

Maternal Risk Factors Associated with Loss to Follow-up for Diagnosing Hearing Loss in Georgia Infants Who Failed Newborn Hearing Screening, 2015–2018

2020 Early Hearing Detection and Intervention
Annual Meeting

Michael Lo, MSPH

Brandt Culpepper, PhD, CCC-A

Judith Kerr, MPH

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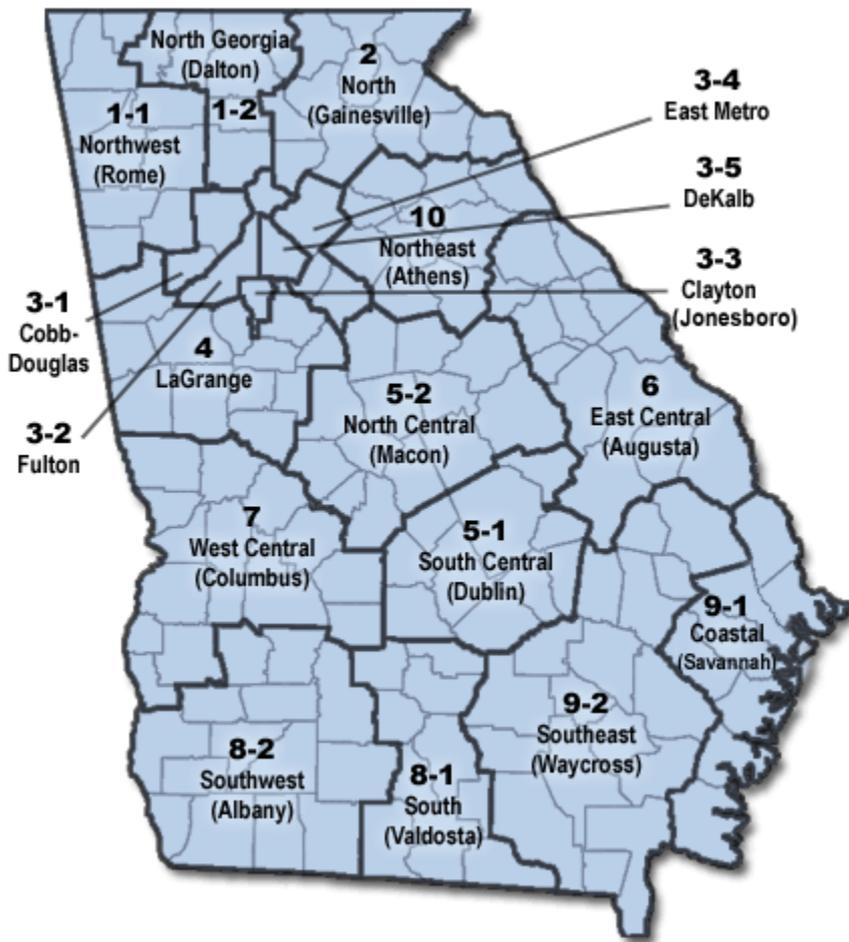
Financial Disclosure Statement

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Background

- Undiagnosed hearing loss results in delays in language, literacy, cognitive, and social-emotional skills^{1,2}
- Loss to follow-up (LFU) among newborns who fail their hearing screen may put them at risk for undiagnosed hearing loss^{1,2}
- Tennessee has identified maternal risk factors associated with LFU²
 - Mothers with \leq high school education
 - U.S.-born low-income African-American mothers residing in non-metro areas
 - Foreign-born mothers (protective factor)
- Goal: Identify maternal risk and protective factors associated with LFU of Georgia resident infants who failed their hearing screen

EHDI Follow-up and Data Collection in Georgia



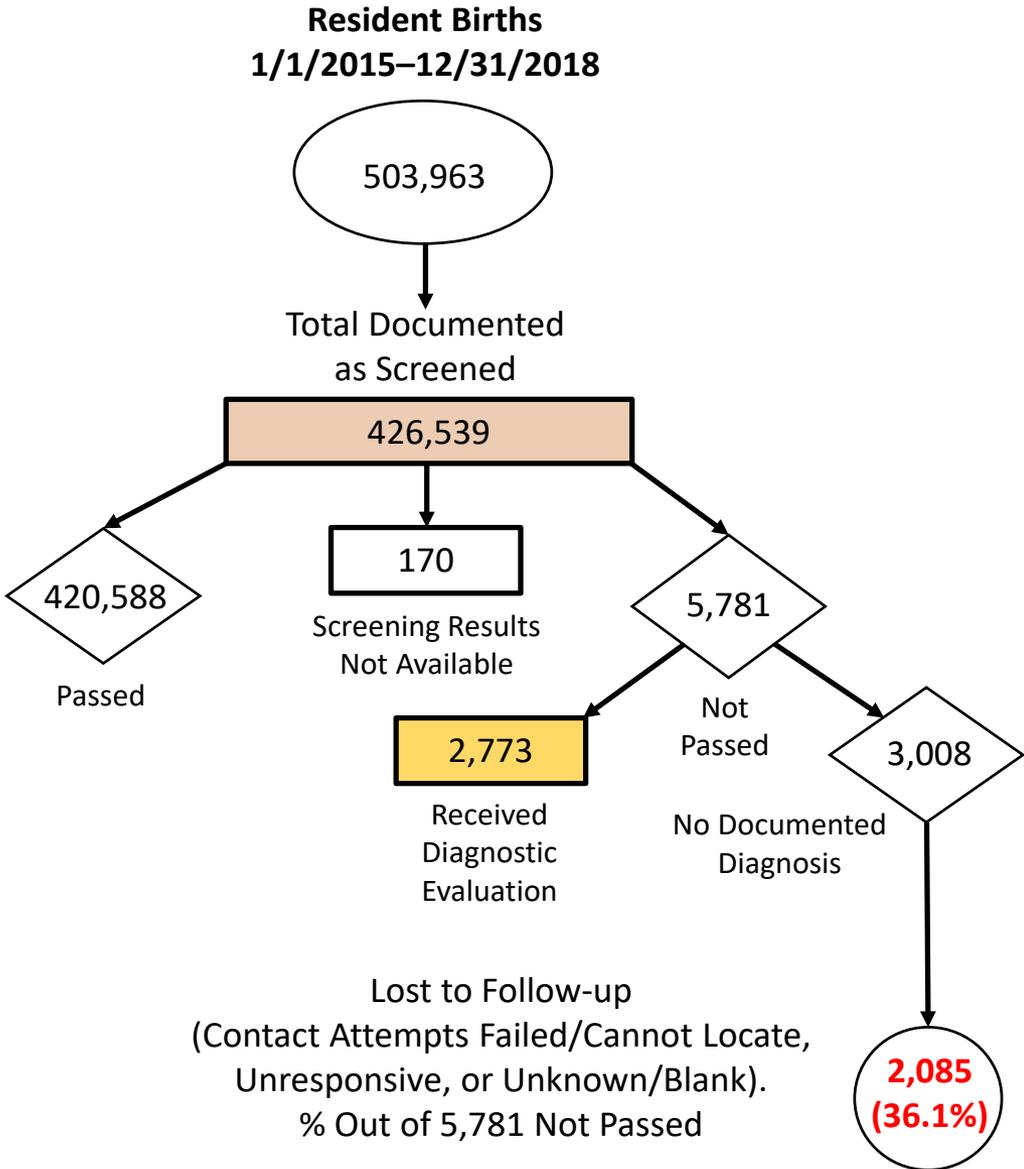
- 159 Counties
- 18 Public Health Districts
- 18 District EHDID Coordinators
 - Conduct follow-up on infants in each district through the EHDID 1-3-6 process
 - Enter 1-3-6 data into State Electronic Notifiable Disease Surveillance System (SendSS)
 - Lapses in full-time staffing are associated with decreased follow-up³

What Maternal Risk Factors are Associated with Loss to Follow-up for Diagnosing Georgia Infants for Hearing Loss After a Failed Hearing Screen?



