

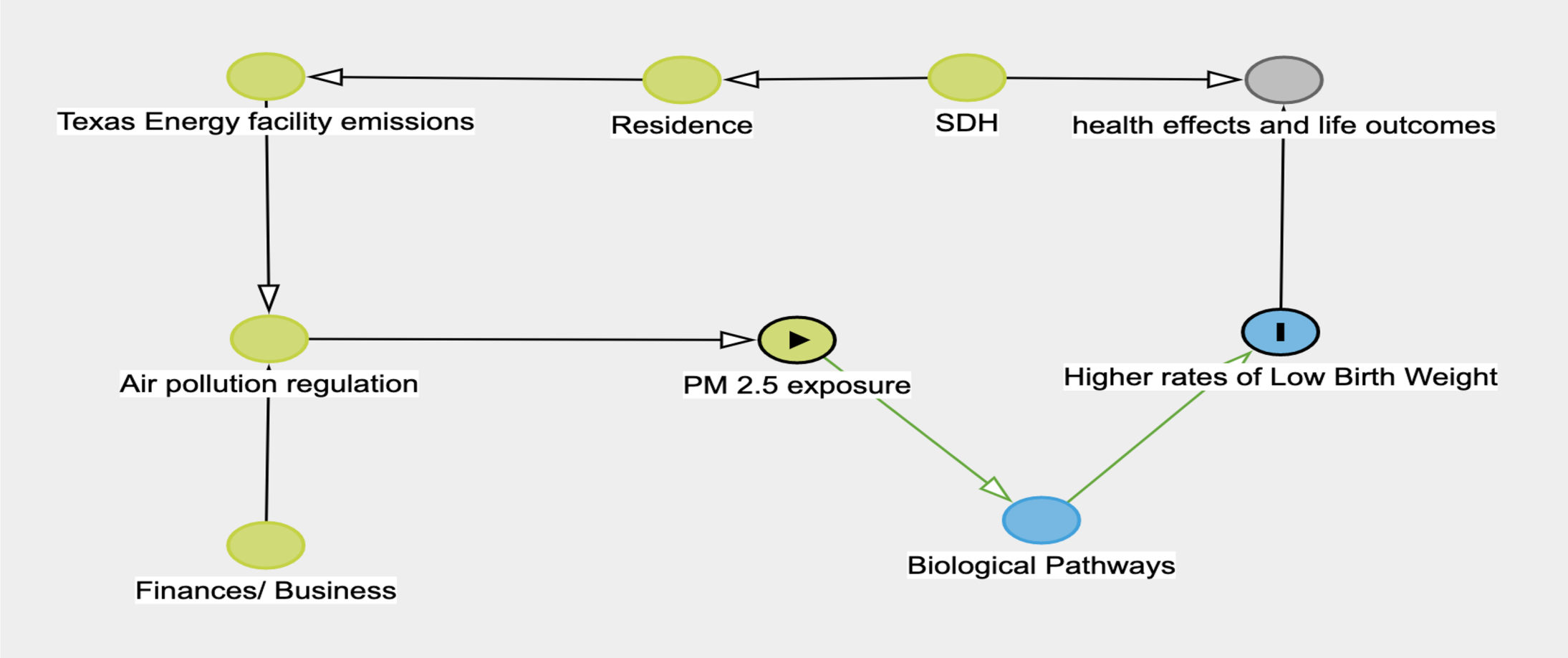
An Investigation into the Correlation between PM 2.5 and Low Birth Weight Rates in Texas

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Data Analytics in Student Hands

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Background

This project is a culmination of the group members' interests in environmental justice, the Texas energy sector emissions, health outcomes, and laws & regulations which interplay and affect various social determinants of health. Since 1993, low birthweight increased 22% from 6.9% to 8.4% of live births in 2019. The city of Houston is known as the energy capital of the world, with over 4,600 energy related companies within its limits. With the plethora of strong research identifying various correlating mechanisms of PM 2.5 and low-birth weight rates around the world, this investigation aimed to take a look at a possible relationship between the dense, PM-2.5 emitting energy facilities in various Texas counties and their low-birth weight rates annually.



