



Limited Audiometric Testing after Not Passing the Newborn Hearing Screen

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Disclaimer

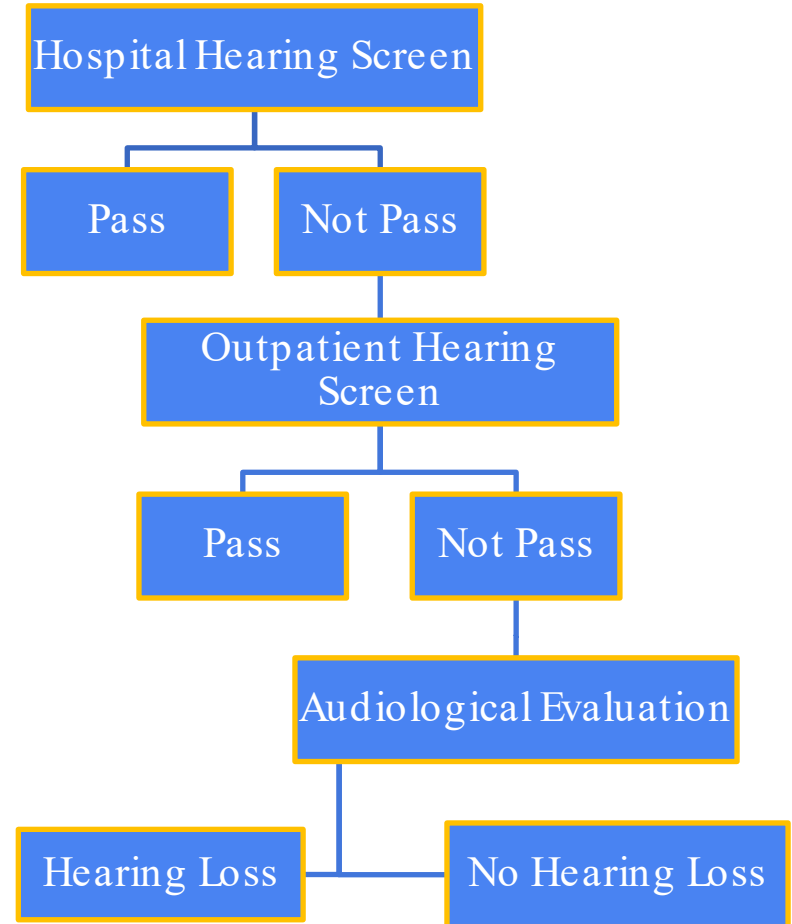
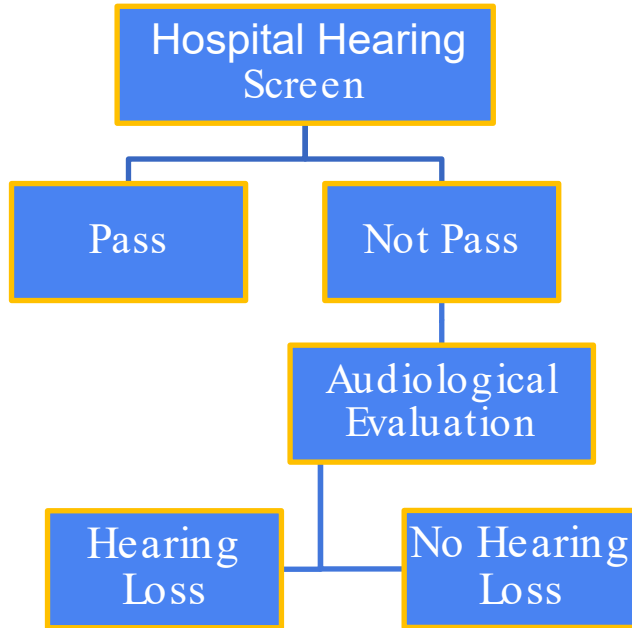
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Learning Objectives

1. Participants will be able to **describe best practice screening and audiological evaluation on infants not passing** the newborn hearing screening.
2. Participants will learn the **frequency of infants not receiving an Auditory Brainstem Response (ABR)** as part of the audiological evaluation at time of diagnosis.
3. Participants will be able to **describe the impact of limited audiometric testing** at time of diagnosis on EHCI benchmarks.