Methods

Analysis Population



Data Sources

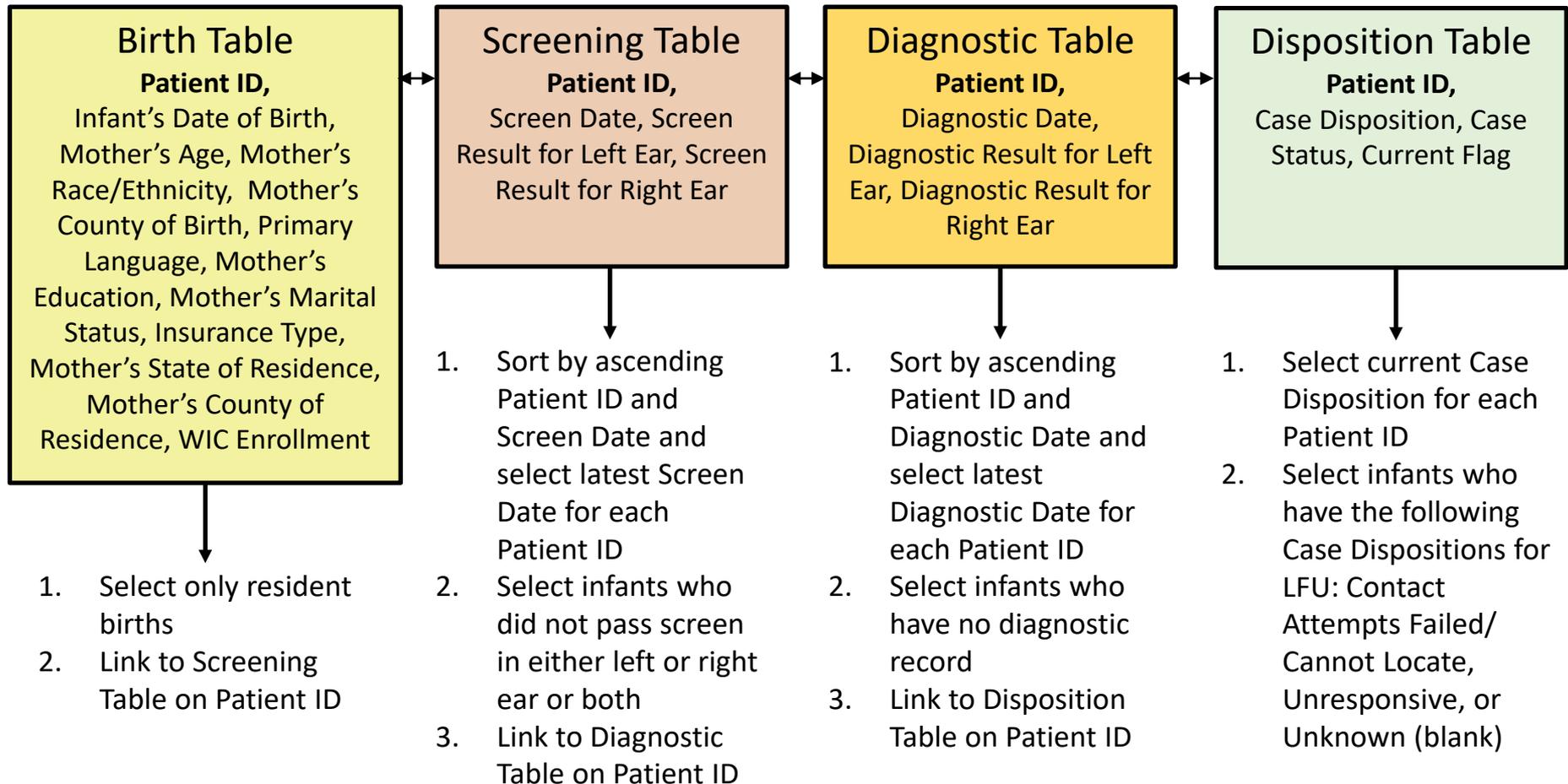
Georgia Birth Certificate Records
American Community Survey

Hearing Screening Records

Audiological Diagnostic Records

Case Disposition Records

Data Linkage



Maternal Risk Factors

Risk Factor	Classes	Risk Factor	Classes
Mother's Age at Delivery	≤23 >23*	Mother's Marital Status	Married* Not Married
Mother's Race/Ethnicity	White, Non-Hispanic* Black, Non-Hispanic Hispanic, All Races Asian, Non-Hispanic Multiracial, Non-Hispanic Other, Non-Hispanic	Insurance Type	Private Insurance* Medicaid/Other Government Self Pay, Military, Other, Unknown
Mother's Country of Birth	U.S.-Born Foreign-Born	Mother's County of Residence	18 Public Health Districts
Primary Language	English (including ASL)* Not English	Mother's County of Residence in Atlanta MSA	In Atlanta MSA Not in Atlanta MSA*
Mother's Education	High School/GED or Less Some College or Higher*	WIC Enrollment	Enrolled Not Enrolled*

