

Analyzing Environmental Exposure Impacts on Birth Outcomes

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Background

Extreme temperature and air pollution are risk factors for low birth weight and pre-term birth. The purpose of this practicum experience was to build foundational statistical and epidemiological skills to analyze how these environmental variables may be impacting residents in Northeast Ohio. Data were obtained from satellite remote monitoring sites and birth records will be obtained from the Ohio Bureau of Vital Statistics upon IRB approval. This study will inform local organizations, like the Cleveland Department of Public Health (CDPH), on developing public health intervention strategies and programs that are unique for the local community.

Population

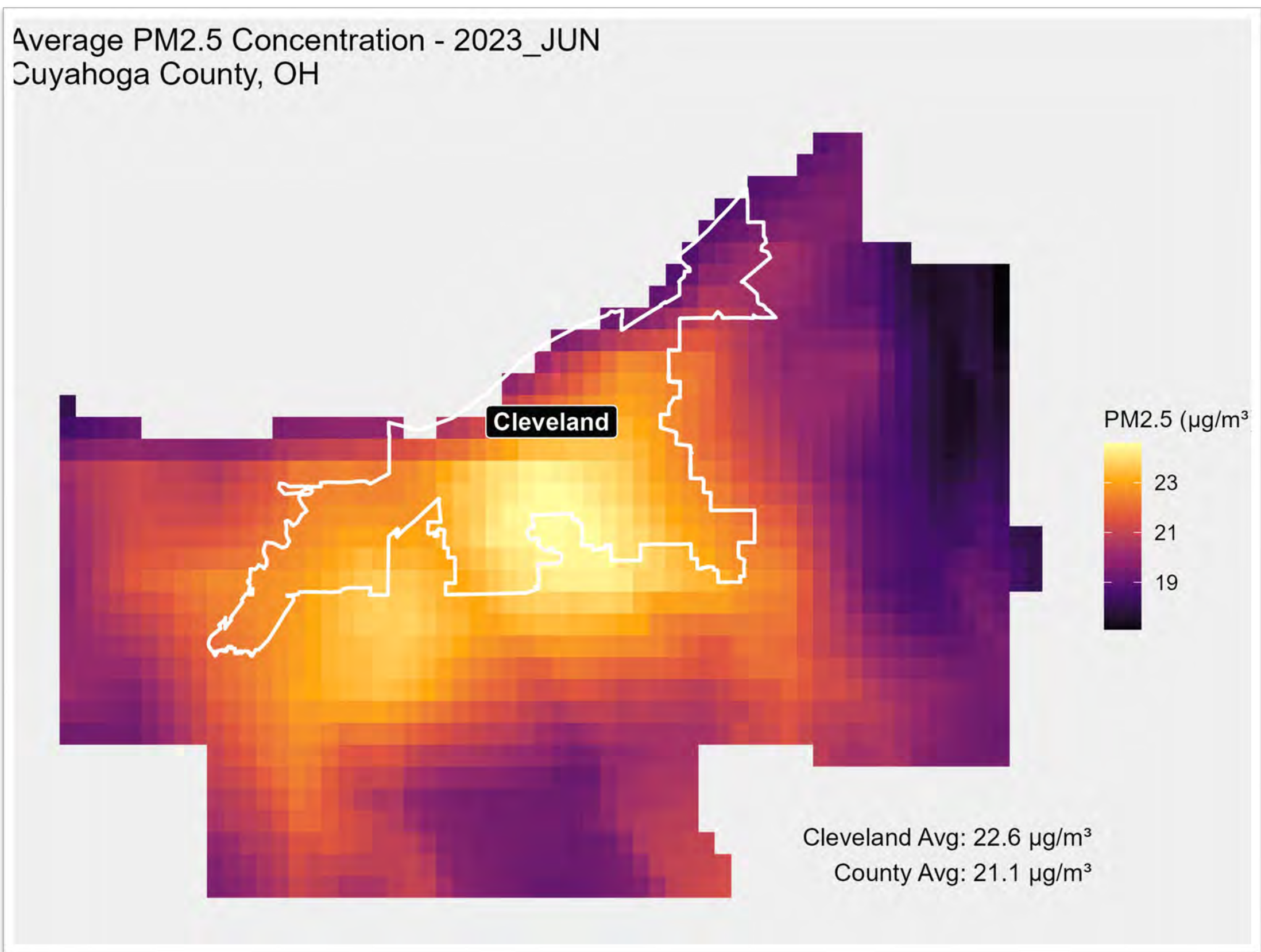
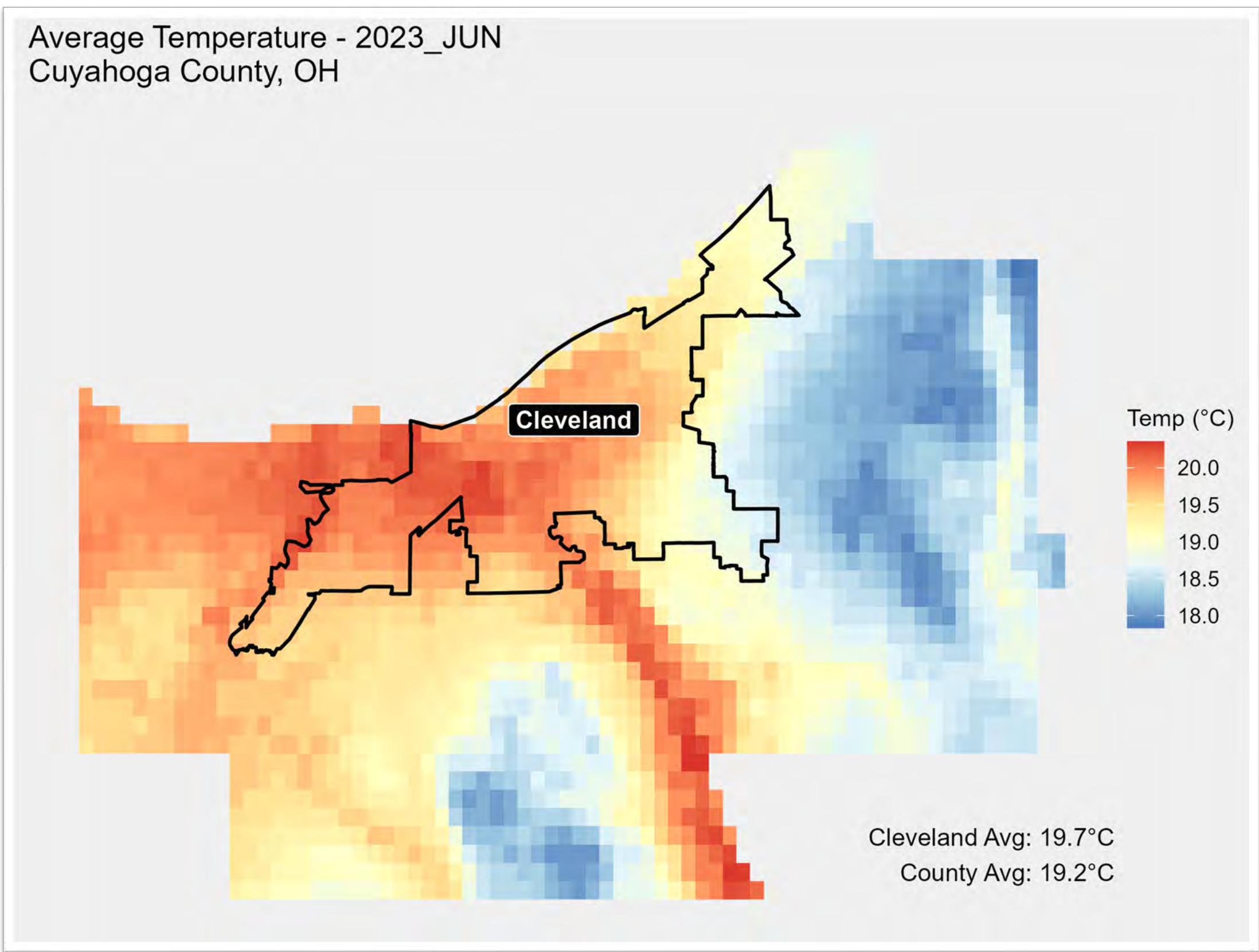
The vision of the Cleveland Department of Public Health is to be the most responsive, most trusted, and most impactful health department in the country. Although CDPH was the host site for this project, residents in Northeast Ohio are the population served. This research aims to meet CDPH's vision by addressing environmental issues and health outcomes that are directly impacting the local community with targeted intervention strategies.

