

## **Multivariate Analysis of Factors Associated with Loss to Follow-up after Initial Hearing Screening in Tennessee**

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### **Introduction**

Newborn hearing screening is now a standard of care in Tennessee. In 2012, 97.8% of infants born in Tennessee were screened for hearing loss at birth and 4.18% of them did not pass initial hearing screening. All infants who do not pass initial hearing screening are encouraged to follow-up to get further tests to confirm diagnosis of hearing loss. Loss to follow-up is defined as a newborn who fails initial hearing screening but does not follow-up for further hearing tests and evaluation. The percent of loss to follow-up among Tennessee newborns who did not pass initial hearing screening in 2012 is 34.6%, which is close to the average rate of loss to follow-up (35.9%) in 2012 in the United States. Tennessee Early Hearing Detection and Intervention program (EHDI) has been developing and implementing change strategies to reduce loss to follow-up. Considering the fact that a newborn who died before hospital discharge, who moved out of Tennessee, or whose parents declined service has been cleanly censored, the cases of loss to follow-up in the analysis are limited to newborns whose parents could not be contacted, whose family were unresponsive, or who did not follow-up with unknown reasons after failing initial hearing screening. This study aimed to assess the demographic factors associated with loss to follow-up after initial hearing screening and to help improve follow-up and early intervention service in Tennessee.

### **Methods**

The data of Tennessee EHDI newborn hearing screening linked with birth certificates were used for analysis. The study included 3350 infants who were born in 2012 and failed initial hearing screening. Among them, 1174 newborns were lost to follow-up after failing initial hearing screening and were classified as cases of loss to follow-up. The rest of 2176 infants who have

successfully completed follow-up evaluation were served as controls for this case-control study. The dependent variable is loss to follow-up and the independent variables include child sex, history of Neonatal Intensive Care Unit (NICU), maternal age, mother marital status, maternal race and ethnicity, mother education level, maternal residence, source of payment for delivery and hearing loss risk factors. The crude Odds Ratios (OR) were obtained from the univariate analyses and the adjusted ORs were estimated through Logistic regression modeling. SAS 9.3 was used for data analysis. Alpha was set at 0.05 for statistical significance.

## **Results and Discussion**

The classification of independent variables and the results of data analyses are listed in the Table 1, Associations of Maternal and Infant Factors with Loss to Follow-up among Newborns Who Failed Initial Hearing Screening, Tennessee 2012. The results show that infants born to non-resident mothers are more likely to be lost to follow-up, with adjusted OR of 1.95 (95% CI, 1.51 to 2.52); infants having any risk factor of hearing loss are less likely to be lost to follow-up, with adjusted OR of 0.56 (0.41-0.76); compared to White and Others, African Americans are more likely to be lost to follow-up, with adjusted OR of 1.53 (95% CI, 1.27 to 1.86). Tennessee families with low incomes can apply for the public insurance (TennCare in Tennessee) for their payments of health service delivery. Infants whose families have the payment source from TennCare are more likely to be lost to follow-up, with adjusted OR of 1.46 (95% CI, 1.19 to 1.78). Loss to follow-up was also found to be associated with mother education level and marital status. Infants born to mothers with education level less than high school or born to unmarried mothers are more likely to be lost to follow-up, with adjusted ORs of 1.38 (95% CI, 1.16 to 1.65) and 1.33 (95% CI, 1.12 to 1.58), respectively. The crude ORs obtained from the univariate analyses for maternal age and infant NICU history were significant but the adjusted ORs become insignificant after adjusting for other variables in the study. No association of loss to follow-up was found with child sex and maternal ethnicity.

The results of multivariate analyses of maternal and infant factors associated with loss to follow-up have been discussed among Tennessee EHDI program partners. The findings from the study may be used to guide the development and enhancement of change strategies to reduce loss to follow-up among infants who fail initial hearing screening.

**Table 1 Associations of Maternal and Infant Factors with Loss to Follow-up  
Among Newborns Who failed Initial Hearing Screening, Tennessee 2012**

Variables	Loss to Follow-up		Odds Ratio (95% CI)	
	Yes	No	Crude	Adjusted*
<b>Child Sex</b>				
Male	631	1,202	1.06 (0.92-1.22)	0.99 (0.85-1.16)
Female	543	974	Reference	Reference
<b>NICU History</b>				
Yes	170	207	1.61 (1.30-2.00)	1.23 (0.92-1.68)
No	1,004	1,969	Reference	Reference
<b>Maternal Age</b>				
< 20 y	145	213	1.30 (1.04-1.62)	0.95 (0.74-1.22)
>= 20 y	1,029	1,963	Reference	Reference
<b>Maternal Race</b>				
Africa American	334	384	1.86 (1.57-2.20)	1.53 (1.27-1.86)
White (Others)	840	1,792	Reference	Reference
<b>Maternal Ethnicity</b>				
Hispanic	165	259	1.21 (0.98-1.50)	1.04 (0.81-1.35)
Non-Hispanic	1,009	1,916	Reference	Reference
<b>Maternal Residence</b>				
Non-Tennessee	133	156	1.94 (1.50-2.50)	1.95 (1.51-2.52)
Tennessee	1,041	2,020	Reference	Reference
<b>Mother Marital Status</b>				
Not married	672	931	1.80 (1.55-2.07)	1.33 (1.12-1.58)
Married	501	1,245	Reference	Reference
<b>Mother Education Level</b>				
< High School	336	446	1.56 (1.32-1.84)	1.38 (1.16-1.65)
>= High School	834	1,725	Reference	Reference
<b>Source of Payment</b>				
TennCare	799	1,179	1.50 (1.26-1.80)	1.46 (1.19-1.78)
Non TennCare	375	996	Reference	Reference
<b>Hearing Loss Risk Factors</b>				
Yes	121	235	0.95 (0.75-1.20)	0.56 (0.41-0.76)
No	1,053	1,941	Reference	Reference

\*Data were adjusted for variables in the tables.