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Maternal Health Trends and Disparities in Hawai'i: Visualizing Pregnancy Risk Assessment Monitoring System Data Through an Interactive Shiny Web Application

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Keywords: Hawai'i, PRAMS, maternal health, health disparities, Shiny App

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Abstract

Significant racial and socioeconomic disparities persist in maternal health outcomes in Hawai'i, particularly among Native Hawaiian, Pacific Islander, and other historically marginalized populations. While the Pregnancy Risk Assessment Monitoring System (PRAMS) offers robust maternal health surveillance data, few tools exist to dynamically explore this information at the state level. The objective of this study was to develop and deploy an interactive data visualization tool using Hawai'i PRAMS data to examine maternal health patterns stratified by race, education level, and socioeconomic status. The authors developed an R Shiny web application using publicly available PRAMS data from 2000 to 2022 (Phases 4–8). The application includes a trend-display tab using survey-weighted estimates and a logistic regression tab examining adjusted associations between demographic factors and maternal outcomes. Both features account for the complex survey design. A total of 32 710 responses were analyzed. The application displayed differences across racial, educational, and socioeconomic groups, while cross-phase comparisons were treated as exploratory because questionnaire items and coding changed over time. Multivariable logistic regression identified associations between demographic characteristics and selected maternal health outcomes. This tool offers an accessible platform for exploring maternal health data in Hawai'i and supports hypothesis generation and data-informed discussion among researchers, public health professionals, and policymakers.

Abbreviations and Acronyms

ARF = PRAMS Automated Research File
NHPI = Native Hawaiian and Pacific Islander
OR = odds ratio
PRAMS = Pregnancy Risk Assessment Monitoring System
PSU = primary sampling unit
SES = socioeconomic status

Introduction

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a nationwide, state-based surveillance system conducted by the Centers for Disease Control and Prevention (CDC) in collaboration with state health departments. PRAMS collects information on maternal behaviors, conditions, and experiences before, during, and after pregnancy.[1,2] In Hawai'i, approximately 200 mothers are selected each month from birth certificate files.[3] Selection uses a site-specific stratified random sampling plan, with geographic and other subpopulations sampled at different rates to support reliable jurisdictional estimates.[2,3] Hawai'i PRAMS uses separate state- and county-level analysis weights to support both types of reporting. The present analysis used the state-level weight released in the PRAMS Automated Research File (ARF); the county-level weight was not included in that file.

Hawai'i's unique multiethnic population makes it a particularly important case study for understanding maternal racial health disparities. National pregnancy-related research may not fully capture Hawai'i's diverse maternal health experiences. Local analyses using Hawai'i PRAMS data are essential for developing targeted interventions, given persistent racial disparities in maternal outcomes. Previous research studies have documented significant disparities in postpartum depression, gestational diabetes mellitus, and preeclampsia among Native Hawaiian and Pacific Islander (NHPI) populations.[4-6] Such disparities highlight the need for accessible, interactive tools that enable both clinicians and researchers to explore maternal and infant health trends in Hawai'i.

Critical gaps remain in the dissemination of PRAMS data, particularly in interactive and customizable formats. National PRAMS resources include static summaries such as Selected Maternal and Child Health Indicators by Site.[7] The Hawai'i Department of Health produces reports, and the Hawai'i Health Data Warehouse (HHDW) PRAMS dashboard provides weighted estimates and customizable filters.[8,9] These resources primarily present summary statistics and do not offer user-specified survey-weighted regression. To complement these resources, the study team developed a web application that provides stratified visualizations and regression outputs from the Hawai'i subset of the CDC public-use ARF. The publicly available Hawai'i PRAMS Data Explorer was deployed using shinyapps.io.[10]

Methods

Overview of the Shiny Application Framework

The interactive Shiny application was designed to provide an accessible, user-friendly interface for exploring Hawai'i PRAMS data. The app consists of multiple tabs supporting different analytical functions. Upon launching the application, users are first greeted by an "About" page, which provides a brief overview of the app's purpose and features. The 2 primary analytical components of the app include a trend analysis tab and a multivariable logistic regression tab, each allowing for survey-weighted exploration of the PRAMS dataset.

Help dialogs are available throughout the application, and users can export selected plots as HTML, PNG, or PDF files. HTML downloads retain plot interactivity.

PRAMS Data

The primary manuscript analyses used cross-sectional PRAMS data for Hawai'i from 2000 through 2022: Phase 4 (2000–2003), Phase 5 (2004–2008), Phase 6 (2009–2011), Phase 7 (2012–2015), and Phase 8 (2016–2022).[1] The 2017 Hawai'i survey year was excluded because the state did not deem it valid for reporting; data was not collected in 2018. PRAMS datasets were accessed through the CDC ARF portal.[1] The files were de-identified and contained no directly identifying information. *Note:* The application screenshots in **Figures 3** and **4** include an illustrative 2023 (Phase 9) output; that display is identified separately and is not included in the cross-phase results summarized in the text.