One Stage versus Two Stage Hearing Screening Protocol



What should be included as part of an Audiological Evaluation after not passing final hearing screen??

- Appropriate audiometric tests to include:
 - Frequency-specific assessment of the Auditory Brainstem Response (ABR)
 - Distortion product or transient evoked otoacoustic emissions (OAE)
 - Tympanometry
 - Acoustic reflexes
- The audiological evaluation is performed to quantify frequency-specific thresholds (for each ear)
 - An ABR for estimation of hearing thresholds is the gold-standard for determination of hearing thresholds under 6 months of age¹

Characteristics of Audiological Tests

	ABR	OAE	Tympanometry	Acoustic Reflex(es)
What it Measures	Cranial Nerve VIII	Outer Hair Cell Function	Middle Ear Status	Contraction of the Stapedius Muscle
Infant Status	Natural Sleep or with Sedation	Quiet and Still	Quiet and Still	Quiet and Still
Test Duration	1 to 2 hours	< 1 minute	< 1 minute	< 1 minute
How Results are Interpreted	Provides Thresholds ^a at Frequencies Tested	Present ^b (“Pass”) or Absent ^b (“Not Pass”)	Normal or Abnormal	Normal, Elevated, or Absent
Measures Precise Hearing Level?	Yes	No	No	No

^a Threshold = lowest sound audible

^b For a specific frequency range

Barriers to Completion of Audiological Examination, Specifically the ABR

- Infant doesn't sleep
- Referred to audiological practice that does not have ABR capability

So then what?

- If ABR can't be completed, but OAEs can, infants who pass the OAE screen might not be encouraged to return for an ABR and a mild hearing loss might be missed



Consequences of Not Conducting an ABR

- If OAEs are completed, but not an ABR, the goal of the audiological evaluation (to quantify frequency-specific thresholds) is not achieved
 - At best, if the infant has present OAEs, a significant hearing loss can be ruled out, but a minimal hearing loss could be missed

Additionally....

- When an ABR is not completed during the audiological evaluation, there is no standard, defined way this information is reported to EHDI
 - The audiologist can report the limited audiological evaluation as an additional (final) hearing screening or an audiological evaluation (diagnostic)

But there is this...

- “No Hearing Loss” definition provided on Hearing Screening and Follow-up Survey (HSFS)
 - Total with No Hearing Loss
 - This field is the total number of infants who did not pass a hearing screening but were found to have no documented permanent hearing loss (e.g., normal hearing) following an audiological diagnostic evaluation/testing that included appropriate audiometric test(s)

So What?

- Infants who are reported as “No Hearing Loss” to EHDI as a diagnosis but did not receive the appropriate testing (ABR) to measure precise hearing levels impacts data quality
 - These infants effectively received an additional hearing screening even if other testing like tympanometry or acoustic reflexes were completed
 - Not best practice, does not follow protocol, but it happens for various reasons

Purpose of Study

- To quantify how frequently infants are referred for an audiological evaluation but do not receive an ABR
 - Specifically, those infants receiving a diagnosis and reported as “No Hearing Loss” to EHDI
- Then, determine the impact on EHDI benchmarks of screened by 1 month of age and diagnosis by 3 months of age by recategorizing these infants who did not receive an ABR at time of audiological evaluation to a final hearing screen

Methods

Methods

Population: Deidentified individualized data received under the current CDC Cooperative Agreement DD20-2006 “Improving Timely Documentation, Reporting and Analysis of Diagnostic and Intervention Data through Optimization of EHDI Surveillance Practices and Information Systems”

- Infants from **36 jurisdictions** included
- Data submitted to CDC EHDI in May of 2023 on all **2021 births**

