

# **Universal Infant Hearing Screening: Successes and Continuing Challenges**



**Sound Foundations 2010  
Chicago, Illinois, USA**

**Karl R. White**

**National Center for Hearing Assessment and Management**

**[www.infanthearing.org](http://www.infanthearing.org)**

Total  
Communication

Cued  
Speech

Sign  
Language

Listening  
& Spoken  
Language



Visual  
Language

Spoken  
Language





MONTREAL ORAL  
SCHOOL  
GROUP - 4  
200-4 1977-78



Audio and picture courtesy of Susan Nittrouer, Ohio State University

A woman with blonde hair, wearing a pink top, is holding a young child with dark hair. They are in a room that appears to be a library or classroom, with bookshelves and books visible in the background. The image is slightly faded and has a soft, warm tone.

**Spring is my favorite season. The sun shines bright. The flowers begin to grow. I like spring.**

Audio and picture courtesy of Susan Nittrouer, Ohio State University





# What enabled us to move from ....



There



to

Here?





# What enabled us to move from ....



**There**



**Here?**



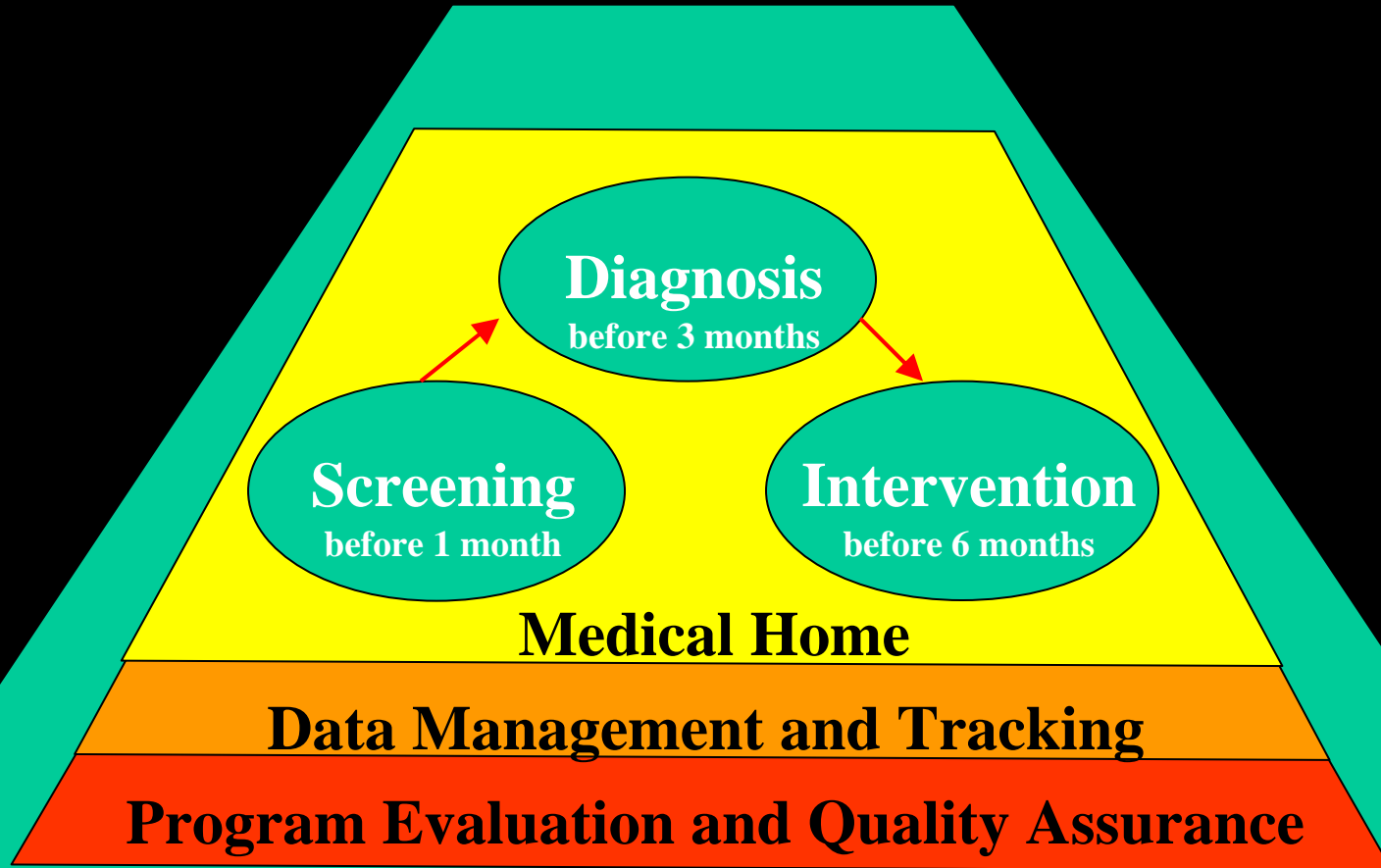
**Earlier Identification of  
Hearing Loss**