The ARF was restricted to respondents from Hawai'i. Demographic variables included maternal race/ethnicity, education, and socioeconomic status (SES). Income-based SES categories were defined separately within each phase and were not treated as absolute equivalents across phases. For example, Phase 8 categories were low (<$37 000), middle ($37 000–$84 000), and high (>$84 000); Phase 7 categories were low (<$43 000), middle ($43 000–$77 000), and high (>$77 000). Accordingly, SES displays represent approximate within-phase rankings.

Maternal conditions and behaviors were defined from released PRAMS questionnaire or analytic variables for diabetes, hypertension, depression, asthma, smoking, alcohol use, intimate partner violence, and insurance. **Supplementary Table S1** lists the application variables, their definitions, phase availability, and restrictions on cross-phase comparison. Availability in multiple phases was not considered sufficient evidence of comparability; variables with material changes in wording, recall period, or coding were limited to comparable periods or displayed cross-sectionally. The 2019 cycle had a substantially smaller sample than adjacent years, increasing uncertainty. Estimates with fewer than 30 unweighted observations were suppressed.

Statistical Methods

PRAMS uses jurisdiction-specific stratified sampling and survey weighting.[2] Hawai'i program data include separate analysis weights for state- and county-level reporting. The national ARF used for this study contains the state analysis weight, which accounts for sampling probabilities, nonresponse, and noncoverage; the released stratification variable was also incorporated. Because the county-level weight is not included in the national ARF, county-level analyses were not performed. Survey-weighted variances were estimated with Taylor series linearization.

Weighted proportions were estimated for maternal health indicators by demographic group and year. Survey-weighted logistic regression models used binary outcomes and selected demographic predictors; adjusted odds ratios (ORs), 95% confidence intervals (CIs), and *P* values were reported. These analyses were implemented with the same survey-design object used throughout the application.

Missing observations were handled by complete-case analysis separately for each display or model. Because users can select different outcomes, stratifiers, phases, and predictors, the number and percentage excluded are analysis-specific rather than a single fixed value. The application displays the unweighted analytic denominator for each trend estimate, and regression outputs use all records complete for the selected model. Multiple imputation was not performed because the application was designed for exploratory visualization and model demonstration rather than confirmatory inference.

Descriptive statistics were calculated to summarize participant demographics and key maternal health indicators across survey years. These statistics provide an overview of the sample demographic characteristics, including race, education, and SES. For these variables, sample size counts and frequencies (percentages) were calculated.

Shiny App Features

The second tab provides a user-selection panel for the trend tool (**Figure 1**) and an interactive trend graph (**Figure 2**). Users select a maternal indicator and a stratifier such as race/ethnicity, education, or SES. Each point represents a survey-weighted percentage for a year-by-subgroup cell. The graph displays 95% CIs, and the interactive tooltip reports the year, subgroup, estimate, and unweighted analytic denominator. Cells with fewer than 30 unweighted observations are suppressed. Cross-phase displays are exploratory and are restricted or discouraged when questionnaire wording, coding, or construct definitions changed across phases. The trend tool also permits simultaneous display of 2 or 3 selected variables. These visual comparisons are intended for exploratory use and do not constitute formal tests of temporal change.

The third tab provides survey-weighted multivariable logistic regression. Users select an outcome, predictors, and 1 of 3 phase ranges: Phase 8, Phases 6–8, or Phases 4–8. Results are presented as a regression table with a mini forest plot (**Figure 3**) and as a forest plot (**Figure 4**). Binary outcomes use "No" or 0 as the reference category. **Figure 3** and **Figure 4** show illustrative application outputs using 2016 and 2019–2023; 2017 and 2018 are absent. The 2023 observation belongs to Phase 9 and is shown only as part of the application demonstration, not the Phase 4–8 cross-phase