All births

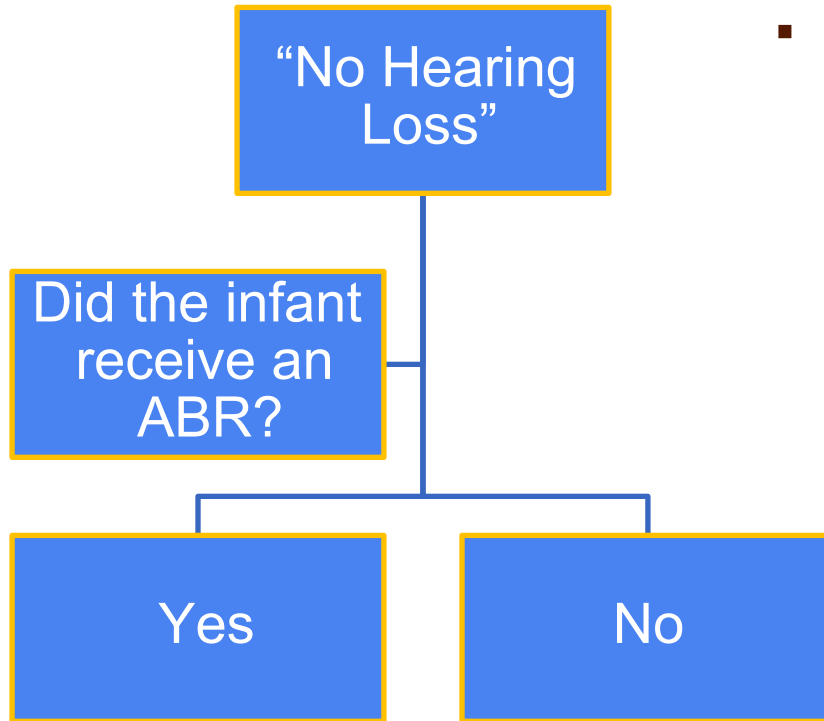
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graph TD; A[All births] --> B[Did Not Pass Final Hearing Screen or Referred Straight to Diagnosis]; B --> C[Received at least 1 Diagnostic Evaluation]; C --> D[Reported to EHDI as "No Hearing Loss"];
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Did Not Pass Final Hearing Screen
or Referred Straight to Diagnosis

Received at least 1 Diagnostic
Evaluation

Reported to EHDI as "No Hearing
Loss"

Methods continued...



- Infants not receiving an ABR with “No Hearing Loss” reported at time of diagnosis = Limited Audiometric testing
 - Final hearing screen date was updated to the date of completion of the limited audiometric test

Methods: EHDI Performance Measures Before and After Recategorization

- Calculated screened by 1 month and diagnosed by 3 months “as is”
- Then - all infants receiving limited audiometric evaluation with “No Hearing Loss” reported at time of diagnosis were coded as a “Pass” final hearing screen
 - Therefore, the total number of infants not passing the final hearing screen decreased by the number of infants receiving limited audiometric testing
 - The date of the final hearing screen was also updated to the date of the limited audiometric evaluation
- Re-calculated screened by 1 month and diagnosed by 3 month after the recategorization