**Availability of Better  
Hearing Technology**

**High Quality Early  
Intervention Programs  
that focus on teaching  
LANGUAGE**

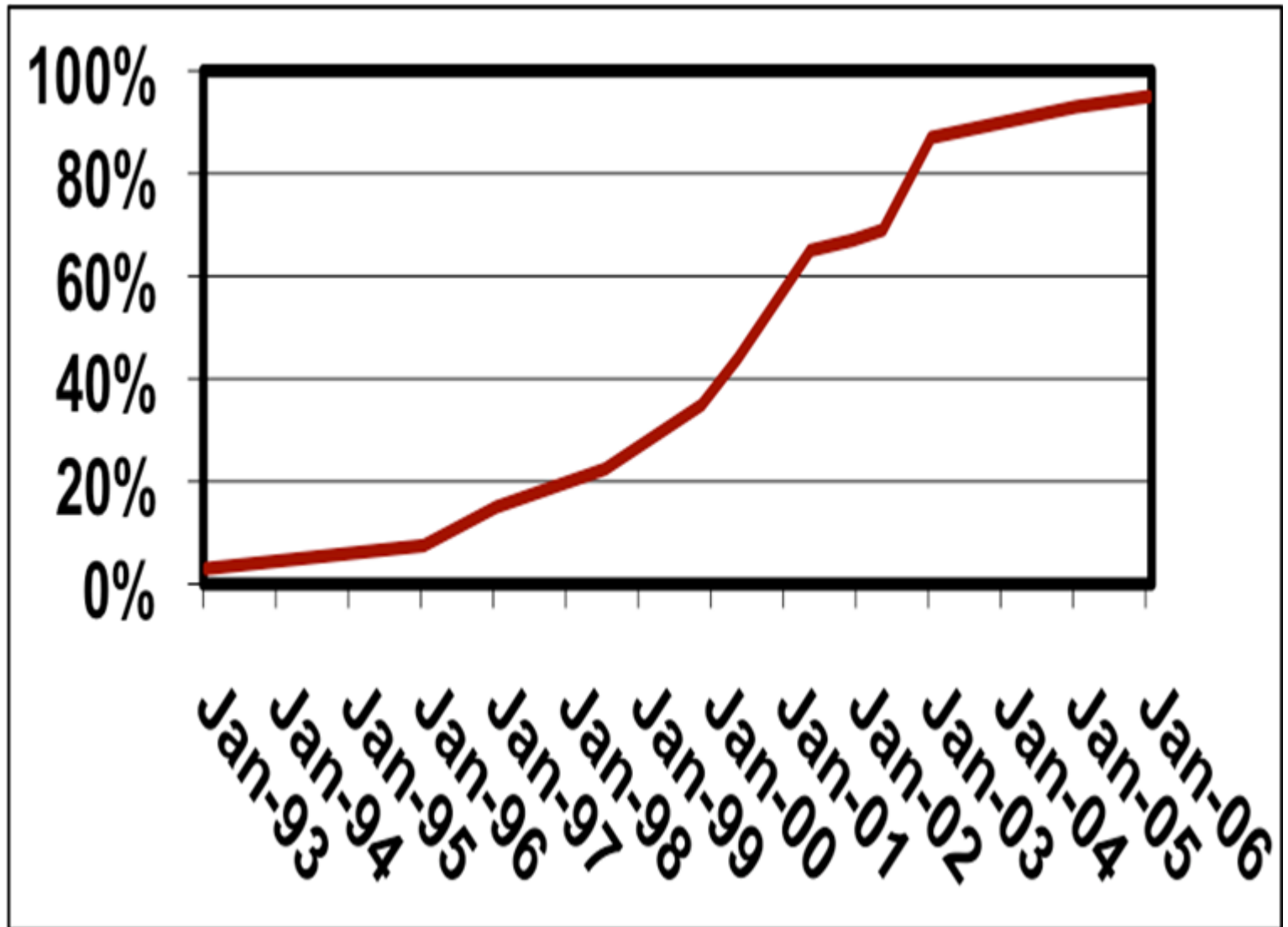


# Components of an Effective Early Hearing Detection and Intervention (EHDI) Program



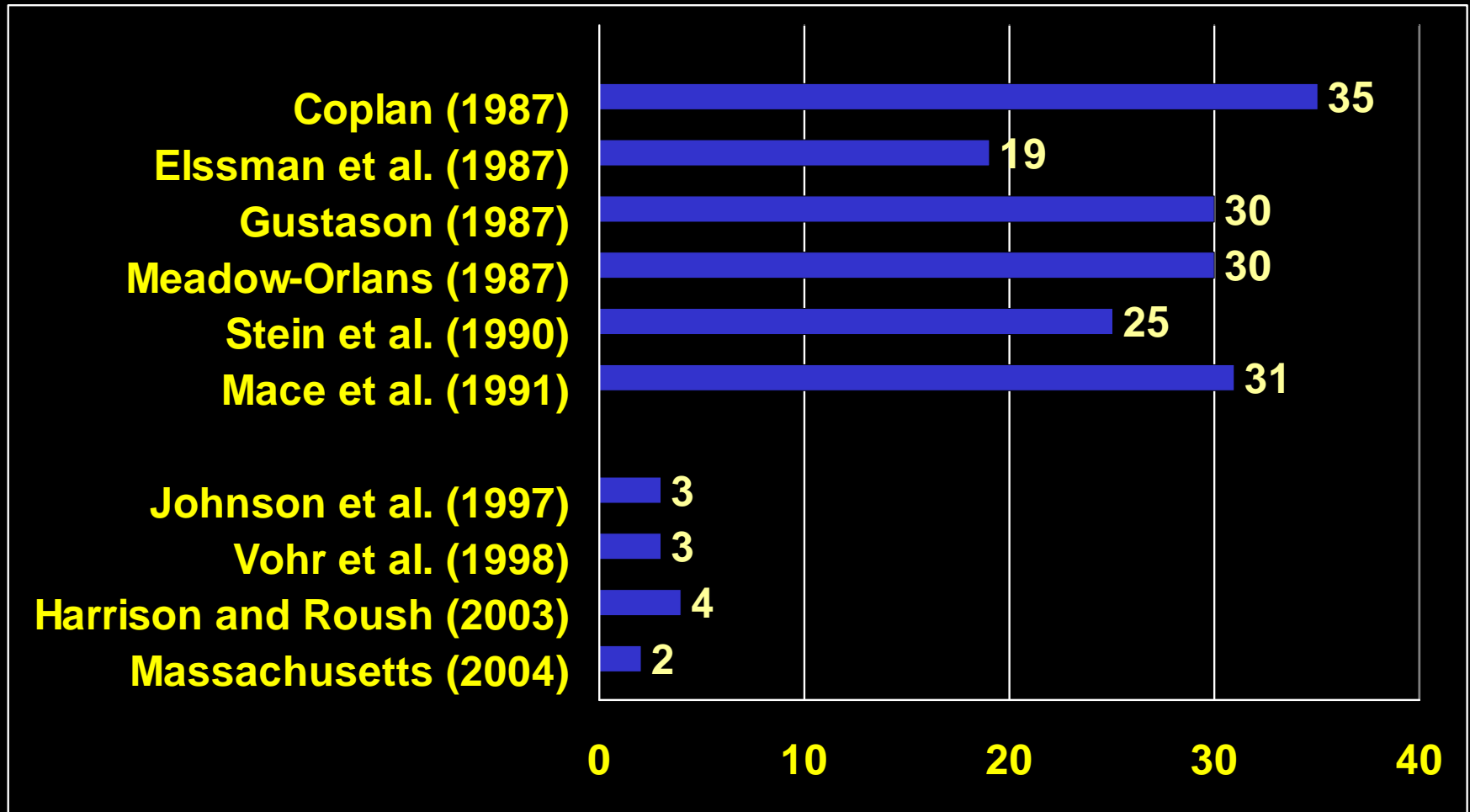
**Family Support!!**

# Percentage of Babies Screened in the United States Over Time



**White KR**, Forsman I, Eichwald J, Munoz K (2010). The evolution of early hearing detection and intervention programs in the United States. *Semin Perinatol.* 34(2):170-9.