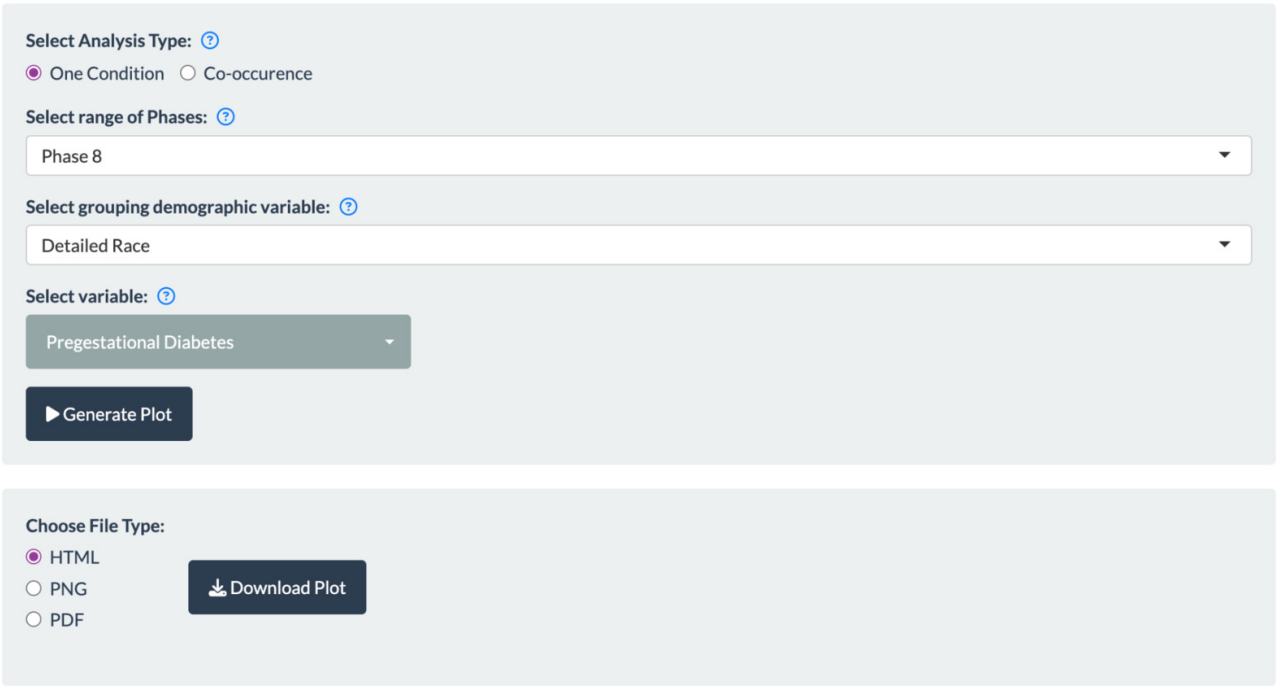


Figure 1. Example User-selection Panel Showing a Phase 8 Selection.

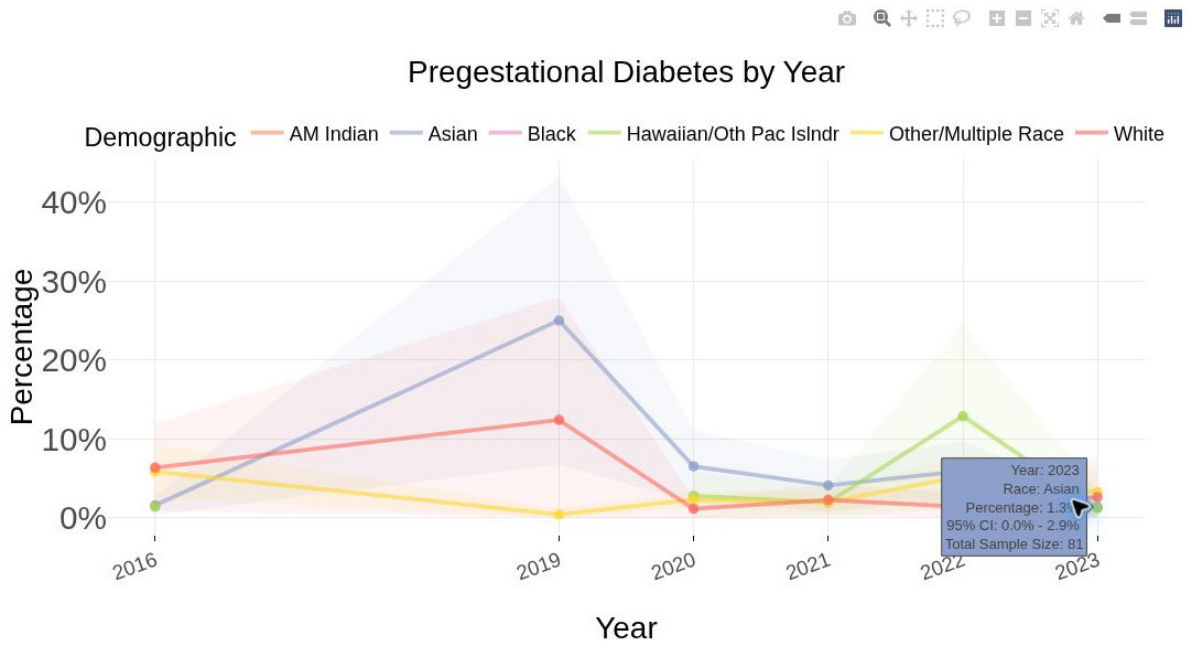


Figure 2. Screenshot of the Interactive Pregestational Diabetes Display by Race/Ethnicity, with the Tooltip Open for Asian Respondents in 2023.[a,b]

[a]Figure 2 is a separate Phase 9 tooltip demonstration and is not the output generated from Figure 1 selection
[b]The 2023 point is a Phase 9 demonstration and is not pooled with Phase 4–8 summaries; 2017 and 2018 are absent.

analyses summarized in the manuscript. **Figure 1** and **Figure 2** are separate illustrative screenshots: **Figure 1** shows a Phase 8 selection, whereas **Figure 2** shows a 2023 Phase 9 output solely to demonstrate the tooltip.

