

# South Australian Perinatal Practice Guideline

# Newborn Hearing Screening

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## Note:

This guideline provides advice of a general nature. This state-wide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this state-wide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient's medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This state-wide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

*Note: The words woman/women/mother/she/her have been used throughout this guideline as most pregnant and birthing people identify with their birth sex. However, for the purpose of this guideline, these terms include people who do not identify as women or mothers, including those with a non-binary identity. All clinicians should ask the pregnant person what their preferred term is and ensure this is communicated to the healthcare team.*

## Explanation of the aboriginal artwork.

The Aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the Aboriginal culture. The horse shoe shape design shown in front of the generic statement symbolises a woman and those enclosing a smaller horse shoe shape depicts a pregnant woman. The smaller horse shoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.



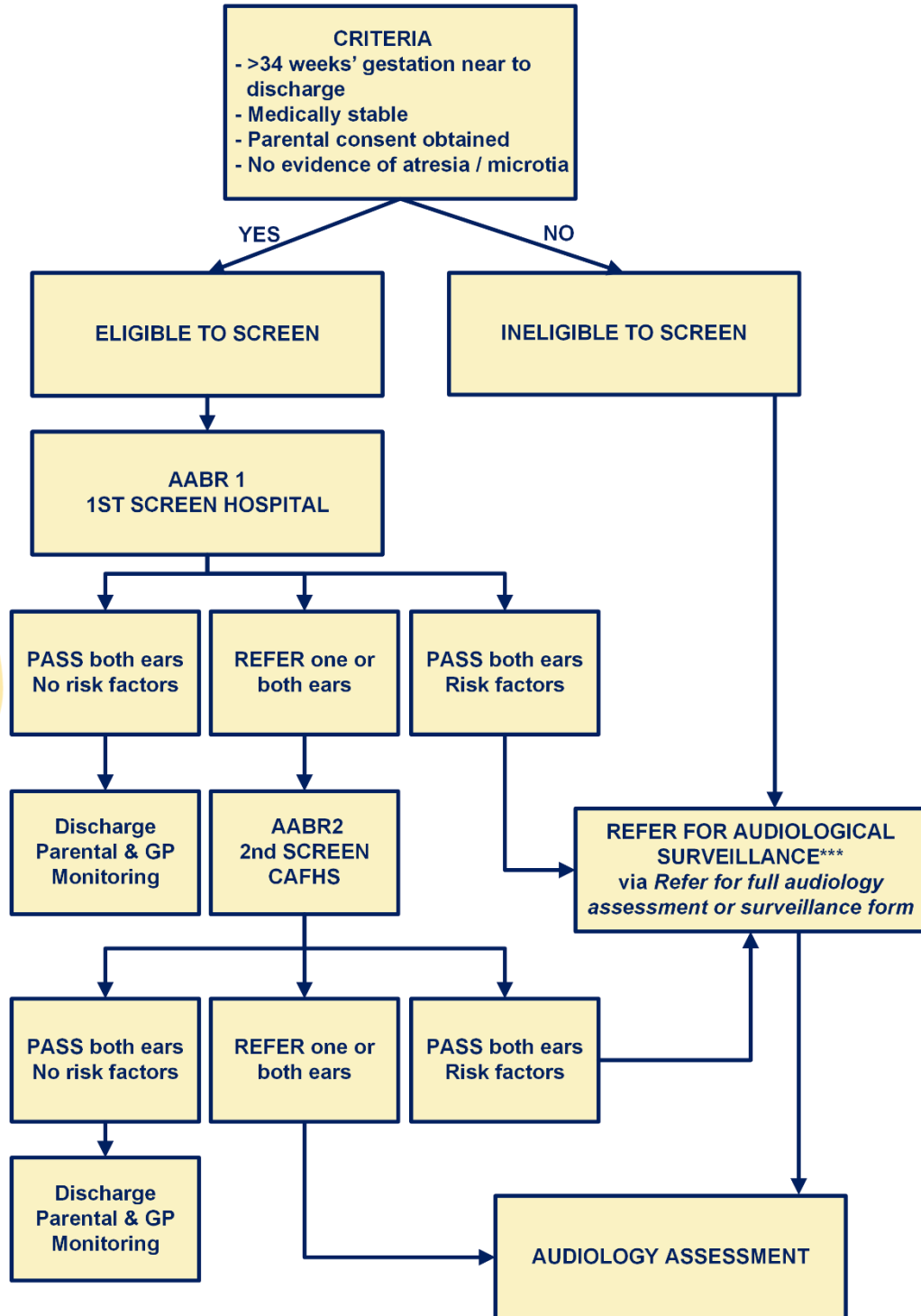
**Australian Aboriginal Culture is the oldest living culture in the world yet Aboriginal people continue to experience the poorest health outcomes when compared to non-Aboriginal Australians. In South Australia, Aboriginal women are 2-5 times more likely to die in childbirth and their babies are 2-3 times more likely to be of low birth weight. The accumulative effects of stress, low socio economic status, exposure to violence, historical trauma, culturally unsafe and discriminatory health services and health systems are all major contributors to the disparities in Aboriginal maternal and birthing outcomes. Despite these unacceptable statistics, the birth of an Aboriginal baby is a celebration of life and an important cultural event bringing family together in celebration, obligation and responsibility. The diversity between Aboriginal cultures, language and practices differ greatly and so it is imperative that perinatal services prepare to respectfully manage Aboriginal protocol and provide a culturally positive health care experience for Aboriginal people to ensure the best maternal, neonatal and child health outcomes.**

## Purpose and Scope of PPG

This Perinatal Practice Guideline has been produced to ensure newborn hearing screening is performed uniformly across all birth hospital sites in South Australia. It provides an overarching set of guidelines to achieve a high level of service delivery, which has the ability to identify and respond to common challenges and needs consistently regardless of geographic location.

**Flowchart 1 – Newborn Hearing Screening Pathway**

Flowchart 1 provides an overview of the Newborn Hearing Screening pathway. Any deviation to the pathway will require approval from the Newborn Hearing Screening Program. The Newborn Hearing Screening Program may advise a rescreen in certain circumstances.



