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Epidemiologic Trends of Congenital Hearing Loss Diagnosis and Intervention in Hawai'i from 2017-2022

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Abstract

This study aimed to analyze recent epidemiologic trends in congenital hearing loss among newborns in Hawai'i, with a focus on screening, diagnosis, and enrollment in Early Intervention Services (EIS). The authors conducted a retrospective epidemiologic study using de-identified, aggregated data from the Hawai'i Department of Health's Universal Newborn Hearing Screening (UNHS) Program, encompassing all birthing facilities statewide from January 1, 2017, to December 31, 2022. All newborns during the study period were included. Variables analyzed included annual birth counts, screening completion rates, failed screening rates, confirmed diagnoses of hearing loss, and EIS enrollment. Trend analyses were performed to assess changes over time, with statistical significance set at α =.05. Screening rates remained consistently high (>97%) throughout the study period. The incidence of diagnosed hearing loss increased from 3.5 to 5.1 per 1000 live births (*P*=.034). Enrollment in EIS declined from 61% in 2017 to 39% in 2022 (*P*=.019), with a corresponding 22 percentage-point increase in loss to follow-up. Despite high compliance with newborn hearing screening in Hawai'i, gaps in follow-up and intervention persist. These findings highlight the need for system-level strategies to improve care coordination and ensure timely access to early intervention services.

Abbreviations and Acronyms

COVID-19 = Coronavirus disease 2019
EHDI = Hawai'i Early Hearing Detection and Intervention
EIS = Early Intervention Services
HDOH = Hawai'i Department of Health
UNHS = Universal Newborn Hearing Screening

Introduction

Hearing loss is the most common congenital sensory deficit, affecting approximately 1–2 per 1000 newborns in the United States.[1] Early identification is critical, as untreated hearing loss is associated with delays in speech, language, and cognitive development, with downstream effects on educational achievement and social integration.[2-4] Universal Newborn Hearing Screening (UNHS) programs have significantly improved early detection and form the foundation of Early Hearing Detection and Intervention (EHDI) systems.

Hawai'i has historically been a leader in newborn hearing screening, becoming the first state to mandate UNHS in 1990, with full statewide implementation by 1999.[5] Prior analyses of Hawai'i Department of Health (HDOH) UNHS data, including a study published in 2017, demonstrated high screening rates while identifying challenges in follow-up and early intervention.[6] Since that time, changes in health care delivery, population dynamics, and disruptions such as the COVID-19 pandemic may have influenced screening outcomes and access to care.

Despite near-universal screening, loss to follow-up remains a persistent limitation of EHDI programs nationally. Hawai'i presents a unique context in which geographic dispersion, inter-island travel requirements, and health care access disparities may further exacerbate these challenges. It remains unclear whether high screening rates in Hawai'i have translated into consistent diagnostic follow-up and early intervention in recent years.

The objective of this study is to update and extend prior HDOH UNHS analyses on newborns by evaluating statewide trends from 2017–2022 in (1) newborn hearing screening outcomes, (2) incidence of confirmed congenital hearing loss, and (3) enrollment in Early Intervention Services (EIS). Using 2017 HDOH data as a baseline, this study aims to assess whether improvements in early detection have translated into timely intervention and to identify gaps in the continuum of care.

Methods

This retrospective epidemiologic study analyzed trends in congenital hearing loss among newborns in Hawai'i from 2017 to 2022, using de-identified aggregated data. At the time of data acquisition, 2022 was the most recent year for which statewide data were available from the Hawai'i Department of Health's Universal Newborn Hearing Screening (HDOH UNHS) Program.

All newborns in Hawai'i from January 1, 2017, to December 31, 2022, were included in the dataset, regardless of birth weight, gestational age, or medical history. Newborn hearing screening was performed using otoacoustic emissions (OAE) testing, a physiologic test that assesses inner ear (cochlear) function. Infants who did not pass the initial screening were referred for confirmatory diagnostic auditory brainstem response (ABR) testing, which evaluates neural responses to sound along the auditory pathway.

Table 1. Total Newborns Screened for Hearing Loss and Total Newborns Who Failed the Hearing Screen in the State of Hawai'i from 2017-2022.

