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Factors influencing Pandemic-Era EHDI Utilization and Access

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March 14th , 2022

Disclosures

- NIH/NIDCD Grant: R01 DC017770 (PI: MLB)

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Objectives of this talk

- Discuss hearing loss in infants and loss of follow- up to diagnostic testing
- Examine impact of health disparities on infant hearing healthcare
- Discuss possible ways of addressing health disparities

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Hearing loss in infants

- Hearing loss affects nearly 2 of every 1,000 American newborns screened
- Most common congenital sensory disorder
- Impact on language development, school performance, and life-long quality of life

https://www.cdc.gov/ncbddd/hearingloss/data.html

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Addressing Infant Hearing Loss

Universal Newborn Hearing Screening

Early Hearing Detection and Intervention (EHDI) program

Loss of Follow-Up

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THE JOURNAL OF PEDIATRICS • www.jpeds.com

ORIGINAL ARTICLES

Delays in Diagnosis of Congenital Hearing Loss in Rural Children

Matthew L. Bush, MD[1], Kristin Bianchi, BA[2], Cathy Lester, MSSW[3], Jennifer B. Shinn, PhD[1], Thomas J. Gal, MD, MPH[1], David W. Fardo, PhD[4], and Nancy Schoenberg, PhD[5]

Table. Kentucky congenital hearing loss data (2009-2011)

Region of birth	Appalachia	Non-Appalachia
Live births	43 636	119 615
Failed newborn screens	1788	5182
Permanent childhood hearing loss	56	223
Severe sensorineural hearing loss	28	93
Percentage of families obtaining diagnostic testing after unilateral or bilateral failed screening test	76.1%	82.7%
Percentage of families obtaining diagnostic testing following bilateral failed screening test	73.4%	84.6%
Children with hearing loss enrolled in early intervention program	51.8%	52%

Hearing Loss Incidence: 1.7:1000 live births

25% lost to follow-up

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Age of Final Diagnosis in Kentucky

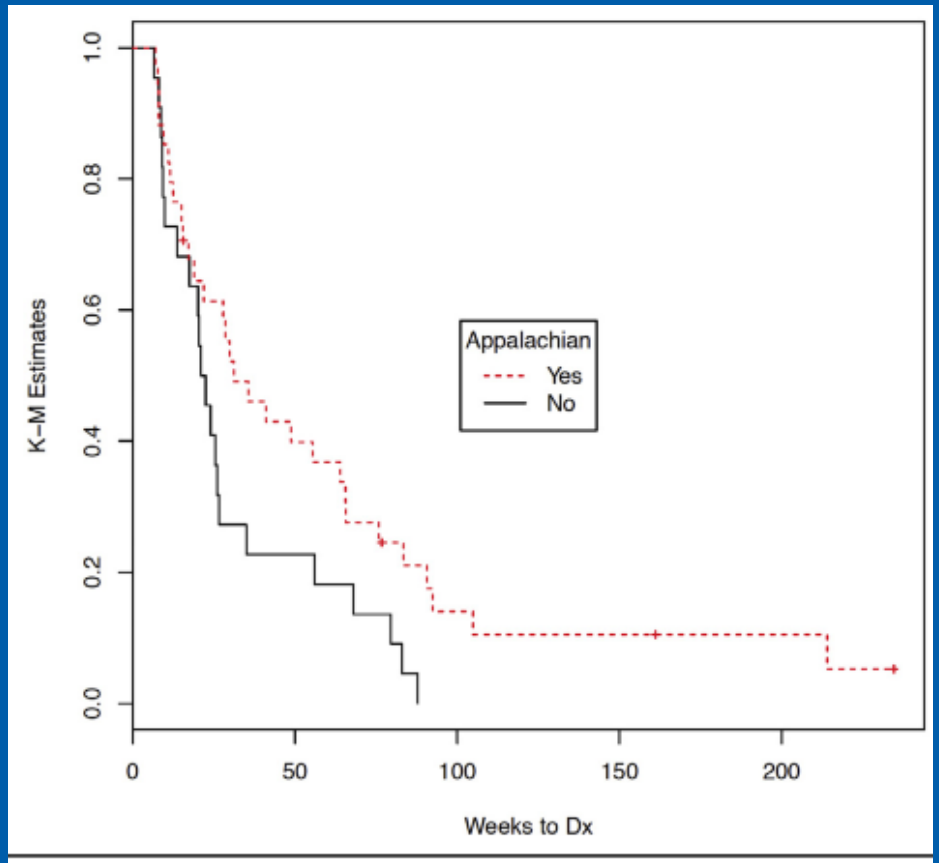

Figure 1. Kaplan–Meier (K–M) analysis of time (weeks after birth) to final diagnosis (Dx) of congenital hearing loss.

