commensurate with the hearing resources available within their AHS.

Appendix 6 details further information related to identifying risk factors for late onset or progressive hearing loss and outlines guidelines for the ongoing management of these newborns.

#### **Risks Requiring Surveillance**

The following risks require ongoing surveillance by a medical physician such as a Paediatrician or General Practitioner according to the Joint Committee on Infant Hearing 2007 Position Statement, please refer to Appendix 6 for further details.

An audiological assessment should be performed in the following circumstances:

- Parental or professional concern about the infant's hearing, development of auditory or vocal behaviour
- Any craniofacial abnormalities

- Family history of permanent sensorineural hearing loss (SNHL) from early childhood (in parents and siblings only)
- NICU child who had intermittent positive pressure ventilation for more than 5 days
- Jaundice or hyperbilirubinaemia requiring exchange transfusion
- Neurodegenerative or neurodevelopmental disorders
- Ototoxic drugs with levels outside the therapeutic range
- Proven or possible congenital infection due to one of the following:
  - Toxoplasmosis
  - Rubella
  - Cytomegalovirus
  - Herpes

## 4. Audiological assessment

### 4.1 Overview

Audiological Assessment should be offered to all newborns who:

1. receive a 'refer' result in either or both ears following the completion of the second screening event.
2. are unable to be screened due to screening exclusion criteria.

Dedicated SWISH Audiological Assessment services are offered through the three tertiary paediatric hospitals associated with the program, which are:

- Sydney Children's Hospital, Randwick;
- The Children's Hospital at Westmead; and
- John Hunter Children's Hospital, Newcastle.

If timely services are unable to be offered by these services, or an alternate paediatric audiological service, such as Jim Patrick Audiology Centre, North Rocks, is used due to family preference or geographical location, a referral may be made to an alternate paediatric audiology service, eg. an out of state audiological centre. These patients would not be eligible for travel and transport assistance from the SWISH program.

Referrals for audiological assessment should be made by the SWISH Area Coordinator in consultation with the relevant paediatric audiologist. The timeframe from referral of an infant to the infant attending an audiological assessment appointment should not exceed three weeks. The SWISH program performance indicator is for diagnosis of hearing impairment to be confirmed by three months of age.

### 4.2 Seeking Consent

The SWISH Area Coordinator shall ask the infant's parent/guardian for consent to make a referral to diagnostic audiology and for information to be released, prior to a referral for audiological assessment

The SWISH Area coordinator will supply the audiological service with comprehensive referral information so that the audiological service can contact the family to organise an assessment appointment.

If further referral is required following audiological assessment the audiologist should obtain consent for releasing the infant's information to other clinical services and organisations (eg. *Australian Hearing*).

Parents/guardians may refuse audiological assessment on behalf of their infant. If a parent/guardian refuses audiological assessment (either via active refusal or via passively refusing by repeatedly failing to attend scheduled audiological assessment appointments) the following steps should be taken by the audiology service:

1. Information should be provided to the parent/guardian regarding the relevance and importance of audiological assessment, and

assessment re-offered, either in the immediate future or at a delayed interval

2. If a parent passively refuses attendance, the family will be referred to the SWISH parent support (social worker) service to evaluate if extra assistance is required for the family to attend diagnostic audiology services. The relevant SWISH Area Coordinator may also be contacted to determine if assistance to attend an audiological appointment can be offered by the SWISH Area Coordinator
3. If a parent ultimately refuses to attend for diagnostic audiological assessment the infant should be referred back to the GP/Paediatrician for local monitoring and follow up if available

Areas are responsible for documenting refusals and developing protocols for management of infants whose parents refuse diagnostic audiology services dependant upon the audiological services available within their Area Health Service.

### **4.3 Timing of audiological assessment**

SWISH Audiologists are to confirm with SWISH Area Coordinators within 24 hours that they have received the referral for diagnostic audiological assessment. If no contact is made within this time the Coordinator is to follow up directly. SWISH Area Coordinators are to remain in contact with parents/guardians during this time to ensure that support is provided.

A waiting time of no longer than three weeks should be maintained between an infant being referred for diagnostic audiology assessment, and the initial assessment appointment that is offered. On occasion infants will require multiple audiology assessment appointments to confirm a diagnosis of permanent hearing impairment. The SWISH performance indicator is for diagnosis of hearing impairment to be completed by three months of corrected age.

Where possible, audiology assessment appointments for families who need to travel long distances should be scheduled to minimise the need for the family to have an overnight stay, thus reducing the amount of SWISH travel assistance funding which may need to be provided. Only one return journey for diagnostic assessment is paid for under the SWISH travel assistance program.

### **4.4 Hearing loss and your baby: the next step**

This resource is provided by the Audiologist to the parents of the infant who has been diagnosed with a hearing loss in the SWISH program. The resource includes information on hearing loss, where to find further information, a list of professionals that may be involved in their infants care,

### **4.5 Documentation**

The results of the audiological assessment shall be documented in a medical file, as appropriate to the paediatric audiology service. Any reports written as



a result of the assessment shall be made available to all relevant service providers by the audiology service. Consent from the parent/guardian should be required for these reports to be released.

The resource *Hearing Loss and Your Baby: The Next Step*, includes a section to be inserted into the baby's Personal Health Record.

#### **4.6 Results of the audiological assessment**

Once an audiological diagnosis has been confirmed through audiological assessment, this diagnosis should be immediately communicated to the infant's parent/guardian. The results of the audiological assessment should be presented to the infant's parent/guardian in both oral and written forms, and additional information packages related to hearing impairment should also be provided to parents. SWISH parent support (Social Worker) services should also be utilised when discussing the results of a SWISH diagnostic audiology assessment with an infant's parent/guardian.

Interpreters should be used to provide results if the parents are from a Culturally and Linguistically Diverse (CALD) background.

#### **4.7 Follow up**

Once an audiological diagnosis has been confirmed the results of all assessments should be communicated to all relevant parties so that appropriate follow up can be organised; this includes infants who are diagnosed with no significant hearing impairment or transient hearing impairment.

The SWISH audiology service should organise all appropriate referrals for infants requiring further investigation, medical assessment and intervention to the appropriate service for the infant's individual circumstances.