Software and Packages

All analyses and application components were implemented in R version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria).[11] The survey package specified the released PRAMS survey-design variables and fit survey-weighted models.[12] The *gtsummary* package created

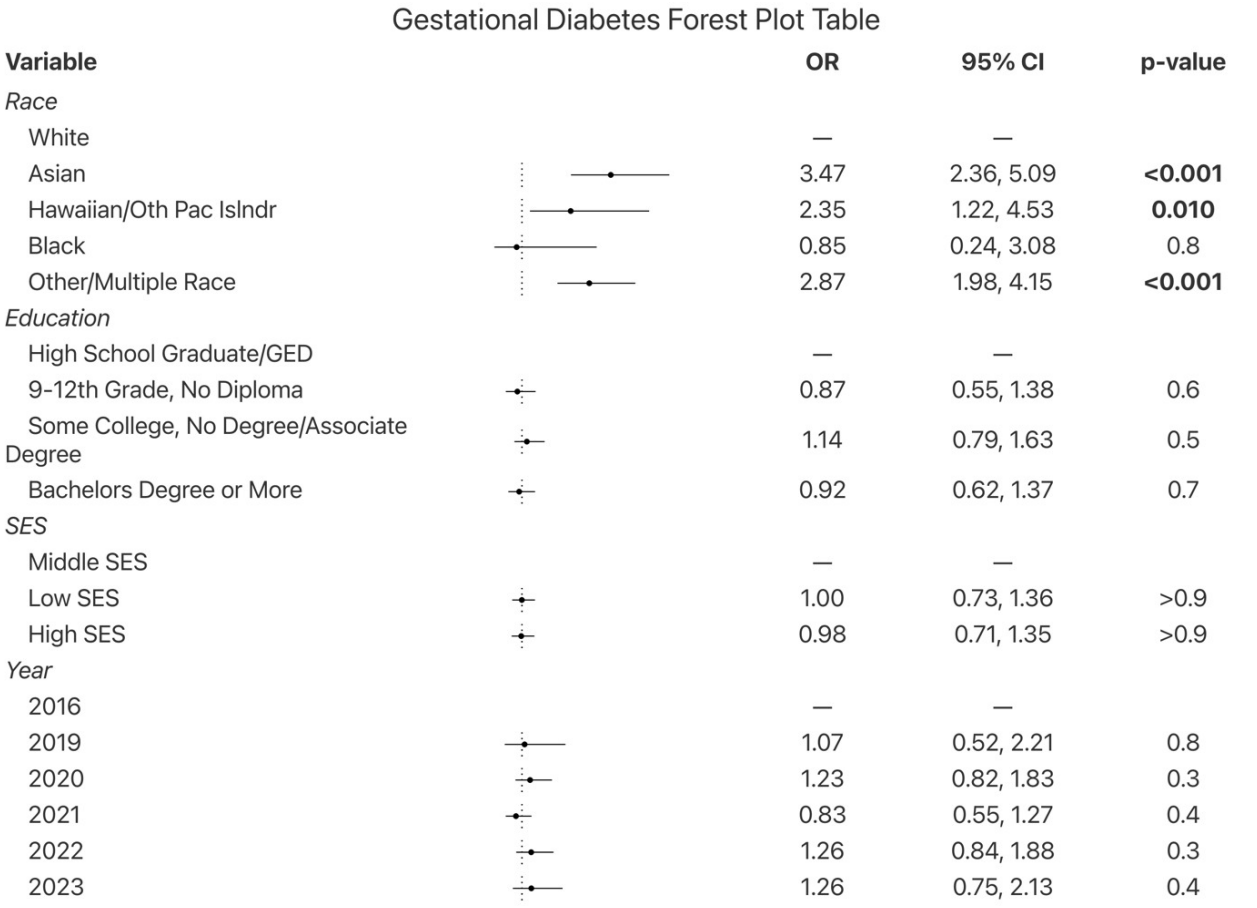


Figure 3. Illustrative Survey-Weighted Logistic Regression Output for Gestational Diabetes, Including Race/Ethnicity, Education, Phase-specific SES, and Year.[a]

[a] Years 2017 and 2018 are absent, and 2023 is Phase 9 and is shown only as an application demonstration. Columns display predictors, mini forest plots, ORs, 95% CIs, and *P* values.

descriptive and regression summaries,[13] *tidyverse* packages supported data management and plotting,[14] *gt* generated display tables,[15] and *Shiny* provided the web application framework.[16] These are R software packages executed by the application; CDC does not designate or approve specific software packages. Methodological compliance depends on correctly applying the released PRAMS design variables, weights, and reporting rules. Statistical significance was defined as $P<.05$.