# Age in Months at Which Permanent Hearing Loss Was Diagnosed

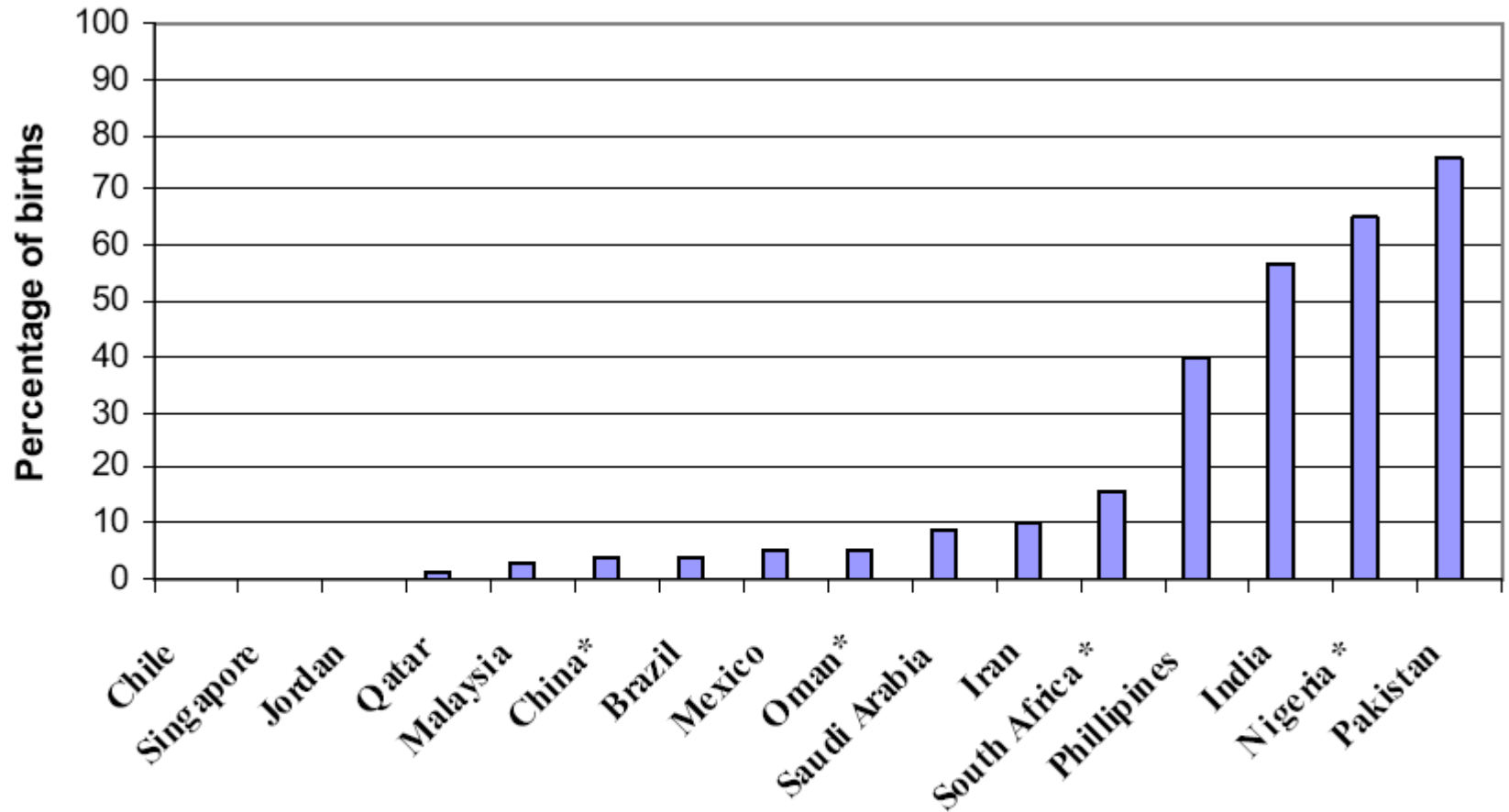


White KR, Forsman I, Eichwald J, Munoz K (2010). The evolution of early hearing detection and intervention programs in the United States. *Semin Perinatol.* 34(2):170-9.

# Newborn Hearing Screening Programs

<b>Screening &gt; 90%</b>  <b>(n=9)</b>	<b>Screening 30-80%</b>  <b>(n=8)</b>	<b>Published Reports of Pilot programs</b>  <b>(n=41)</b>		
<b>Austria</b> <b>Croatia</b> <b>Luxembourg</b> <b>Germany</b> <b>Poland</b> <b>Netherlands</b> <b>Singapore</b> <b>United Kingdom</b> <b>USA</b>	<b>Australia</b> <b>Belgium</b> <b>Canada</b> <b>Chile</b> <b>Denmark</b> <b>Oman</b> <b>Russia</b> <b>Taiwan</b>	<b>Argentina</b> <b>Brazil</b> <b>China</b> <b>Columbia</b> <b>Costa Rica</b> <b>Czech Republic</b> <b>Finland</b> <b>France</b> <b>Greece</b> <b>Hong Kong</b> <b>Hungary</b> <b>India</b> <b>Iran</b> <b>Israel</b>	<b>Italy</b> <b>Japan</b> <b>Jordan</b> <b>Lithuania</b> <b>Luxembourg</b> <b>Malaysia</b> <b>Malta</b> <b>Mexico</b> <b>New Zealand</b> <b>Nigeria</b> <b>Norway</b> <b>Oman</b> <b>Pakistan</b> <b>Philippines</b>	<b>Portugal</b> <b>Qatar</b> <b>Romania</b> <b>Saudi Arabia</b> <b>Serbia</b> <b>Slovak Republic</b> <b>Slovenia</b> <b>South Africa</b> <b>South Korea</b> <b>Spain</b> <b>Sweden</b> <b>Switzerland</b> <b>Turkey</b>

# Proportion of Births Outside of Hospital Facilities



Data Source: UNICEF 2005 [50]

See also WHO, World Health Statistics 2009, available at:  
<http://www.who.int/whosis/whostat/2009/en/index.html>.

## **Programs for early identification of hearing loss should have:**

- ✓ Clearly-stated goals with well-specified roles and responsibilities for those people who are involved.
- ✓ A clearly-designated person who is responsible for the program.
- ✓ People doing the screening who have received hands-on training in what they are expected to do.
- ✓ Regular monitoring to ensure that the protocol is being correctly implemented.
- ✓ Specific procedures about how to inform parents of results and recording and reporting of information about the screening for each child.
- ✓ A documented protocol based on local circumstances



**Newborns/Infants  
to be Screened**

				<b>Screening Methods</b>		
				<b>Family Questionnaire</b>	<b>Behavioral</b>	<b>Physiological</b>
<b>Targeted by: Geographical Subset</b>						
<b>NICU Babies</b>						
<b>Babies with Risk Factors</b>						
<b>Population-based</b>						