*Indicates reference group in multivariate analysis

Statistical Analysis

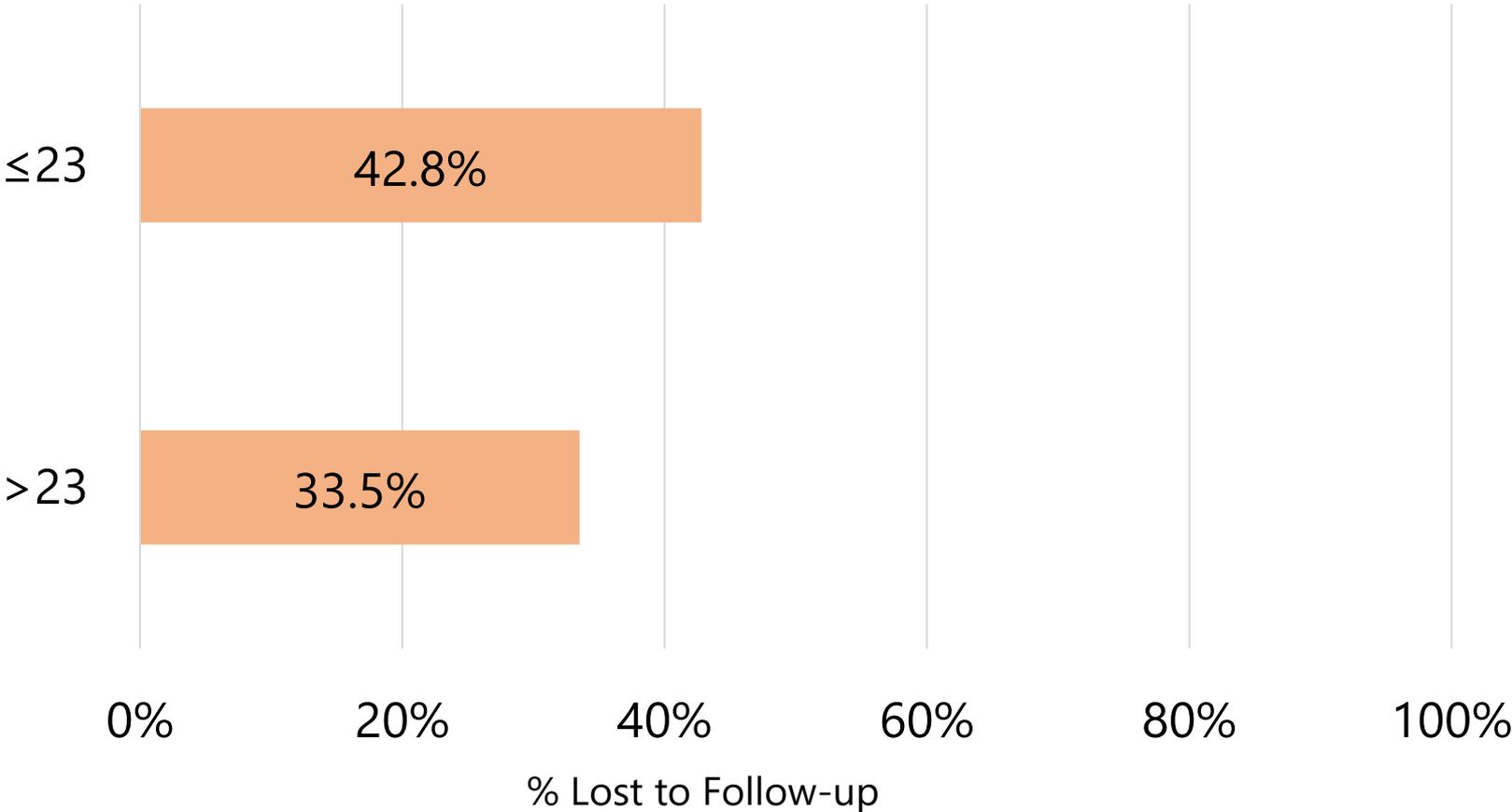
Bivariate: Maternal Risk Factors x LFU (% of LFU)

Multivariate: Logistic Regression Model (odds of LFU)

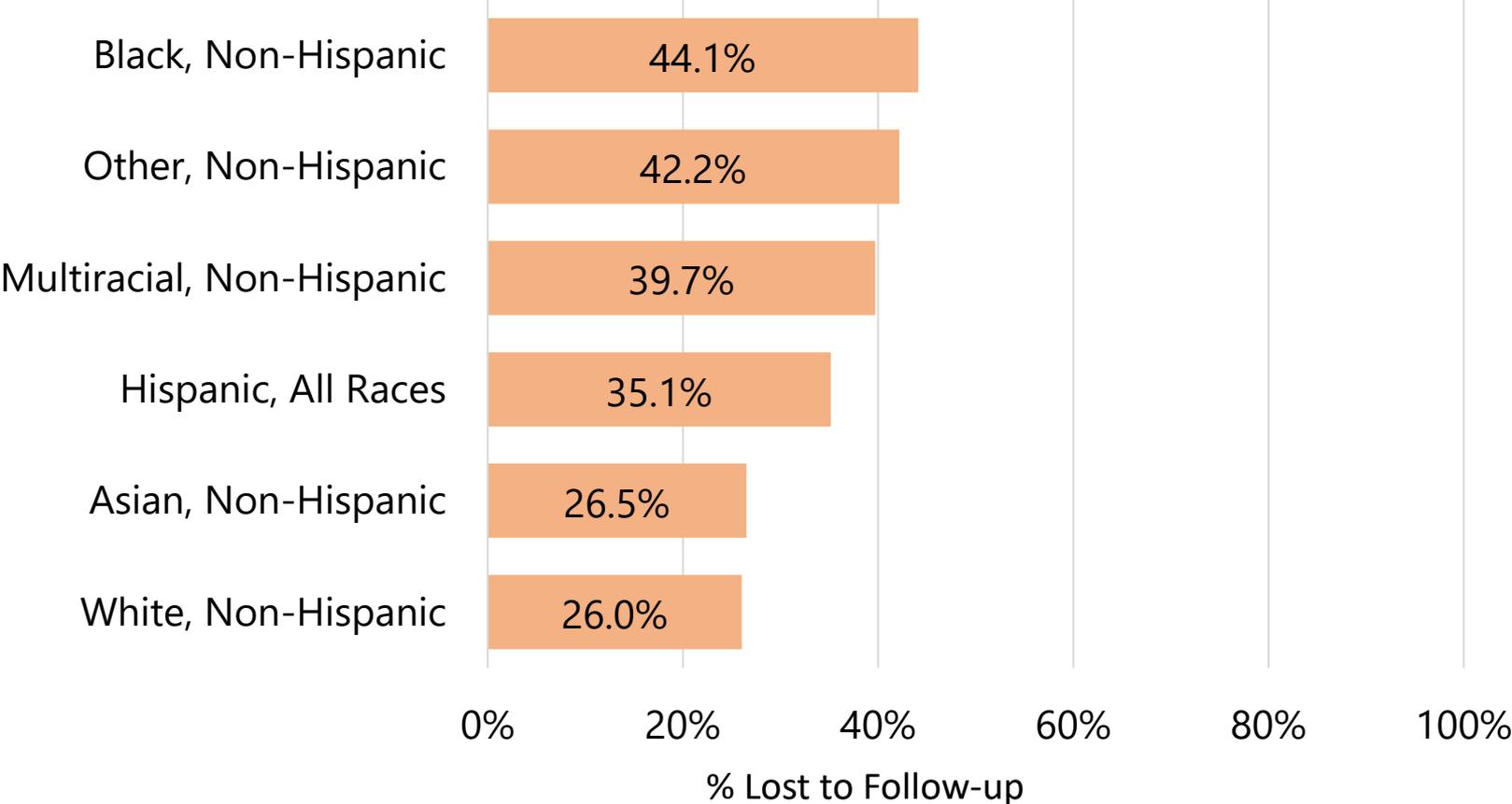
- Dependent Variable: LFU (yes/no)
- Independent Variables: Maternal Risk Factors
 - Test model fit (regression diagnostics) using tolerance analysis
 - Mother's country of birth and primary language were collinear
 - Primary language was chosen but did not enter final model
 - Use forward selection method for entering single variables and all possible two-way interactions into model (significance level for entry = .05)
 - Model based on 5,359 infants (out of 5,781 who did not pass hearing screening) who had no missing data