\*\*\*Please see [Screening with Audiology Follow-up Due to Risk Factors](#) for a full list of conditions and circumstances that warrant referral for audiological surveillance

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## Summary of Practice Recommendations

- > Newborn hearing screen is an important test in the postnatal period and should be offered to all babies >4 hours old before discharge from the hospital
- > Babies are required to be settled before hearing screening can be performed
- > Greater than 80% of newborns will pass the first hearing screen
- > Birth hospitals are responsible for providing quality hearing screens
- > South Australia performs below the national average across each key performance indicators. Achieving a quality and valid screen in the hospital setting ensures that follow-up services do not experience high wait times so families can access a second screen before 30 days of age and reduce unnecessary parental anxiety due to false positives.
- > **Aboriginal women can ensure better health outcomes for their babies if they have control over their experiences during pregnancy and the postnatal period**



## Abbreviations

AABR	Automated auditory brainstem response
CaFHS	Child and Family Health Service
COAG	Council of Australian Government
NHS	Neonatal Hearing Screen
WCHN	Women's and Children's Health Network

## Definitions

AABR	A test of how well the brain and the hearing nerve reacts to sound
AABR 1	The first hearing screen where a REFER or PASS result is obtained for either ear using automated auditory brainstem response testing.
AABR 2	The second hearing screen performed following a REFER outcome in one or both ears on the first automated auditory brainstem response
Atresia	Atresia is the absence or closure of the external auditory ear canal. The malformation of the middle ear bones (incus, stapes, and malleus) may be affected, including the ear canal narrowing, known as canal stenosis.
Microtia	Microtia is a congenital deformity affecting the outer ear where the ear does not fully develop during the first trimester of pregnancy. A microtia ear is often smaller in size, can have a peanut-shaped appearance, only have a small nub or lobe present, or be completely absent at birth.
Pass result	Indicates that hearing is adequate at the time of screening for speech and language development. It does not indicate the baby can hear at normal levels or guarantees that the baby's hearing will not change over time. A slight hearing loss could still be present, and hearing can change over time so ongoing parental monitoring using the "My Health and Development" record (blue book) is essential
Primary carer	Refers to the parent/s or caregiver/s
Refer result	Only indicates that further assessment is required. It does not indicate that a hearing loss is present, though it is important to acknowledge that this is one possibility.
Screeener	A person conducting the hearing screen. Could include hospital midwife, Child and Family Health Service Nurse or designated hearing screener
Screening	A procedure applied to a selected population to identify those who require further diagnostic assessment. The advantage of screening is identifying individuals who would not otherwise be suspected of having a problem. Screening results are not diagnostic; they only indicate the possible presence or absence of a targeted condition.
Significant hearing impairment	Hearing impairment where the degree of loss is great than 40dB in the better ear



## Literature Review

- > The detection of hearing loss in the first 12 months of life is challenging without technology and often escapes detection by parents and/or carers or health care workers until the child fails to attain language milestones.
- > Most children with permanent congenital hearing impairment are born to hearing parents and have no health issues or risk factors for hearing loss.<sup>[1]</sup> Hence, a population program approach is required to identify hearing impairment early.
- > Early detection of permanent childhood hearing impairment (PCHI), coupled with access to appropriate intervention, minimises the impact of the child's hearing impairment by potentially improving their communication and language skills, subsequent education and employment prospects and psychological wellbeing.<sup>[2,3]</sup>
- > Recent technology advancements have produced a range of valid and reliable automated instruments to screen newborn babies for hearing impairment.
- > Population-based newborn hearing screening using automated auditory brainstem response technology is offered to all newborns in all states and territories in Australia. Newborn hearing screening has been available to all South Australian children since 2006. There is a range of hearing screening equipment capable of performing automated auditory brainstem response testing. Since 2014, South Australia has used the BERAphone® to screen newborns for hearing impairment. The BERAphone® is currently used across New Zealand, New South Wales and Tasmania.

## Incidence

- > The incidence of significant hearing impairment is 1-2 per 1000 live births.
- > Permanent congenital hearing impairment is more frequent than any other condition included in the neonatal metabolic screening.<sup>[1,4]</sup>
- > For South Australia, 30-40 infants are diagnosed with PCHI through the Newborn Hearing Screening Program.

## Program Targets

SA Health is a signatory to the Council of Australian Government (COAG) 2013 agreement regarding the National Framework for Neonatal Hearing Screening standards. This framework defines the screening pathway for neonatal hearing screening. It outlines the minimum national standards that underpin the reporting for neonatal hearing screening in Australia and Tier 2 SA Health reporting.<sup>[5]</sup>

The Newborn Hearing Screening Program in South Australia has established the following targets aligned with the National Framework.

Target Area	Key Performance Indicator
<b>Screening Rates</b>	>97% of eligible South Australian births completed hearing screening by 30 days (corrected gestational age) >97% of eligible South Australian births complete a hearing screen before discharge from hospital
<b>Referral Rates</b>	>80% of infants pass their hospital hearing screen in both ears. <2% of babies screened (i.e. eligible) are referred for diagnostic audiological testing.

Currently, South Australia performs below the national average across each target area. Achieving a quality and valid screen in the hospital setting ensures that follow-up services do not experience high wait times so families can access a second screen before 30 days of age.



## Newborn Hearing Screening Training

The Newborn Hearing Screening Program has developed an e-learning training course designed to be completed by all hearing screeners. The e-learning course is available free of charge on the WCHN Digital Media Site and will require a key code. The Digital Media website is available on Microsoft Edge or Chrome on SA Health Computers. The details you will need to access the course are listed below.

Website: <https://digitalmedia.sahealth.sa.gov.au/>

Key Code: j2ludb

Staff can register a new account with the WCHN Digital Media e-learning platform. Where the registration requests workplace, you can select your hospital SA Health > Country Health SA Local Health Network (CHSALHN) > Eyre, Flinders & Far North > Port Augusta Hospital [Select appropriate hospital]

## Newborn Hearing Screening Criteria

As a general rule, all newborns should be screened. However, in some situations, the screen may need to be delayed, and in rare cases, screening may not be possible or is medically inadvisable.

### Screening Eligibility Criteria

To be eligible for a hearing screen, a baby must;

- > Be >34 weeks' gestational age (actual or corrected gestational age)
- > Have a normal outer ear for both ears (as outlined in the Exclusion Criteria)
- > Be asleep or in a quiet state and recently fed
- > Be medically stable and have completed any antibiotic or phototherapy treatment
- > Have had informed verbal parental consent obtained.