Abstract

Studies from countries such as Brazil and the Czech Republic show pregnancy and infant abnormalities relating to an increased concentration of particulate matter (PM) 2.5 in the atmosphere for inhalation by mothers during the second trimester. Time and time again, Texas has been highlighted as one of the United States' most polluted states due to excess petrochemical and manufacturing facilities, which emit PM 2.5 along with other carcinogens. This study evaluates the possible impact of PM 2.5 emissions on the newborn population in Texas by comparing regional emissions data provided by the Texas Commission on Environmental Quality (TCEQ) to reported Low Birthweight (LBW) Rates of newborns across Texas. Average PM 2.5 measurements are taken in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) throughout different regions where air monitors are distributed, sorted by county. Low Birthweight Rates are identified as the average population of reported newborns under 2,500 grams in a given year per county. Furthermore, this study identifies the top PM 2.5 emission sites in Texas throughout the years of 2014-2018 and compares them to trends in their yearly county LBW rate. LBW has been linked to increasing complications with age including diabetes and heart disease. The findings of this study can provide further insight onto whether Texas, who receives one of the highest funding allocations for air quality monitoring and pollution control of any state by the EPA, should redistribute a bulk of its funding from monitoring to preventative measures in PM 2.5 pollution due to harmful links associated with these prenatal inhalants by mothers.

Question

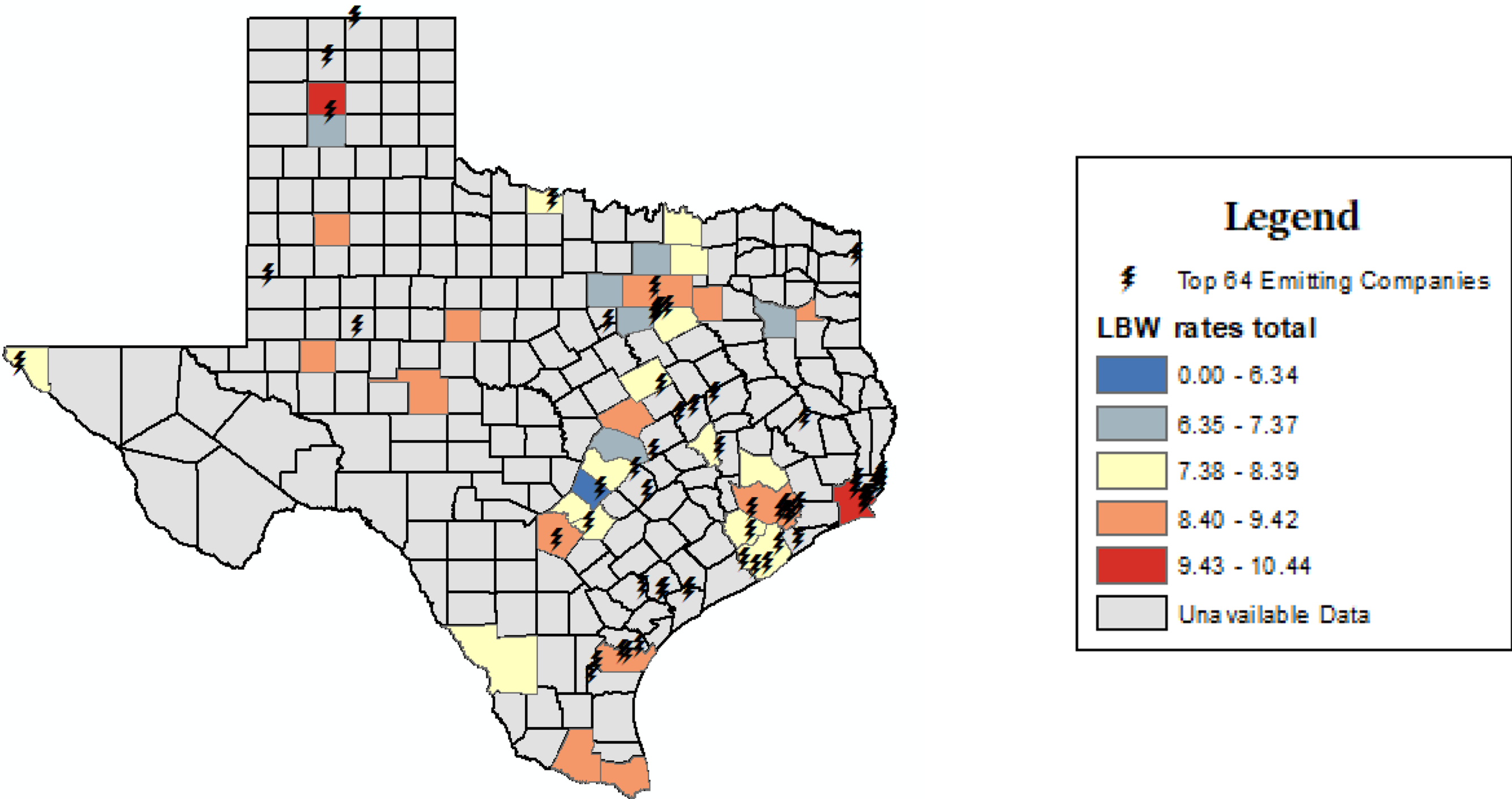
How is newborn weight impacted as a result of varying PM2.5 levels in the air?