Referral agencies may include:

- Medical and developmental assessment services eg. SWISH medical (Paediatrician) services
- Hearing service providers eg. *Australian Hearing*
- SWISH Hearing Support to discuss options for early intervention options

Verbal consent should be sought from the infant's parent/guardian prior to these referrals being made.

The SWISH audiology services in the Area Health Services should ensure that there are appropriate quality protocols in place for referring infants for further assessment or intervention by external agencies to NSW Health.

#### **4.8 Data collection and management**

SWISH Audiology services are required to collect data regarding the SWISH program infants offered audiological assessment. This data should be used to monitor the performance of the program at an audiological service and statewide level. The data should also be used in the day to day operation of the audiological service to ensure that all babies referred from screening are offered diagnostic audiology services, and that they subsequently attend for diagnostic audiology services within the required timeframes.

Audiological services should develop appropriate data collection and management systems which allow for easy extraction of information whilst maintaining the relevant electronic information privacy policies. All data collected by SWISH audiology services should be securely managed both for the integrity of the data and for the privacy of the individuals involved.

Audiological services are required to report the data from infants referred as a result of the SWISH newborn hearing screening program on a monthly and ongoing basis to the Department of Health for collation of the statewide data. All data submitted to centralised agencies should be de-identified, numerical and consistent with the data reporting requirements.

## **5. Parent support services**

### **5.1 Overview**

SWISH parent support services are offered via dedicated counselling staff (generally social workers) with a focus on hearing related issues. Social workers providing SWISH parent support services are located in the same three tertiary paediatric hospitals as the SWISH audiology services and SWISH paediatric medical assessment services, ie. The Children's Hospital at Westmead, Sydney Children's Hospital, Randwick and John Hunter Children's Hospital, Newcastle.

Examples of the types of support the SWISH parent support services may provide include:

- practical assistance during the pathway from newborn hearing screening to accessing early intervention
- counselling services
- referral to appropriate agencies
- assistance to access financial support

SWISH parent support services are available to any infant who has accessed the SWISH program, although generally parent support services are accessed onwards from the time of an infant not passing newborn hearing screening.

### **5.2 Referral to parent support services**

Each SWISH parent support service should develop a referral system to ensure capture of all families who require the assistance of SWISH parent support services. Generally, families will be referred to the SWISH parent support services via another SWISH professional (eg. SWISH Area Coordinator, SWISH Audiologist or SWISH Paediatrician), although self-referrals may also be initiated.

### **5.3 Timing and provision of parent support services**

SWISH parent support services should be provided as soon as possible after a referral for parent support is received. The SWISH parent support service should conduct ongoing evaluation of what type of parent support is appropriate for and required by each individual family, eg, parents of infants who have been diagnosed with a hearing impairment.

Each SWISH parent support service is responsible for developing a service delivery model which is appropriate to the needs of the families for which it provides services and commensurate with the resources available. The service delivery models should incorporate consideration of:

- the cultural and linguistic needs of families
- the socioeconomic status of families accessing their service
- the special needs of individual families

- the geographical location for families to access the service
- the support requirements of individual families.

For example services may be delivered via multidisciplinary clinic, individual consultation, home visiting, phone contact, video teleconferencing or other appropriate service delivery model dependant upon the needs of families and the resources available.

Examples of the type of parent support which may be provided by the SWISH parent support service include:

- arranging travel and/or accommodation for audiological or paediatric medical assessment
- assisting families to access funding through the SWISH Travel Assistance Scheme
- informational counselling regarding hearing, medical or intervention issues
- grief or crisis counselling at the time of audiological or medical diagnosis
- attending subsequent medical, hearing or intervention related appointments with the family
- referring families onto appropriate services including support groups
- assisting with access to eligible disability funding
- collaborating in multidisciplinary assessment of infants
- psychosocial assessment to identify any other concerns that may effect the family's ability to adequately support the child diagnosed with hearing loss eg. child protection, mental health issues and to identify appropriate support

Families are able to access SWISH parent support services on an ongoing basis until SWISH parent support is no longer required by the family, or the role of parent support is undertaken by another more appropriate service provider, eg. early intervention agency or hearing device fitting agency.

It is important to note that not all families will require the same level of parent support to be provided, and that SWISH parent support services have a level of flexibility in order to meet the needs of all families.

#### **5.4 Documentation**

Any contact made with families by the SWISH parent support services, including referral to other agencies, shall be documented in a medical type file, as appropriate to the service.

## 6. SWISH Travel Assistance Scheme

If diagnostic audiological assessment is needed as follow up of screening results or due to screening being unsuitable prior to discharge, assistance is available through the SWISH Travel Assistance Scheme for the infant and one accompanying parent/guardian.

To be eligible for assistance under the SWISH Travel Assistance Scheme the diagnostic assessment must be performed at one of the three following centres in NSW:

- The Children's Hospital at Westmead;
- John Hunter Children's Hospital, Newcastle; and
- Sydney Children's Hospital, Randwick

Follow up assessment for bilateral refers, unilateral refers and direct refers are eligible for travel assistance under the SWISH Travel Assistance Scheme.

The SWISH Travel Assistance Scheme has been incorporated under the *Transport for Health Policy*, however the conditions for SWISH Travel have not changed.

The eligibility criteria for obtaining financial assistance under the scheme is:

- Distance – travel at least 100km (one way) from their place of residence to the assessment facility; and
- Referral – a formal referral must be made by the SWISH Area Coordinator to one of the three identified tertiary assessment facilities.

Further information regarding the Transport for Health framework can be found in the *Transport for Health policy directive PD2006\_068*.

## Appendix 1

### Principles for Selection of Babies for Newborn Hearing Screening using AABR

Newborn hearing screening technology relies on comparing a newborn's responses to sounds to a prescribed template and generating a "pass" or "refer" result in comparison to this template.

This template is developed by gathering normative data from well newborns between 34 weeks gestation and 6 months of age.

The underlying principle for screening is to ensure that newborns who are screened are in a comparable state to the well newborns from whom the template was developed. Newborns should also be screened under conditions comparable to normative screening conditions. ie. low electromagnetic interference and ambient noise.

Newborns who have conditions which affect either the brain's EEG signal, craniofacial/ear anatomy or skin conditions, should not be selected for newborn hearing screening as their conditions are not in a comparable state to the normative sample.

Once conditions in the newborn are comparable to the normative sample, newborn hearing screening can be conducted.

