

Pilot Study for an Ecological Comparison between Maternal Residence and Cleft Palate Prevalence

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Introduction

Orofacial clefts are a common congenital anomaly within the United States but is seen with a higher prevalence in Louisiana when compared nationally. Orofacial clefts result from improper folding of the lateral and medial nasal processes during early embryological development leaving a sinus between the nose and lips or nasal cavity and oral cavity. The process of clefting is thought to be multifactorial, involving various genetic and environmental factors which include teratogens such as: phenytoin, valproic acid, thalidomide, dioxin, tobacco, alcohols, and pesticides. The agricultural sector and chemical production are a large portion of Louisiana's industry which contributes to increases in pollutants surrounding the plants or fields. Higher prevalence of orofacial clefts in Louisiana suggests environmental factors from these industries impact Louisiana residents and their children. This research study aims to explore if the incidence of orofacial clefts in Louisiana varies based on geographic location at the time of birth, the concentration of environmental pollution by geographic location, or other risk factors present during pregnancy. These results have the potential to identify demographic or environmental pollutant exposure risk factors that affect mothers and their developing offspring. Understanding this impact could guide further research, public health initiatives, and state/federal policies to increase safeguards against environmental exposures.

Methods

Data publicly available from the Louisiana Department of Health (LDH) was used to compare the areas of increased orofacial clefts by regions to the areas of increased air pollution by parish. The prevalence for each region and orofacial cleft types was compiled to determine the highest prevalence of clefting per region. For the environmental data, the air pollution data from 2015-2017 was averaged to determine the parishes with the highest pollution. Then the highest values were cross referenced to determine the areas with the highest prevalence of orofacial clefts and concentration of pollution.

Cleft Lip with Cleft Palate

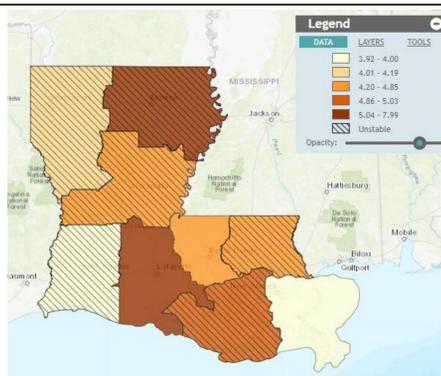


Figure 1: The prevalence of cleft lip with cleft palate per 10,000 live births including all ethnicity/race. Data includes all 9 regions and spans from 2015-2017.

Cleft Lip without Cleft Palate

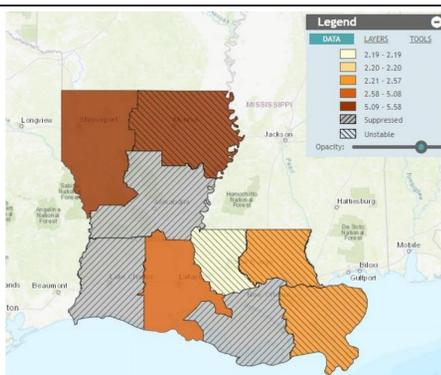


Figure 2: The prevalence of cleft lip without cleft palate per 10,000 live births including all ethnicity/race. Data includes all 9 regions and spans from 2015-2017.

Cleft Palate without Cleft Lip

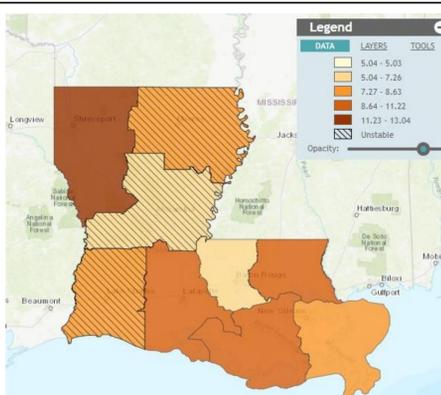


Figure 3: The prevalence of cleft palate without cleft lip per 10,000 live births including all ethnicity/race. Data includes all 9 regions and spans from 2015-2017.

Cleft Lip with Cleft Palate

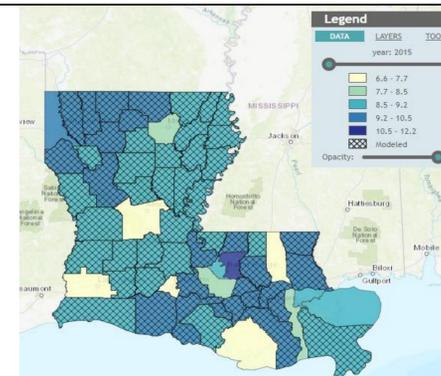


Figure 4: The annual average concentration of particulate matter (Pm) 2.5 in $\mu\text{G}/\text{M}^3$ per parish monitored and modeled data from 2015 to 2017.

Results

The Acadiana, Northwest, and Northeast regions have the highest prevalence of orofacial clefts with a prevalence of 20.92, 22.82, and 20.35 per 10,000 live births, respectively. The Northeast region is the only region to correspond with a high prevalence of orofacial clefts and contain multiple parishes with the high concentrations of air pollution. The parishes in the Northeast region with high concentrations of pollution are Bienville (9.53 Pm), Bossier (10.07 Pm), Caddo (10.43 Pm), Desoto (9.63 Pm), Natchitoches (9.43 Pm), and Red River (9.57 Pm). The Baton Rouge and Northshore regions contain parishes which have some of the highest concentrations of air pollution with Ascension (10.07 Pm), East Baton Rouge (11.53 Pm), and Livingston (9.9 Pm).

Conclusion

Aligning with our hypothesis, the areas in Louisiana with increased prevalence of orofacial clefts corresponds to the parishes with increased levels of air pollution, most exemplified in the Northeast region. Plans to expand on this pilot study have begun, and this project has partnered with the LDH for access to comprehensive data detailing cleft information, determinants of health, and zip code/census code of maternal residence at time of birth. LDH and LSUHSC will combine resources by creating an integrated team with members from LDH LBDMN, LSUHSC Public Health Faculty, a LSUHSC Craniofacial Pediatrician, and a LSUHSC student to identify specific pollutants connected to orofacial clefts.