The study population will include live births in Cuyahoga County from 2014 – 2023 from adult women. Females under 18 years old and incarcerated women will be excluded to account for confounding factors that also contribute to low birth weights and pre-term births.

Learning Objectives

This primary learning objective of this practicum was to build basic data analysis and statistical skills for conducting an epidemiological study. In order to complete the study, environmental data were retrieved from two different sources resulting in 240 individual files. Monthly particulate matter 2.5 files were downloaded from the Atmospheric Composition Analysis Group from the Washington University in St. Louis and temperature data were obtained Northwest Alliance for Computational Science and Engineering. The skills developed include data wrangling, writing code in R programming language, and geospatial visualizations.

Mean Particulate Matter 2.5 and Temperature (June 2023)



Deliverable 1: IRB Submission

STUDY20251078: Analyzing environmental exposure impact on birth outcomes

Principal investigator: Shannon Conrey
Submission type: Initial Study
Primary contact: Christina Yoka
PI proxies: Christina Yoka

IRB office: CWRU IRB
IRB coordinator: Erin Zaletei
Letter: Correspondence_for_STUDY20251078 (1).pdf(0.02)
Regulatory authority: 2018 Requirements



The IRB protocol HRP-503ACQUIREDATA was submitted on 8/20/2025. This protocol was used because the proposed study collects and analyzes data but does not interact with human subjects. The pre-review process included clarification requests on how data would be stored and managed, clarification on the role of CDPH, and documentation from CDPH confirming support of the analysis. The IRB reviewers requested minor modifications including addressing two errors in the IRB protocol and a copy of CDPH's Data Use Agreement with the Ohio Department of Public Health. The IRB protocol was approved on 11/6/2025.

Number of Birth Records to be Analyzed By Year											
Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Cuyahoga County Birth Count	14,787	14,538	14,520	14,334	13,687	13,783	13,034	12,994	12,659	12,528	136,864