Newborns who have conditions which would permanently exclude them from newborn hearing screening should be referred directly to diagnostic audiology, in consultation with the newborn's Paediatrician/ GP and the audiologist from the relevant SWISH diagnostic audiology centre.

Excluding inappropriate newborns from the screening process ensures appropriate use of the screening technology, and maintains the integrity of the screening program.

The application of these screening principles relies on adequate training being provided to hearing screening staff on when it is appropriate to exclude a baby from screening. If screening staff are unsure regarding the appropriateness of screening the newborn's case should be referred to the relevant SWISH Area Coordinator.

#### **1. Newborns who should be referred directly to diagnostic audiology and not to be screened using AABR**

- A newborn with a known or suspected neurological condition eg. epilepsy, hydrocephaly, neural tube disorders, tumours etc

Neurological conditions can affect the newborn's EEG signal. This newborn should be referred to diagnostic audiology in consultation with the newborn's Paediatrician and relevant audiologist.

- A newborn with known or suspected culture positive post-natal infections associated with sensorineural hearing loss including confirmed bacterial and viral (including herpes viruses and varicella) meningitis.

Meningitis is known to cause permanent sensorineural hearing loss. Infants with a known or suspected case of meningitis should be directly referred to diagnostic audiology and an Ear, Nose & Throat Specialist in consultation with the newborn's Paediatrician and relevant audiologist.

- A newborn with a craniofacial abnormality eg. facial clefts, malformed pinnae, microtia etc.

Craniofacial abnormalities affect the anatomy of the head. There are a number of definite exclusions to screening, which are not to be screened and are to be referred to diagnostic audiology directly and a number of possible exclusions, which are to be referred to diagnostic audiology in consultation with a Paediatrician are outlined in the Craniofacial abnormality protocol below.

### Craniofacial abnormality protocol

This protocol is a component of the protocol for selecting babies for newborn hearing screening using Automated Auditory Brainstem Response (AABR) technology.

Not all babies are suitable for newborn hearing screening using AABR technology. This protocol for the exclusion criteria for the use of current AABR technology on newborns with craniofacial anomalies (CFA) is informed by the manufacturers of the SWISH AABR equipment, expert professional opinion and the principles and requirements of screening programs.

Area Health Services should ensure that they follow these exclusion criteria and that any newborn who is not suitable to be screened using AABR technology by one month of corrected age is referred directly to diagnostic audiology services, in consultation with the relevant medical and audiological professionals.

The current screening equipment used within the SWISH program are not designed for infants with known absence or malformation of external, middle, or internal ear structures. The specificity and sensitivity of the machines is at the stated levels, 96% and >99% respectively, for a normative sample of infants.

When selecting a baby for screening the screener must ensure that only: "Newborns with normal outer ear anatomy and no obvious deformities of the head or neck."<sup>13</sup>

All newborns who have any abnormalities of the head or neck should be referred directly to diagnostic audiology for diagnostic assessment

<sup>13</sup> Natus Inc. (2001) ALGO 3 Newborn Hearing Screener User Manual, San Carlos, California, p 25

Conditions that are to be referred directly to diagnostic audiology include the following:

- Cleft Lip
- Cleft Palate
- Submucous Cleft Palate
- Facial Clefts
- Microtia
- Atresia
- Craniosynostosis
- Encephalocele
- Newborns under investigation for syndrome associated with craniofacial abnormality and hearing loss, ie. Aperts, Crouzons, Downs, Goldenhar, Pfiesser, Treacher-Collins.

Other conditions that may require referral to diagnostic audiology, in consultation with a paediatrician/GP and the Diagnostic Audiologists include:

- Ear pits/dimples
- Ear tags
- High arched palate
- Hypertelorism
- Exo/Endophthalmus
- Tumours of the Head and Neck
- Nasal deformities
- Jaw deformities
- Downward sloping eyes
- Unusually shaped ears
- Cranial nerve paralysis including facial nerve paralysis
- Vascular birthmarks of the head and neck

All eligible CFA newborns referred for Diagnostic Audiology will be covered by SWISH Travel.

## **2. Newborns whose conditions require discussion and clinical decision making.**

- A newborn receiving central nervous system stimulants eg. caffeine, amphetamines etc.

Central nervous system stimulants affect the newborn's EEG signal. This newborn should not be screened until it can be ascertained that the CNS stimulants are no longer present. The newborn's Paediatrician or neonatologist should be consulted regarding the appropriateness of screening. If this can not be ascertained the newborn should be referred to diagnostic audiology in consultation with the newborn's Paediatrician/GP and relevant audiologist.

- A newborn receiving Ototoxic medications,

Ototoxic medications have the potential to damage the cochlear. This newborn should not be screened until it can be ascertained that the Ototoxic medications are no longer present. The newborn's Paediatrician



or neonatologist should be consulted regarding the appropriateness of screening. If this can not be ascertained the newborn should be referred to diagnostic audiology in consultation with the newborn's Paediatrician/GP and relevant audiologist.

### **Ototoxic Medications**

**Aminoglycoside Antibiotics** – degeneration of inner hair cells.

**Chemotherapeutic Agents** – cochlear metabolism toxicity

**Salicylates** – cochlear metabolism toxicity – reversible

**Nonsteroidal anti inflammatory drugs** – cochlear metabolism toxicity – reversible

**Quinine** – cochlear metabolism toxicity.

**Loop Diuretics**- degeneration of inner hair cells.

**Erythromycin** – possible effect on central nervous system pathways.

**Vancomycin** – etiology unknown, usually enhances aminoglycoside toxicity.

### **3. Newborns for whom screening should be delayed.**

- A well newborn of 33 weeks or less gestation.

This newborn's age is not comparable to the normative sample. This newborn should not be screened until they are 34 weeks corrected age.

- A newborn receiving intervention for jaundice

Jaundice affects the newborn's skin condition. This newborn should not be screened until the jaundice has resolved sufficiently not to require intervention.

## Appendix 2

### Template Screener Checklist

This checklist is a template of the minimum requirements that need to be asked by the Screener. This template can be developed in each Area Health Service.

