

2015 Alabama Newborn Screening Conference



Marriott Hotel and Conference Center
Prattville, Alabama
Friday, September 18, 2015

Best Practices in Hearing Screening and Intervention

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A Look Back in Alabama History: Identification of Hearing Loss in the + Pediatric Population

Prior to Universal Newborn Hearing Screening...

- Primary reason for hearing test: parental concern
- Age of identification: 2-3 years
- Age of initial amplification: 3½ years
- Years in speech therapy: 5-8 years
- Typical adult reading level: 8th grade
- Typical educational level: high school diploma



Economic Cost of a Child with Hearing Loss



• During the 1999 - 2000 school year, the total cost in the United States for special education programs for children who were deaf or hard of hearing was **\$652 million, or \$11,006 per child**

• The lifetime educational cost (year 2007 value) of hearing loss (more than 40 dB permanent loss without other disabilities) has been estimated at **\$115,600 per child**

• It is expected that the lifetime costs for all people with hearing loss who were born in 2000 will total **\$2.1 billion (in 2003 dollars)**

Economic Cost of a Child with Hearing Loss



TABLE: Estimated prevalence and lifetime economic costs* for mental retardation, cerebral palsy, hearing loss, and vision impairment, by cost category—United States, 2003

Developmental disability	Rate ¹	Direct medical costs ² (millions)	Direct nonmedical costs ³ (millions)	Indirect costs ⁴ (millions)	Total costs ⁵ (millions)	Average costs per person
Mental retardation	12.0	\$1,061	\$5,249	\$30,121	\$36,431	\$1,014,000
Cerebral palsy	3.0	1,175	1,064	9,241	11,480	\$21,000
Hearing loss	1.2	132	640	1,330	2,102	\$17,000
Vision impairment	1.1	109	406	1,916	2,431	\$22,000

* Present value estimates in 2003 dollars, of lifetime costs for persons born in 2000, based on a 3% discount rate.

¹ Per 1,000 children aged 5-10 years, on the basis of Metropolitan Atlanta Developmental Disabilities Surveillance Program data for 1994-1994.

² Includes physician visits, prescription medications, hospital inpatient stays, assistive devices, therapy and rehabilitation for persons aged <18 years, and long-term care (for persons aged 18-76 years), adjusted for age-specific survival.

³ Includes costs of home and vehicle modifications for persons aged <16 years and costs of special education for persons aged 3-17 years.

⁴ Includes productivity losses from increased mortality (i.e., inability to work or limitation in the amount or type of work performed) and premature mortality for persons aged <18 years with mental retardation, aged <20 years with cerebral palsy, and aged <17 years with hearing loss and vision impairment.

JAMA The Journal of the American Medical Association Impact Factor & Information, 2000

1978 : A TALE OF TWO CHILDREN

- **Birth History:**
 - Identical Twins born 6 weeks premature
 - weighed 4 and 5 lbs. at birth
 - Twin A was smaller than twin B
 - Twin A required oxygen longer
- No family history of childhood hearing loss
- Like many twins, A and B developed their own language (*idioglossia*)



1978 : A TALE OF TWO CHILDREN

- At age 3, the parents were concerned about speech and language delays, so they brought the twins to the Auburn Speech and Hearing Clinic
- After 6 months of biweekly speech therapy sessions:
 - Twin B was making significant progress
 - Twin A was making little progress



1978 : A TALE OF TWO CHILDREN

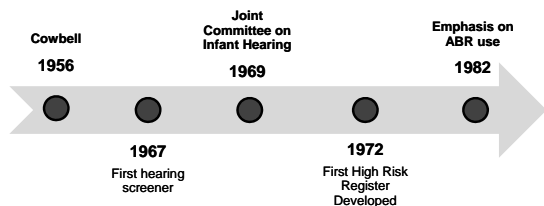
- Hearing test completed when twin A was 3.5 years old
 - *mild to profound* bilateral permanent hearing loss
- Twin A was amplified at 3 years, 9 months
- Twin B was discharged from speech therapy at age 4
- Twin A remained in therapy until entering High School



1967 : LOOKING BACK AT EARLY TECHNOLOGY USED IN NEWBORN HEARING SCREEN



Fig. 7.3. Trained volunteers performing the arousal test with sleeping newborns.