Results: Bivariate Analyses

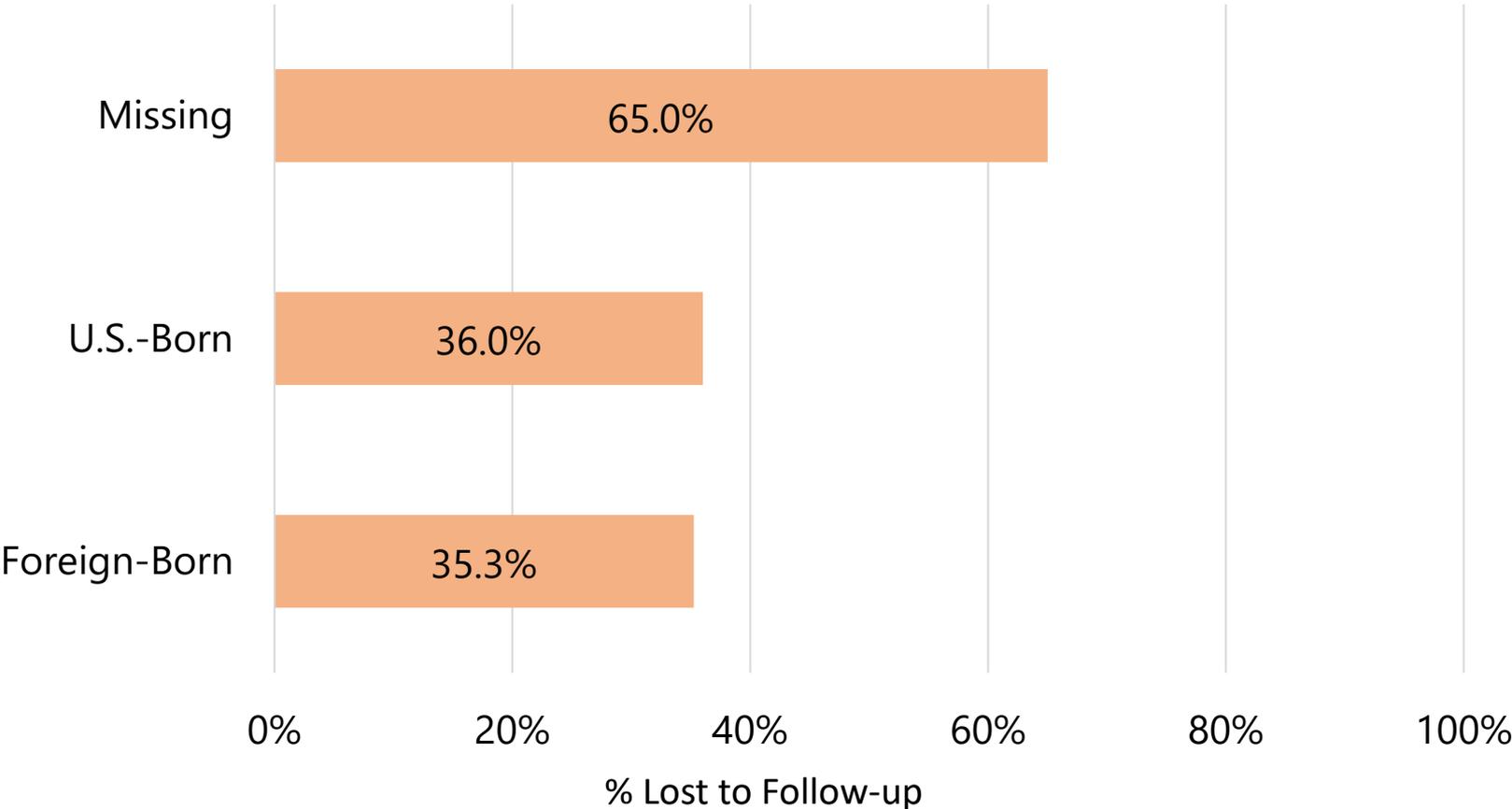
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's Age at Delivery



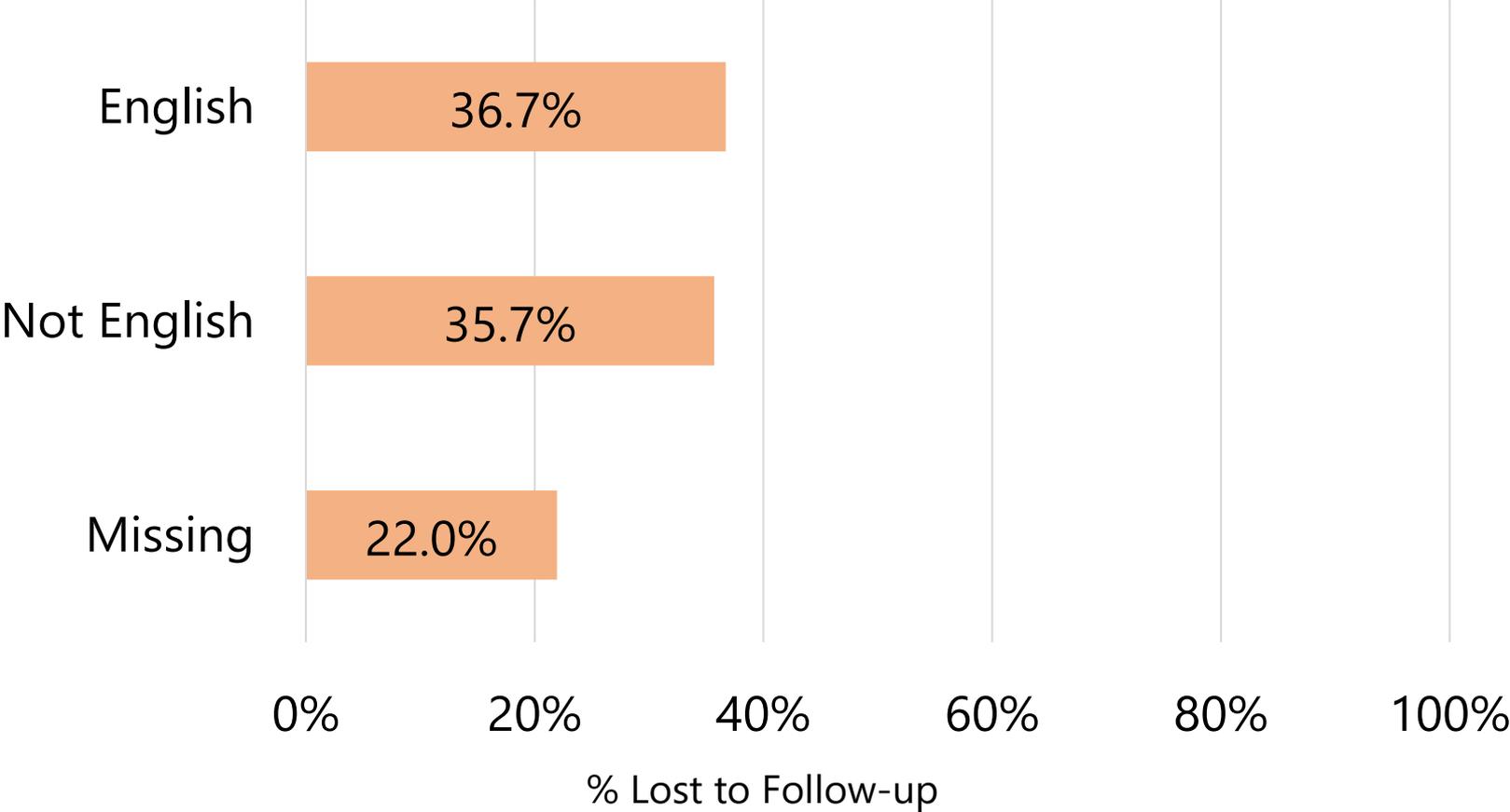
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's Race/Ethnicity



