Factors Associated with Late Hearing Screening and Late Diagnosis of Hearing Loss in Early Childhood

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INTRODUCTION

❖ The Early Hearing Detection and Intervention (EHDI) program recommends that all newborns be screened by 1 month of age, preferably by hospital discharge; an audiologist complete diagnosis by 3 months of age for infants who failed screenings;

and intervention services be received before 6 months of age for infants identified with hearing loss.

❖ No research has been done observing Louisiana statewide data to identify factors that would support in the prevention of late hearing screening and diagnosis in the state.

❖ **The objective of this study** is to use 2011-2013 surveillance data from the Louisiana EHDI data linked with birth records to define causes and factors related to hearing screening after 1 month of age and/or completing diagnosis after 3 months of age.

METHODS

❖ **Data sources:** 2011-2013 Louisiana Early Hearing Detection and Intervention Surveillance data linked with birth certificates were used for analyses.

❖ **Sample size:** The study included 181,692 newborns who were born between 2011 and 2013 in Louisiana for late screening and 8,599 newborns with eligible follow-up data for late diagnosis. Infants recorded as LTF (loss to follow-up) in EHDI data were excluded.

❖ **Statistical methods:** Unadjusted and adjusted logistic regression models were conducted to evaluate relationships between late newborn hearing screening and diagnosis with the characteristics of newborns and mothers.

❖ **Variables:** Race/ethnicity, maternal age, maternal education, birth weight, NICU admission, etc. were analyzed to see if there was an association with late screening and diagnosis.

❖ **Alpha** was set at .05 for statistical significance.

❖ **Software**: Linkpro 3.0 and SAS 9.3 were used for data linkage and analyses.
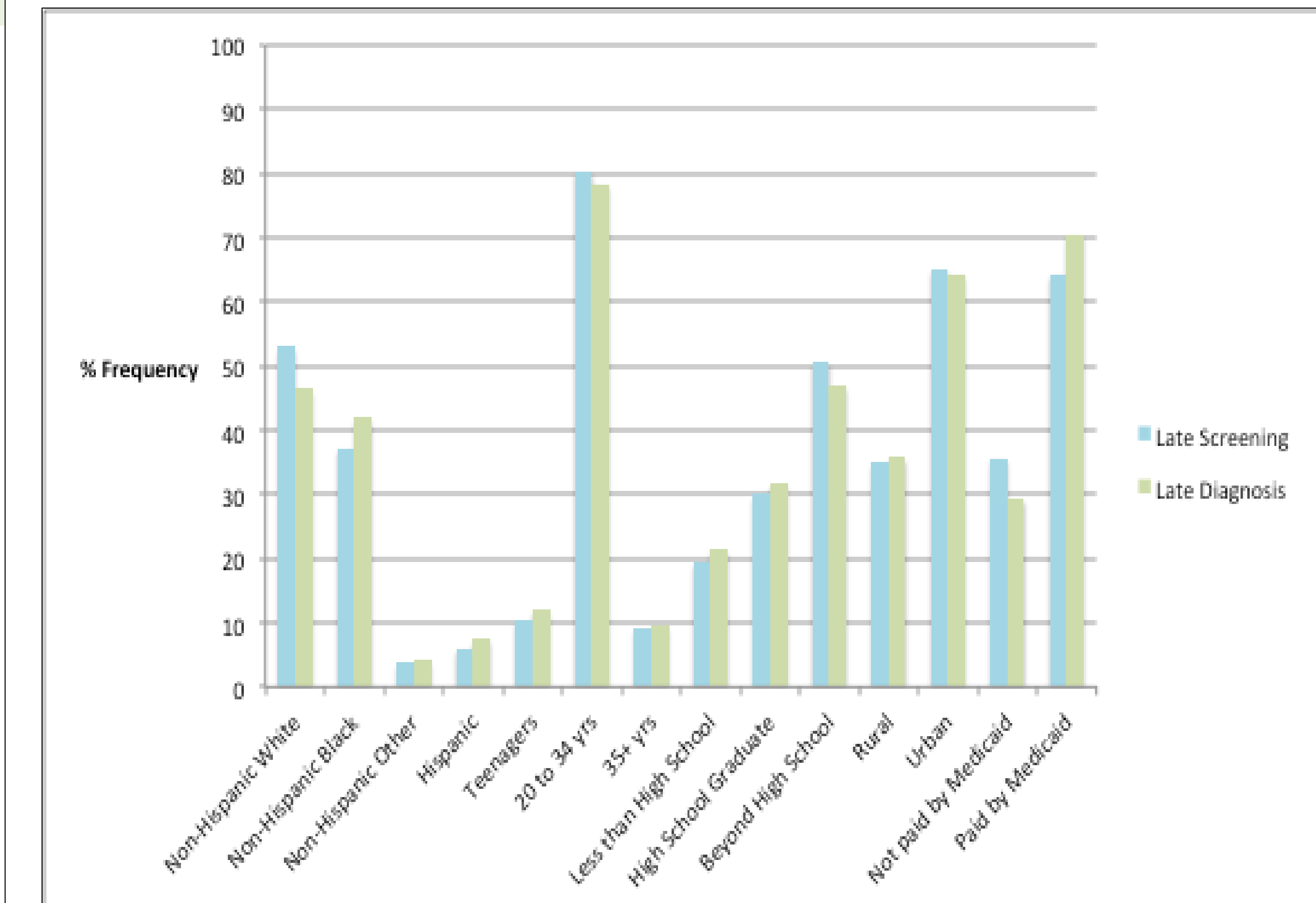
RESULTS