Task		Yes	No		
Is the equipment checked and calibrated?					
Are there consumables available?					
Do the parents need an interpreter?					
Has information been provided to parents on SWISH Program?					
Does the parent give consent for the screen?					
If refused, provide reason:					
History	CFA Definite <input type="checkbox"/>	CFA Possible <input type="checkbox"/>	Risk Factors <input type="checkbox"/>	Medical Consultation sought <input type="checkbox"/>	Outcome:
Have you performed screen?					
Have you documented the result?					
Has the SWISH Area Coordinator been informed of result?					

#### To complete if “refer” result gained

Task	Yes	No
If ‘refer’ result gained, have you provided “Why does my baby need a repeat hearing screen?”		
Have you documented results of repeat screen?		
Have you contacted the SWISH Area Coordinator and informed them of the result?		

## Template Coordinator Checklist

This checklist is a template of the minimum requirements that need to be asked by the Coordinator. This template can be developed in each Area Health Service.

Task	Yes	No
Have you got the screen results from screener?		
Have you, or the screener, informed the parents of the process?		
Have you, or the screener, provided "Why does my baby need a hearing check?"		
Have you provided appropriate support?		
If screen refused, have you documented the reason?		

### To complete if 'refer' result gained

Task	Yes	No
If 'refer' result gained, have you organised repeat screen?		
Have you provided parents with "Why does my baby need a repeat screen?"		
Have you provided appropriate support?		
Has repeat screen been performed?		
If repeat screen refused, have you documented the reason?		

### To complete if double 'refer' result gained

Task	Yes	No
Have you informed parents of the result?		
Have you provided parents with "Why does my baby need a diagnostic assessment?"		
Have you provided appropriate support?		
Have you made the referral to the appropriate diagnostic assessment facility?		
If diagnostic assessment refused, have you documented the reason?		
Have you contacted the SWISH Social Worker at the appropriate diagnostic assessment facility?		

## Appendix 3

### Why does my baby need a hearing check?

NSW STATEWIDE INFANT SCREENING – HEARING (SWISH) PROGRAM

## Why does my baby need a hearing check?



### Why does my baby need a hearing check?

By the time children say their first word they have been listening to the language that surrounds them for about a year.

About 1 to 2 babies out of every 1000 babies born will have a significant hearing loss.

The NSW Statewide Infant Screening – Hearing (SWISH) Program aims to identify babies born with significant hearing loss and introduce them to appropriate services as soon as possible.

Your baby will be offered a series of routine health checks in the first few weeks of life. These checks will include a screening for hearing loss. The hearing screen will be offered as soon as possible after birth. If it is not possible while you and your baby are in hospital, you will be offered a repeat hearing screen for your baby as an outpatient or at a local community location, soon after discharge from hospital.

### What is involved in screening my baby?

A trained hearing screener will carry out the screen when your baby is asleep or resting quietly. The screener will place small sensor pads on your baby's head and play soft clicking sounds into the baby's ears through a soft ear tip or earphone.

The sensor pads electronically record your baby's responses to the sounds.

You are welcome to stay with your baby while the screen is being done.

The screen usually does not unsettle the baby.

The screen may take 10–20 minutes to complete.

### Results

You will be given the results as soon as the screen is completed. The results will be recorded in your baby's Personal Health Record (Blue Book).

If the results indicate that a repeat screen is required, it does not necessarily mean that your baby has a hearing loss. There may be other reasons for this result.

The most common reasons for a repeat screen being required are:

- your baby may have been unsettled at the time of the screen
- there was fluid or a temporary blockage in the ear after the birth.

Hearing may not always remain the same over time.

It is important to monitor your baby's speech and language development as well as responses to sound.

Please refer to the checklist in the Personal Health Record (Blue Book) or the checklist overleaf.

If you are concerned about your child's hearing or speech and language development in the future, please arrange to have your child's hearing tested. Your doctor can arrange for a referral to an appropriate location for testing your child's hearing.

Hearing can be tested at any age.

### For further information contact:

NSW Department of Health  
73 Miller Street  
North Sydney NSW 2059  
Tel. (02) 9391 9000  
Fax. (02) 9391 9101  
NSW HealthWeb site: [www.health.nsw.gov.au](http://www.health.nsw.gov.au)

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# HEARING CHECKLIST

<b>Birth to 3 months</b>	Reacts to loud sounds.....	<input type="radio"/>
	Quiets to familiar voices or sounds .....	<input type="radio"/>
	Makes cooing noises .....	<input type="radio"/>
	Responds to speech by looking at speaker's face.....	<input type="radio"/>
<b>3-6 months</b>	Turns eyes or head toward sounds.....	<input type="radio"/>
	Starts to make speech-like sounds .....	<input type="radio"/>
	Laughs and makes noises to indicate pleasure and displeasure .....	<input type="radio"/>
<b>6-9 months</b>	Babbles, 'dada' 'ma-ma' 'baba' .....	<input type="radio"/>
	Shouts/vocalises to get attention .....	<input type="radio"/>
	Will often respond to 'no' and own name .....	<input type="radio"/>
	Responds to singing and music.....	<input type="radio"/>
<b>9-12 months</b>	Imitates speech sounds of others .....	<input type="radio"/>
	Understands simple words, eg 'ball', 'dog', 'daddy' .....	<input type="radio"/>
	Turns head to soft sounds .....	<input type="radio"/>
	First words emerge.....	<input type="radio"/>
<b>12-18 months</b>	Appears to understand some new words each week .....	<input type="radio"/>
	Follows simple spoken instructions, eg 'get the ball' .....	<input type="radio"/>
	Points to people, body parts or toys when asked.....	<input type="radio"/>
	Continually learns new words to say although may be unclear .....	<input type="radio"/>
<b>18-24 months</b>	Listens to simple stories or songs.....	<input type="radio"/>
	Combines two or more words in short phrases eg 'more juice'.....	<input type="radio"/>

## Local contact details:

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## Why does my baby need a repeat hearing screen?

NSW STATEWIDE INFANT SCREENING – HEARING (SWISH) PROGRAM

### Why does my baby need a repeat hearing screen?



#### Why does my baby need a repeat hearing screen?

Many babies need to have a repeat hearing screen. It does not necessarily mean that your baby has a hearing loss. There may be other reasons for rescreening.

The most common reasons for a repeat hearing screen are:

- your baby may have been unsettled at the time of the screen
- there was fluid or a temporary blockage in your baby's ear after the birth.