Methods

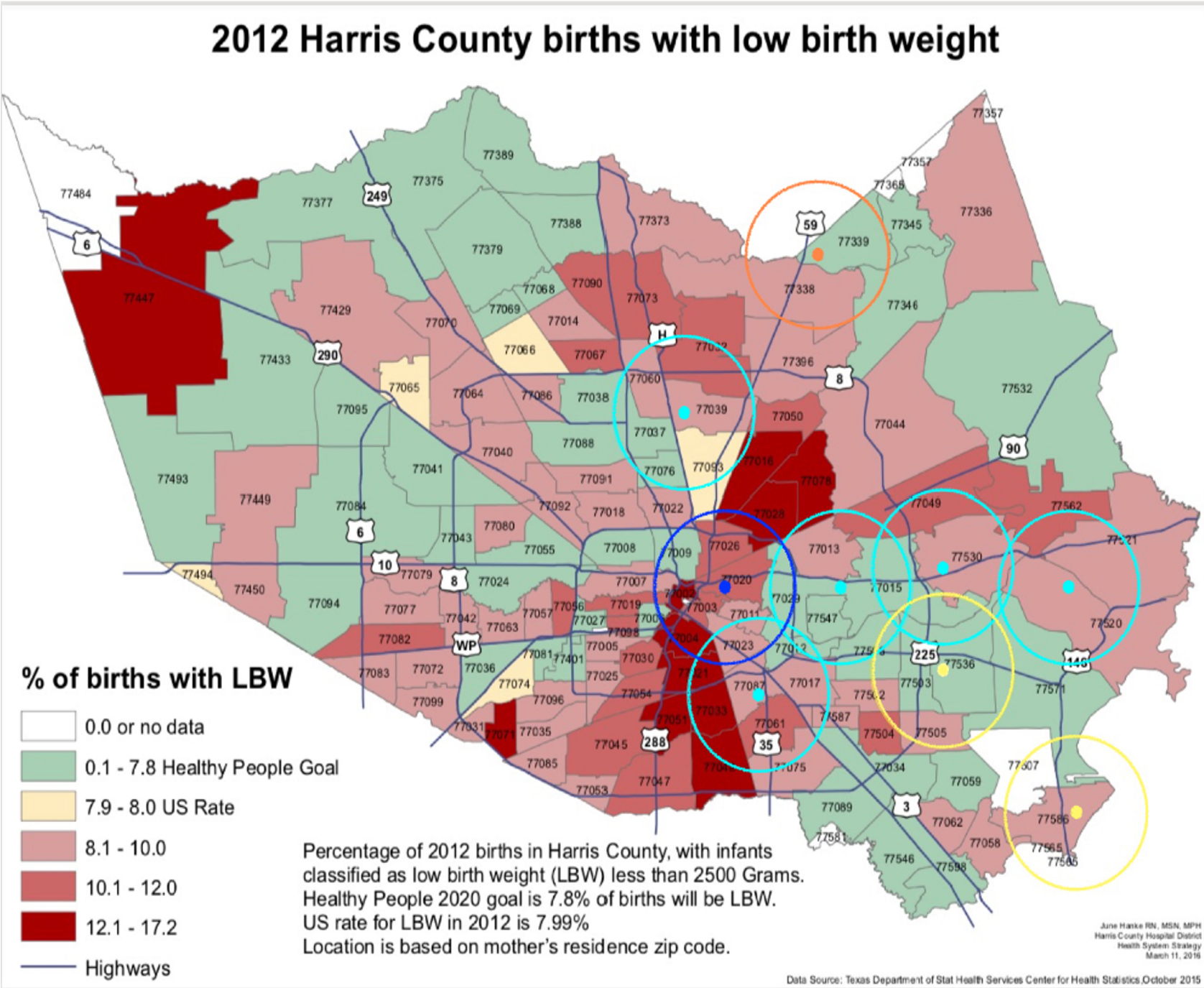
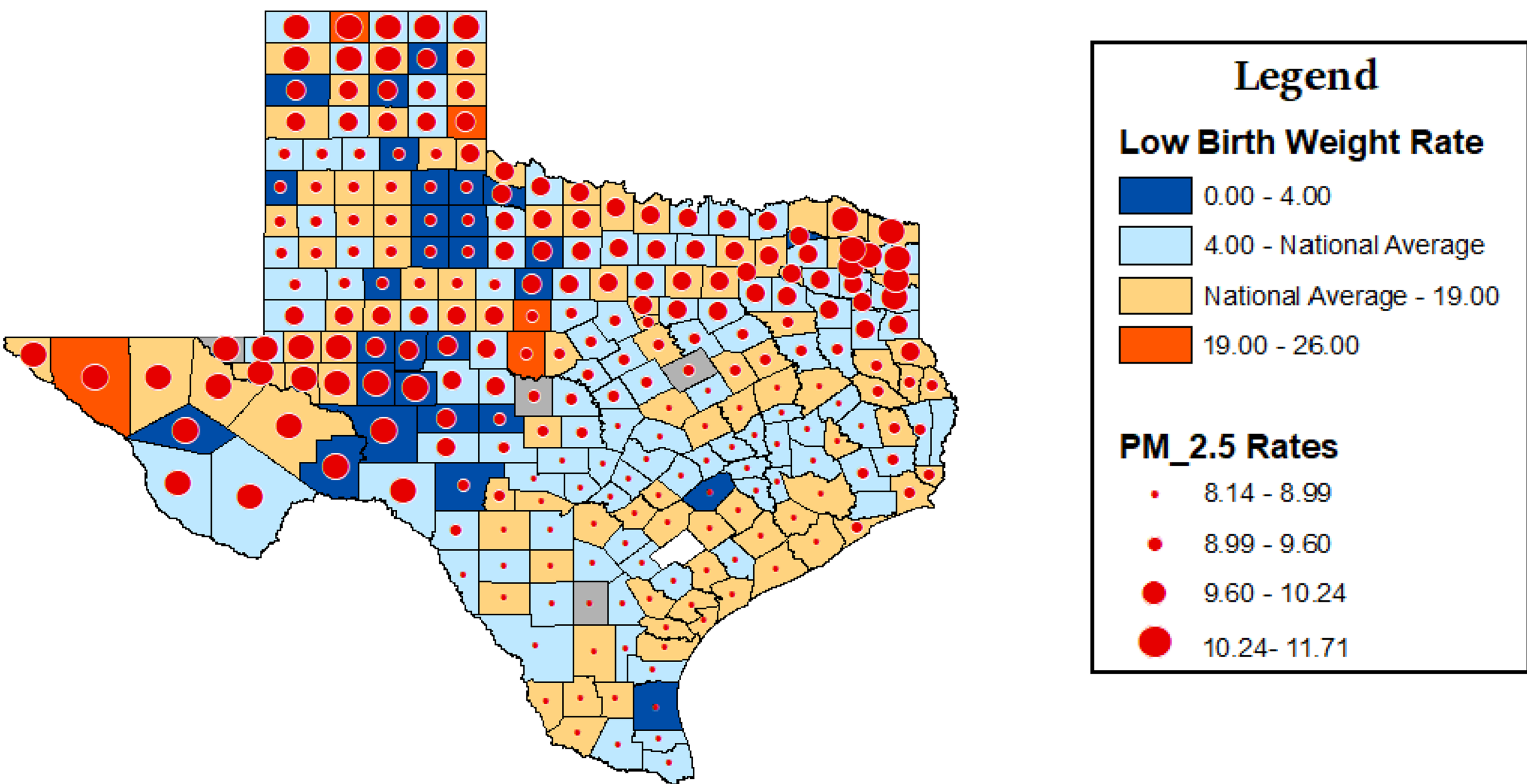
PM 2.5 emissions in tons per year (TPY) for over 2,000 Texas facilities from the years 2014- 2018 from the TCEQ website was analyzed, and the top 50 emitters from each year were ranked. The facility location based on the the corresponding counties were identified. The ArcGIS was utilized as our primary visualization tool for data sets available for public use from the CDC, TCEQ, and the TDSHS. In addition, various confounding variables were eliminated utilizing the CDC Wonder system and databases.