Table 1. Adjusted Logistic Regression Model for Late Hearing Screening and Diagnosis

Late Screening	%	Odds Ratio	95% CI	Late Diagnosis	%	Odds Ratio	95% CI
Year				**Year**			
2011	1.84	1.16	1.01 - 1.34	2011	18.04	1.40	1.20 - 1.64
2012	1.87	1.21	1.05 - 1.40	2012	13.88	1.00	0.85 - 1.18
2013	1.81	1.00		2013	13.45	1.00	
MaternalAge				**Maternal Age**			
20 to 34 yrs	1.82	*		20 to 34 yrs	14.80	*	
Teenagers	1.85	*		Teenagers	15.64	*	
35+ yrs	2.03	*		35+ yrs	16.67	*	
Race/Ethnicity				**Race/Ethnicity**			
Non-Hispanic White	1.38	1.00		Non-Hispanic White	15.17	1.00	
Non-Hispanic Black	2.60	0.84	0.74 - 0.95	Non-Hispanic Black	14.43	0.70	0.59 - 0.79
Non-Hispanic Other	1.35	0.85	0.60 - 1.20	Non-Hispanic Other	15.65	0.92	0.66 - 1.26
Hispanic	1.46	1.22	0.94 - 1.59	Hispanic	17.78	1.11	0.86 - 1.40
Maternal Education				**Maternal Education**			
High School Graduate	2.07			High School Graduate	15.84	1.00	
Less than High School	2.13	*		Less than High School	15.99	1.03	0.86 - 1.23
Beyond High School	1.59	*		Beyond High School	14.19	0.85	0.73 - 0.98
Urban				**Urban**			
Urban	1.78	*		Urban	14.45	*	
Rural	1.91	*		Rural	16.14	*	
Married				**Marital Status**			
Married at Birth	1.50	*		Married at Birth	15.39	*	
Not Married at Birth	2.14	*		Not Married at Birth	14.85	*	
Inpatient				**Inpatient**			
Inpatient	1.72	1.00		Inpatient	15.65	1.00	
Outpatient	45.91	316.99	255.22 - 393.70	Outpatient	4.60	0.16	0.09 - 0.27
Birthweight				**Birth Weight**			
Normal Weight	0.37	1.00		Normal Weight	12.64	1.00	
Low Birth Weight	3.32	3.51	2.85 - 4.32	Low Birth Weight	24.19	1.43	1.14 - 1.82
Very Low Birth Weight	77.63	56.31	43.85 - 72.30	Very Low Birth Weight	52.19	1.02	0.60 - 1.74
Prenatal Care				**Prenatal Care**			
Prenatal Care Received	1.77			Prenatal Care Received	14.91	*	
No Prenatal Care	5.40	*		No Prenatal Care	22.91	*	
Smoke				**Smoking**			
No Smoking during Pregnancy	1.78	1.00		No Smoking during Pregnancy	15.21	*	
Smoked during Pregnancy	2.26	1.22	1.04 - 1.44	Smoked during Pregnancy	14.07	*	
Csection				**C-Section**			
Vaginal Delivery	1.04	1.00		Vaginal Delivery	12.67	1.00	
Csection	3.05	1.22	1.08 - 1.38	C-Section	19.34	1.27	1.11 - 1.46
Ventilation				**Ventilation**			
No Ventilation Aid	1.32	1.00		No Ventilation Aid	14.20	*	
Less than 6 hours Ventilation Aid	14.49	1.48	1.15 - 1.91	Less than 6 days	32.23	*	