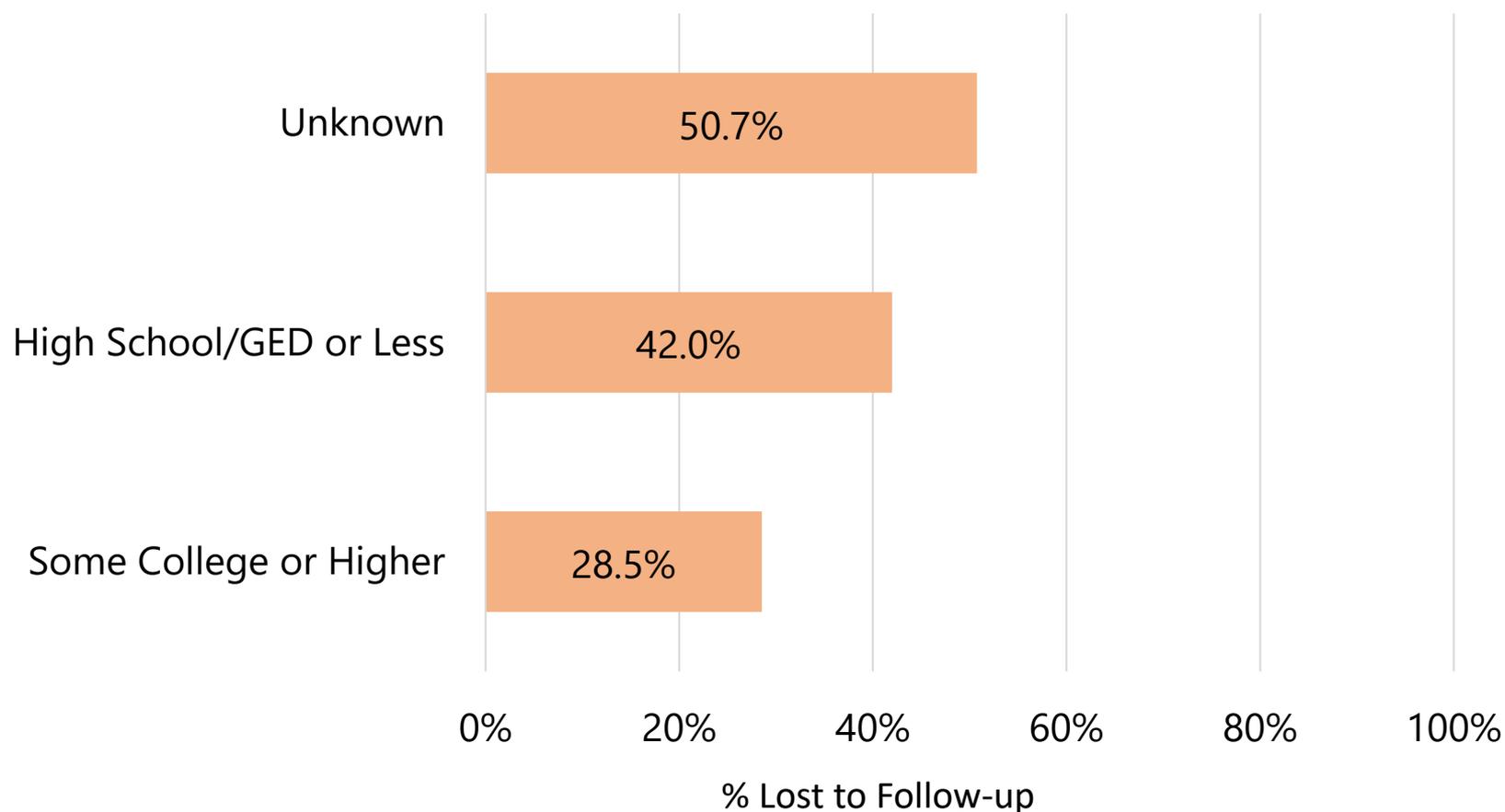
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's Country of Birth



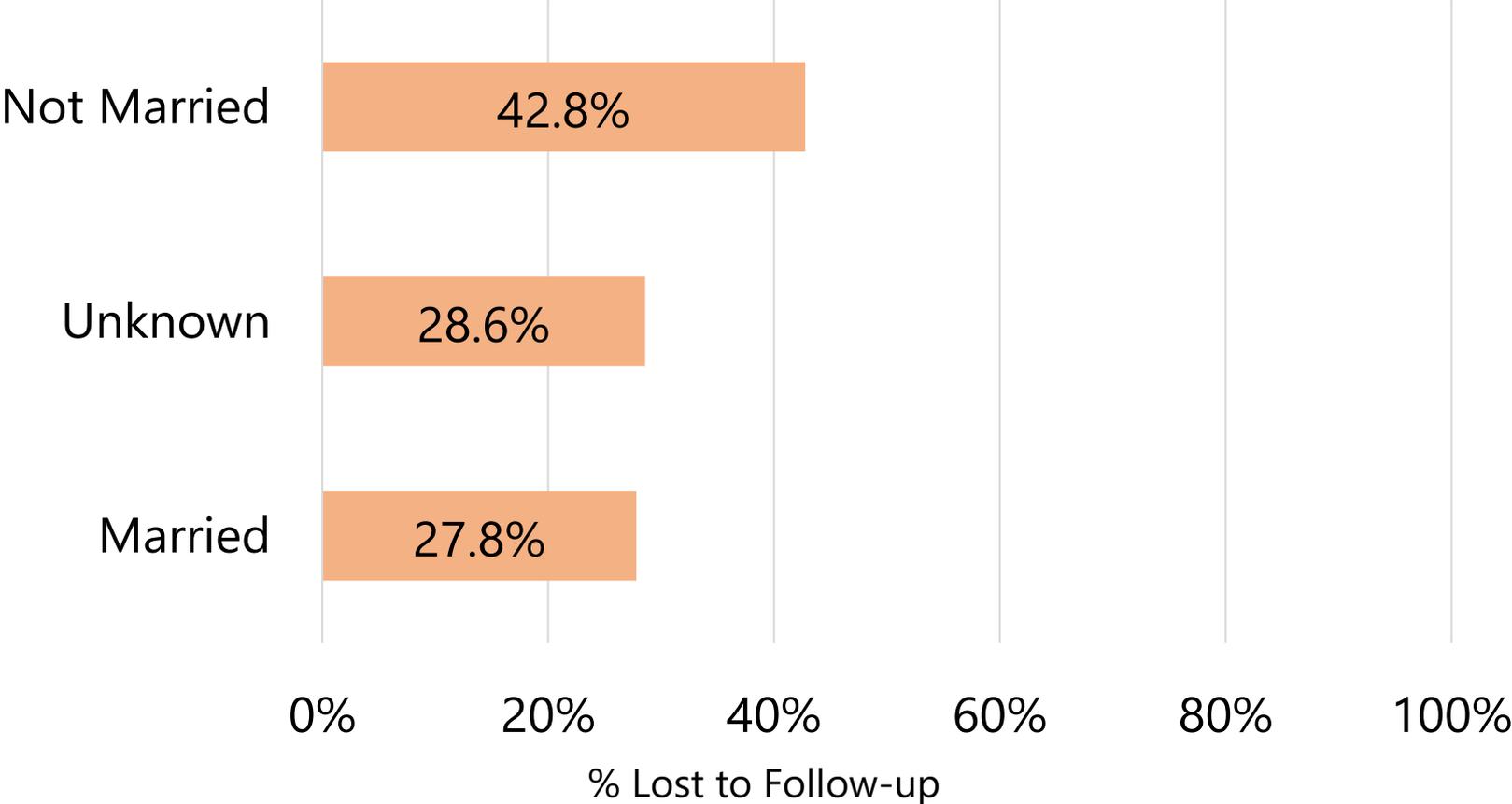
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Primary Language