Data

2018 Low Birth Weight - Top 64 Emitting Companies



2012 Low Birth Weight - PM 2.5 Levels



Results

Annual comparisons between low birth weight and the corresponding previous year of PM(2.5) emissions demonstrate a positive correlation. Considerations were taken for various confounding variables including smoking, prenatal care, and previous existing conditions in the mother. Although the rates were generally lower, the correlation between low birth weight and PM(2.5) levels was positive. For a year-by-year comparison of low birth weights and PM(2.5) emissions, scan the QR code below.

In addition, monitoring sites with high PM(2.5) levels align fairly well with areas of high low birth weights within a 10 mile radius in Harris County.

The results of our financial, cost-benefit analysis pointed toward the heightened expenses of low birth weight and premature babies. Preterm and low birth weight infants have some of the highest healthcare costs of any population. Over the first six months after birth, low birth weight infants cost an average of \$114,437 while normal birth weight infants cost an average of \$6,743. Additionally, low birth weight is associated with long-term health problems such as diabetes, cardiovascular disease, obesity, and renal disease. Reducing the number of low birth weight infants by 1% would save Texas over 33 million dollars annually in healthcare costs.

Discussion

The research and results explore areas that have not yet been extensively studied to the extent of our analysis. Focusing on newborn weight helps to eliminate confounding variables associated with adult health cases as a result of pollution. The elimination of confounding variables ensures a more accurate analysis of the relationship between low birth weight and PM(2.5) emissions as purely as possible with current data limitations. In spite of eliminating various confounding variables, limitations in data persist.

Access to restricted datasets for low birth weight by more specific areas and financial allocation records for energy and petrochemical companies could be greatly beneficial in providing more in depth analysis and backing for the results seen from this research. The hope for our research is to encourage transparency in pollution abatement cost allocations and increased monitoring and community awareness efforts regarding pollution.

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