

The Follow-up Gap: Racial Disproportionality and Social Determinants of Health in New Jersey's Hearing Detection and Intervention Program

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Purpose

The purpose of this study was to assess how race/ethnicity and social determinants of health are related to loss to follow-up (LTF) from NJ's Early Hearing Detection and Intervention (EHDI) program.

RESEARCH QUESTION:
How are maternal SDOH and race related to being completely LTF from New Jersey's EHDI program?

Introduction

EHDI programs seek to identify the 2-3 infants per 1,000 born yearly with hearing loss (Centers for Disease Control and Prevention, 2010). The goals of these programs are to screen all infants for hearing loss by 1 month of age, diagnose those with hearing loss by 3 months, and initiate treatment by 6 months (i.e. 1-3-6 Plan) (Joint Committee on Infant Hearing, 2019; Awad et al., 2019). Loss to follow-up (LTF) and racial disproportionality have been persistent problems nationally. Six in ten infants of White (59.5%) and Asian mothers (62.0%) referred for outpatient hearing healthcare completed a diagnostic evaluation. Less than half of infants of Black (47.1%), Native Hawaiian/Pacific Islander (28.8%), and American Indian/Alaska Native (30.8%) mothers completed a diagnostic evaluation (Centers for Disease Control and Prevention, 2021).

Structural racism is an endemic negative SDOH that has disproportionate impacts on Black communities (Yerby, 2022). While race, racism, and SDOH are related to LTF in EHDI systems, it is unclear what specifically drives LTF. A deeper understanding of how negative SDOH relates to LTF may assist healthcare systems develop more effective interventions.

Subjects

Population: New Jersey infants born between June 2015 and June 2017 who completed a hearing screening (N = 197,888). Exclusions: those who passed the screening (n = 193,673) and infants with missing screening data (n = 74). Final analytic sample: 4,141 infants referred for audiological follow-up, of whom 3,698 (89.3%) attended at least one follow-up appointment and 443 (10.7%) were completely lost to follow-up.

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Table 1. Description of the sample.

	Mean (SD)
Maternal age (yrs)	29.53 (6.11)
Prior live births	1.17 (1.38)

	Frequency (%)
Maternal race/ethnicity	
White, non-Hispanic	1257 (32.41%)
Black, non-Hispanic	697 (17.97%)
Hispanic	1716 (44.25%)
Asian	208 (5.36%)
Married	
No	1804 (43.57%)
Yes	2336 (56.43%)
College graduate	
No	2832 (68.67%)
Yes	1292 (31.33%)
Health insurance type	
Private	1883 (45.47%)
Medicaid/NJ Family Care	1654 (39.94%)
Other	48 (1.159%)
Self Pay/Charity	556 (13.43%)
WIC Participant	
No	2588 (67.62%)
Yes	1239 (32.38%)

Methods

Between June 2015 and June 2017, 197,888 infants in New Jersey received a hearing screening at birth. After excluding infants who passed the screening (n = 193,673) and those with missing data (n = 74), 4,141 infants referred for follow-up remained. Of these, 3,698 (89.3%) attended at least one appointment, while 443 (10.7%) were lost to follow-up (LTF).

Data sources included:

- **Birth Record System:** Provided maternal and infant details such as race/ethnicity, insurance type, WIC enrollment, maternal education, marital status, and birth county.
- **EHDI System:** Offered follow-up recommendations, appointment dates, and diagnoses.
- **Neighborhood Information:** Assessed using the NJ State Hospital Association's zip-code ranking for vulnerability and structural racism metrics per Siegel et al.

Bivariate analyses examined relationships among race/ethnicity, family-level SDOH, and neighborhood context, including vulnerability and structural racism. Stepwise multi-level logistic regression accounted for county-level clustering in infant delivery and hearing healthcare. Four models were tested: (1) an intercept-only model to assess county-level clustering, (2) race as a fixed effect on LTF, (3) addition of family-level SDOH, and (4) inclusion of community context variables. Additional models explored interactions and random effects. Clustering was assessed via the intraclass correlation coefficient (ICC), and model fit was compared using the Bayesian information criterion (BIC).

Results

Bivariate Analysis: Most predictors, including race/ethnicity and SDOH, were significantly associated with LTF, except for WIC participation (p>0.05).

Model 1 (Intercept-Only): County-level clustering accounted for ~12% of LTF variance, justifying a multilevel approach.

Model 2: Improved model fit (lower BIC), but clustering effects persisted. Infants of Black mothers had 89% higher odds of LTF (OR=1.89, p<0.01), while infants of Asian mothers had 62% lower odds (OR=0.38, p<0.05) compared to White mothers.

Model 3: Further improved fit; clustering effects remained. Significant predictors included:

- **Race/Ethnicity:** Black (OR=1.45, p<0.01), Hispanic (OR=0.54, p<0.01) vs. White.
- **Maternal Age:** Each additional year reduced LTF odds by 4% (OR=0.96, p<0.01).
- **Education:** College degree or higher reduced LTF odds by 41% (OR=0.59, p<0.01).
- **WIC Enrollment:** Reduced LTF odds by 40% (OR=0.60, p<0.01).