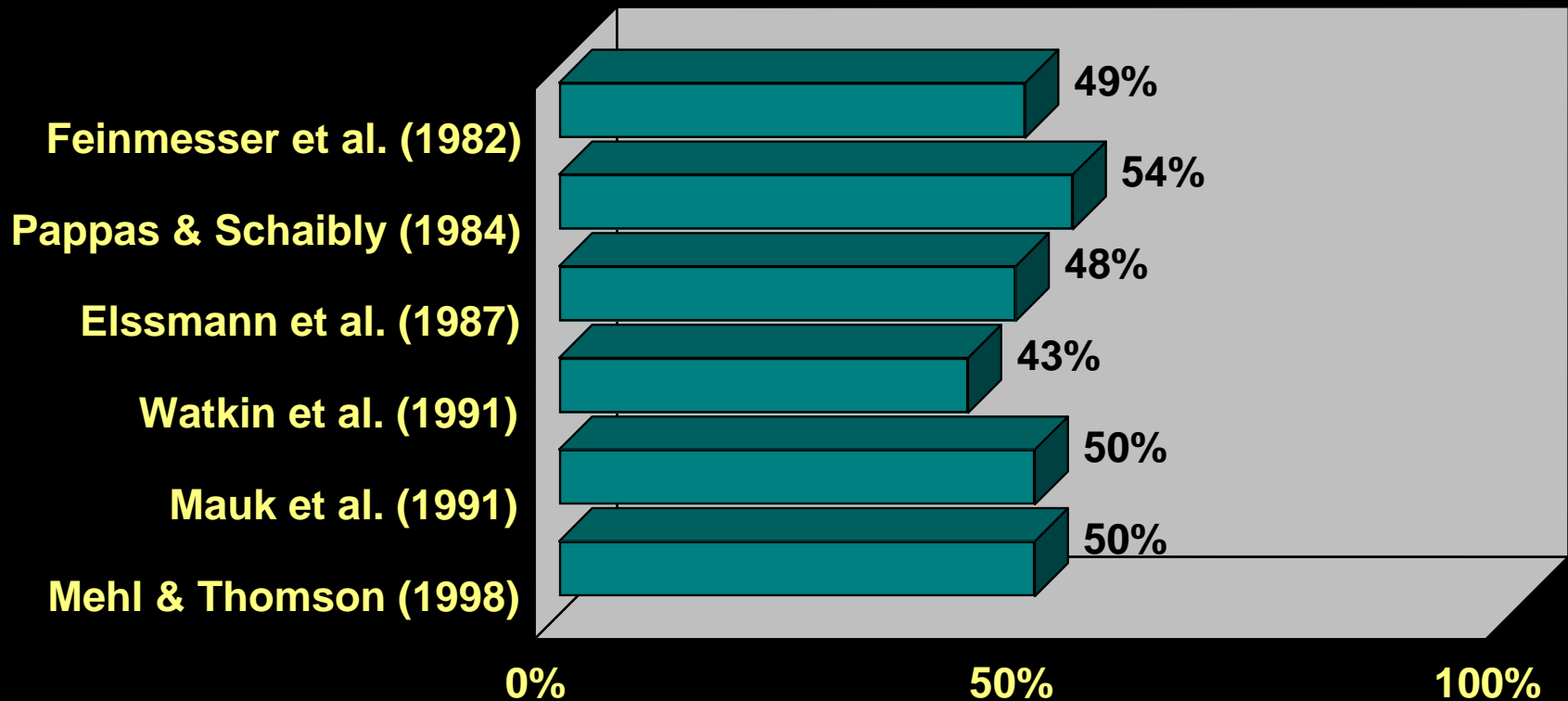


**Guiding Principles for Newborn/Infant Hearing Screening**



# What Percentage of Hearing Impaired Children were High Risk as Infants?

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# Accuracy of High Risk Based UNHS Programs Mahoney and Eichwald (1987)

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Program operational from 1978-1995.

JCIH indicators incorporated into legally required birth certificate.

Computerized mailing and follow-up, and free diagnostic assessments at regional offices and/or mobile van.

Program now discontinued because:

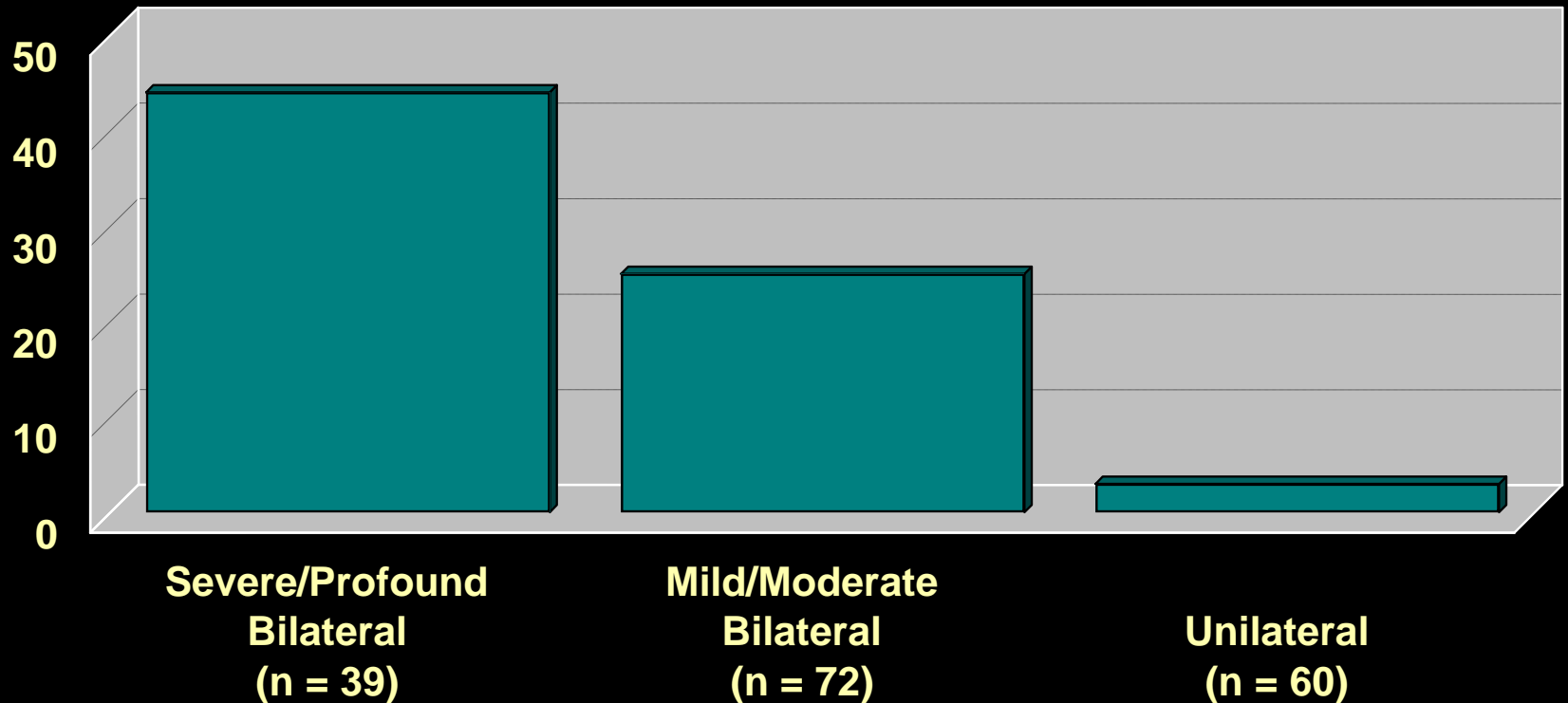
**parents only made appointments for about 1/2 the children who had a risk indicator.**

**only about 1/2 of the children with an appointment showed up.**

**difficulty obtaining accurate information from hospitals for some risk indicators.**

Mahoney, T.M., & Eichwald, J.G. (1987). The ups and "downs" of high-risk hearing screening: The Utah statewide program. Seminars in Hearing 8(2), 155-163.