Year	Total Births	Newborns Screened for Hearing Loss n (%)	Newborns Who Failed Hearing Screen n (%)
2017	17362	17205 (99.1)	171 (1.0)
2018	16909	16753 (99.1)	191 (1.1)
2019	16708	16579 (99.2)	250 (1.5)
2020	15712	15496 (98.6)	293 (1.9)
2021	15552	15178 (97.6)	245 (1.6)
2022	15490	15169 (97.9)	248 (1.6)

Variables analyzed included annual birth counts, screening completion rates, failed screening rates, confirmed diagnoses of hearing loss, and enrollment in EIS.

Descriptive statistics were used to summarize yearly outcomes. Linear regression was used to evaluate temporal trends in the annual incidence of hearing loss and Early Intervention Service enrollment over time. Statistical significance was defined as $P<.05$. All analyses were performed using R software version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria).

This study utilized de-identified data and was deemed exempt from review by the University of Hawai'i Institutional Review Board (Protocol No. 2024-00430).

Results

The total number of births and the number of newborns screened in Hawai'i were summarized by year, with screening rates consistently exceeding 97% across all years (**Table 1**). However, there was a slight, non-significant decrease in screening rates over time, from 99.1% in 2017 to 97.9% in 2022, with a nadir of 97.6% in 2021.

The proportion of newborns who failed initial screening increased modestly over the study period, from 1.0% in 2017 to 1.6% in 2022. Newborns who failed the initial screening underwent confirmatory testing to diagnose hearing loss. There was a slight but statistically significant increase in the rate of newborns diagnosed with hearing loss during the study period from 3.5 per 1000 live births in 2017 to 5.1 per 1000 live births in 2022 ($P = .034$) (**Figure 1**). Most cases of hearing loss during this period were bilateral, affecting both ears (65%).

Enrollment in EIS among infants diagnosed with hearing loss declined significantly during the study period, from 61% in 2017 to 39% in 2022 ($P = .019$) (**Figure 2**). Over the same period, the proportion of children lost to follow-up increased by 22 percentage points.

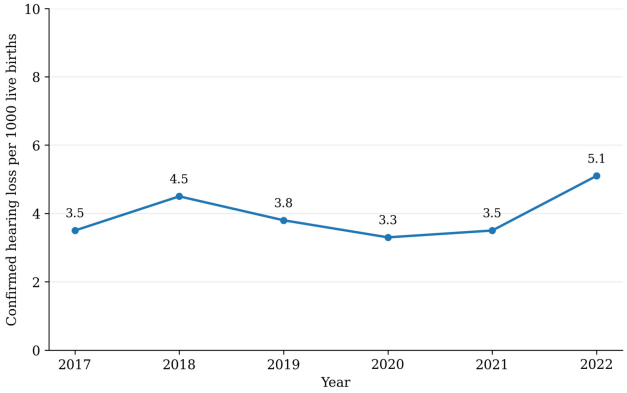

Figure 1. Incidence of Confirmed Congenital Hearing Loss in Hawai'i from 2017-2022.

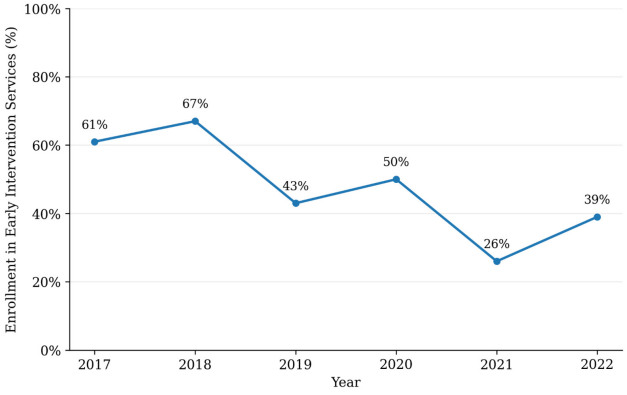

Figure 2. Percentage of Newborns with Diagnosed Hearing Loss Who Were Enrolled in Early Intervention Services in Hawai'i from 2017-2022.

Discussion

This study provides an updated, statewide evaluation of Hawai'i's newborn hearing screening and intervention system, demonstrating that while screening rates remain consistently high, significant gaps persist in the transition from diagnosis to early intervention. These findings suggest that the primary challenge within the Hawai'i Department of Health Early Hearing Detection and Intervention (HDOH EHDI) continuum in Hawai'i has shifted from identification to ensuring timely and effective linkage to care.