In most cases the repeat hearing screen will be done before you and your baby leave hospital. If it is not possible while you are in hospital, you will be offered a repeat hearing screen for your baby as an outpatient or at a local community location, soon after discharge from hospital.

The person who gave you this brochure will advise you when and where the repeat hearing screening will take place.

The results of the repeat hearing screen will be discussed with you at the time of the screen.

If the repeat hearing screen does not show a clear result, your baby will be referred for a diagnostic hearing assessment by an Audiologist.

#### For further information contact:

NSW Department of Health  
73 Miller Street  
North Sydney NSW 2059  
Tel. (02) 9391 9000  
Fax. (02) 9391 9101  
NSW Health Web site: [www.health.nsw.gov.au](http://www.health.nsw.gov.au)

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**NSW HEALTH**  
Working as a Team

## Why does my baby need a diagnostic assessment?

NSW STATEWIDE INFANT SCREENING – HEARING (SWISH) PROGRAM

### Why does my baby need a diagnostic assessment?



#### Why does my baby need a diagnostic assessment?

If your baby did not show a clear result for the first two hearing screens, they will need a diagnostic assessment. There can be a number of reasons for this.

It could be that:

- your baby was unsettled during both screens
- there was fluid or a temporary blockage in your baby's ear after the birth
- your baby may have some degree of hearing loss.

It is important to find out as soon as possible how well your baby hears so that you and your baby can get the correct advice and support.

#### What will happen at the assessment?

The aim of the diagnostic assessment is to obtain a more complete picture of your baby's hearing. The evaluation will include a number of tests. These will give detailed information about how your baby hears.

An audiologist, who is a specialist in hearing testing, will carry out the tests. None of the tests will hurt your baby.

#### How do I prepare my baby for the assessment?

It is best if your baby sleeps during the tests. It is helpful if feeding and sleep can be delayed on the day until you are at the Audiology Department. Arrive a little early to give yourself time to feed and settle your baby to sleep.

If you have other children at home, please arrange to have someone mind them, so that you can stay with your baby.

As the diagnostic assessment includes more tests than in the initial screen, you should be prepared to set aside the morning or afternoon, depending on when your appointment has been scheduled.

#### How is the diagnostic test done?

This diagnostic test is called the Auditory Brainstem Response (ABR) test. Sensors similar to those used in the screen will be placed on your baby's head. Sounds will be played through headphones or earplugs to your baby.

Your baby's responses to the sounds are recorded electronically and will determine the softest levels that your baby can hear.

#### What will happen after the tests?

The Audiologist will be able to inform you of the results and explain what the results mean, usually on the same day. If your baby is found to have a hearing loss, you will be referred to the appropriate specialist services. A report will be sent to these services and a copy sent to you and your doctor with your consent. The Audiologist and the Area Health Service Coordinator will assist you and your baby to get the services and support that you may need.

If your baby is found to have normal hearing but at a later stage you become concerned about your child's hearing, speech or language development, please arrange to have your child's hearing tested again.

Hearing can be tested at any age.

The appointment for your baby is:

#### For further information contact:

NSW Department of Health  
73 Miller Street  
North Sydney NSW 2059  
Tel. (02) 9391 9000  
Fax. (02) 9391 9101  
NSW HealthWeb site: [www.health.nsw.gov.au](http://www.health.nsw.gov.au)

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November 2002 SHPN (PHCC) 020237

## Appendix 4

### Template letters and forms for parents or guardians

These templates have been developed to provide guidelines for the minimum requirements needed from parents or guardians when they consent or refuse screening or diagnostic assessment on behalf of their baby.

#### Consent to Screen

Consent to perform a screen on an infant in the NSW Statewide Infant Screening – Hearing (SWISH) program is required from parents or guardians before screening is performed. Information on the screen should be provided both verbally and in written forms.

The following is a template consent form that should be provided to parents or guardians for their signature.

#### ***Template consent form***

Name of baby:

Date of birth:

Parents:

Date of screen:

The hearing screen offered to my baby under the NSW Statewide Infant Screening – Hearing (SWISH) program has been explained clearly to me and I wish to consent to having the screen performed on behalf of my baby.

- I have been provided with the information brochure “Why does my baby need a hearing check?”
- I understand that my child’s hearing may not remain the same over time
- I understand that it is important to monitor my baby’s speech, language development and responses to sound as outlined in my baby’s Personal Health Record (Blue Book)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name

\_\_\_\_\_  
Relationship to child

\_\_\_\_\_  
Date



## Refusal of screen

Refusal of screens can happen either within the hospital, place of birth, or after the baby has left the hospital. It is important that the parents or guardians understand the reason for performing hearing screening on newborns. This is outlined clearly in “Why does my baby need a hearing check?”

Parents and guardians must be advised that they can still monitor their baby’s hearing through the child health checks outlined in their baby’s Personal Health Record. Parents and guardians must be advised that they can contact the AHS SWISH service, Child Health Nurse or General Practitioner if they have any concerns about their baby’s hearing.

### *Template form*

Name of baby:

Date of birth:

Parents:

The hearing screen offered to my baby under the NSW Statewide Infant Screening – Hearing (SWISH) program has been explained clearly to me, however, I wish to decline having the screen performed on behalf of my baby.

- I have been given and read the parent information leaflets.
- I understand that identifying a hearing loss early, results in better outcomes for my child’s development.
- I understand that an infant’s behaviour is not a reliable assessment of hearing.
- Although I have declined now, my child’s hearing can be tested at any age.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name

\_\_\_\_\_  
Relationship to child

\_\_\_\_\_  
Date

## Refusal of diagnostic assessment

Refusal of diagnostic assessment can happen either within the hospital, place of birth, or after the baby has left the hospital. It is important that the parents or guardians understand the reasons their baby may have been referred to diagnostic assessment.

As previously advised, it is important to advise parents or guardians that they can still monitor their baby's hearing through the child health checks outlined in their baby's Personal Health Record. Parents and guardians must also be advised that they can contact the AHS or SWISH Area Coordinator at any time if they have concerns about their baby's hearing.

### *Template letter*

Dear [insert parent/guardian's name here],

Enclosed is the form "Decline of Referral to Diagnostic Assessment". Please read it carefully. If you have any questions please contact me on [insert direct telephone line] or via email on [insert email address].