Model 4 Summary:

- **Predictor Consistency:** Significant predictors in Model 3 remained significant in Model 4.
- **Race/Ethnicity:**
 - Infants of Black mothers had **67% higher odds** of LTF compared to White mothers (OR=1.67, p<0.01).
 - Infants of Hispanic mothers had **33% lower odds** of LTF compared to White mothers (OR=0.67, p<0.01).
- **Maternal Age:** Each additional year reduced LTF odds by **5%** (OR=0.95, p<0.01).
- **Education:** Infants of mothers with a college degree or higher had **32% lower odds** of LTF compared to those with lower education levels (OR=0.68, p<0.01).
- **WIC Enrollment:** Infants of WIC-enrolled mothers had **39% lower odds** of LTF than those not enrolled (OR=0.61, p<0.01).
- **Model Fit:** No significant interactions were identified, and adding random effects did not improve fit.

Fixed Effects: Results summarized in Table 3.

Table 3. Logistic regressions predicting LTF.

Predictors	Model 1		Model 2		Model 3		Model 4	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Maternal race (compared to White, non-Hispanic)								
Black non-Hispanic	1.89**	1.39 – 2.57	1.45*	1.02 – 2.06	1.67**	1.14 – 2.43	1.67**	1.14 – 2.43
Hispanic	0.38*	0.28 – 0.52	0.54**	0.39 – 0.76	0.67*	0.46 – 0.95	0.67*	0.46 – 0.95
Asian			0.48*	0.22 – 1.01	0.57	0.26 – 1.22	0.57	0.26 – 1.22
Maternal age (years)			0.96**	0.94 – 0.98	0.95**	0.93 – 0.97	0.95**	0.93 – 0.97
Private insurance (compared to public or none)			0.75	0.55 – 1.01	0.81	0.59 – 1.11	0.81	0.59 – 1.11
Parents married (compared to not married)			0.97	0.73 – 1.28	0.90	0.67 – 1.20	0.90	0.67 – 1.20
College degree or higher (compared to no degree)			0.59**	0.42 – 0.82	0.68*	0.48 – 0.98	0.68*	0.48 – 0.98
WIC enrolled (compared to no WIC)			0.60**	0.45 – 0.79	0.61**	0.46 – 0.82	0.61**	0.46 – 0.82
Neighborhood vulnerability					1.00	0.86 – 1.17	1.00	0.86 – 1.17
Structural racism					0.98	0.69 – 1.38	0.98	0.69 – 1.38
ICC	0.12	0.12	0.12	0.12	0.12	0.12	0.07	0.07
BIC	2779.01	2561.78	2276.16	2276.16	2096.79	2096.79		

**p<0.01; *0.05≥p≥0.01

Community Context

- While community context did not directly predict LTF, it did reduce the variation between counties and improved overall model fit.
- This indicates that overall differences in LTF remain between counties and accounting for community context, including structural racism and neighborhood vulnerability, helps explain those differences.
- Future research should further explore the role of community context in LTF as distinctly different from individual and family level factors.

Discussion

Racial Disparities in LTF

- **Initial Findings:** Without adjusting for any SDOH, infants of Black mothers had 89% higher odds of being LTF compared to those of White, non-Hispanic mothers.
- **Adjustment for Family-Level SDOH:** When factors such as maternal age, education, and WIC participation were included, the increased odds for infants of Black mothers dropped to 45%.
- **Inclusion of Community-Level SDOH:** Once community-level variables were added, the odds for infants of Black mothers increased to 67% higher than their White counterparts. This suggests that community context may impose additional disadvantages.

Findings for Hispanic Mothers

- **Unadjusted Model:** Initially, there were no significant differences in LTF odds between infants of Hispanic and White mothers.
- **After Adjusting for Family-Level SDOH:** The odds for infants of Hispanic mothers became significantly lower than for White infants.
- **Community-Level Adjustments:** Although the odds increased slightly when community-level SDOH were considered, infants of Hispanic mothers still had significantly lower odds of LTF compared to White infants.

Role of WIC Participation

- **Positive Influence on Follow-Up:** Consistent with previous research, families enrolled in WIC showed reduced odds of LTF. This is notable because, despite being an indicator of lower socioeconomic status, WIC participation appears to promote better engagement with pediatric health services.
- **Broader Implications:** These findings align with other studies that link WIC participation with positive health behaviors such as increased breastfeeding, regular well-child appointments, and higher vaccination rates.

Conclusion

Conclusions and Future Research

- **Complex Interplay of Factors:** The study underscores how both family and community SDOH contribute to healthcare disparities. In particular, the community context may exacerbate the disadvantages faced by infants of Black mothers.
- **Need for Further Study:** The observed relationship between WIC participation and improved healthcare outcomes suggests a need for additional research to better understand the underlying mechanisms and to potentially inform targeted interventions.

This comprehensive analysis highlights that while family-level factors are crucial, the broader community environment also plays a significant role in influencing LTF outcomes in pediatric care.

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