

Defining care pathways for infants with risk factors for late-onset/progressive hearing loss.

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BACKGROUND

NEWBORN HEARING SCREENING (NHS)

- NHS identifies infants with congenital hearing loss, while additional pathways are needed to target identification of infants who develop hearing loss after the immediate birth period
- Early identification and intervention of hearing loss is associated with many positive outcomes, including improved language skills, social development, and quality of life (e.g., Yoshinaga-Itano et al., 2021)

JOINT COMMISSION ON INFANT HEARING (JCIH, 2019)

- Established risk factors for late-onset/ progressive hearing loss guide which children warrant continued hearing monitoring beyond NHS
- JCIH (2019) position statement updated the list of risk factors for late-onset/ progressive hearing loss identifying 12 (perinatal and postnatal) classifications
- New guidance recommends at least one hearing evaluation between birth hospital discharge and 9 months of age for infants with most risk factors, a change from the previously recommended 24-30 months

STUDY OBJECTIVES

- Review and characterize the JCIH 2019 risk factors and follow-up recommendations in our clinical practice
- To optimize care pathways to audiologic assessment by 9 months of age for those identified from NHS with risk factors for late onset/progressive hearing loss
- Describe challenges and potential solutions for adoption of optimized care pathways

METHODS

- Two timeframes were examined:
 - TWO-MONTH SAMPLE** Babies who had inpatient NHS 1/1/2021 to 2/28/2021 at Mayo Clinic in Rochester (n=379)
 - YEAR-LONG SAMPLE** All babies screened who were born 1/1/2020 to 12/31/2020 at Mayo Clinic in Rochester (n=2,313)
- Two step screening workflow as described in Martin et al. (2021) with JCIH (2019) risk factor tracking in custom system
 - Risk factors retrieved from the custom EHD application (developed at Mayo Clinic Rochester in 2009) with detailed manual review of the electronic medical record (Epic Plummer Chart) to confirm audiologic follow-up and hearing outcomes

RISK FACTOR CHARACTERIZATION

TWO-MONTH SAMPLE

- Of the 379 babies who were screened in a two-month time period in 2021, 70 babies passed NHS **AND** required follow-up due to one or more JCIH 2019 risk factors for late-onset/ progressive hearing loss (**Table I**)
- All the babies with a known risk factor were in a NICU while inpatient
- Some had multiple risk factors
- Thirty-three (33) babies (47%) with JCIH 2019 risk factors had diagnostic follow-up documented approximately one year after initial screening

Table I. Risk factor summary of babies (n=70) screened January-February 2021 by nursery type.

Nursery	# with Risk Factors	Risk Factor Descriptions
Well-baby	0	None
NICU Level III	37	NICU stay > 5 days: 36 Family history of childhood HL: 1 Syndrome associated with HL: 1
NICU Level IV	33	NICU stay >5 days: 31 Family history of childhood HL: 3 Syndrome associated with HL: 1 Hypoxic ischemic encephalopathy: 1

CARE PATHWAY AND HEARING MONITORING REVIEW

TWO-MONTH SAMPLE

- Additional analysis of hearing monitoring was completed for the 33 babies who returned for follow-up due to one or more JCIH 2019 risk factors for late-onset/progressive hearing loss (**Figure 1**)
- Age** at first evaluation varied, with the majority (58%) returning in the 6-9 month timeframe
- Number of visits** varied, yet most (76%) required more than one visit to obtain the hearing outcome
- Hearing outcomes** within the first year of life, demonstrated no permanent hearing loss identified in the babies who returned for hearing evaluation
- 16 babies had abnormal tympanometry at least once during hearing monitoring

YEAR-LONG SAMPLE

- 355 babies (15%) born in 2020 identified with risk factors for late-onset/progressive hearing loss
- Electronic medical records were reviewed to evaluate hearing outcomes (**Figure 2**)
 - Out of the 41 babies with HL identified, 4 (~1%) identified with permanent HL

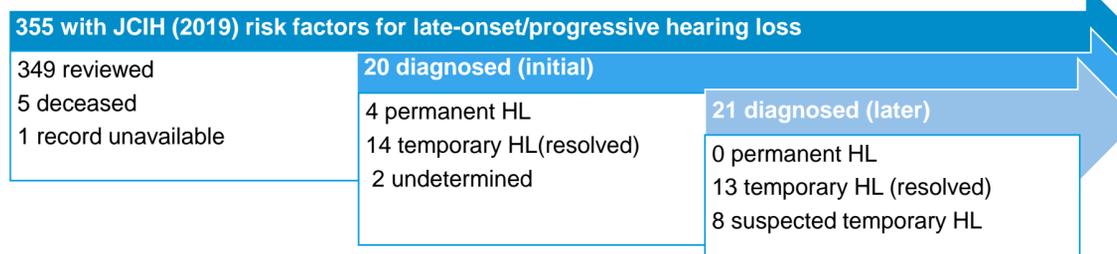


Figure 2. Hearing monitoring follow-up for 2020 full population with risk factors. Hearing loss (HL) was categorized as permanent or temporary (typically resolved conductive). Cases labeled as undetermined had limited follow-up obtained yet aligned with suspected HL warranting ongoing hearing monitoring.

Age at first outpatient hearing evaluation

<6 months: 6 babies (18%)	6-9 months: 19 babies (58%)	>9 months: 8 babies (24%)
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Number of visits

1 visit: 8 babies (24%)	2+ visits: 25 babies (76%)
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Hearing outcome

Permanent HL: 0 babies	Temporary HL: 10 babies	Hearing within normal limits: 23 babies
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Figure 1. Hearing monitoring breakdown for sample population with outcome within the first year of life.

DISCUSSION

- Successful transition for JCIH (2019) risk factor identification with NHS tracking
- Opportunities for improving care pathways to maximize timely and appropriate accessibility
- Criteria to confirm hearing status could reduce the need for multiple appointments
- Considerations: care transfer logistics, inpatient/outpatient care, illness, family-centered, loss to follow-up, etc
- Care team communications for coordination
- Coordinated messaging to care teams for hearing monitoring to align immediate and longer-term recommendations
- Need for clarifying audiologic approaches for risk factor targeted hearing monitoring
- Considerations: reliability of findings, frequency of monitoring, prematurity, cost/time and accessibility concerns, criteria for exiting monitoring program, transient middle ear dysfunction, audiology-extender models (audiology assistants or nurses), etc

CONCLUSIONS

- Successful and ongoing efforts to optimize care pathways and hearing monitoring protocols (inpatient and outpatient)
- Opportunities for defining optimal timeline for outpatient hearing monitoring
- NICU follow-up requires special considerations for monitoring given prematurity and medical complexity common in this population
- NHS outcomes from infants at increased risk of late-onset/ progressive hearing loss warrant continued efforts to improve follow up adherence

REFERENCES

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