Once you have signed the form return it in the envelope provided.

If you become concerned about your baby's hearing in the future, please contact me on the number listed above. Monitoring of your baby's development can be done by completing the child health checks in your baby's Personal Health Record "My first health record". Alternatively you can contact your General Practitioner or Child & Family Health Nurse.

Yours sincerely,

[insert name]  
[insert position]

*Template form***Decline of Referral to Diagnostic Assessment****Re:** [insert baby's name]**DOB:****Parents:****1<sup>st</sup> screen result:** [insert date] Right Refer, Left Refer**2<sup>nd</sup> screen result:** [insert date] Right Refer, Left Refer

The recommended follow up of my child has been explained to me and I understand the following, however I wish to decline the referral for diagnostic assessment.

- The possible reasons for a refer result on the first two hearing screens are:
  - Baby was unsettled during both screens
  - There was fluid or a temporary blockage in your baby's ear after the birth
  - Baby may have some degree of hearing loss.
- I have been given and read the parent information leaflets.
- I understand that travel assistance is available to attend a diagnostic assessment.
- I understand that identifying a hearing loss early, results in better outcomes for my child's development.
- I understand that an infant's behaviour is not a reliable assessment of hearing.
- Although I have declined now, my child's hearing can be tested at any age.

---

 Signature

---

 Name

---

 Relationship to child

---

 Date

## Appendix 5

### Explanation of Results to Parents

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Listed below is a guide for screeners to use when advising parents of the results of the SWISH Screening.

#### **Scenario 1: PASS Result in both ears. No Risk Factors.**

- Advise the parents that the result indicates that the baby's hearing system is working and that they should continue to observe the baby's responses to sound.
- Advise parents about the speech and language checklist written on the back page of the "Why check my baby's hearing?" brochure. Inform parents that routine monitoring and surveillance of hearing is available from the GP or Early Childhood Centre using the parent questionnaires in the Personal Health Record (PHR).
- Brief outline of speech and language milestones: From birth to 6-8 weeks, the baby will startle to sudden noises when awake. This startle response is often erratic and usually slowly diminishes by 6-8 weeks but may be sustained until about 3 months. The baby won't usually startle when feeding, crying or asleep.
- From 6 – 8 weeks, the baby will quieten to softer sounds. The baby's cry might change or he/she may quieten briefly in response to the mother's voice when the mother is outside the baby's line of vision.
- At 3 – 6 months, the baby will be very responsive to sound with eye and head turns.
- If parents are concerned about their baby's hearing responses or speech development in the future, they are advised to contact their GP, Paediatrician or Early Childhood Health Centre to arrange a hearing test for their baby or child.
- Parents can also contact the SWISH Area Coordinator if they have any concerns in the future and contact details should be supplied.
- A baby is never too young for a full diagnostic hearing test.
- Advise the SWISH Area Coordinator of the results by the end of the screening shift.
- Screening result recorded in the Personal Health Record (PHR)

## **Scenario 2: PASS Result in both ears with Risk Factors**

Risk factors may include the following:

- Family history.
- Congenital infections: eg rubella, toxoplasmosis, cytomegalovirus, herpes, syphilis
- Syndromes associated with hearing loss: eg Down's, Pierre- Robin, Waardenburg's, Treacher-Collins
- Craniofacial abnormalities eg Atresia, Microtia, hypoplastic ears, peri-auricular skin tags and dimples, abnormality of the pinna, dysmorphic features.
- Refer to guidelines for Identification and Management of Babies with Risk Factors for Hearing Loss within the Statewide Infant Screening – Hearing program (Appendix 6).
- Babies who obtain a Pass result with identified Risk Factors require ongoing monitoring and management by parents. Parents to be advised to monitor their infants hearing and if concerned to contact their GP for referral to audiological assessment
- Advise the SWISH Area Coordinator of the results by the end of the screening shift.
- Screening result recorded in the Personal Health Record (PHR)

## **Scenario 3: Refer result in one or both ears after first (or initial) AABR screen**

- Provide parents with the “Why does my baby need a repeat hearing screen?” brochure.
- Parents are advised that a repeat hearing screen may occur during their current hospital stay.
- If the initial screen is just prior to discharge, parents or carers are given an outpatient appointment for a repeat hearing screen. Parents or carers are given the SWISH Area Coordinator's contact details and are encouraged to contact the SWISH Area Coordinator should they require further information or support.
- Advise the SWISH Area Coordinator of the results by the end of the screening shift.
- Screening result recorded in the Personal Health Record (PHR)

#### **Scenario 4: Refer result in one or both ears following repeat hearing screen**

- Parents are advised that the SWISH Area Coordinator will contact them to organise a diagnostic assessment.
- Provide parents with the “Why does my baby need a diagnostic assessment?” brochure and the SWISH Area Coordinators contact details. Ask parents to contact the SWISH Area Coordinator if follow-up hasn’t occurred or if they would like information and support.
- Advise the SWISH Area Coordinator of the results by the end of the screening shift.
- Screening result recorded in the Personal Health Record (PHR)

Monitoring procedures will typically include notifying the family’s local Medical Officer and providing written information to the parents.

## **Appendix 6**

### **Identification and Management of Babies with Risk Factors for Hearing Loss within the Statewide Infant Screening – Hearing program**

#### **1. Background**

The Statewide Infant Screening - Hearing (SWISH) program was established to identify and allow access to intervention for infants born with significant permanent hearing loss. Infants suspected of having hearing loss are identified via automated auditory brainstem response (AABR) screening, and a diagnosis of hearing loss is confirmed via diagnostic audiological assessment.

However not all children with hearing loss are born with this impairment, some may pass the SWISH AABR screen but will develop hearing loss as they grow, ie. a late onset, or progressive hearing loss, or a hearing loss is acquired through trauma, or disease pathology.

There are particular conditions that have been identified as risk factors for a child developing late onset or acquiring a hearing loss. As the SWISH program is the initial step in a process of maintaining a child's hearing health, it is important that these hearing risk factors be identified and a management process be established for infants who are identified as having risk factors for late onset and progressive hearing loss.

#### **2. Purpose of this section**

The purpose of this appendix is to define the conditions which constitute a risk factor for developing progressive, delayed onset hearing loss or acquiring a hearing loss post hearing screening by AABR through the SWISH Program. These are identified under the term "hearing risk factors".