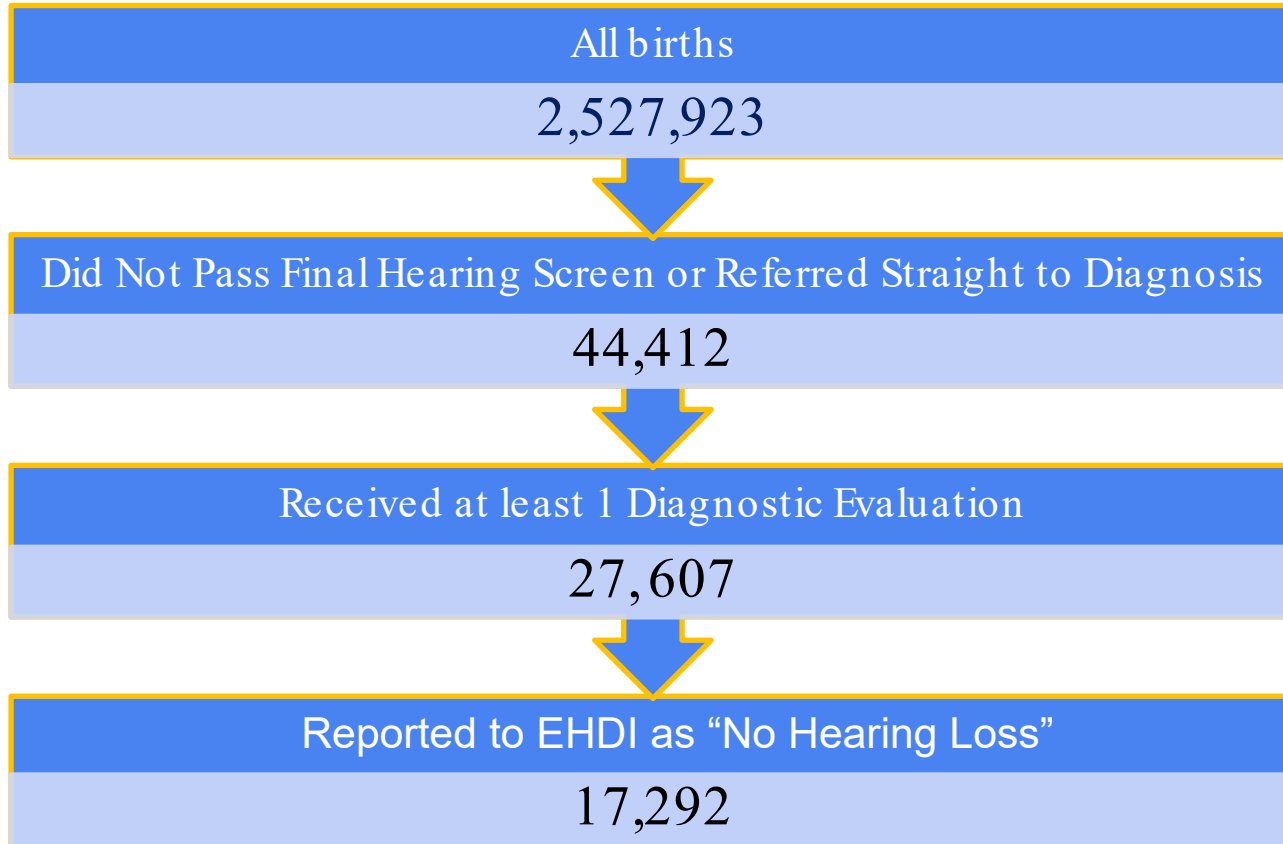
Formulas

- **Screened by one month:**
 - Number of infants with final screening by 30 days of age \div total births x 100

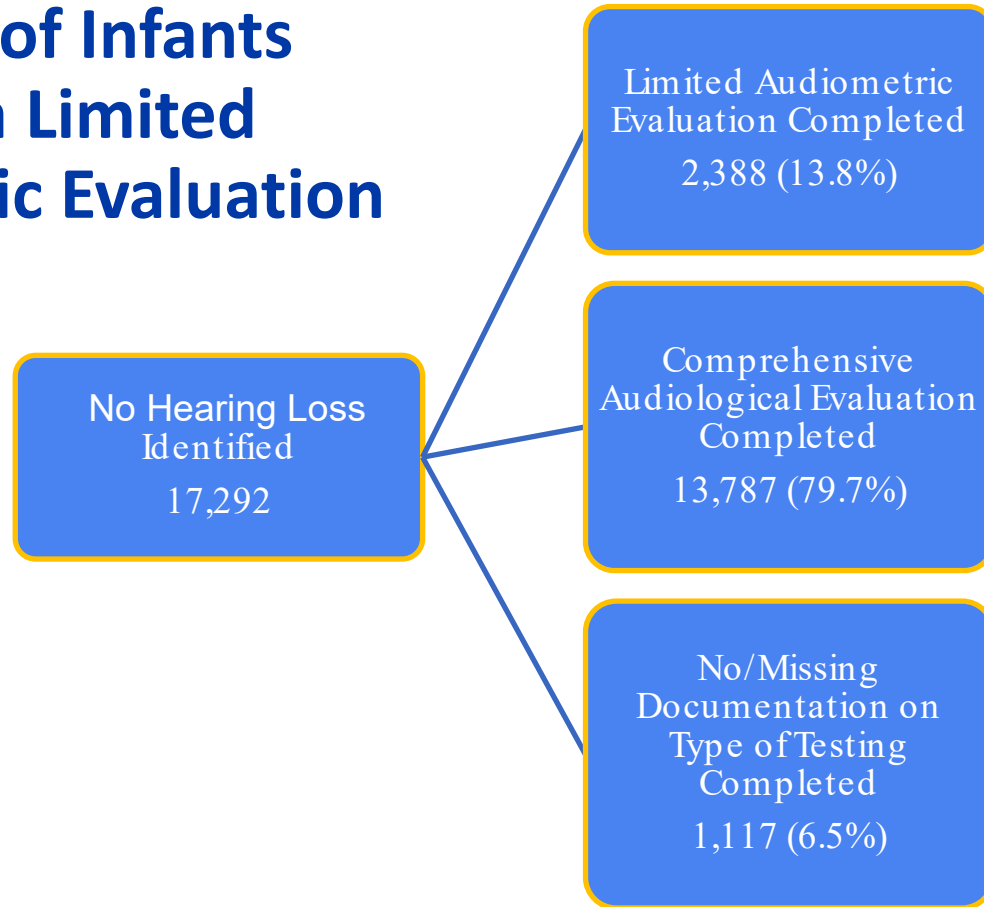
- **Diagnosed by three months:**
 - Number of infants receiving diagnosis by 90 days of age \div total not pass final hearing screen x 100