### Exclusion Criteria

In rare situations, screening may not be possible or is medically inadvisable. These babies are referred directly to Audiology for assessment (Appendix A – Referral for Diagnostic Audiological Assessment / Audiology Surveillance). Babies who should not receive AABR hearing screening following birth include babies;

- > With atresia or microtia in one or both outer ears. Do not screen the 'good' (normally formed) ear for babies with one normal-looking ear.
- > With a programmable ventriculoperitoneal shunt to treat hydrocephalus. The headphone of the BERAPHone emits a magnetic field that can adjust the programmable shunt, resulting in life-threatening changes to the shunt function. Infants with a manual ventriculoperitoneal shunt can have their hearing screened using the BERAPHone
- > Older than six months (corrected gestational age)
- > With skin that is not intact, or if the baby has a contagious dermatological condition such as scabies or chickenpox. The BERAPHone is intended for use on intact, external skin around the ears and on the scalp.

Aboriginal woman and/or family should be consulted on the care of the newborn baby in the first instance. Consult with an Aboriginal healthcare worker or Aboriginal Liaison Officer if requested.



### Screening to be Delayed/Postponed

Hearing screening should be delayed in the following situations:

Baby's condition	When to screen
Baby is <34 weeks gestation	When the baby is ready for discharge and >34 weeks
Medically unstable, requiring continuous cardio-respiratory or oximetry monitoring	When the baby is healthy enough and off monitors which cause electrical interference
Being treated for hyperbilirubinemia	After treatment is ceased
Being treated with potentially ototoxic medications (e.g. gentamicin/vancomycin/cisplatin)	Once the medication is ceased*
On a ventilator or in an incubator	When the baby is healthy enough for discharge
Persistently agitated or irritable	Once the baby has settled

\*If there is a risk of missing a baby due to immediate discharge or loss to follow-up, the Newborn Hearing Screening Program might decide to screen a baby while undergoing a course of ototoxic medication.

### Babies receiving palliative care

The decision to offer hearing screening to babies receiving palliated care is made in consultation with the treating team and parents. Please speak to the Newborn Hearing Screening Program when you are notified that a baby is receiving palliative care to determine the appropriate action.

*Aboriginal babies – Aboriginal people experience very high levels of Grief and Loss in their communities. Perinatal loss demands ceremonial acknowledgement. Please consult an appropriately skilled Aboriginal Healthcare worker and/or Aboriginal cultural support.*

### Screening with Audiology Follow-up Due to Risk Factors

Some children who pass their hearing screen but have one or more risk factors for progressive hearing loss should be referred to audiology for follow-up hearing throughout their childhood. The risk factors which require surveillance and referral to audiology include;

- > Immediate family history of **permanent** childhood hearing loss (baby's parents or siblings). NOTE: Family history of grommets, ear infections or ear surgery is excluded
- > Syndrome with a known risk factor for hearing loss, e.g. Down's Syndrome, Waardenburg's Syndrome, Pierre Robin Syndrome
- > Craniofacial abnormality, e.g. hydrocephalus, cleft palate, microcephaly, dysmorphic facial features
- > Invasive ventilation > 5 days
- > Cytomegalovirus (CMV) – congenital asymptomatic or symptomatic CMV confirmed in baby

## Hearing Screening Logistics

### Screening Equipment

The Newborn Hearing Screening Program in South Australia conducts hearing screening using the BERAphone and associated notebook. The device is mobile and non-invasive, utilising Automated Auditory Brainstem Response (AABR) technology to assess the auditory system from the external ear to the auditory brainstem.

The BERAphone operates by delivering a soft (35 dBnHL) chirp stimulus to the baby's ear via earphone. Each "chirp" stimulus evokes a series of identifiable nerve responses from the auditory nerve and brainstem. The electrodes that contact the skin at specific sites pick up the baby's neural response to sound and transmit the signal to the BERAphone device, where it is



analysed. A PASS result is highly correlated with normal hearing. A REFER result does not confirm the presence of hearing loss since a variety of conditions can cause a REFER result. However, it is essential that the child is referred for a follow-up evaluation to rule out or confirm the presence of hearing loss.

The following items are required when completing a hearing screen

- > BERAphone
- > Notebook with power cord
- > Electrode Gel (not ultrasound gel)
- > Infection control (i.e. Tuffie 5 or Clinell wipes)
- > Hand hygiene (alcohol gel and gloves where required)
- > "My Health and Development" record (blue book)
- > Your Baby's Hearing Screening Brochure
- > Your Baby's Follow-up Hearing Screening Brochure
- > Child and Family Health "Child and Family Health Service (CaFHS) REFERRAL FORM. (Page 1) – Client Details". – for babies who refer on their hospital screen or who miss their hospital screen)
- > Audiology Referral Form – for babies who bypass Screening or need hearing surveillance if they have one or more risk factors for hearing loss.

### Screening Location

Hearing Screening using a BERAphone can be performed in any relatively quiet location free from electrical interference. The types of environments where hearing screening may occur include:

- > At the mother's bedside in the postnatal ward
- > In a designated hearing screening room, or Outpatient clinic room
- > Special care or well-baby nursery
- > Office area of clinician's room
- > The baby's home

Parents are encouraged to be present at the hearing screen, but the screen can be conducted in their absence, providing they have agreed to this arrangement.

**Aboriginal women should be consulted about any decisions in the first instance. Ensuring a culturally safe and appropriate space for Aboriginal families is important in alleviating anxieties in the context of intergenerational trauma**

### Screening Staff

The hearing screen is to be undertaken by a Registered Midwife, Registered Nurse, Enrolled Nurse or designated screener who has completed the newborn hearing screening e-learning training and achieved competencies in performing the hearing screen using the BERAphone. Where staff who perform hearing screening have a refer rate of >20%, additional training is recommended to ensure a quality hearing screen program, reduce unnecessary anxiety for parents and improve wait times for those infants who require audiological assessment following "true" refer results. Screening staff are responsible for:

- > Explaining the hearing screen
- > Obtaining informed consent from parent/s or primary carer for performing hearing screen
- > Explain results to parent/s or carer and provide referral pamphlet/written information where required
- > Documenting results
- > Actioning referrals to Child and Family Health Service, Aboriginal Community Controlled Health Services or the Newborn Hearing Screening Program (refer to pathway)
- > Maintaining hearing screening equipment including secure storage, cleaning, data management (exporting data), troubleshooting faults.