# Percentage of Children with Permanent Hearing Loss Identified by the Infant Distraction Test Performed at 8 Months of Age



Watkin, P. M., Baldwin, M., & Laoide, S. (1990). Parental suspicion and identification of hearing impairment. *Archives of Disease in Childhood*, 65, 846-850.

# Rate Per 1,000 of Permanent Childhood Hearing Loss in EHDI Programs

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Site	Sample Size	Prevalence Per 1000
Texas (Finitzo et al 1998) (1/94 to 6/97)	54,228	2.15
Colorado (Mehl & Thomson, 1998) (1/92 - 12/96)	41,976	2.56
New Jersey (Barsky-Firsker & Sun) 1/93-12/95)	15,749	3.30
Hawaii (Johnson et al 1997) 1/96 - 12/96)	9,605	4.15
Massachussets (2004) (1/06 – 12/06)	78,515	2.87

# Population-based Ascertainment of Hearing Loss

	NHANES II		NHANES III	
	Point	Cumulative	Point	Cumulative
<b>Profound Bilateral</b> ( $PTA_4 > 75$ dB HL)	0.75	<b>0.75</b>	0.57	<b>0.57</b>
<b>Severe Bilateral</b> ( $45$ dB HL $< PTA_4 \leq 75$ dB HL)	0.51	<b>1.26</b>	0.28	<b>0.85</b>
<b>Moderate Bilateral</b> ( $30$ dB HL $< PTA_4 \leq 45$ dB HL)	2.37	<b>3.63</b>	1.66	<b>2.51</b>
<b>Mild Bilateral</b> ( $15$ dB HL $< PTA_4 \leq 30$ dB HL)	13.7	<b>17.33</b>	13.8	<b>16.31</b>
<b>Unilateral</b> (mild, moderate, severe)	49.0	<b>66.33</b>	57.0	<b>73.31</b>

National Health & Nutrition Examination (NHANES II: 1976–1980 NHANES III 1988–1994 )

Target population is the civilian, non-institutionalized U.S. population.

Sample size for audiometry in children, 6 to 19 years old, was 7,119 in NHANES II and 6,166 in NHANES III.

$PTA_4$  is the pure-tone average of air-conduction thresholds at 0.5, 1, 2, & 4 kHz; Normal hearing —  $PTA_4 \leq 15$  dB HL, both ears

# 1

## Rate Per 1,000 of Permanent Childhood Hearing Loss in EHDI Programs

Site	Sample Size	Prevalence Per 1000	% of Refers with Diagnosis
Texas (Finitzo et al 1998) (1/94 to 6/97)	54,228	2.15	31%
Colorado (Mehl & Thomson, 1998) (1/92 - 12/96)	41,976	2.56	48%
New Jersey (Barsky-Firsker & Sun) 1/93-12/95)	15,749	3.30	41%
Hawaii (Johnson et al 1997) 1/96 - 12/96)	9,605	4.15	98%
Massachussets (2004) (1/04 – 12/04)	78,515	2.87	89%

# What Contributes to “Loss to Follow-up”?

- **Referral rates in the hospital are too high** (because of poorly trained screeners, poorly maintained equipment, lack of commitment, etc)
- **Ineffective information for parents** (about initial results, need for follow-up, what to do next, etc)
- **Accurate data isn’t shared quickly with the right stakeholders** (hospitals, state EHDI program, medical home, audiologists, early interventionists, etc)
- **Shortage of pediatric audiologists** (because of not enough training programs, poor reimbursement rates, rural/remote residences, etc)
- **Lack of knowledge about current “effective practices”** (among program managers, health care providers, early interventionists, etc).
- **Not enough public awareness about importance of issue** (taxpayers, administrators, extended family, etc)
- **Lack of resources** (for screening, follow-up diagnosis, early intervention, case management, etc)

# 2 The Hearing Head Start Project

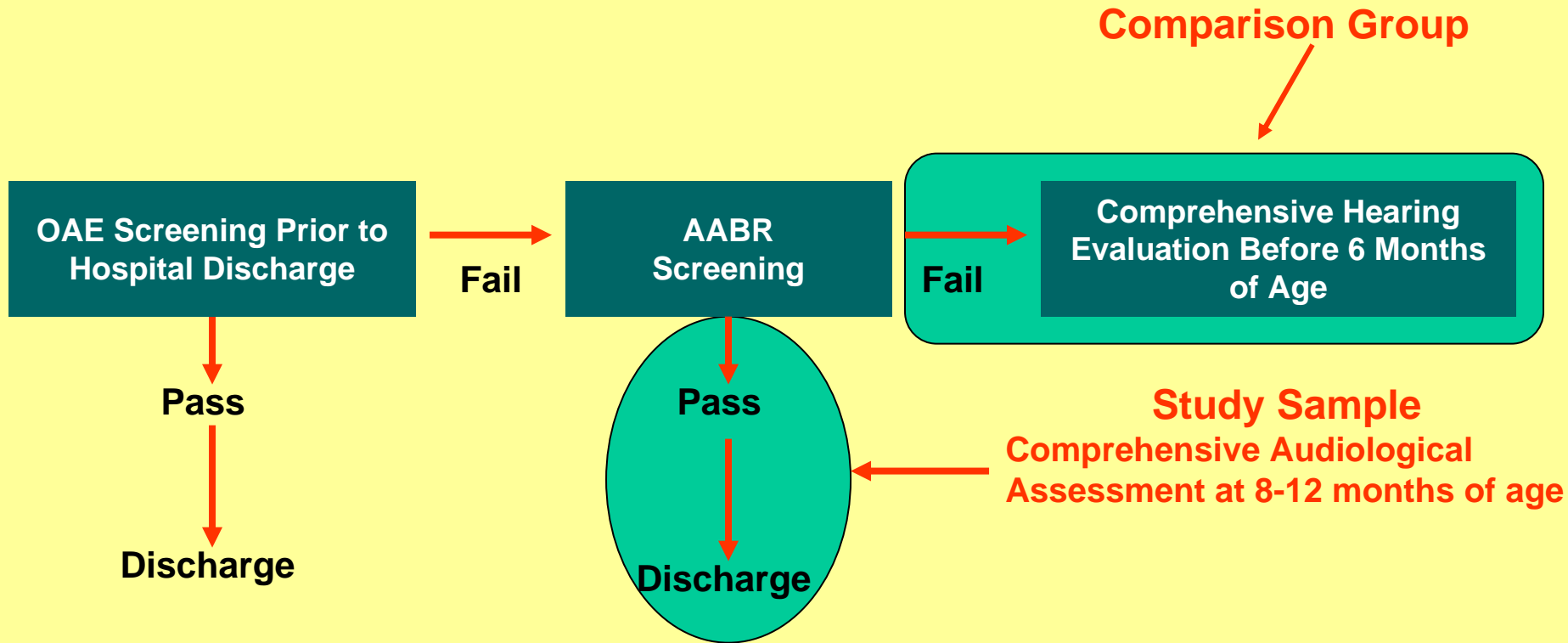
- Feasibility study from 2001-2004
- 69 programs in 3 states with 3,000+ children screened
- Identified 2 per 1,000 with permanent hearing loss and 20 per 1,000 with unidentified transient losses
- Currently in 21 of 50 states—expanding to others by 2015