The observed increase in the incidence of diagnosed congenital hearing loss contrasts with prior reports from Hawai'i, which demonstrated a decline from approximately 4.0 to 2.6 per 1000 live births between 2007 and 2013.[6] Notably, the trend observed in the present study was not

strictly linear, with fluctuations across the study period, including a transient decline between 2019 and 2020 followed by an increase through 2022. These patterns suggest that the apparent rise in incidence may reflect a combination of improved diagnostic capture, temporal variability, and evolving population or environmental risk factors, rather than a uniform increase in disease burden alone.

Several mechanisms may underlie the increase in diagnosed hearing loss. Improvements in follow-up diagnostic testing may have led to greater identification of mild, unilateral, or previously under-recognized cases. Additionally, changes in underlying risk factors, such as congenital cytomegalovirus infection, perinatal exposures, or demographic shifts in the birthing population, may contribute to true changes in incidence.[7,8] Variations in screening protocols, referral thresholds, or reporting practices over time may also influence observed trends. Importantly, these findings underscore the need for continued surveillance and more individual-level analyses to better understand drivers of disease burden.

A key finding of this study is the widening gap between diagnosis and enrollment in EIS. Despite near-universal screening, the proportion of infants successfully linked to intervention declined substantially over the study period, accompanied by a corresponding increase in loss to follow-up. When compared with earlier estimates of loss to follow-up in Hawai'i (reported at approximately 25–35%), the current findings suggest a growing gap in the continuum of care.[9] This pattern has important implications for EHDI programs, as early detection alone does not improve outcomes without timely intervention.[10,11]

Multiple factors likely contribute to these trends. Hawai'i's unique geographic context, characterized by inter-island travel requirements and uneven distribution of specialty services, presents inherent barriers to accessing diagnostic and intervention services. These structural challenges may be compounded by logistical, socioeconomic, and communication barriers that affect family engagement and health care navigation.[9,12-14] Furthermore, the COVID-19 pandemic likely contributed to disruptions in care during the latter portion of the study period, including delays in diagnostic evaluation, reduced access to in-person services, and challenges in care coordination.

Efforts to address loss to follow-up in Hawai'i have included targeted initiatives such as the Hawai'i Baby HEARS Project, as well as outreach to primary care providers through collaborations with organizations including the American Academy of Pediatrics.[10] Despite these efforts, the current data suggest that these interventions have not resulted in sustained population-level improvements. This may reflect the persistence of systemic barriers that are not easily addressed through isolated quality improvement initiatives. Prior studies have also identified gaps in provider awareness, confidence, and communication regarding newborn hearing screening and follow-up, which may further contribute to incomplete linkage to care.[15,16]

Taken together, these findings highlight the need for a shift in focus from screening performance alone to strengthening the systems that support continuity of care. Potential strategies include the development of centralized care coordination infrastructure, expansion of tele-audiology and telehealth services to mitigate geographic barriers, and implementation of culturally responsive, family-centered engagement approaches. Enhancing communication between screening programs, primary care providers, and specialty services may also improve follow-up completion and early intervention enrollment.

This study has several limitations. The use of aggregated, de-identified data limits the ability to assess individual-level risk factors associated with loss to follow-up, including socioeconomic status, geographic location, and maternal or infant characteristics. The available data do not capture the reasons for non-enrollment in EIS, limiting the ability to determine whether barriers such as family preference, communication challenges, geographic access, or other system-level factors contributed to the decline in EIS enrollment over time. Additionally, the team was unable to evaluate the timing of diagnostic confirmation or intervention relative to established HDOH EHDI benchmarks. Changes in data reporting practices over time may have influenced observed trends, and the observational design precludes causal inference. Despite these limitations, this study provides important population-level insights into the performance of Hawai'i's EHDI system over time.

Conclusion

Hawai'i continues to demonstrate high performance in newborn hearing screening; however, significant challenges remain in ensuring timely follow-up and access to early intervention services. The increasing incidence of diagnosed hearing loss, coupled with rising rates of loss to follow-up, highlights a critical gap in the continuum of care.

Addressing these challenges will require coordinated, system-level approaches that improve access to diagnostic and intervention services, strengthen care coordination, and enhance family and provider engagement. Ensuring that early detection translates into timely and effective intervention is essential to improving developmental outcomes and reducing disparities among children with hearing loss.

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Disclosures

None of the authors identify any conflict of interest.

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