(Bush 2014)

Mean Age to Diagnosis

- **Appalachia: 7 months**
- Non-Appalachian Kentucky: **5.1 months**
- The Goal is: **3 months**

Log-rank test P=0.038

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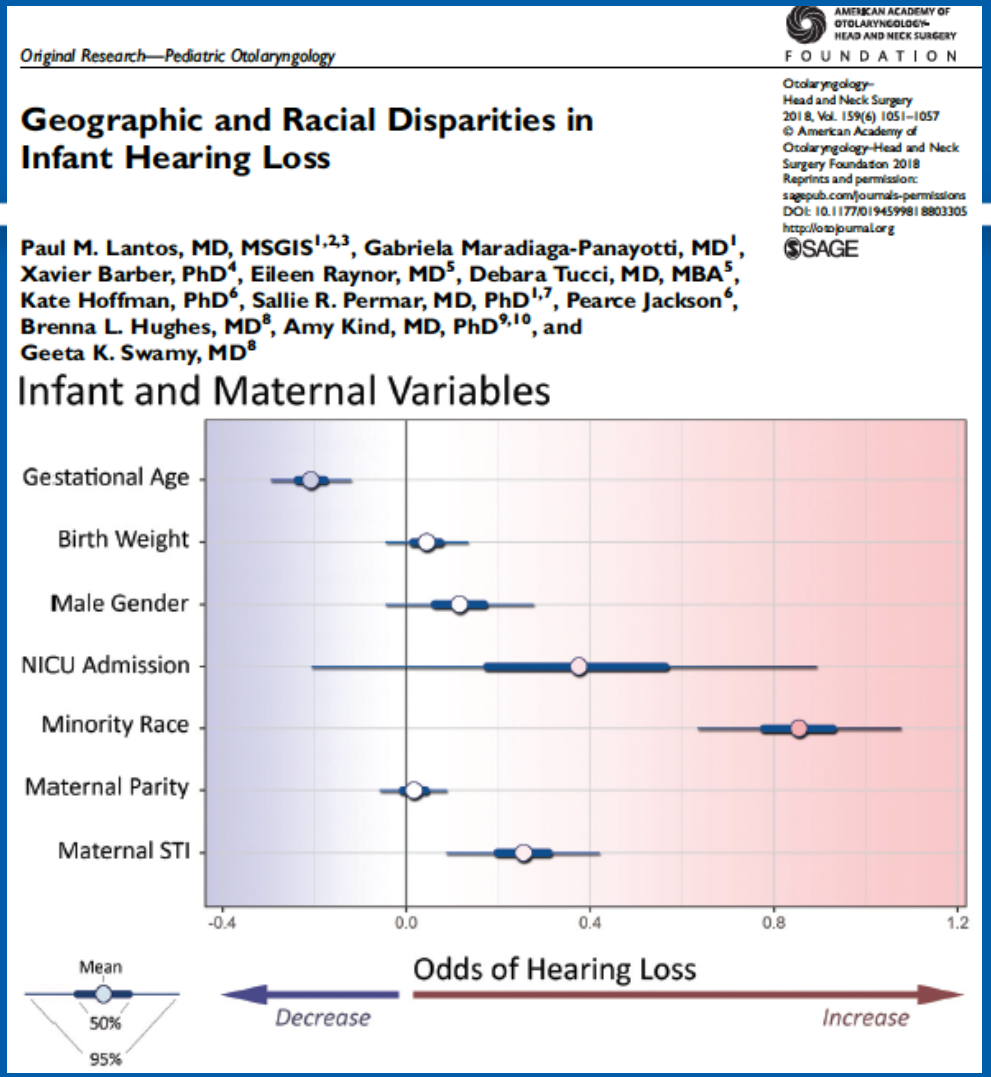
Infant Hearing Loss

- **Non-white race**: 2.45 higher odds of hearing loss
- **Urban low-income neighborhoods**: Higher prevalence of hearing loss



Original Research—Pediatric Otolaryngology

AMERICAN ACADEMY OF OTOLARYNGOLOGY–HEAD AND NECK SURGERY FOUNDATION

Geographic and Racial Disparities in Infant Hearing Loss

Otolaryngology–Head and Neck Surgery
2018, Vol. 159(6) 1051–1057

DOI: 10.1177/0194599818803305
http://otojournal.org
SAGE

Paul M. Lantos, MD, MSGIS[1,2,3], Gabriela Maradiaga-Panayotti, MD[1], Xavier Barber, PhD[4], Eileen Raynor, MD[5], Debara Tucci, MD, MBA[5], Kate Hoffman, PhD[6], Sallie R. Permar, MD, PhD[1,7], Pearce Jackson[6], Brenna L. Hughes, MD[8], Amy Kind, MD, PhD[9,10], and Geeta K. Swamy, MD[8]

(Lantos 2018)

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What are Health Disparities?