3

# Does a 2-stage (OAE/AABR) newborn hearing screening protocol miss babies with mild hearing loss?



# How Many Additional Babies with Permanent Hearing Loss were Identified?

	Comparison Group (Fail OAE/ Fail AABR)	Study Group (Fail OAE/ Pass AABR)	Total
Number of Babies	<b>158</b>	<b>21</b>	<b>179</b>
Prevalence per 1,000	<b>1.82</b>	<b>.55*</b>	<b>2.37</b>

\*Adjusted for proportion of OAE fails that enrolled

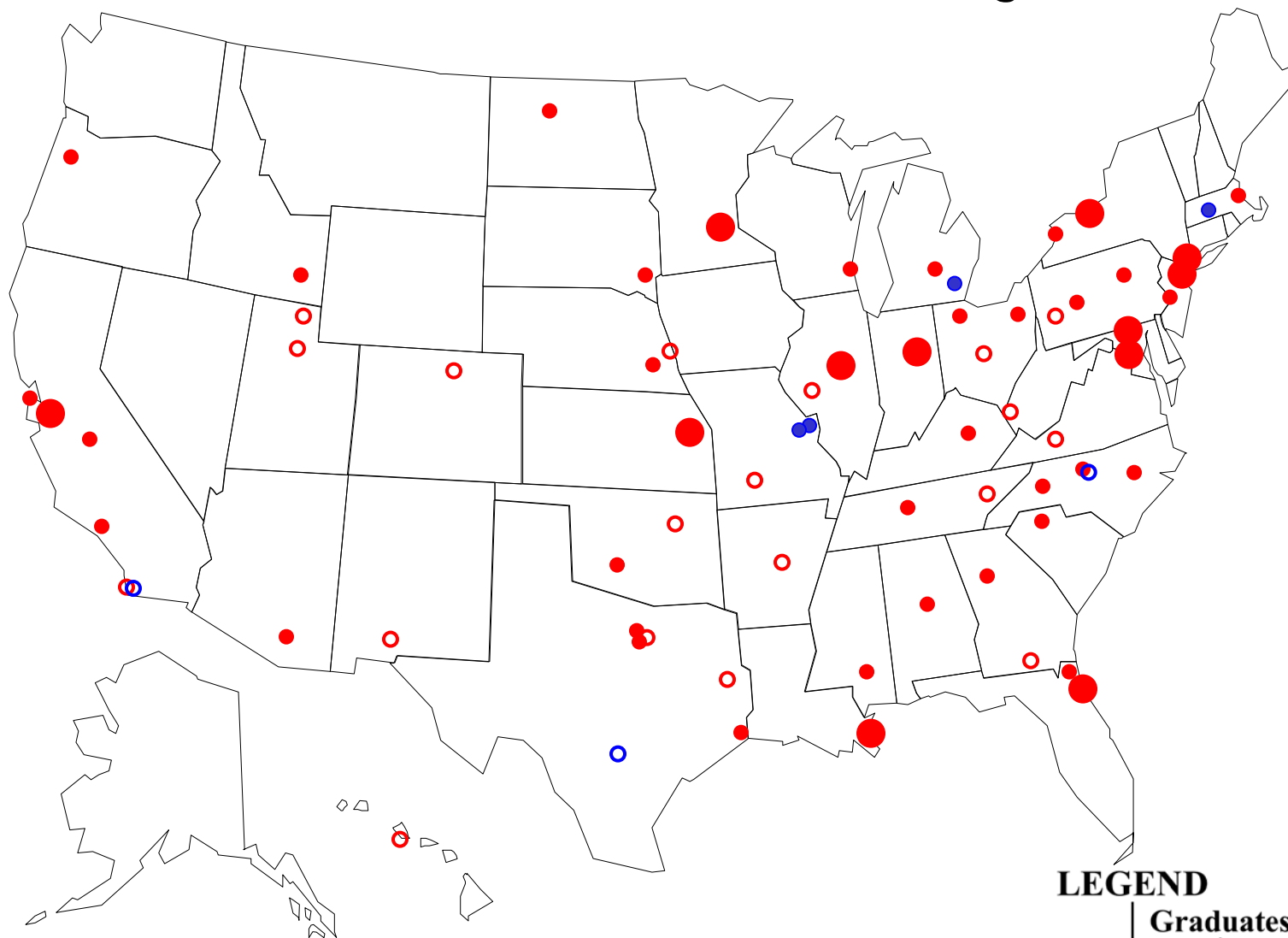
Represents 23%  
of all babies with  
PHL in birth  
cohort

# 4

## Many Early Intervention Programs for Children with Hearing Loss are "Out-of-Sync"

- Most programs for young deaf children were developed 30+ years ago when:
  - The majority of deaf children were identified at 2-3 years of age
  - Sign language was the principle communication option
- 95% of all newborns with hearing loss have parents with normal hearing.
- In one state-wide EHDI program, when parents had choices:
  - In 1995:** 60% chose sign-language options; 40% chose spoken-language options
  - In 2005:** 15% chose sign-language options; 85% chose spoken-language options