Results

A total of 32 710 Hawai'i respondents from Phases 4–8 were included. Overall, 64.9% were represented in the national ARF category Asian/Pacific Islander, 22.1% as White, and 10.3% as Other/Multiple Race. College graduates comprised 29.6% and high school graduates 35.1% of respondents; 49.0% were classified as low SES under phase-specific cut points. Apparent changes in race/ethnicity composition across phases were not interpreted as population trends because the national ARF aggregation of Hawai'i race categories changed over time. Similarly, education was not compared across the 2014 birth-certificate change.

Exploratory Trend Analysis

Exploratory trend displays showed year-to-year variability in several indicators. Estimates for 2019 were notably imprecise because of the reduced sample. No formal test was performed to determine whether the 2019 values were sampling artifacts; they were therefore interpreted cautiously and not treated as evidence of abrupt population change. Pregestational diabetes was not trended across the 2009 questionnaire change, and variables with other material wording changes were restricted as detailed in **Supplementary Table S1**. The application therefore supports visual exploration while emphasizing CIs, analytic denominators, and phase-specific interpretation.

Multivariable Logistic Regression

Survey-weighted logistic regression across available comparable data examined pregestational diabetes, gestational diabetes, chronic hypertension, and intimate partner violence. In these exploratory models, the Asian/Pacific Islander and Other/Multiple Race categories had higher odds of selected diabetes outcomes than the White category. The Asian/Pacific Islander category had higher odds of preges-

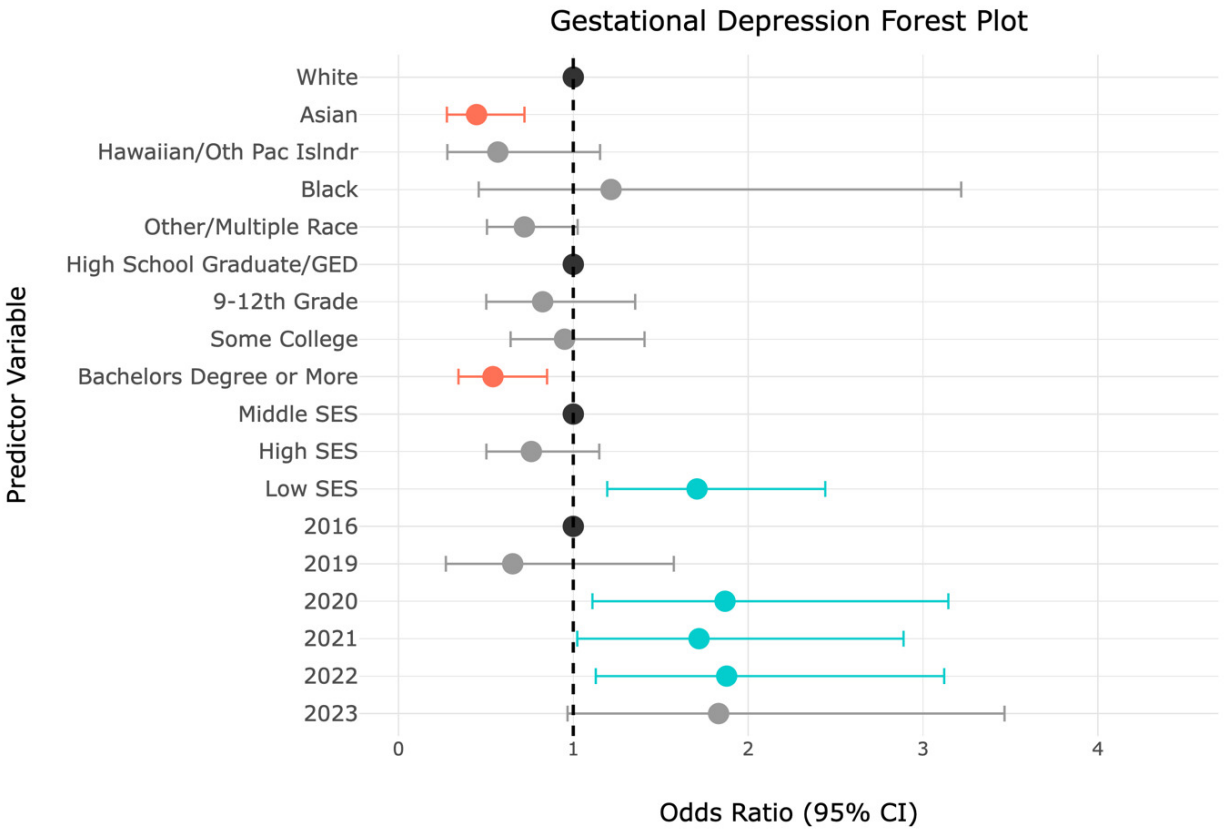


Figure 4. Illustrative Survey-Weighted Logistic Regression Output for the Application-Defined Depression Outcome[a] Including Race/Ethnicity, Education, Phase-specific SES, and Year[b]

[a]PRAMS depression items refer to phase-specific periods before or after pregnancy, so the label "Gestational Depression" should not be interpreted as a harmonized cross-phase construct.