## Screening Timeframe

To ensure high participation in newborn hearing screening, screening should be performed during the birth admission. The hearing screen can be performed >4 hours after birth for those babies who are discharging <24 hours of age. Screening <4 hours of age is not recommended to not disrupt the first few hours of bonding between parents and baby. A very early hearing screen has the potential for false refer outcomes due to the presence of birth fluid and debris in the ear canals. Ear canal massage and a settled baby will assist in screening young babies.

The optimum timeframe is from 12-24 hours after birth if the baby's discharge home is imminent. Alternatively, 24-72 hours after delivery if the baby is still an inpatient. Where a REFER result is obtained in ideal screening conditions for the AABR1, the screen can be repeated with results recorded as AABR1. If the screening conditions are not conducive for a good screen (e.g. unsettled baby), AABR1 can be repeated up to 3 more times. A period of at least 48 hours should elapse before the AABR2 is performed and recorded.

The screening process should be completed (AABR1 and AABR2 when indicated) before the baby reaches one month corrected age.

## Hearing Screening Medico-legal Considerations

### Consent

Informed consent is required for the Newborn Hearing Screening Program and may be given by:

- > Either parent/guardian
- > The Department of Child Protection (DCP)
- > A person nominated by the Family Court
- > Treating consultant if the parent is unable to be located/contacted
- > **Aboriginal woman should be consulted on the care of the newborn baby in the first instance. Consult with the preferred Aboriginal healthcare professional if requested**

In order for parents to give informed consent, they first must be given:

- > A copy of the brochure "Your Baby's Hearing Screen"
- > A verbal explanation of; the screening process, potential results and follow-up processes
- > An opportunity to ask questions
- > **Aboriginal women should be offered cultural support to assist with interpretation and understanding of the newborn hearing screening procedure and the results.**

If parents do not speak and/or read English, an interpreter will be required to obtain consent and inform parents of the results of the screen and follow-up action is required.

**For Aboriginal & Torres Strait Islander babies, recommend that parents have the option of having an Aboriginal Liaison Officer or AMIC worker present at this discussion. It is not the ALO or AMIC worker's job to get the consent, but to support the parent / guardian understanding the screening and why it is being done. Cultural safety must always be considered and this is especially important in this screening since electrodes are going to be used**

### Hearing Screening Declined by Parents

A parent's decision to decline the hearing screen is respected. However, it is appropriate to ascertain reasons for declining and to correct any misunderstandings regarding the hearing screening process. Parents must be fully informed of the potential implications should their baby have an undetected hearing loss.

Where a parent/s continues to decline the screen, the screener is required to:

- > Record the decline as "D" (Decline) on the Neonatal Hearing Screening Card
- > Record the decline in the baby's medical record as per local documentation guidelines
- > Record the decline in the baby's "My Health and Development" record (blue book)

- > Advice parent/s that ideally babies should be screened within 1 month corrected age, but they may have a hearing screen performed by CaFHS up to 6 months of age. The testing works best when the baby is asleep, so it's harder to perform the hearing screen on babies older than 3 months.

## What to Say to Parents – Screener's Script

Scripts have been developed and are available in the e-learning resource (<https://digitalmedia.sahealth.sa.gov.au/>) to be used by screeners when talking to parents in various situations. The scripts in the e-learning course can be varied to suit individual situations and communication styles. The scripts have been developed for several scenarios, including

- Offering a hearing screen
- Gaining consent
- Screening outcomes

## Hearing Screening Using a BERAphone

### Performing the Hearing Screening in the Hospital Setting

- In the hospital setting, it is preferable to use the crib when conducting the hearing screen. The best positioning for the baby is well wrapped, with both arms secured firmly, and this enables complete control for positioning the baby and sets the screener up for good manual handling posture. Screeners should be mindful of their position to ensure that their stance aligns with manual handling guidelines.
- Screening the baby whilst in the bed with their mother is not the best practice for two main reasons. You will more than likely engage in unsuitable positioning to reach the baby to screen
- The second reason this practice is unsuitable is due to the electric beds in most hospitals. Screening in an electric bed will interfere with the AABR and will cause electrical interference, which can prevent a successful screen.

### Ideal Screening Conditions

- Once you have established a baby is eligible to be screened, the last set of criteria to apply are the ideal screening conditions. The baby, their family, the environment and the screener all contribute to ideal screening conditions.

	Recommendation	Rationale
<b>Family and baby</b>	Informed Consent	Screening can only commence after informed consent it gained
	A calm, quiet baby, preferably sleeping	Muscle movement from the baby will contribute to a high EEG reading which disrupts the capture response during the screen. A noisy EEG reading will contribute to longer screens, and higher refer rates
	A baby who has been fed	More likely to remain calm, quiet, settled
	A baby who is firmly wrapped	Wrapping promotes a settled baby
	Baby settled in their cot	Easier to troubleshoot and for safe baby handling. Be mindful of correct back position to avoid twisting and/or bending
	Calm, relaxed parents (particularly if holding baby)	If the person touching/holding the baby is relaxed, this will contribute to a settles baby.

	Close to discharge	Baby is well and will have completed most medical treatment and allows most time for ears to dry out.
<b>Environment</b>	Low environmental noise	The best condition for BERAphone to achieve pass result
	Hospital staff requirements	May need to negotiate to complete the hearing screen around other activities for the baby and their family
<b>Screener</b>	Calm and professional	Presenting a calm, confident persona contributes to professional relationships with parents and staff Explain what you are doing and ask permission before you handle the baby. Respect and respond to parents requests
	Organised	Arrive at each screen with correctly functioning screening equipment and supplies and knowing what you are planning to do (e.g. prepared for first screen or repeat screen)
	Prepared	Screening requires troubleshooting and communication techniques for a wide range of potential situations. Continually reassess the situation and alter your actions as required