# Primary Emphasis of University Training Programs for Teachers of Deaf and Hard of Hearing Children

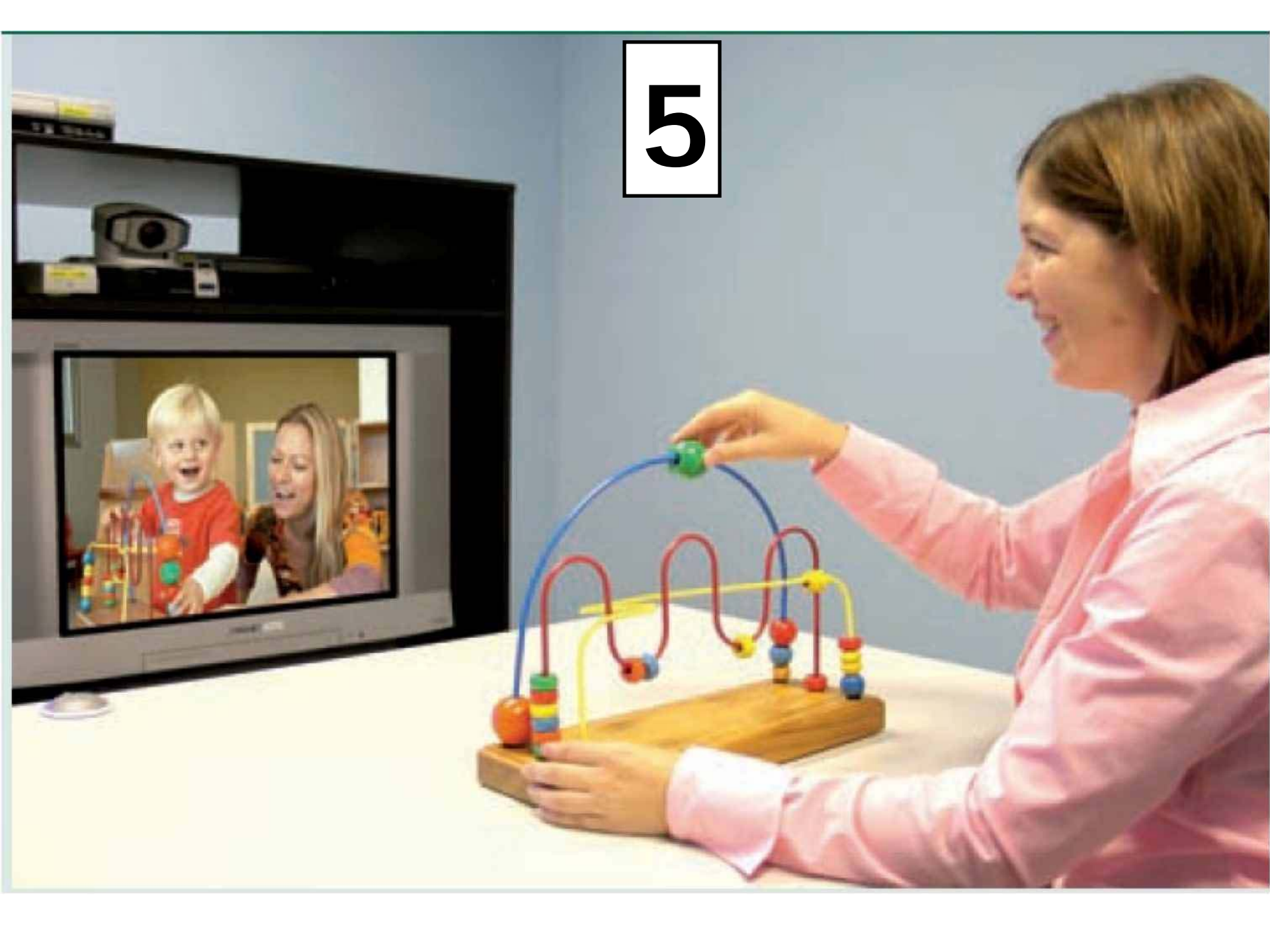


## LEGEND

Primary Emphasis	Graduates per Year:		
	1-5	6-15	16+
Sign Language-based	○	●	●
Spoken Language-based	○	●	●

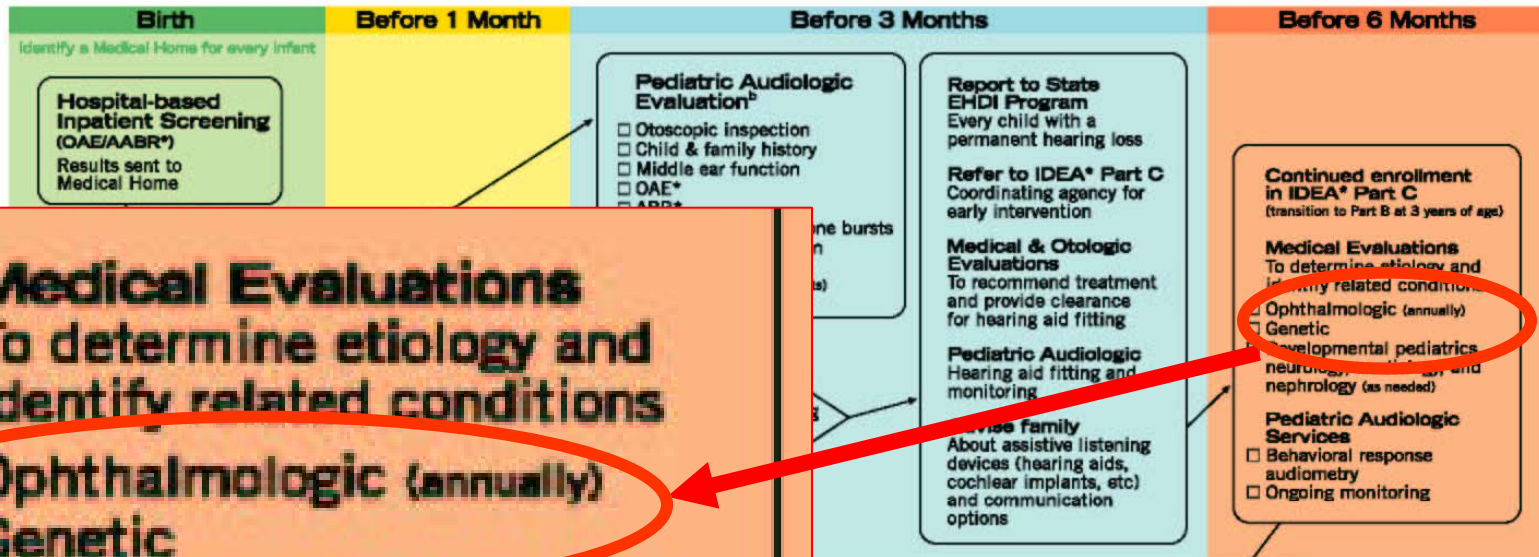
White KR (2007) Early Intervention for children with permanent hearing loss: Finishing the EHDI revolution. *The Volta Review*. 106(3), 237-258.

5



# American Academy of Pediatrics

## Universal Newborn Hearing Screening, Diagnosis, and Intervention Guidelines for Pediatric Medical Home Providers



### Medical Evaluations

To determine etiology and identify related conditions

- Ophthalmologic (annually)
- Genetic
- Developmental pediatrics, neurology, cardiology, and nephrology (as needed)

### Pediatric Audiologic Services

- Behavioral response audiometry
- Ongoing monitoring

\*OAE = Otoacoustic Emissions, AABR = Automated Auditory Brainstem Response, ABR = Auditory Brainstem Response, IDEA = Individuals with Disabilities Education Act

#### Notes:

(a) In screening programs that do not provide Outpatient Screening, infants will be referred directly from Inpatient Screening to Pediatric Audiologic Evaluation. Likewise, infants at higher risk for hearing loss, or loss to follow-up, also may be referred directly to Pediatric Audiologic Evaluation.