[b] Years 2017 and 2018 are absent, and 2023 is Phase 9 and is shown only as an application demonstration. Points show adjusted ORs and horizontal lines show 95% CIs; color indicates statistically significant decreased (orange) or increased (blue) odds, and black points denote reference categories.

tational diabetes (OR=2.67; 95% CI, 1.86–3.83), and the Other/Multiple Race category had higher odds of intimate partner violence (OR=2.47; 95% CI, 1.47–4.14). A bachelor's degree or higher was associated with lower odds of pregnancy-induced hypertension (OR=0.75; 95% CI, 0.64–0.87) and intimate partner violence (OR=0.45; 95% CI, 0.33–0.63) than a high school education. These estimates should be interpreted within the relevant phase and variable definitions.

In the recent-year application output, Asian, NHPI, and Other/Multiple Race respondents had higher odds of gestational diabetes than White respondents (**Figure 3**). Adjusted ORs were 3.47 (95% CI, 2.36–5.09) for Asian respondents, 2.35 (95% CI, 1.22–4.53) for NHPI respondents, and 2.87 (95% CI, 1.98–4.15) for Other/Multiple Race respondents. Lower SES was associated with higher odds of the app-defined depression outcome (OR=1.71; 95% CI, 1.19–2.44) than middle SES (**Figure 4**). Because "gestational depression" is not a standard PRAMS construct and depression questions refer to phase-specific periods before or after pregnancy, this application label is interpreted only as the exact underlying item for the selected phase. No substantive conclusion was drawn from the isolated 2019 year coefficient because of the reduced sample.

Regarding insurance type, Asian and Other/Multiple Race respondents had higher odds of job-based insurance or Medicaid than White respondents. Black respondents had higher odds of military insurance (OR=4.66; 95% CI, 2.25–9.65), and NHPI respondents had higher odds of Medicaid coverage (OR=2.25; 95% CI, 1.28–3.95), compared with White respondents (*data not shown*).

Discussion

This study demonstrates how an interactive R Shiny application can make the Hawai'i subset of the national PRAMS ARF easier to explore. The tool combines survey-weighted descriptive displays with user-selected regression outputs. Its principal contribution is access and hypothesis generation; it does not replace Hawai'i-specific analyses using the state's more granular race/ethnicity data and county-level weights.

Limitations

This study has several limitations. PRAMS questionnaires and coding changed across phases, so data availability alone does not establish trend comparability. Pregestational diabetes was not compared across the 2009 item

change, postpartum depression questions changed across phases, intimate partner violence items changed, and maternal education was affected by the 2014 birth-certificate revision. Income was unavailable in Phase 4, and phase-specific income cut points provide only approximate relative SES rankings. The analysis used the Hawai'i subset of the national CDC ARF rather than Hawai'i-specific files; consequently, the more granular local race/ethnicity categories and county-level weights were unavailable. The 2017 survey year was excluded, data was not collected in 2018, and the reduced 2019 sample produced unstable estimates. Cells with fewer than 30 unweighted observations were suppressed. Missing-data exclusions varied by user-selected analysis, and multiple imputation was not performed. Formal external validation against matching CDC or HHDW estimates was not completed. PRAMS questionnaires are only available in English and Spanish,[1] and survey participation may therefore underrepresent respondents who prefer other languages. Finally, the illustrative application screenshots include a 2023 Phase 9 output, which was not pooled into the manuscript's Phase 4–8 cross-phase summaries.

Public Health Implications

The application can help researchers, public health professionals, and community organizations generate stratified state-level displays and exploratory models. Findings should be interpreted alongside Hawai'i-specific reports and, when county or granular race/ethnicity inference is required, confirmed with Hawai'i program data and the appropriate local weights.

The *Shiny* framework provides a reproducible approach for presenting survey-weighted PRAMS outputs. Potential uses include preliminary exploration, hypothesis generation, educational activities, and identification of questions requiring confirmatory analysis with Hawai'i-specific data. Extension to another jurisdiction would require site-specific variable mapping, sampling-design specifications, and review of phase comparability.

Conclusion

The Hawai'i PRAMS Data Explorer provides an accessible way to explore state-level maternal health data from the CDC public-use ARF. By pairing interactive visualizations with survey-weighted models and explicit cautions about phase comparability, suppression, and precision, the tool can support responsible hypothesis generation and data-informed public health discussion.

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Conflict of Interest and Disclosures

None of the authors identify any conflict of interest.