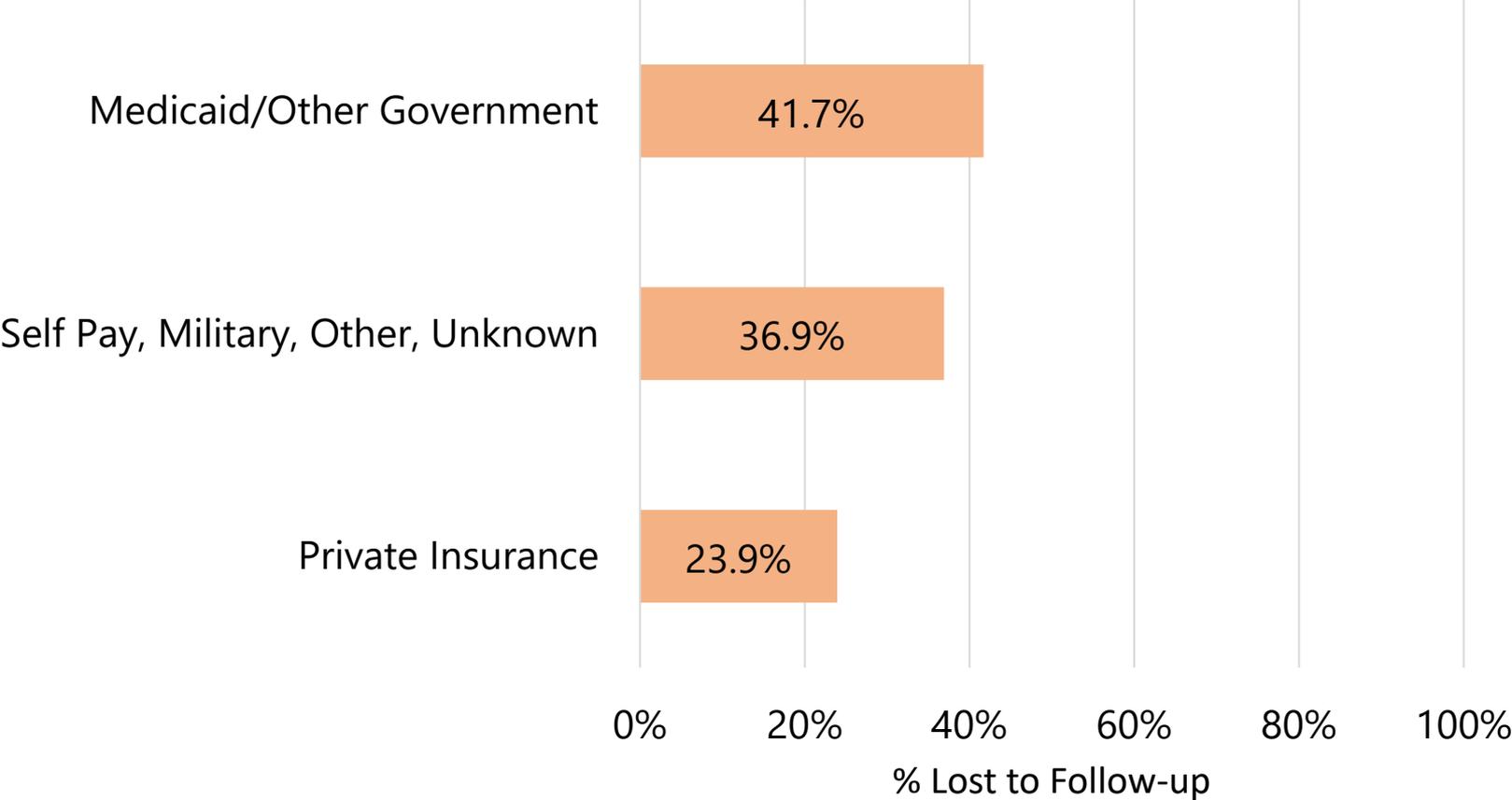
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's Education



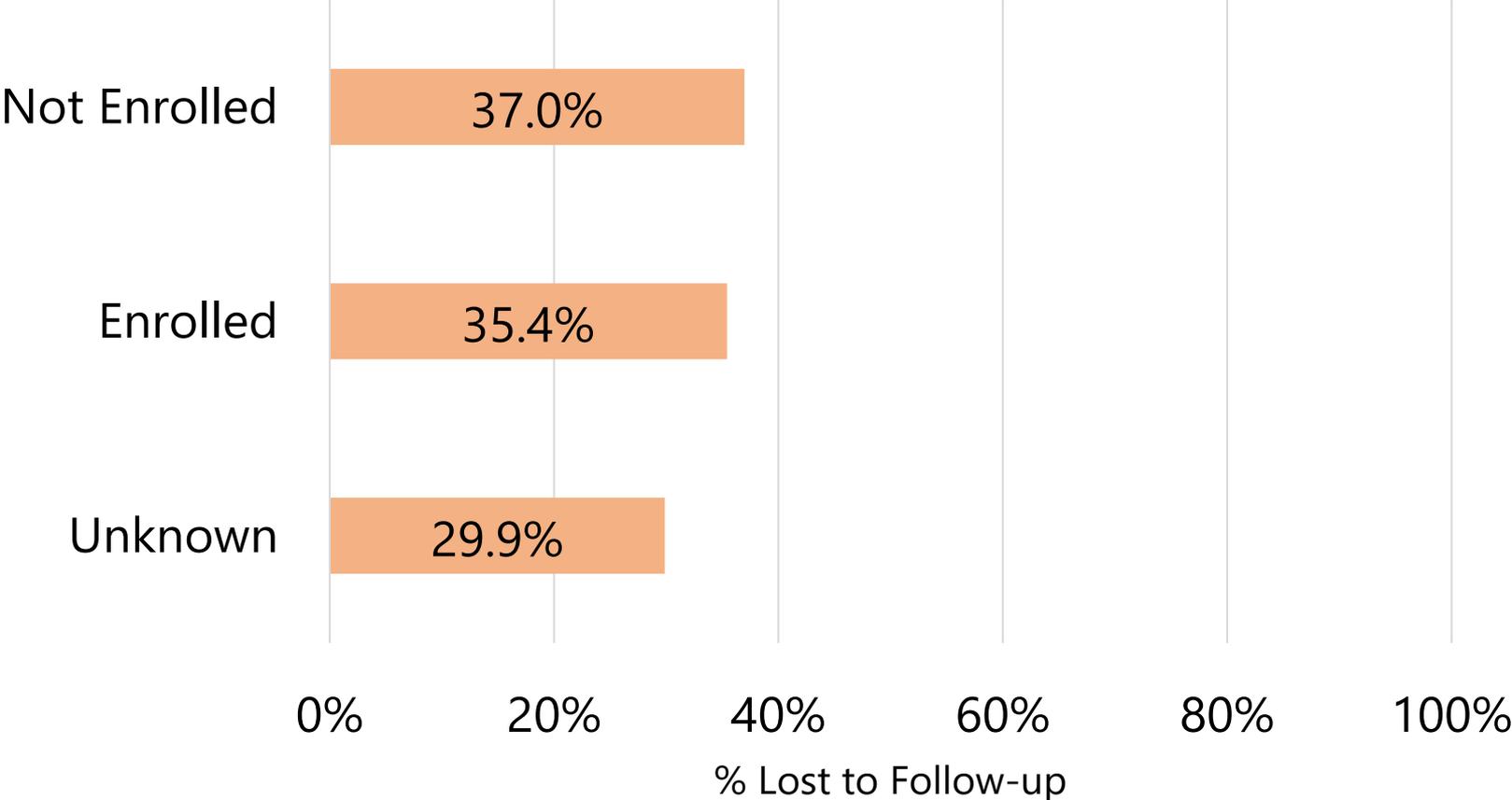
Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's Marital Status



Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Principal Insurance Type

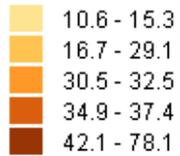


Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's WIC Enrollment

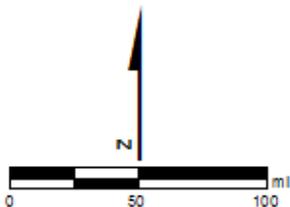
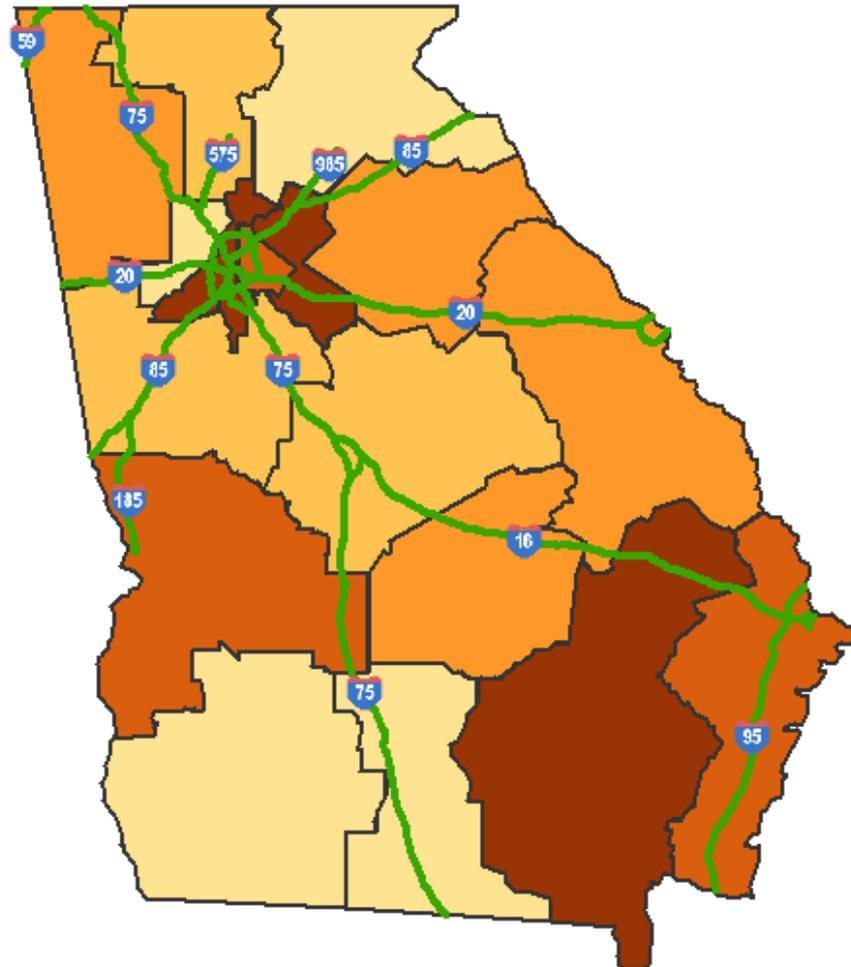


Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Public Health District (PHD)

Percent



Legend



Created using the OASIS Map-Your-Own-Data Mapping Tool
Georgia Department of Public Health
Office of Health Indicators for Planning (OHIP)
Data supplied by Map Author

Map Created: 2/11/2020 4:02:23 PM
Data Classification Method: Quantile

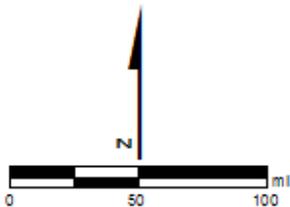
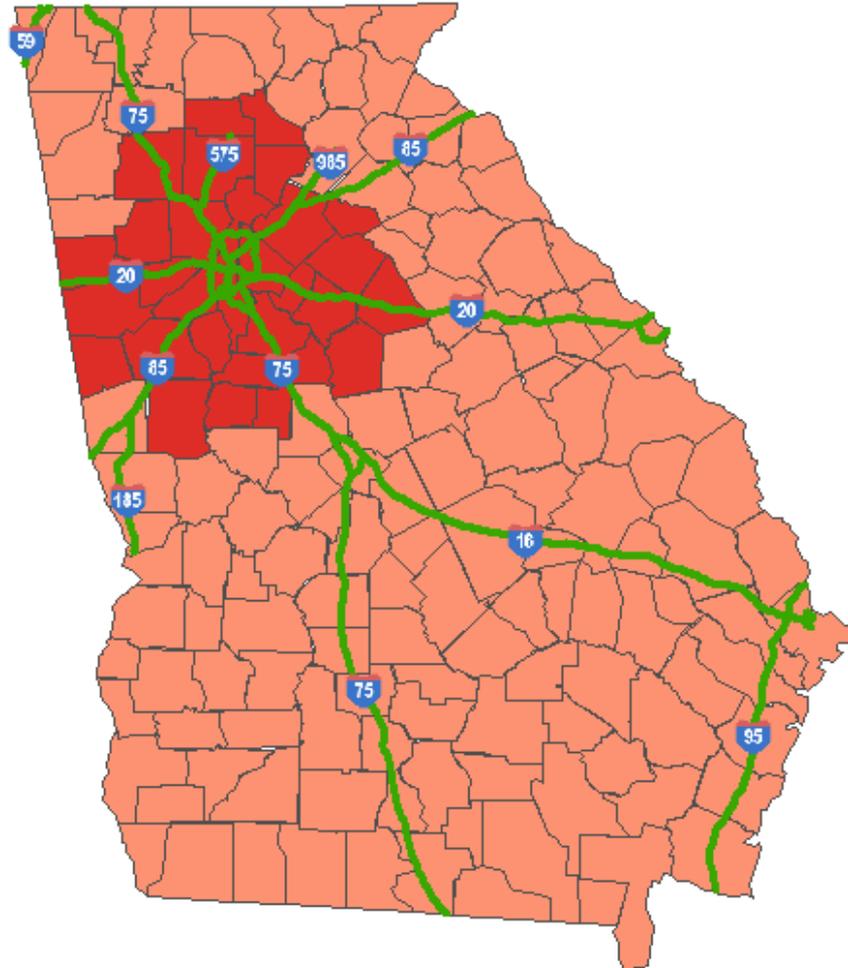
Note: This is a color map
Map author: Maternal and Child Health Epidemiology Unit

Percentage of Georgia Infants Born 2015–2018 Who Did Not Pass Hearing Screening and Were Lost to Follow-up, by Mother's County of Residence In or Not in Atlanta MSA*

Percent
 27.3
 43.0

Legend
 Interstates
 County

*Atlanta Metropolitan Statistical Area (MSA) is defined by the U.S Office of Management and Budget to include the following 29 Georgia counties shown in red: Barrow, Bartow, Butts, Carroll, Cherokee, Clayton, Cobb, Coweta, Dawson, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Haralson, Heard, Henry, Jasper, Lamar, Meriwether, Morgan, Newton, Paulding, Pickens, Pike, Rockdale, Spalding, and Walton.