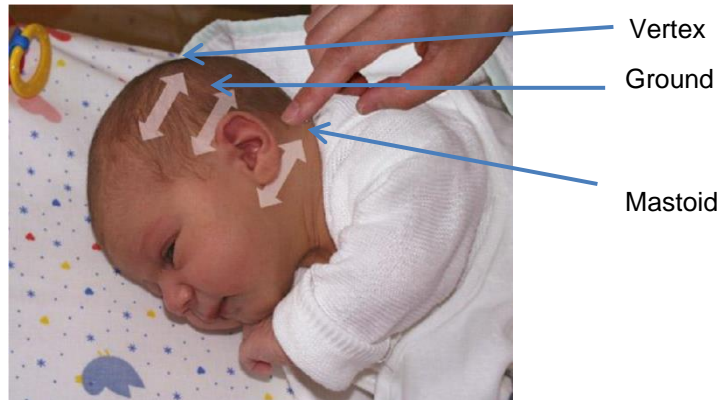
### Preparing the baby for measurement and use of equipment

- Once the baby is settled and positioned well, screening can start. Gently turn the baby's head to the side. Avoid turning the baby's body to lie on their side, as this can cause muscle extension and can interfere with the screen.
- Apply a **small** (pea-sized; Figure 2) quantity (approx. 0.1 to 0.2 ml) of gel on a gauze swab and rub approximately 10 to 15 times at the located areas, in the direction of from the front of the head to the back of the head (3). It is advisable to start with the position above the earlobe, then prepare for the vertex electrode and then finally apply electrode-gel below the earlobe.



**Figure 2 - Gel Usage**

- Never squeeze the gel directly onto the electrodes, as this can cause too much gel to clog the sensors and does not follow correct infection control practices.
- Rub the gel into the baby's skin where the three sensors on the AABR handset will sit, taking care not to merge the three gel sites. As a guide, the sites are: the Mastoid – just under the baby's earlobe, the Ground, directly above the baby's ear and the vertex, at the front of the baby's hairline (
- 
- Figure 3)
- Ensure the gel is rubbed very well into the skin so that it is absorbed and ready for measuring the connection (or impedance) of the three sensors on the AABR handset.

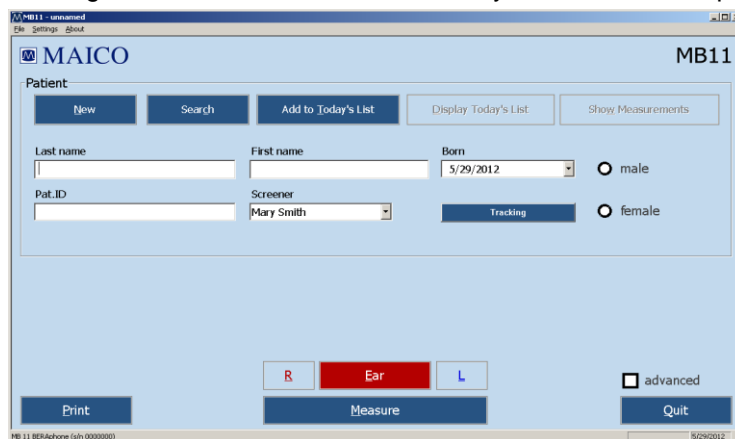


**Figure 3 - Application of Electrode Gel**

- **IMPORTANT** If the baby's head has had lotion /oil or treated with any greasy skincare products in the region where the electrodes should contact then the lotion/oil must be removed carefully with water and a cloth before further preparation
- Massaging the baby's ear gently and slowly rotating the pinna to open up the ear canal can loosen moisture in the baby's ear canal, leading to a faster, more accurate screen.
- **IMPORTANT:** Avoid fluid bridges caused by too much electrode-gel application as well as the electrode gel sites connecting. Fluid bridges can be avoided by always rubbing in the direction from the face towards the back of the head to ensure three distinct gel areas that do not contact each other and the correct amount of gel used. The distance between the electrode above the ear (ground electrode) and the vertex electrode is particularly critical. Ensure that a finger-wide area remains free of electrode-gel!
- Finally, apply a small drop of electrode-gel on a clean gauze swab to each electrode of the BERAphone.

### Turning on the Notebook (laptop) and Starting the BERAphone

- The notebook and BERAphone must be connected by the USB port on the notebook and the transducer on the BERAphone
- Turning the notebook on will automatically launch the BERAphone software (Figure 4)



**Figure 4 - BERAphone software startup screen**

### Entering Patient Data/Information

- Enter the baby's details, including last name, first name, gender, date of birth and hospital location, with the keyboard in the hearing screening software. If the baby's name is not known, enter "Baby of...(the mother's first name)"



- Move between the different entry fields using the <tab> key or a mouse click in the required data field.
- Patient ID is not required, the software will automatically assign a record number. In the screener section, write or select the hospital name, on most notebooks, the location is already set to the screening location.
- Select the ear to be tested, < R > for right or < L > left, using the Ear button or the R/L toggle control just above the "Measure" button.
- Quick Keys can also be used, any letter with a line underneath activates the quick key function, such as the R and L tabs above, use the R and L keys on the notepad.

### Starting Screening

- Once patient data is loaded/ entered, select the ear to be tested by clicking on "R" for right or "L" for left (5).
- Start the test by clicking on "Measure": The measurement screen opens (Figure ) and place the handset onto the three gel sites on the baby's head.
- Most babies will usually give a little wriggle when the handset is placed on the head. Keep the handset in place and wait until the baby resettles.

The screenshot shows the MAICO MB11 software interface. At the top, it displays the patient name 'Anderson, Carl' and birth date '3/21/2012'. Below this, there are buttons for 'New', 'Search', 'Add to Today's List', 'Display Today's List', and 'Show Measurements'. The main form contains fields for 'Last name' (Anderson), 'First name' (Carl), 'Born' (3/21/2012), 'Pat.ID' (8457325252), and 'Screener' (Mary Smith). There are radio buttons for 'male' and 'female', with 'male' selected. A 'Tracking' button is also present. At the bottom, there are buttons for 'R', 'Ear', and 'L', with 'Ear' highlighted in red. Below these are 'Print', 'Measure', and 'Quit' buttons. A checkbox for 'advanced' is also visible.