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Health Disparities

- Health difference that is closely linked with economic, social, or environmental disadvantage.
- Adversely affect groups of people who have systematically experienced greater social or economic obstacles to health
- Contributing factors: race, ethnicity, religion, socioeconomic -status, gender, age, sexual orientation or gender identity, or geographic location

(Healthy People 2030)

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Health Disparities

- "Health disparities are **preventable** differences in the burden of disease, injury, violence, or opportunities to achieve optimal health that are experienced by socially disadvantaged populations."

https://www.cdc.gov/healthyyouth/disparities/index.htm

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What causes disparities?

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Social Determinants of Health

Economic Stability	Neighborhood and Physical Environment	Education	Food	Community and Social Context	Health Care System
Employment	Housing	Literacy	Hunger	Social integration	Health coverage
Income	Transportation	Language	Access to healthy options	Support systems	Provider availability
Expenses	Safety	Early childhood education		Community engagement	Provider linguistic and cultural competency
Debt	Parks	Vocational training		Discrimination	
Medical bills	Playgrounds	Higher education		Stress	Quality of care
Support	Walkability				
	Zip code / geography				

Health Outcomes

Mortality, Morbidity, Life Expectancy, Health Care Expenditures, Health Status, Functional Limitations

https://www.kff.org/disparities-policy/issue-brief/disparities-in-health-and-health-care-five-key-questions-and-answers/

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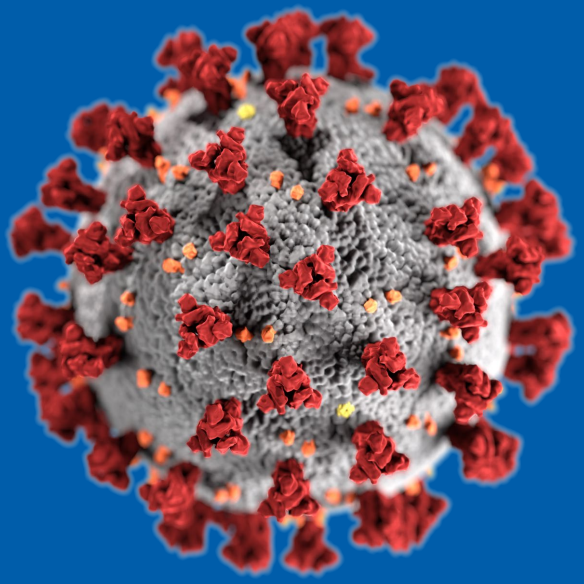
COVID-19 amplifies Health Disparities



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Striving for Health Equity

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Study Objectives

1. Compare EHDI diagnostic testing adherence (diagnostic testing by 3 months of age) and the incidence of infant hearing loss before and during the COVID-19 pandemic.
2. Evaluate the association of racial, ethnic, and linguistic factors on diagnostic testing adherence.
3. Identify sociodemographic factors that influence timing of diagnostic testing.

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Methods Overview

Step 1: Database Access

EHDI data of 75,132 infants born in Kentucky (April 1, 2019-September 30, 2020)

Dependent Variable: Receipt of Infant diagnostic testing by 3 months (Secondary – timing)

Independent Variables: Race, Ethnicity, Language, ZIP code, Maternal Education, Insurance status

Coding outcomes and variables both before (April 1, 2019-February 28, 2020) and during (March 1, 2020 – September 30, 2020) the pandemic.