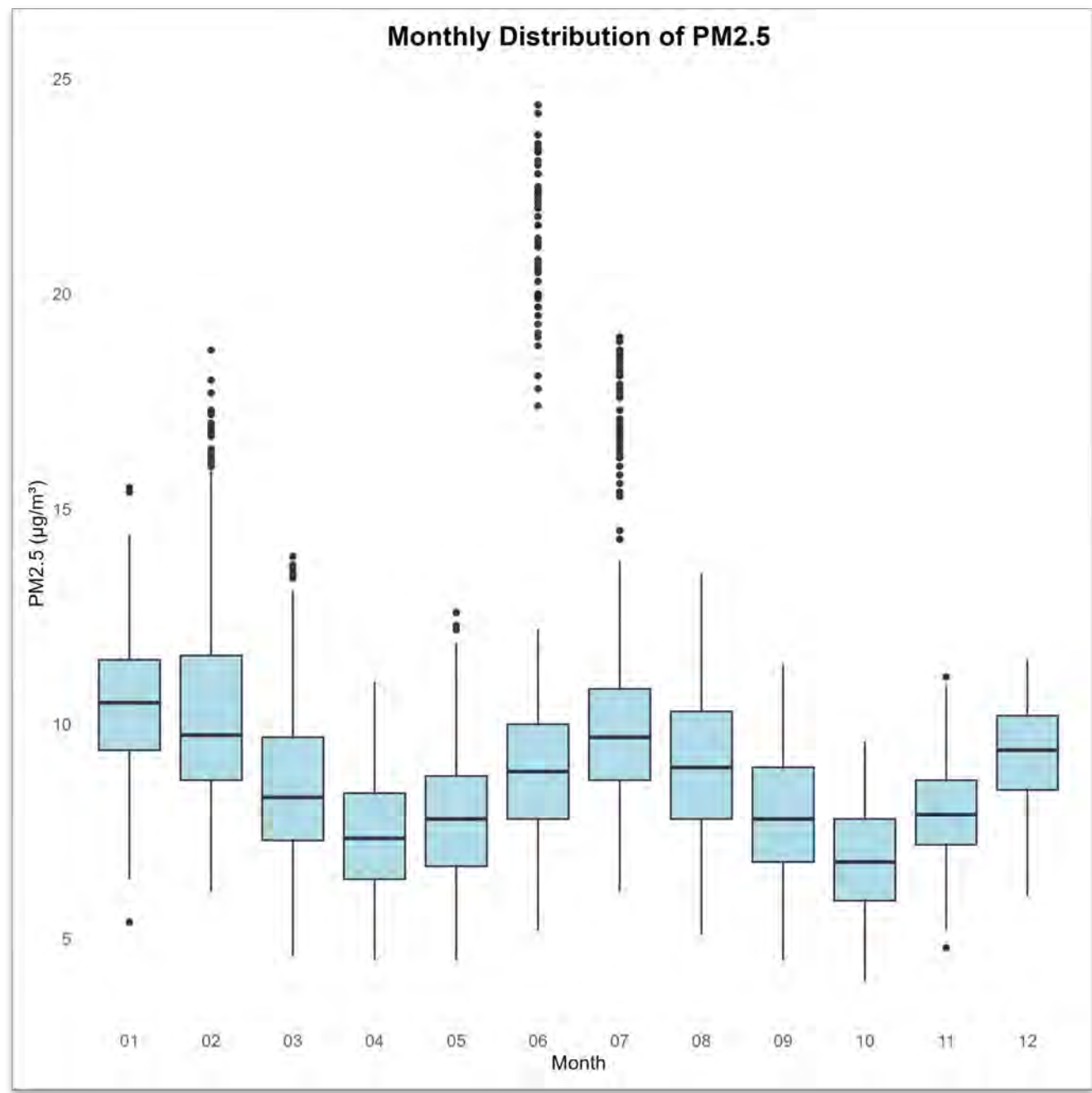
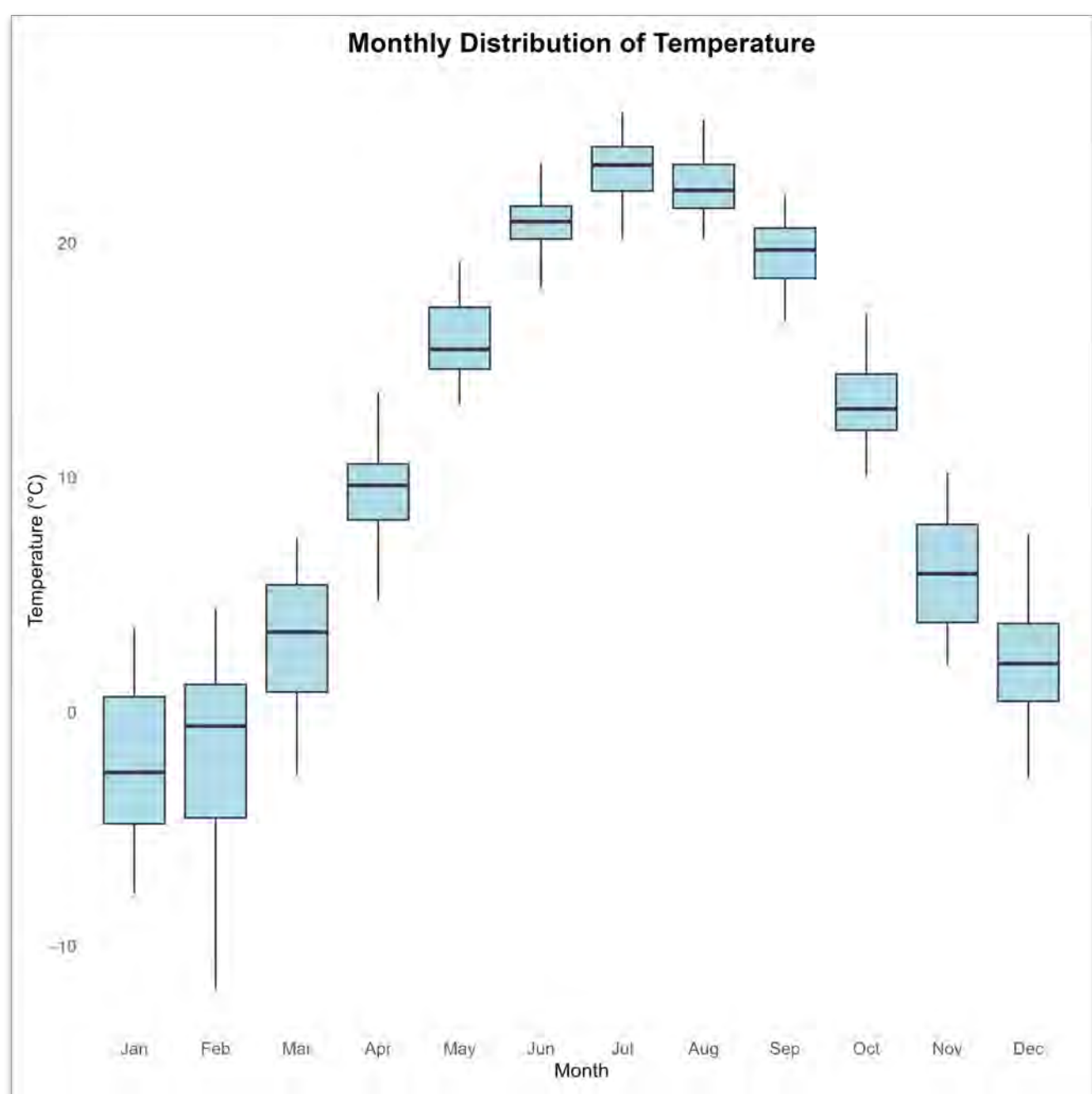
Public Health Implications