This document also outlines how infants with these hearing risk factors should be managed at an Area Health Service level, to ensure that any child who develops a hearing loss is identified and managed in an appropriate and timely manner.

It must be noted that within the SWISH program, providing management and follow up is only possible for hearing risk factors that are identifiable at the time of the hearing screen.

Any infant who has an event subsequent to passing the AABR hearing screen that would be considered a risk factor for developing hearing loss, needs to receive ongoing surveillance and monitoring by either their parent, GP, Paediatrician, Child and Family Health Centre or Audiologist, as follow up for these infants is beyond the scope of the SWISH program.

### 3. Definition of risk factors

The risk factors for developing late onset hearing loss or acquiring a hearing loss were previously separated into two categories:

- Risk factors which are reportable or identifiable at the time of newborn hearing screening ie. birth to 28 days, and
- Risk factors which occur between 29 days and 3 years.

In the *2007 Position Statement* a single list of risk indicators is presented as there is considerable overlap in the indicators associated with congenital/neonatal hearing and those associated with delayed onset/acquired or progressive hearing loss. Heightened surveillance is recommended for all infants with risk factors<sup>40</sup>

#### Risk Indicators Associated With Permanent Congenital, Delayed-Onset, or Progressive Hearing Loss in Childhood

Risk indicators that are marked with a “§” are of greater concern for delayed-onset hearing loss.

1. Caregiver concern § regarding hearing, speech, language, or developmental delay.<sup>14</sup>
2. Family history § of permanent childhood hearing loss.<sup>15 16</sup>
3. Neonatal intensive care of more than 5 days or any of the following regardless of length of stay: ECMO, § assisted ventilation, exposure to ototoxic medications (gentimycin and tobramycin) or loop diuretics (furosemide/Lasix), and hyperbilirubinemia that requires exchange transfusion.<sup>17 18</sup>
4. In utero infections, such as Cytomegalovirus (CMV), § herpes, rubella, syphilis, and toxoplasmosis.<sup>19 20 21 22 23 24</sup>
5. Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.<sup>25</sup>

14 Roizen NJ. “Etiology of hearing loss in children: nongenetic causes” *Pediatric Clinics of North America*, Volume 46, Issue 1, pp49–64, 1999

15 Cone-Wesson B, Vohr BR, Sininger YS, et al. Identification of neonatal hearing impairment: infants with hearing loss. *Ear & Hearing* Volume 21, Issue 5, pp488–507, 2000

16 Morton CC, Nance WE. “Newborn hearing screening: a silent revolution” *New England Journal of Medicine*, Volume 354, pp2151–2164, 2006

17 Fligor BJ, Neault MW, Mullen CH, Feldman HA, Jones DT. “Factors associated with sensorineural hearing loss among survivors of extracorporeal membrane oxygenation therapy” *Pediatrics*, Volume 115, Issue 6, pp1519–1528, 2005

18 Roizen NJ. “Nongenetic causes of hearing loss” *Mental Retardation and Developmental Disabilities Research Reviews*, Volume 9, Issue 6 pp120–127, 2003

19 Fligor BJ, Neault MW, Mullen CH, Feldman HA, Jones DT. “Factors associated with sensorineural hearing loss among survivors of extracorporeal membrane oxygenation therapy” *Pediatrics*, Volume 115, Issue 6, pp1519–1528, 2005

20 Fowler K, Stagno S, Pass R, Britt W, Boll T, Alford C. “The outcome of congenital cytomegalovirus infection in relation to maternal antibody status” *New England Journal of Medicine*. Volume 326, pp663–667, 1992

21 Madden C, Wiley S, Schleiss M, et al. “Audiometric, clinical and educational outcomes in a pediatric symptomatic congenital cytomegalovirus (CMV) population with sensorineural hearing loss” *International Journal of Pediatric Otorhinolaryngology* Volume 69, Issue 9, pp1191–1198, 2005

22 Rivera LB, Boppana SB, Fowler KB, Britt WJ, Stagno S, Pass RF. “Predictors of hearing loss in children with symptomatic congenital cytomegalovirus infection” *Pediatrics*, Volume 110, pp762–767, 2002

23 Nance WE, Lim BG, Dodson KM. Importance of congenital cytomegalovirus infections as a cause for pre-lingual hearing loss. *Journal of Clinical Virology*, Volume 35, pp221–225, 2006

24 Pass RF, Fowler KB, Boppana SB, Britt WJ, Stagno S. Congenital cytomegalovirus infection following first trimester maternal infection: symptoms at birth and outcome. *Journal of Clinical Virology* Volume 35, pp216–220, 2006

25 Cone-Wesson B, Vohr BR, Sininger YS, et al. Identification of neonatal hearing impairment: infants with hearing loss. *Ear & Hearing* Vol 21, Issue 5, pp488–507, 2000



6. Physical findings, such as white forelock, that are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.<sup>26</sup>
7. Syndromes associated with hearing loss or progressive or late-onset hearing loss, § such as neurofibromatosis, osteopetrosis, and Usher syndrome<sup>27</sup>; other frequently identified syndromes include Waardenburg, Alport, Pendred, and Jervell and Lange-Nielson.<sup>28</sup>
8. Neurodegenerative disorders, § such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich ataxia and Charcot-Marie-Tooth syndrome.<sup>29</sup>
9. Culture-positive postnatal infections associated with sensorineural hearing loss, § including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.<sup>30 31 32</sup>
10. Head trauma, especially basal skull/temporal bone fracture § that requires hospitalization.<sup>33 34 35</sup>
11. Chemotherapy. §<sup>36</sup>

At the time of SWISH AABR hearing screening information regarding risk factors for hearing loss should be gathered from the infant's medical record and via parent interview. These hearing risk factors should be clearly documented on the infant's SWISH Patient Report form, and entered into the AABR screening device if applicable.