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Supplementary Materials

Supplementary Table S1. Variables Included in the Hawaiʻi PRAMS Interactive Shiny Application: Phase Availability and Comparison Restrictions

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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.

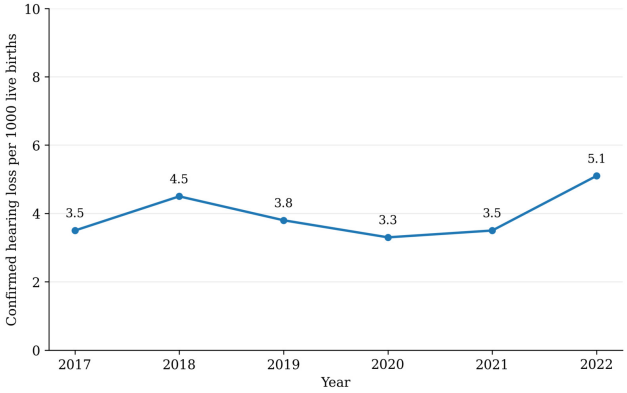


Figure 1. Incidence of Confirmed Congenital Hearing Loss in Hawai'i from 2017-2022.

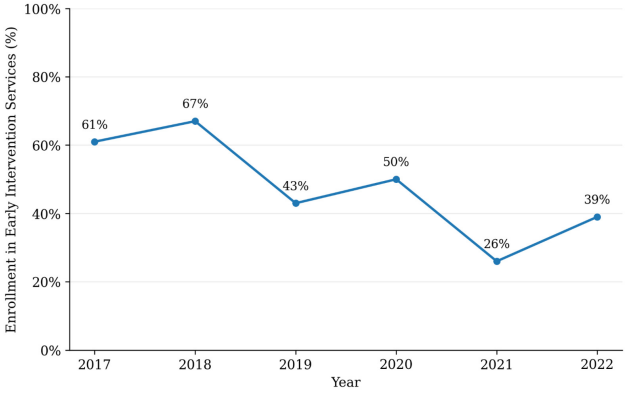


Figure 2. Percentage of Newborns with Diagnosed Hearing Loss Who Were Enrolled in Early Intervention Services in Hawai'i from 2017-2022.

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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Easa D. The Qualities of a Good Clinical Teacher. *Hawaii J Health Soc Welf*. 2026;85(11):327-329. doi:10.62547/UYND8851

The Qualities of a Good Clinical Teacher

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The Medical School Hotline of the University of Hawai'i John A. Burns School of Medicine was founded in 1993, by Satoru Izutsu PhD (former vice-dean UH JABSOM). It is a periodic column and is edited by Kathleen Kihmm Connolly PhD, HJH&SW Contributing Editor.

I was recently asked to assist a medical school faculty member compete for a prestigious teaching award at the University of Hawai'i at Mānoa (UHM). As 1 of about 3 dozen UHM faculty members I had previously helped prepare their academic promotion dossiers, I was both familiar with her academic record and eager to help. After much thought, I contemplated a strategy to provide the most compelling argument for her to compete effectually for the award. Along the way, I broadened my appreciation for the attributes of an exceptional teacher. Literature focused on important attributes of an effective lecture, as well as non-cognitive human qualities of the teacher helped inform my reformulation.[1,2]

I believed that over the span of my 50-year academic career at the John A. Burns School of Medicine in the Department of Pediatrics, Dean's office, UHM Office of the Vice Chancellor for Research and Graduate Education, and my subsequent academic involvement as a Professor Emeritus, I possess a decent grasp of the attributes of a "good" teacher. Indeed, many of my mentors and colleagues were highly respected and effective teachers that I admired throughout my career. Moreover, the diversity of positions that I occupied allowed me to witness and interact with a respectable number of teachers within and outside of my discipline. Sadly, I had parochially focused my definition of a good teacher on the credentials, academic standing, and presentation quality of the lecture and lecturer, foregoing any meaningful reflection on the human qualities and motivation of the teacher. My subsequent revelation emerged through a thoughtful reexamination of the question, a cursory review of the literature, and the critical evaluation of the exceptional career of a junior faculty member half my age.

The attributes of a good teacher were succinctly summarized in an insightful editorial.[3] Factors include being learner-focused in a stimulating learning environment; maintaining a supportive relationship between teacher and students; clear, effective instruction modified to best suit the content, audience, and desired learning goals; and assessment methods that lead to modification of techniques based on results. However, including only cognitive attributes is shortsighted. Indeed, the authors keenly include human elements such as "love and patience": "Love of the material being taught, love of the students themselves, and love of seeing people's lives change for the good because they have learned something new. Patience with ourselves as teachers and as communicators who are always working on getting better, patience with our students who may need more time than we think, and patience to see newly found knowledge transform into life-changing behaviors."[3] However, when I attempted to apply some of these principles to the clinical faculty member I was helping, I was faced immediately with questions and concerns.