(b) Part C of IDEA\* may provide diagnostic audiologic evaluation services as part of Child Find activities.

(c) Infants who fail the screening in one or both ears should be referred for further screening or Pediatric Audiologic Evaluation.

(d) Includes infants whose parents refused initial or follow-up hearing screening.

# Educating Primary Health Care Providers About Early Identification of Hearing Loss

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Assume a newborn for whom you are caring is diagnosed with a moderate to profound bilateral hearing loss. If no other indications are present, to which specialists would you refer the baby?:

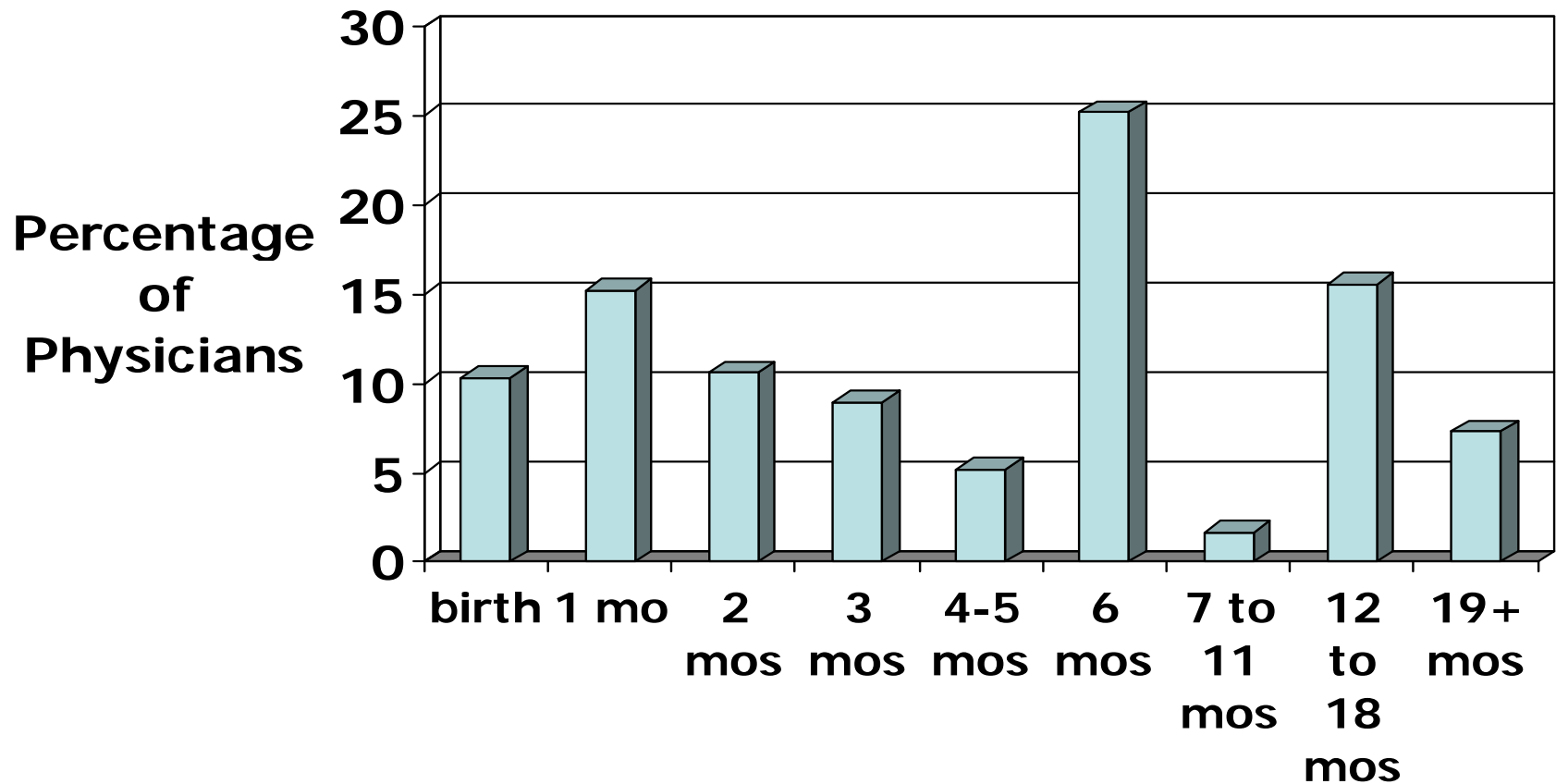
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	Always or Often
Ophthalmological evaluation	0.6%
Genetic evaluation	8.9%
Otolaryngological evaluation	75.6%

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Responses of 1975 physicians in 21 states

# When can an infant be fit with hearing aids?





# Take Home Messages



**Ah, but a man's reach should exceed  
his grasp. Or what's a heaven for?**

---- Robert Browning

- 1. Reducing Loss to Follow-up**
- 2. Identifying later onset hearing loss**
- 3. More efficient and better targeted screening**
- 4. More and better trained providers**
- 5. Better access to services**
- 6. Better education of stakeholders**



Search [infanthearing.org](http://infanthearing.org) 🔍

- Home
- Components
- Resources
- States
- Legislation
- About Us

## News and Events

We have a new look! All of our information and resources are still available.



((NCHAM serves as the **National Resource Center** for the implementation and improvement of comprehensive and effective Early Hearing Detection and Intervention (EHDI) systems. As a multidisciplinary Center, our goal is to ensure that all infants and toddlers with hearing loss are identified as early as possible and provided with timely and appropriate audiological, educational, and medical intervention.

## EHDI Components

- Newborn Hearing Screening
- Early Childhood Hearing Screening
- Diagnostic Audiology
- Early Intervention
- Family Support
- Medical Home
- Data Management
- Financing & Reimbursements
- Program Evaluation



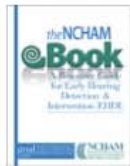
## EHDI/UNHS Resources

- UNHS Implementation Guide
- Addressing Privacy Regulations
- Position Statements
- EHDI/UNHS FAQ
- Slideshow Presentations
- Educational and Training Videos
- Fact Sheet [PDF]
- NCHAM Materials
- EHDI Implementation in Latin America
- EHDI E-Book
- More EHDI/ UNHS Resources...



## EHDI E-Book

The EHDI E-Book is Now Available to Download.



## State EHDI Information

- Status of the United States
- State Profiles
- Web Sites & Guidelines
- EHDI Contacts
- 2004 State EHDI Survey
- State Coordinator Toolbox



## EHDI Legislation

- State Legislation
- Rules & Regulations
- Legislative Summaries
  - By State: Table | Text
  - By Provisions



## NHSTC DVD

Our Newborn Hearing Screening training curriculum DVD is now available.