Methods Overview

Step 2: Formatting database to facilitate analysis

Out of state infants and infants with no hearing screening were removed (n=71,208)

Step 3: Univariate and Multivariate Analysis

Demographics of study sample

Demographics	Count
Gender	
Male	**n=36187 (51%)**
Female	**n=35019 (49%)**
Race	
White	**n=57733 (81%)**
BIPOC	**n=13475 (19%)**
Ethnicity	
Non-Hispanic	**n=66137 (93%)**
Hispanic	**n=4938 (7%)**
Maternal Language	
English	**n=68464 (96%)**
Non- English	**n=2744 (4%)**

n=71,208

Unknowns excluded from calculations

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Demographics of study sample

Demographics	Count
Maternal Education	
Less than Highschool	**n=8805 (12%)**
Highschool or greater	**n=62036 (88%)**
Location	
Urban Counties	**n=84 (70%)**
Rural Counties	**n=36 (30%)**
COVID-19	
Born prior to COVID-19 pandemic	**n=43843 (62%)**
Born during the COVID-19 pandemic	**n=27365 (38%)**
Insurance	
Private	**n=12121 (45%)**
Medicaid	**n=14556 (55%)**

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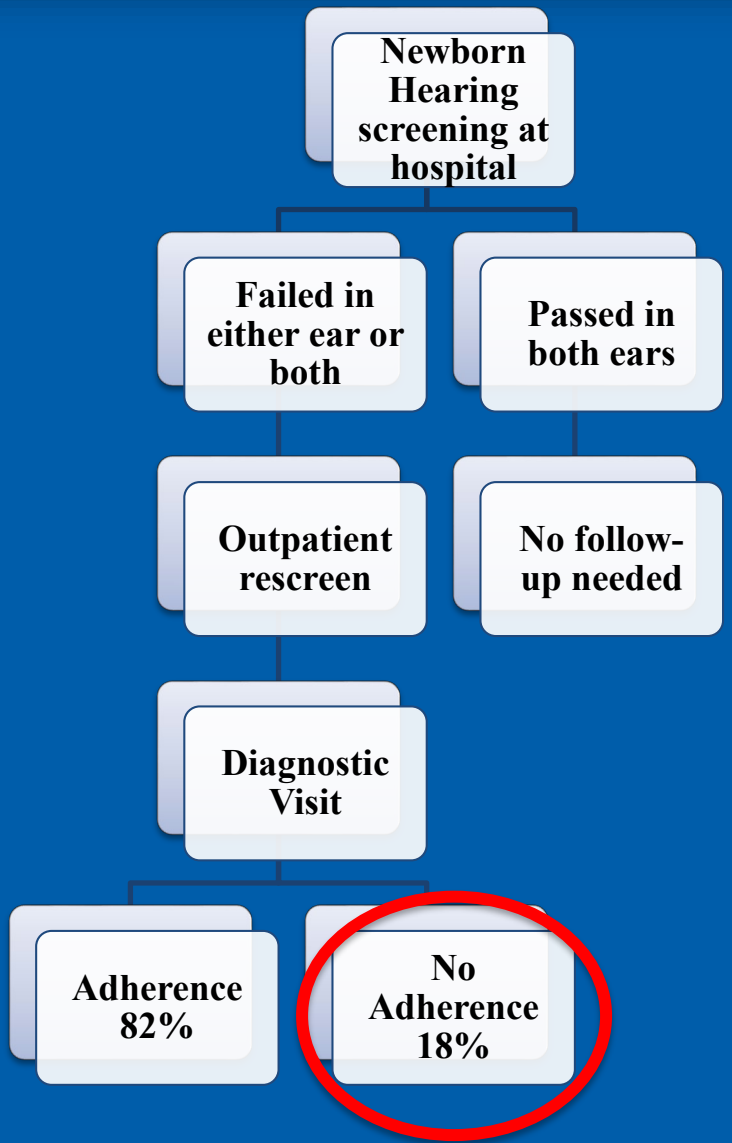
Overall diagnostic testing adherence in our study



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Initial newborn hearing screening results

	Passed Hearing Screening	Failed Hearing Screening	No Hearing Screening
Pre-COVID-19 Infants born: (April 1, 2019-February 28, 2020)	95.14%	4.37%	0.49%
COVID-19 Infants born: (March 1, 2020-September 30, 2020)	94.69%	4.45%	0.68%

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Hearing loss incidence

	No Hearing Loss	Unilateral Hearing Loss	Bilateral Hearing Loss
Pre-COVID-19 Infants born: (April 1, 2019-February 28, 2020)	99.01%	0.63%	0.36%
COVID-19 Infants born: (March 1, 2020-September 30, 2020)	98.78%	0.73%	0.49%

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COVID-19 pandemic impact on diagnostic testing adherence

	Diagnostic Testing Adherence	p value	Odds ratio	95% Confidence Interval
COVID-19		0.05	0.76	0.57 - 1

Multivariate logistic regression (holding COVID, Gender of Infant, location of residence, race, ethnicity and hearing loss status constant)

During the pandemic infants had a 24.3% lower odds of hearing testing adherence. Adherence - 83.6% (Pre-Covid) vs. 79.8% (Covid)

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Ethnicity impact on diagnostic testing adherence

Diagnostic Testing Adherence	p value	Odds ratio	95% Confidence Interval
Hispanic Ethnicity	0.04	0.55	0.31 – 0.96

Multivariate logistic regression (holding COVID and insurance status constant)

Hispanic infants have 46% lower odds of EHDI adherence, compared with non-Hispanic infants.