Results

Study Population



Frequency of Infants Receiving a Limited Audiometric Evaluation



EHDI Indicator	As Reported	Adjustment	EHDI Indicator with Recategorization	Difference
Screened by 1 Month ^a	2,410,224 (95.3%)	-1,715 ^b	2,408,509 (95.3%)	0%
Not Pass Final Screen	44,412	-2,388 ^c	42,024	
Infants Receiving Diagnosis	27,607	-2,388 ^c	25,219	
Diagnosis by 3 Months ^d	18,072 (40.7%)	-1,858 ^e	16,214 (38.6%)	-2.1%

^a Number of infants with final screening by 30 days of age ÷ total births x 100

^b Final screen was by one month, but limited audiometry completed >30 days

^c Infants whose final screen was a “not pass”, but had limited audiometric testing that when updated, indicated a “pass” for final screen result

^d Number of infants receiving diagnosis by 90 days of age ÷ total not pass final hearing screen x 100

^e Number of infants who received limited audiometry ≤90 days and reported as a diagnosis, but were recategorized as a final screen

Limitations

Limitations

- Not all jurisdictions collect hearing tests performed during the comprehensive audiological evaluation
 - 1,117 (6.5%), infants of 17,292 did not have information on types of testing completed at time of diagnosis
- Not inclusive of all states and territories
 - Only included jurisdictions funded by the CDC currently
 - Excluded data from 3 of the 39 funded jurisdictions due to data quality concerns

Limitations continued...

- In July of 2022, the CDC EHDI program provided guidance to recipients to re-code infants who did not receive an ABR as a final screen
 - Not required, but strongly encouraged
 - Therefore, some infants not receiving an ABR might have been already recoded as a final hearing screen and would be missed in this study's calculations, even though the audiologist reported the results as a diagnostic evaluation to the jurisdictional EHDI program
 - 16/36 jurisdictions counted for all the cases counted as limited audiometric testing in this study

Conclusions and Next Steps

- 2,388 (16.4%) infants documented to have received an audiological evaluation and categorized as “No Hearing Loss” did not receive an ABR as part of their audiological evaluation
- How audiological testing results are reported to the jurisdictional EHDI program has an impact on measuring EHDI indicators of screened by one month and diagnosis by three months
- It is important that infants not receiving a comprehensive audiological evaluation are reported to the jurisdictional EHDI program the same way, regardless of number of previous hearing screenings

References

- (2019). Year 2019 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. *Journal of Early Hearing Detection and Intervention*, 4(2), 1-44. DOI: <https://doi.org/10.15142/fptk-b748>



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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