---

26 Cone-Wesson B, Vohr BR, Sininger YS, et al. Identification of neonatal hearing impairment: infants with hearing loss. *Ear & Hearing* Vol 21, Issue 5, pp488–507, 2000

27 Roizen NJ. "Nongenetic causes of hearing loss" *Mental Retardation and Developmental Disabilities Research Reviews*, Volume 9, Issue 6 pp120–127, 2003

28 Nance WE. The genetics of deafness. *Mental Retardation and Developmental Disabilities Research Reviews* Volume 9 pp109–119, 2003

29 Roizen NJ "Nongenetic causes of hearing loss" *Mental Retardation and Developmental Disabilities Research Reviews*, Volume 9, Issue 6 pp120–127, 2003

30 Arditi M, Mason EO Jr, Bradley JS, et al. Three-year multicenter surveillance of pneumococcal meningitis in children: clinical characteristics, and outcome related to penicillin susceptibility and dexamethasone use. *Pediatrics*. 1998;102: 1087–1097

31 Roizen NJ "Nongenetic causes of hearing loss" *Mental Retardation and Developmental Disabilities Research Reviews*, Volume 9, Issue 6 pp120–127, 2003

32 Biernath KR, Reefhuis J, Whitney CG, et al. Bacterial meningitis among children with cochlear implants beyond 24 months after implantation. *Pediatrics*. Volume 117, pp284–289, 2006

33 Lew HL, Lee EH, Miyoshi Y, Chang DG, Date ES, Jerger JF. "Brainstem auditory-evoked potentials as an objective tool for evaluating hearing dysfunction in traumatic brain injury" *American Journal of Physical Medicine & Rehabilitation* Volume 83, pp210–215, 2004

34 Vartiainen E, Karjalainen S, Ka" rja" J. "Auditory disorders following head injury in children" *Acta Oto-Laryngologica*. Volume 99, pp529–536, 1985

35 Zimmerman WD, Ganzel TM, Windmill IM, Nazari GB, Phillips M. "Peripheral hearing loss following head trauma in children" *Laryngoscope* Volume 103, pp87–91, 1993

36 Bertolini P, Lassalle M, Mercier G, et al. "Platinum compound related ototoxicity in children: long-term follow-up reveals continuous worsening of hearing loss" *Journal of Pediatric Hematology/Oncology* Volume 26, Issue 10, 649–655, 2004

#### **4. Recommended management for infants identified by the SWISH program as having a hearing risk factor**

Infants who pass SWISH AABR screening, but at the time of screening are identified as having hearing risk factors, should receive ongoing monitoring of their hearing status.

The 2007 Joint Committee on Infant Hearing Position Statement outlines an updated set of guidelines for continued surveillance, screening and referral of infants and toddlers.

- At each visit infants should be monitored for auditory skills, middle-ear status, and developmental milestones (surveillance). Concerns elicited during surveillance should be followed by administration of a validated global screening tool. A validated global screening tool is administered to all infants at 9, 18, and 24 to 30 months or, if there is physician or parental concern about hearing or language, sooner.
- If an infant does not pass the speech-language portion of the global screening in the medical home or if there is physician or caregiver concern about hearing or spoken-language development, the child should be referred immediately for further evaluation by an audiologist and a speech-language pathologist for a speech and language evaluation with validated tools.
- Once hearing loss is diagnosed in an infant, siblings who are at increased risk of having hearing loss should be referred for audiological evaluation.
- All infants with a risk indicator for hearing loss, regardless of surveillance findings, should be referred for an audiological assessment at least once by 24 to 30 months of age. Children with risk indicators that are highly associated with delayed-onset hearing loss, such as having received Extracorporeal Membrane Oxygenation (ECMO) or having Cytomegalovirus (CMV) infection, should have more frequent audiological assessments.
- All infants for whom the family has significant concerns regarding hearing or communication should be promptly referred for an audiological and speech-language assessment.
- A careful assessment of middle-ear status (using pneumatic otoscopy and/or tympanometry) should be completed at all well-child visits, and children with persistent middle-ear effusion that last for 3 months or longer should be referred for otologic evaluation.

While this recommendation is comprehensive and will ensure capture of any child with late onset or acquired hearing loss, the SWISH program recognises that individual Area Health Services do not have the facilities or funding to provide such comprehensive ongoing audiological management, even with the assistance of external hearing agencies such as Australian Hearing.

With this consideration in mind, the management recommended for infants who pass their SWISH AABR screening but have hearing risk factors is multi-levelled with a defined minimum standard of care. All AHS shall meet this minimum standard of care. However some AHS are able to offer care above this level. Because of this, there are also defined levels of care which exceed this minimum standard, these are graduated

steps up to the “gold standard” set by the Joint Committee on Infant Hearing of hearing assessment every 6 months to age 3 years.

Area Health Services should strive towards the “gold standard” set by the Joint Committee on Infant Hearing, but should ultimately aim for the highest level of management which can be achieved with the resources available within the AHS.

The levels of management for infants who pass SWISH AABR screening but are identified as having hearing risk factors are defined in the table below.

<b>Level</b>	<b>Management to be undertaken</b>
<b><i>Minimum Standard</i></b>	<ul style="list-style-type: none"> <li>• Risk Factors are investigated at the time of hearing screen</li> <li>• Risk Factors are documented on the SWISH Patient Report form</li> <li>• Parents are informed that their infant has hearing risk factors</li> <li>• Parents receive a Hearing Checklist at the time of screening and are advised to monitor their child’s hearing</li> <li>• Hearing risk factors are documented clearly in the Personal Health Record</li> <li>• The parent is given information regarding who to contact if they are concerned about their infant’s hearing in the future.</li> </ul>
<b>Intermediate Management Levels</b>	<p>In addition to the minimum level the following management could be undertaken to improve the follow up services offered by the SWISH Program:</p> <ul style="list-style-type: none"> <li>• Early Childhood Centre notified of hearing risk factors</li> <li>• General Practitioner notified of hearing risk factors</li> <li>• Risk factor follow up contact with parents every 3, 6 or 12 months advising of hearing milestones, and who to contact if concerned</li> <li>• Risk factor follow up contact with parents every 3, 6 or 12 months advising them to have their child’s hearing assessed, and who to contact.</li> <li>• AHS audiology services notified of hearing risk factors</li> <li>• Other hearing service eg. Australian Hearing advised of infants with hearing risk factors (with parents’ consent)</li> <li>• Follow up hearing assessment at 6 or 12 months organised by hearing service.</li> </ul>

<b>Gold Standard</b>	The requirements of the minimum standard, and as many of the intermediate level management options as required to ensure that hearing assessment is completed every 6 months until the age of 3 years.

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