To be sure, evaluation of clinical faculty's teaching ability is particularly challenging. Formal classroom instruction typically consumes a minority of teaching commitment. Instead, teaching occurs at scheduled and unscheduled times and in diverse settings: on the wards, at the bedside, in the cafeteria, the parking lot, and even in social settings during interactions with learners at all levels. Teaching in this context is an extension of the daily communication between teacher and student. Teaching moments emerge fluidly from discussions of patient care, queries from students, patients, and their families, and/or programmed into the day's activities. Sadly, it has been my experience that too many faculty members lack the province or patience to provide a safe, interactive, and meaningful teaching experience. Too many answer questions without giving enough time for their learners to chime in. This tendency is exacerbated when teaching is held in any busy ward service or intensive care unit where patience is at its limit, and when making timely decisions is critical to providing the best and most responsive care for patients. Faculty members tend to overlook the educational needs of students in this setting.

Moreover, students engaged in medical training behave more like apprentices than classical classroom learners. They follow their teachers and "learn" to mirror their daily routines in the provision of medical care. It is particularly critical in this context that the clinician/teacher act courteously, patiently, attentively, and professionally, cognizant of the student's presence at all times. This is necessary to personify the attributes of a trusted role model to insure a safe and effective learning experience. Hence, it follows that this non-classroom decorum is intimately tied to the student's overall appreciation of the teacher's teaching ability and value.

Notwithstanding these significant challenges, what follows is my distilled description of the qualities of a "good teacher." The ideal clinical teacher is one who carefully prepares, and polishes the delivery of lectures, seminars, informal presentations, and other verbal interactions with learners. The ideal teacher exudes a gentile humanity and an ever-present, inviting demeanor, while attentively educating learners as well as patiently listening and responding to their queries and concerns. Motivation stems from

the sincere goal of paying back for the educational opportunities received during their medical training, and a desire to formatively contribute to the next generation of medical practitioners. The ideal teacher is genuinely interested in and cares for their sphere of attentive learners, and is not just spewing out knowledge as an academic obligation of their status in the medical school. When it does not conflict with on-call duties or family responsibilities, an ideal teacher graciously accepts invitations to speak and/or participate in educational activities with a full spectrum of learners including undergraduate students, medical students, residents, fellows, community members, colleagues from relevant clinical departments, nurses, the media, etc. without hesitation. Taken together, an ideal teacher is truly an unselfish role model who is naturally driven to fulfill their professional and personal roles: at home, in the classroom, at the bedside, and in the community. Additionally, as an ultimate measure of success, the ideal teacher is one who inspires a student to identify them as the reason that they choose their specialty!

What I realized as I was considering how I would counsel this faculty member on how to frame this teaching award application, was the distinct difference between giving a brilliant lecture and being a brilliant teacher. I have witnessed many brilliant lectures throughout my career, many from well-known dignitaries and renowned academics without knowing the person behind the accolades. They may or may not be considered good teachers or inspiring role models. A good teacher is more than the sum of what or how well they teach. A good teacher is a balanced individual who is able to somehow manage the multifaceted challenges of life with dignity and a positive spirit. Burgeoning learners gravitate to and often mimic those who inspire them in life, to validate their own quest, to give them courage for their future endeavors, and often to receive long-term career advice as they encounter crucial crossroads in their life's journey.

As a postscript, while this essay was prompted by my earnest attempt to assist an exceptional and deserving faculty member to compete for a teaching award, during its formulation I reflected on the impact that one good teacher could have on inspiring their students to emulate their approach and behavior to propagate multiple generations of "good clinicians and teachers". To be sure, the positive influence that one good teacher can have on generations of clinicians and educators to come cannot be overstated. As long as humans are necessary to inspire other humans as decent role models, there is promise that humans will continue to control their destiny. Finally, I'm delighted to announce that the faculty member in question who I supported through the application process was one of a highly select few to be awarded this prestigious teaching award in 2026. I must confess that I was overjoyed as much as the award recipient!

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The HJH&SW encourages authors to use the appropriate diacritical markings (the ‘okina and the kahakō) for all Hawaiian words. We recommend verifying words with the Hawaiian Language Dictionary (http://www.wehewehe.org/) or with the University of Hawai‘i Hawaiian Language Online (http://www.hawaii.edu/site/info/diacritics.php).

Authors should also note that Hawaiian refers to people of Native Hawaiian descent. People who live in Hawai‘i are referred to as Hawai‘i residents.

Hawaiian words that are not proper nouns (such as keiki and kūpuna) should be written in italics throughout the manuscript, and a definition should be provided in parentheses the first time the word is used in the manuscript.

Examples of Hawaiian words that may appear in the HJH&SW:

‘āina	**Māori**	**O‘ahu**
Hawai‘i	**Lāna‘i**	**‘ohana**
kūpuna	**Mānoa**	**Wai‘anae**

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