% LFU (2015–2018), Lack of Vehicles, and Black and Hispanic Workers ≥ Age 16 Taking Public Transportation to Work, by Select Atlanta MSA Counties, 2013–2017

County	% LFU Among Black Infants	% LFU Among Hispanic Infants	% of Workers with No Vehicles	% of Black Workers Taking Public Transportation	% of Hispanic Workers Taking Public Transportation
Fulton	66.3%	61.5%	5.6%	68.3%	10.1%
DeKalb	39.5%	39.4%	5.1%	63.6%	13.4%
Clayton	79.0%*	75.3%*	3.5%	87.0%	6.5%
Statewide	44.1%	35.1%	3.1%	61.3%	11.7%
Gwinnett	42.3%	47.2%	2.4%	35.7%	25.0%
Rockdale	44.4%	57.1%	2.3%	79.9%	3.2%
Cobb	19.1%	10.7%	2.1%	53.1%	19.5%
Henry	23.3%	8.3%	1.6%	64.5%	1.9%

Data sources: GA EHDl; 2013–2017 American Community Survey

*High % LFU due to lack of full-time District EHDl Coordinator

Results: Multivariate Analysis

Adjusted Odds Ratios from Final Logistic Model

Risk Factor	Risk Group	Reference Group	Odds Ratio Estimate	95% Confidence Interval	Risk Type	P-Value
Race/Ethnicity * County of Residence in Atlanta MSA	Hispanic, All Races in Atlanta MSA	Hispanic, All Races not in Atlanta MSA	3.54	2.52–4.97	Risk	<.0001
Race/Ethnicity * County of Residence in Atlanta MSA	Black, Non- Hispanic in Atlanta MSA	Black, Non- Hispanic not in Atlanta MSA	3.07	2.56–3.68	Risk	<.0001
Race/Ethnicity * Insurance Type	Black, Non- Hispanic on Medicaid	Black, Non- Hispanic on Private Insurance	2.36	1.84–3.04	Risk	0.01
Mother's Education	≤ High School/GED	> High School	1.62	1.41–1.87	Risk	<.0001
Marital Status	Not Married	Married	1.38	1.20–1.60	Risk	<.0001
Mother's Age	≤ 23	> 23	1.20	1.04–1.38	Risk	0.01
WIC Enrollment	Enrolled	Not Enrolled	0.67	0.58–0.76	Protective	<.0001

Discussion

Summary – Bivariate Analysis

- Disparities in LFU exist between classes within these risk factors:

Risk Factor	Highest % LFU	% LFU	Lowest % LFU	% LFU
Public Health District	Clayton (Jonesboro)	78.1%*	Southwest (Albany)	10.6%
Mother's Race/Ethnicity	Black, Non-Hispanic	44.1%	White, Non-Hispanic	26.0%
Mother's County of Residence in Atlanta MSA	In Atlanta MSA	43.0%	Not in Atlanta MSA	27.3%
Mother's Age at Delivery	≤ 23	42.8%	> 23	33.5%
Mother's Marital Status	Not Married	42.8%	Married	27.8%
Mother's Education	High School/GED or Less	42.0%	Some College or Higher	28.5%
Principal Insurance Type	Medicaid/Other Government	41.7%	Private Insurance	23.9%

*High % LFU due to lack of full-time District EHDI Coordinator

Summary – Risk Factors

- Single maternal risk factors associated with greater odds of being LFU when compared to their reference groups:
 - Mothers with \leq high school education/GED (**62% more likely**)
 - Unmarried mothers (**38% more likely**)
 - Mothers \leq age 23 at the time of delivery (**20% more likely**)
- Compared to Hispanic infants and Black non-Hispanic infants, respectively, residing outside the Atlanta MSA:
 - Hispanic infants residing inside the Atlanta MSA were **3½ times more likely** to be LFU
 - Black non-Hispanic infants residing inside the Atlanta MSA were **3 times more likely** to be LFU

Summary – Risk Factors (continued)

- Compared to Black non-Hispanic infants whose mothers had private insurance at the time of delivery:
 - Black non-Hispanic infants whose mothers were on Medicaid at the time of delivery were **2.4 times more likely** to be LFU



Medicaid

Summary – Protective Factor

- Compared to infants whose mothers were not enrolled in WIC at the time of delivery:
 - Infants whose mothers were enrolled in WIC at the time of delivery were **33% less likely** to be LFU



Limitations

- Incomplete linkage of screening records to birth certificate records
 - Most complete: 11.3% of 2016 screening records not linked
 - Least complete: 21.6% of 2015 screening records not linked
- Lack of screening records for Georgia resident infants who were born out of state (border babies)
- Lack of information on audiological follow-up for non-resident infants born in Georgia who did not pass hearing screening
- Inconsistent and incomplete reporting of case dispositions across Public Health Districts
- Lack of data on annual household income as a maternal risk factor

Implications for Public Health Practice

EHDI program staff, stakeholders, and partners should:

- Provide culturally and linguistically tailored information and referral
- Inform pediatric medical home providers about the disparities in audiological follow-up that exist within their patient populations
- Expand access to audiological diagnostic services through teleaudiology or mobile audiology within the Atlanta MSA
- Provide economic incentives (e.g. gift cards, bus passes) to promote audiological follow-up
- Continue flagging WIC records of families with infants who need audiological follow-up

Conclusions

- Georgia infants whose mothers are members of racial/ethnic minorities and/or vulnerable/disadvantaged socioeconomic classes have greater percentages and odds of being LFU
- Georgia infants whose mothers were enrolled in WIC at the time of delivery are less likely to be LFU
- Knowledge of these disparities in LFU can be used to:
 - Devise and evaluate follow-up strategies, including use of economic incentives, to minimize LFU in groups more likely to be LFU
 - Expand access to teleaudiology/mobile audiology in counties within the Atlanta MSA where populations more likely to be LFU reside
 - Continue collaborating with WIC to identify infants needing follow-up

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References

1. Shanker, A., Rojas-Ramirez, M. V., Jacobs, J. A., Shinn, J. B., Lester, C., Westgate, P. M., and Bush, M. L. (2019). Assessment of factors involved in non-adherence to infant hearing diagnostic testing. *Journal of Early Hearing Detection and Intervention*. 4(3):1–8.
2. Maxwell, J., and Li, Y. (2019). Risk factors associated with loss to follow-up among infants who failed initial hearing screening. Poster presentation at the 18th EHDI Annual Meeting, Chicago IL, March 2019.
3. Al-Mulki, K., and Todd, N. W. (2020). Relation of public health staffing to follow-up after newborn hearing screening in three health districts in Georgia, 2009–2015. *International Journal of Pediatric Otorhinolaryngology*. Volume 129, article 109784.

Questions?

Have You
Heard?

EHDI

Early Hearing Detection
and Intervention

Michael Lo, MSPH

EHDI Epidemiologist/
Evaluator

Maternal and Child Health
Section

Georgia Department of
Public Health

Michael.Lo@dph.ga.gov

(404) 463-3754



Be sure to have your newborn baby's hearing
checked before leaving the hospital.