**Figure 5 - Ear Selection and starting assessment**

### Placing Handset on Baby

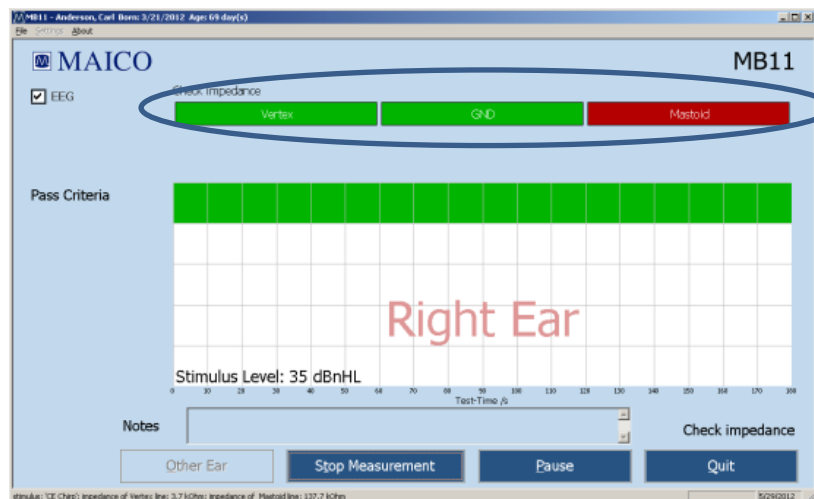
- First, try to position only the mastoid electrode below the earlobe. The other two electrodes are initially left without contact.
- Once this electrode has been positioned, follow any movements of the head with the BERAphone without losing the position of the mastoid electrode.
- The other two electrodes still do not have contact with the skin. Once the baby is calm, the BERAphone is lowered to the vertex, paying attention to a good contact of the electrodes. The correct position of the BERAphone is checked with the Impedance Test (Figure 6).





**Figure 6 - Positioning of BERAprone on Head**

- After placing the handset on the baby's head, the BERAprone software will show you information about the impedance (connection) of the three sensors. Initially, the boxes for each of the three sensors will be red. Once the ABR sensors are correctly placed onto the gel sites on the baby's head, these boxes should change to either green or yellow and the screen will begin. You will see the light on the ABR handset change from red to green once screening begins (Figure 7).
- The earphone with the black ear cushion must be positioned over the ear. Make sure there are no obvious gaps between the cushion and the baby's skin as this may reduce the intensity of the acoustic stimulus delivered to the baby's ear and increase the chance of a "Refer" test outcome.



**Figure 7 - Impedance light indicators**

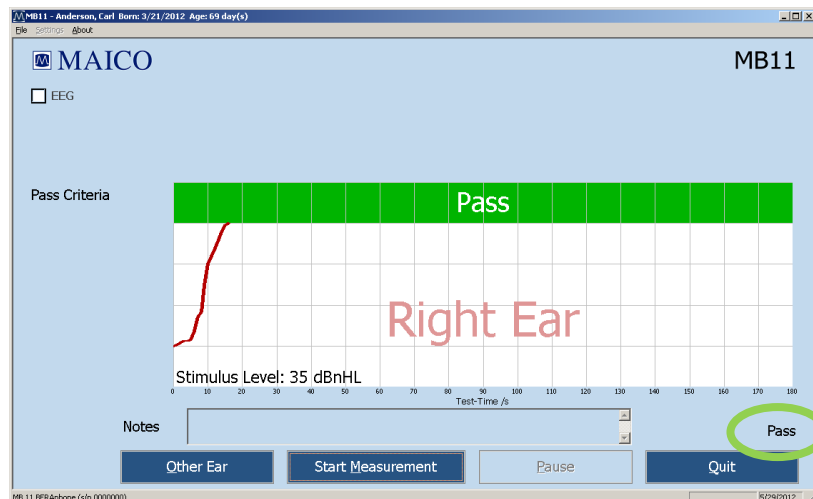
- > Here, the tester can see the status of the impedance test for each of the three electrodes easily. The green colour symbolises good impedance, yellow means not optimal but sufficient to perform the Screening. Red signals indicate bad impedance, and the test will not proceed.
- > The impedance values measured for Vertex / Ground and Mastoid / Ground lines are shown in the status line in the lower-left corner at the screen. In the case of a red light, the impedance must be corrected. This can be done by repeating the preparation with the electrode gel to lower the impedance of the skin.
- > In some cases, it may take a few minutes for the electrode gel to soak into the skin and take effect.
- > The impedance can sometimes be improved by shifting the position of the electrode at that site slightly, making sure to be in contact with the area of the skin which was prepared with the electrode.
- > The impedance test is passed when all three electrodes show green or yellow for seven seconds. The BERAprone has a light on the top, which will flash green for good connection and if it's red you need to move the electrodes to gain green (good) light impedance.

- > After passing the impedance test, the measurement starts and the impedance indicator lights change into the signal quality light.
- > Never place the electrodes in the ear canal.
- > Care must be taken that the mastoid electrode really remains positioned below the earlobe. If there is any doubt, carefully move the BERAphone to one side and check.

## Acquiring the BERAphone Screen – PASS and REFER Results

### Pass Results

- > Once the test starts, keep the handset steady and apply gentle pressure, just enough to keep contact with the skin, do not press down on any of the electrodes. If baby is settled, the EEG line at the top of the software screen will show as a steady straight line and the screen will be completed between 20 and 180 seconds.
- > During the test, a small segment of a line is drawn after each 1 second of data collection. The line displays as blue for a left ear test and red for a right ear test. During the test, the indication line for pass criteria in the diagram continues to move upward on the graph until the green area is reached. Then 100% of the pass criteria is fulfilled and the test was passed successfully. The result "PASS" is shown in the green area and written on the bottom right of the screen (Figure 8).



**Figure 8 - Pass Result**

### Refer Results

- > If the pass criterion is not reached after a specified time, the result **REFER** is displayed in the lower right corner (Figure 19). The BERAphone has been set up to reduce the time of the hearing screen, and a **REFER** will be recorded at 120 seconds when the progress line doesn't reach above the 60% towards the pass criteria.
- > Where the progress line progresses above 60% but doesn't reach the pass criteria, a **REFER** result will be recorded 180 seconds of test time.
- > If the pass criterion is not reached after 180 seconds of test time, the result "Refer" is displayed in the lower right corner (Figure 19)