More than 6 hours Ventilation Aid	40.95	3.58	2.85 - 4.49	More than 6 days	59.48	*	
Intensive Care				**Intensive Care**			
No Admission to NICU	1.56	1.00		No Admission to NICU	14.72	1.00	
Admission to NICU	33.27	16.48	13.37 - 20.30	Admission to NICU	48.86	2.41	1.46 - 3.97
Gestation Week				**Gestation Week**			
Normal	0.38	1.00		Normal	12.47	1.00	
Preterm	2.27	1.79	1.46 - 2.21	Preterm	22.41	1.62	1.30 - 2.01
Very Premature	72.53	34.94	27.49 - 44.40	Very Premature	55.15	3.32	2.05 - 5.47
APGAR Test 5				**APGAR Test 5**			
Less than 7	23.97	1.00		Less than 7	40.25	1.00	
7+	1.53	1.63	1.24 - 2.14	7+	14.55	1.71	1.15 - 2.54
APGAR Test 10				**APGAR Test 10**			
Less than 7	42.17	1.00		Less than 7	55.88	*	
7+	1.72	3.48	2.02 - 5.99	7+	14.91	*	
Plurality				**Plurality**			
Singleton	1.52	*		Singleton	14.64	*	
Not Singleton	10.75	*		Not Singleton	27.21	*	
Medicaid Pay				**Medicaid Pay**			
Not paid by Medicaid	1.56	*		Not paid by Medicaid	14.88	*	
Paid by Medicaid	1.99	*		Paid by Medicaid	15.16	*	
				Age At Screening			
				Screened before 1 month of age	13.69	1.00	
				Screened 1-2 months of age	30.00	2.14	1.38 - 3.32
				Screened 2-3 months of age	58.11	5.31	2.98 - 9.48

* = Removed from model for not meeting 0.05 significance level

RESULTS

Figure 1. Population Characteristics Frequencies, Louisiana 2011-2013

❖ 1.84% of the 181,692 infants had hearing screening performed after 1 month of age.

❖ 16.32% of infants that were eligible for follow-up did not complete hearing follow-up <3 months of age.

❖ Results of adjusted logistic regression model indicated that infants with very low birth weight, very premature birth, and admission to NICU were more likely to be screened after 1 month of age.

❖ Infants screened 2-3 months of age, very premature birth, and admission to NICU were more likely to have diagnosis after 3 months of age.

❖ The odds of late screening and diagnosis were not significantly different between groups of race and ethnicity.

CONCLUSIONS

❖ A reduction in the main factors such as low birth weight and premature birth need to be addressed to see a prominent reduction in late infant hearing screening and diagnosis. This data can assist health professionals to identify these infants with these factors and give special attention to their hearing health.