Cleveland and Cuyahoga County both have poorer health outcomes for infants then the State of Ohio. The pre-term birth rate for Cleveland is 14.6% and the very pre-term birth rate is 3.02%. Per 1,000 live births, the infant mortality rate is 10.5 in Cleveland, 7.5 in Cuyahoga County, and 6.5 overall in Ohio. Although there are many factors that contribute to these poor rates, the development of action plans for mothers exposed to poor air quality and extreme temperature is one tool that can be used for addressing this extreme health inequity.

Deliverable 2: R Coding for Data Analysis and Visualizations

The environmental data are publicly available and initial analysis were conducted while the IRB approval was under review. To analyze the data, these general steps were followed:

1. The temperature and air pollution files were read into R and spatial files were used to mask geography outside of Cuyahoga County
2. A loop was created to analyze all 240 files and generate monthly maps for visualization
3. The data were combined by latitude and longitude to generate a single CSV file for analysis
4. Descriptive statistics were used to understand trends in air pollution and temperature data over time



Next Steps

The next step is to analyze the health data to explore relationships between the health outcomes and environmental variables using regression modeling. The individual and potential additive effects of the variables will be analyzed. Based on the results, policy and program recommendations will be submitted to CDPH. For example, if certain temperature or pollution thresholds are found to be negatively associated with either outcome, CDPH may develop a proactive strategy for public communications directed towards pregnant women or for participants enrolled in the Mom's First program.

Acknowledgements

Thank you to Cleveland Department of Public Health, Elizabeth Svoboda, Dr. Shannon Conrey, and Dr. Maeve MacMurdo for your support. Additionally, I am grateful for the financial support provided by the Public Health Training for Northeast Ohio Workforce (PHT-NOW) that made enrollment in the MPH program possible.