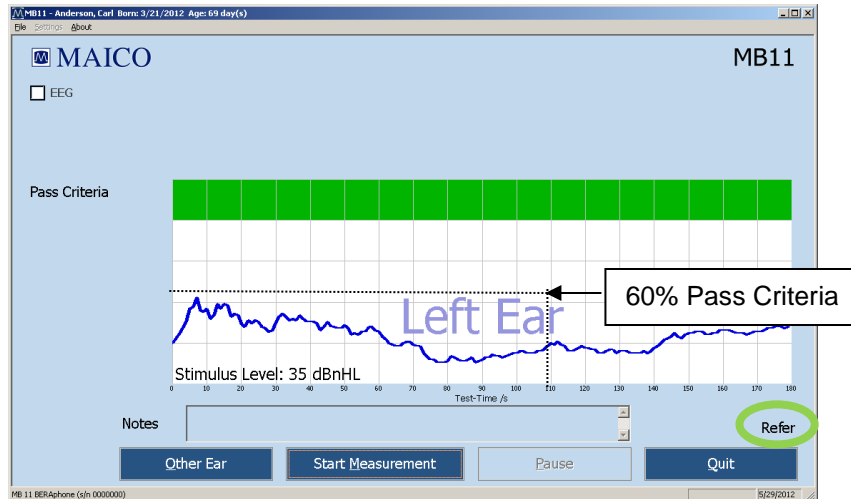


Figure 1 - Refer Results

- > If you cannot exclude poor test conditions as a reason for the "Refer" you should consider performing a retest when the conditions have improved.

### Abort Results / Stop Measurement

A test can be aborted by selecting the Stop Measurement button (Figure 210). The test will be saved as an aborted test in the database. This is recommended if the test conditions have been poor for an over a minute. Three aborts are the maximum recommendation. If more are required, the testing conditions need to be completely altered.



Figure 20 - Abort of Test

### Testing Other Ear

At the bottom part of the test screen are the function buttons. Other EAR: After the test is finished, you can change the ear to be tested. Start Measurement: Clicking on the "Start Measurement" button starts a new test. The function button changes to "Stop Measurement".

### Pause Measurement

Pause: Stops the ongoing test. In this case, this button changes into "Continue..." and the status indication at the bottom of the screen shows "Test in progress". This is beneficial when the infant is moving around and you need to wait for them to settle. The pause button should only be used when the electrodes remain in contact with the skin. Once contact is lost, the impedance needs to

be checked again before continuing the screen. This can be done by selecting Stop Measurement.

### Quit Measurement

Quit: Finishes the measurement and returns to the start screen.

## Screening Documentation and Referral Form

### Documentation on the Neonatal Hearing Screening Card

Screen results are documented in the baby's medical record, all sections of the Hearing Screening Card (Figure 11) and "My Health and Development" record (blue book) with the following acronyms to describe the hearing screen result

- > P = Pass
- > R = Refer
- > D = Decline
- > N = No Test
- > A = Direct to Audiology

**Neonatal Hearing Screen** Enquiries (08) 8303 1585 **DRAFT** 00000000

PLEASE COMPLETE ALL DETAILS - write clearly within the boxes.

Please fill in details or affix Patient ID label

Baby's Surname

Baby's Given Name

Date of Birth Identification Number

Day Mth Yr

Hearing Screen performed:

Day Mth Yr 24hr clock Female  Male

Gestation Birth Weight

Weeks Grams

Birth Hospital

**HEARING SCREENING TEST RESULTS**

Hospital site where screen was performed:

Pass (P)  
Refer (R)  
Declined (D)  
No Test (N)  
Direct to Audiology (A)

AABR Left Ear  Right Ear

Mail to:  
South Australian Neonatal Screening Centre  
SA Pathology, 4th Floor Rogerson Building  
Women's and Children's Hospital  
72 King William Road, North Adelaide SA 5006

**Figure 11 - Neonatal Screening Test Card**

Where a refer result was obtained in one or both ears on AABR1 or the baby was discharged from the hospital without a hearing screen, the hearing section of the CaFHS referral form would be completed.

If AABR2 can be completed in the hospital, these results will need to be recorded in the hospital progress note and emailed to the Newborn Hearing Screening Program ([Health.WCHNHearingScreening@sa.gov.au](mailto:Health.WCHNHearingScreening@sa.gov.au)). The newborn hearing screening database can only capture one screen from the birth hospital.

Where a baby meets the direct referral criteria or risk factor for surveillance, the hospital would complete the Refer for Full Audiological Assessment Form or Surveillance.

### Documentation in "My Health and Development" record (blue book)

The hearing screening result documentation is located on Page 5 of the "My Health and Development" record (blue book). The hearing screening result should be recorded against the first, second, or third hearing screen (Figure 32).

- > The risk factor questionnaire is designed to be completed by parents to determine whether follow-up audiology services should be arranged for their baby.

**Newborn hearing screening**

Newborn hearing screening is usually done in hospital, soon after birth. If needed, follow-up screening may be done in the community by a Child and Family Health Service nurse. **If hearing screen was not undertaken, indicate reason** \_\_\_\_\_ (If your child has an absent or underdeveloped outer ear or ear canal (microtia / atresia), then they will be referred directly for diagnostic hearing assessment with Children's Audiology Service).

Newborn hearing screening results	
Screen 1 Date ____/____/____	
Left ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer
Right ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer
<b>2nd screen required</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Screen 2 Date ____/____/____	
Left ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer
Right ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer
<b>Action: Audiology referral</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No
Screen 3 Date ____/____/____	
Left ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer
Right ear	<input type="checkbox"/> Pass <input type="checkbox"/> Refer

**Risk factors requiring follow-up: questions for parents**

The following questions relate to risk factors for hearing impairment. Please answer each question by ticking the appropriate boxes, as soon as possible after your baby is born. If you answered 'yes' to any of these questions, please tell your doctor, midwife or child and family health nurse who will refer you for audiology review.