1972: High Risk Factors for Hearing Loss

- Family history of childhood hearing impairment
- Rubella or other nonbacterial intrauterine fetal infection (CMV, Herpes)
- Defects of the ear, nose or throat
- Malformed, low-set, or absent pinna
- Cleft lip
- Birth weight less than 1500 grams
- Bilirubin level greater than 20 mg/100ml serum



Additions to the High Risk Registry

1982

- Bacterial Meningitis
- Severe Asphyxia



1990

- Findings associated with a syndrome known to include sensorineural hearing loss
- Prolonged mechanical ventilation for a duration equal to or greater than 10 days (e.g., persistent pulmonary hypertension)



Cowbell

1956

Joint
Committee
on Infant
Hearing

1969

Emphasis
on ABR
use

1982

1967
First
hearing
screener

1972
First High Risk
Register
Developed



Screen all
at risk
babies
prior to
discharge

1990

Hearing
screening
for all
newborns
(1/3/6)

1994

Pediatric
Clinic of
North
America

1999

1993
National
Institute of
Health

1995
Poorly
designed
programs
discussed

2000
Universal
Screening
of Hearing
Loss

1999 : A TALE OF ONE CHILD

- Hearing screening completed at 1 day old using DPOAE screener
- Child failed DPOAE rescreening administered at EAMC and scheduled for follow-up ABR testing at Auburn University
- ABR test completed when child was 9 weeks of age and results indicated a profound bilateral sensorineural hearing loss



1999 : A TALE OF ONE CHILD

- Bilateral earmold impressions made at 11 weeks old
- Bilateral hearing aids were delivered at 14 weeks



1999 : A TALE OF ONE CHILD

- Early Intervention specialist met with parents at the hearing aid delivery
- Monthly meetings with family to facilitate speech and language stimulation activities



1999 : A TALE OF ONE CHILD

- Received cochlear implant at age 1 year
- Began Auditory Verbal Therapy at age 2 years and continued in therapy until dismissed at age 6
- Received Special Education services through 2nd grade



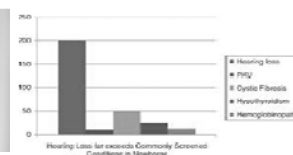
Auburn University Audiology Outreach in Guatemala



Newborn Hearing Screenings: Understanding the Importance of Early Identification

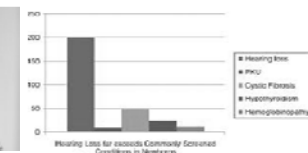
Prevalence of Newborn Hearing Loss

- 2-5 infants per 1000 will be identified with hearing loss in one or both ears
- Approximately 4000 children are born profoundly deaf each year in the US alone
- Another 10-15% of newborns will demonstrate a partial hearing loss that will be educationally significant



Prevalence of Newborn Hearing Loss

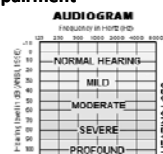
- An educationally significant hearing loss could go undetected in a child as late as 6 years of age
- It's important to obtain the diagnosis as early as possible so intervention and treatment may begin right away
- Those with a mild hearing loss are twice as likely to fall behind, compared to normally developing peers



Degree and Configuration of Hearing Impairments: Implications for Speech Perception

All degrees of hearing impairment must be clearly identified, their impact recognized, and hearing management initiated as soon as possible to minimize potentially devastating consequences of hearing impairment

Even a minimal hearing impairment can sabotage the overall development of a child who is in the process of learning language and acquiring knowledge



1-3-6 Movement

It Starts with US!