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Language impact on diagnostic testing adherence

Diagnostic Testing Adherence	p value	Odds ratio	95% Confidence Interval
Infants of Swahili speaking families	0.005	0.13	0.031 – 0.54
Multivariate logistic regression (holding COVID, insurance status and education constant)			

Infants of Swahili speaking families have 87% lower odds of EHDI adherence

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Maternal education impact on diagnostic testing adherence

	p value	Odds ratio	95% Confidence Interval
Maternal education	**0.02**	**1.50**	**1.06 – 2.12**
Univariate Analysis			
Maternal education	**0.03**	**1.63**	**1.06 – 2.51**
Multivariate logistic regression (holding COVID, Gender of Infant, location of residence, race, ethnicity constant)			

Infants of mothers with ≥ high school degree had:

1. **1.50 times higher odds of EHDI adherence**
2. **1.63 times higher odds of having normal hearing on EHDI testing**

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Maternal education impact on diagnostic testing adherence

	Co-efficient	p value	95% Confidence Interval
Maternal education	-9.53	0.003	-15.73 – -3.32

Multivariate linear regression (holding COVID, Gender of Infant, location of residence, race, ethnicity, and hearing loss constant)

Infants of mothers with ≥ high school degree presented, on average, 9.5 days earlier for testing

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What do we know?

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1. EHDI Services are Effective!

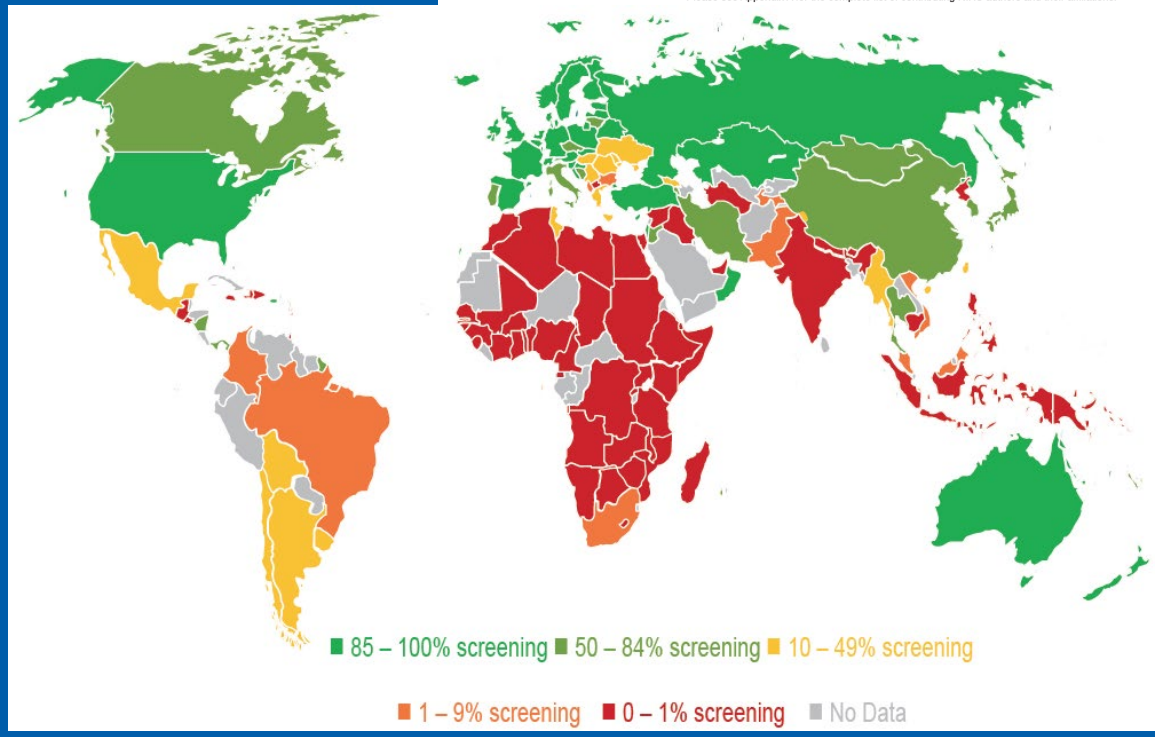
- 38% of the world's population have no EHDI services
- Screening country: Dx at **4.6 months**
- Non-screening country: **34.9 months**