Hearing profile
Does your baby have a parent or sibling with a permanent childhood hearing loss? (family history of grommets, ear infections or ear surgery is excluded) <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure
Does your baby have Down Syndrome (Trisomy 21) or any other syndrome associated with hearing loss (e.g. Waardenburg's Syndrome or Pierre Robin)? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure
Have you noticed anything unusual about your baby's face or neck, such as an unusually shaped face or skin tags? Were they born with a craniofacial abnormality, e.g. Hydrocephalus or cleft palate? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure
Did your baby have severe problems breathing at birth and require oxygen for greater than 5 days? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure
Did you have any cytomegalovirus during pregnancy? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unsure

page 5

Figure 32 - "My Health and Development" record (blue book) Hearing Screening Documentation

**Other Considerations**

**Work Health and Safety**

Incorrect set up of equipment and the patient when performing AABR screening may lead to musculoskeletal discomfort and/or injury due to awkward and sustained postures. To minimise the risk of discomfort/injury:

- > Position the infant close to the notebook to minimise overreaching (Figure 13)



Figure 13 - Positioning of Baby for Hearing Screen to reduce reaching

- > Set up the notebook screen close and directly in front to avoid twisting and overreaching (Figure 44)



Figure 44 - Positioning of Notebook to reduce reaching and twisting



- > Sit on a chair or adopt a half-kneeling position to avoid stooping/bending if the baby is at waist height (Figure 5)



**Figure 15 - Kneeling or standing to avoid bending**

- > Ensure your elbows are close to your side (Figure 56)



**Figure 57 - Elbow/Arm close to the side of the body**

Remember, you can start the procedure by pressing 'measure' BEFORE you have the device set up to minimise awkward postures when getting ready for testing.

### Cleaning

For fast quality screens and to ensure high standard infection control, the BERAphone needs to be cleaned between each screen as well as deep cleans at the end of the day. Each of the electrodes should be free moving (e.g. spring back) and the ear cuff should be free of cracks. Instructions on the clearing requirements of the BERAphone are found in the e-learning course (<https://digitalmedia.sahealth.sa.gov.au/>).

### Troubleshooting

Refer to troubleshooting guide in the e-learning course (<https://digitalmedia.sahealth.sa.gov.au/>) for equipment troubleshooting. Alternatively, contact the Newborn Hearing Screening Program on 8303-1585 for phone support

### Export of Data

Data export is required within the first five business days of the month of the previous month's data. Each site generally has a designated staff member responsible for this task. Refer to the e-learning course for full details on data export. Exporting data to the Newborn Hearing Screening Program is imperative for the quality and safety of the program.



### Security of Equipment

- > There is data stored on the notebooks, including names, dates of birth and hearing screen results. This equipment must be secured at all times as it does contain personal information.
- > It is recommended that all sites individually secure the notebook to a trolley used within a hospital site. For those services where the consult occurs off-site, the notebook is transported in a locked carry bag.
- > Equipment must be securely locked away when not in use.
- > In the event of a stolen laptop, the incident must be raised immediately with the Newborn Hearing Screening Program (8303-1585 or [Health.WCHNHearingScreening@sa.gov.au](mailto:Health.WCHNHearingScreening@sa.gov.au)). The incident should be logged on the SLS system for SA Health sites, and a local escalation process should be followed. For private hospitals, follow local incident management processes. The incident should be reported to the police and a police incident report number forwarded to the Newborn Hearing Screening Program. As the laptop contains patient information, patient incident disclosure may occur.

### Calibration and Repair

- > Annual calibration will be organised through the Newborn Hearing Screening Program. You will be contacted by our site when the equipment is due for calibration. Alternatively, if you notice the equipment is out of calibration, contact our department to arrange a new unit.
- > For issues or repair, contact the Newborn Hearing Screening Program on Tel 08 8303 1585

### Consumables & Resources

The Newborn Hearing Screening Program is responsible for:

- > Costs associated with the repair and calibration of a machine
- > Freight costs
- > The supply and cost of referral forms and brochures related to newborn hearing screen

**Birthing Hospitals are responsible for ordering and costs associated with gel.**

### Quality Assurance Measures

While the Newborn Hearing Screening Program is responsible for the governance and coordination of the hearing screening program, each hearing screener is responsible for following the processes as outlined in this procedure. It is vital that both ears are screened at every visit, irrespective of previous hearing screens of the other ear result. It is also vital that hearing screening outcomes have been correctly documented on the Neonatal Hearing Screening card.

South Australia and other States have recorded incidences where documentation errors or falsification of hearing screen results have occurred, resulting in negative outcomes for the child. If you have any concerns or questions relating to current or previous screens, contact the Newborn Hearing Screening Program on 08 8303 1585.



**Women's and Children's Health Network**

**CLIENT LABEL**

**REFERRAL FOR DIAGNOSTIC AUDIOLOGICAL ASSESSMENT/AUDIOLOGY SURVEILLANCE**

ID Number: .....  
Surname: .....  
Given Names: .....  
D.O.B: ..... Sex: .....

Birth hospital: .....  
Has the baby received AABR screen:  Yes  No  
If yes, date of screen 1: ...../...../..... Date of screen 2: ...../...../.....  
Results of screen 1: L: ..... R: ..... Results of screen 2: L: ..... R: .....  
If the baby transferred hospital, where was the screen performed: .....

**BABY'S DETAILS**

Baby's Surname: ..... Given Name/s: .....  
DOB: ...../...../..... Hospital UR: .....  
Gestational Age: ..... Term Date: ..... Indigenous Status: .....  
Mother's Family Name: ..... First Name: .....  
Postal Address: ..... Postcode: .....  
Mobile Number: .....  
Interpreter Required:  Yes  No Language: .....

**NOTIFICATION OF INFANT REQUIRING FULL AUDIOLOGICAL ASSESSMENT**  
These babies should not be screened

Conditions that necessarily impede hearing e.g. atresia of the external auditory meatus

**RISK FACTORS TO BE FOLLOWED THROUGH AUDIOLOGY SURVEILLANCE**  
Please send in referral

- Immediate family history of permanent hearing loss (parents or siblings of baby only) (excluding grommets/ear infections/trauma) Details: .....
- Syndrome with known risk factor for hearing loss eg Down's, Waardenburg, Pierre Robin, Alports  
Details: .....
- Craniofacial abnormality eg hydrocephalus, microcephaly, cleft palate  
Details: .....
- Assisted ventilation >5 days
- CMV – Congenital asymptomatic or symptomatic cytomegalovirus confirmed in baby

**Completed by**

Staff name: ..... Signature: .....  
Designation: ..... Date: ...../...../..... Hospital: .....

**FAX TO UNHS ON 8303 1640**  
Please call 8303 1585 if you have any questions

**LEGEND:**  
DOB = Date of Birth UNHS = Universal Neonatal Hearing Service  
CMV = Cytomegalovirus UR = Unit number  
ID = Identification

REFERRAL FOR FULL DIAGNOSTIC AUDIOLOGICAL ASSESSMENT RR

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