Early identification and intervention for hearing loss are critical to speech and language development in children



- 1 - Identify children with hearing loss by 1 month
- 3 - Diagnose hearing loss by 3 months
- 6 - Intervention by 6 months

Success of a Child with a Hearing Loss Depends on 7 Factors

1. Proper administration and documentation of Newborn Hearing Screening
2. Accurate diagnosis of configuration and degree of hearing loss
3. Age of child at intervention
4. Type and intensity of Early Intervention



Success of a Child with a Hearing Loss Depends on 7 Factors

5. Appropriateness of amplification
6. Family and professional's confidence in the child's ability to develop auditory skills and communication
7. Support systems available to the child



Hearing as the Basis of Development of Spoken Language

With advances in audiologic equipment and screening techniques, now it is possible for all children with hearing loss to develop spoken language primarily through listening rather than watching

abcdefghijklmnopqrstuvwxyz



Hearing Loss as an Acoustic Filter

- The importance of hearing to the communication and learning process tends to be underestimated because hearing impairment is invisible
 - Any type and degree of hearing impairment can present a significant barrier to a child's ability to receive information from the environment
 - Hearing loss is an invisible acoustic filter that *distorts, smears, or eliminates incoming sounds*



Hearing loss is a silent disability – but very detrimental.

Hearing impairment is typically comorbid with other issues, such as syndromic disorders, language learning problems, dyslexia, etc.

Striving for Excellence in Early Intervention of Hearing Loss

- Children born in a hospital that appropriately administer newborn hearing screenings were 2.6 times more likely to have language within normal range than those born in a hospital without a screening program



The 1st 3yrs of an infant's life are most important for speech language development because this is when the brain is growing and rapidly developing, including the auditory pathway.

Alabama's Recommended Protocol for Newborn Hearing Screening

■ UNHS Program Protocol

■ 3 Primary Components:

- Screen all babies before discharge
- Identify those with potential hearing loss
- Refer them for full evaluation, diagnosis and



UNHS for Well & NICU Babies

■ Protocol for babies who "Refer"

- Babies that refer the first 2 screenings, prior to discharge need to be re-screened within 3 weeks of discharge

- Well babies born in the hospital should be screened no sooner than 8 hours after birth



Consequences of a "False Pass"

- What's the harm in screening until a 'pass' result?

- Screening over the recommended amount can lead to unreliable results

- Unreliable results can lead to potential unidentified *hearing loss*



Risk Factor Checklist for Infants

(birth to 28 days)

- Family history of childhood hearing impairment
- Congenital infection known to be associated with sensorineural hearing loss
- Unusual ear, eye, head, or neck development.
- Birth weight less than 3 lbs. 5 oz
- Severe jaundice
- Use of ototoxic medications
- Bacterial meningitis



Risk Factor Checklist for Infants

(birth to 28 days)

- Birth Apgar scores of 0-3 at 5 minutes
- Prolonged mechanical ventilation (greater than 10 days)
- Indicators associated with a syndrome known to include a hearing impairment



High Risk Registry 2010: Referral for Audiological Follow-up

At Risk for hearing Loss at Birth

- Stigmata associated with a syndrome known to include hearing loss
- Family history of permanent childhood hearing loss
- Craniofacial anomalies
- In-utero infection including CMV, herpes, toxoplasmosis, syphilis, rubella



High Risk Registry 2010: Referral for Audiological Follow-up

At Risk for hearing Loss at Birth Neonatal indicators

- Hyperbilirubinemia with exchange transfusion
- Persistent pulmonary hypertension with mechanical ventilation
- Use of extracorporeal membrane oxygenation



High Risk Registry 2010: Referral for Audiological Follow-up

At Risk for Late-onset or Progressive Hearing Loss:

- Parental concern
- Post natal infection including bacterial meningitis
- Syndromes associated with progressive permanent hearing loss



High Risk Registry 2010: Referral for Audiological Follow-up

At Risk for Late-onset or Progressive Hearing Loss:

- Neurodegenerative disorders (Hunter syndrome)
- Sensory motor neuropathies (Friedreich ataxia, Charcot-Marie-Tooth syndrome)
- Head Trauma Recurrent or persistent Otitis Media Externa for at least 3 months



Communication is Key



Proper and effective communication strategies ensure parent confidence and understanding regarding the explanation of newborn hearing screening results

Faculty

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