JEHDI
The Journal of Early Hearing Detection and Intervention
2020; 5(2): 63-84

A Survey on the Global Status of Newborn and Infant Hearing Screening

Katrin Neumann, MD[1]
Harald A. Euler, PhD[1]
Shelly Chadha, MD[2]
Karl R. White, PhD[3]
The International Newborn and Infant Hearing Screening (NIHS) Group[4]

[1]Department of Phoniatrics and Pedaudiology, University Hospital Münster, University of Münster, Münster, Germany
[2]Sensory functions, Disability and Rehabilitation, Department of Noncommunicable Diseases, World Health Organization, Geneva, Switzerland
[3]National Center for Hearing Assessment and Management, Utah State University, Logan, UT, USA
[4]Please see Appendix A for the complete list of contributing NIHS authors and their affiliations.



(Neumann 2017)

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2. Barriers to Early Diagnosis and Treatment

- COVID-19
- Race/ Ethnicity
- Parental Education
- Health Insurance Status
- Economic Stability
- Zip code/Geography
- Communication

(Deng 2020)
(Bush 2014)

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3. Speech Outcomes = Why this all matters!

- **Meeting EHDI Guidelines**
  - **Expedites CI Activation = 15 months earlier activation**
  - **Higher Vocabulary Quotient**
- **Maternal Education:**
  - **Higher education = Higher Vocabulary Quotient**
- **Age of Implantation**
  - **Younger = Higher Vocabulary Quotient**

Early Hearing Detection and Vocabulary of Children With Hearing Loss

Christine Yoshinaga-Itano, PhD,[a] Allison L. Sedey, PhD,[a,b] Mallene Wiggin, PhD,[a] Winnie Chung, AuD[c]

Language Outcomes Improved Through Early Hearing Detection and Earlier Cochlear Implantation

*†Christine Yoshinaga-Itano, *‡Allison L. Sedey, *Mallene Wiggin, and §Craig A. Mason

(Yoshinaga-Itano 2017, 2018)

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How can we address disparities?

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Principles For Advancing Hearing Health Equity

1. Raising public and provider awareness of racial/ethnic disparities in care
2. Improving capacity and number of hearing healthcare providers and facilities in underserved communities
3. Respect and Involve Communities in Health Equity Initiatives
4. Measure and Evaluate Progress
5. Community Engagement/Outreach
6. Consider long-term impact of COVID-19 on infants among vulnerable populations

https://www.kff.org/racial-equity-and-health-policy/issue-brief/eliminating-racialethnic-disparities-in-health-care-what/
https://www.apha.org

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Clinical Trials to promote Equity

The Laryngoscope

TRIOLOGICAL SOCIETY CANDIDATE THESIS

Promotion of Early Pediatric Hearing Detection Through Patient Navigation: A Randomized Controlled Clinical Trial

Matthew L. Bush, MD, PhD; Zachary R. Taylor, BA; Bryce Noblitt, MD; Taylor Shackleford, MS; Thomas J. Gal, MD, MPH; Jennifer B. Shinn, PhD; Liza M. Creel, PhD, MPH; Cathy Lester, MSSW; Philip M. Westgate, PhD; Julie A. Jacobs, MPH; Christina R. Studts, PhD

1. Patient Navigation Can Improve Access and Utilization of Infant Hearing Healthcare
2. EHDI Infant Dx Follow-up Increased from 68% to 93%
3. Timing improved from 106 days to 68 days
4. Hybrid Effectiveness-Implementation Trial

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Limitations

- Retrospective study
- Missing data, Inaccurate reporting
- Patients excluded— out of state infants and infants with no hearing screening result

Conclusion

1. The COVID-19 pandemic impacted EHDI programs
2. Race/Ethnicity/Language are associated with adherence
3. Maternal education impacts infant hearing outcomes
4. Use this data in programmatic planning and intervention work for vulnerable populations

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Acknowledgements

- I would like to thank Dr. Matthew Bush for his guidance, mentorship and help throughout this project.
- I would also like to thank Marissa Schuh for all her contributions and assistance with this project.

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Thank you for your time!