



# Comparing Air Quality and Health Benefits: Two Case Studies

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- Indiana has made significant emission reductions across the state.
- The air quality in Indiana has improved over time.

## Question:

- Has the health of Hoosiers improved as a result of air quality improvements?



Two studies will focus on Marion County information.



# Marion County Improvements

## Air Quality

2000-2016

- Annual PM-2.5      ↓ 43.6%
- 1-hr NO<sub>2</sub>      ↓ 18.9%
- 1-hr SO<sub>2</sub>      ↓ 85.9%

## Emissions

2000-2014

- Annual VOC      ↓ 50.3%



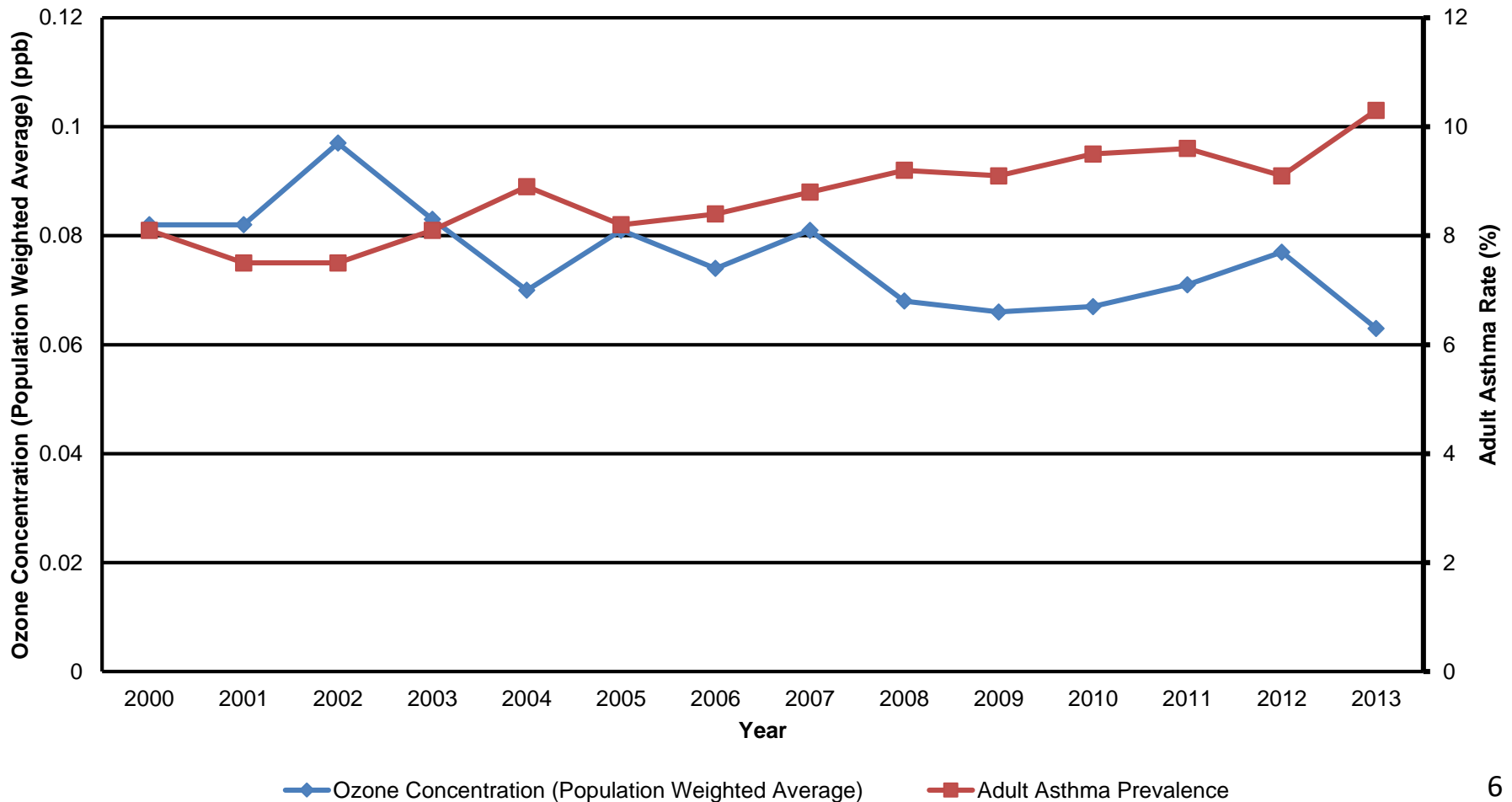
# Asthma Analysis

Several years ago, I compared the adult asthma prevalence in Indiana between 2001 and 2013 with the average ozone levels.

(See next graph)



# Indiana Ozone Concentrations versus Asthma Rates - 2000-2013





# This comparison had two problems

- It compared annual asthma rates with short term ozone levels.
- Asthma rates are not very accurate (based on telephone surveys).

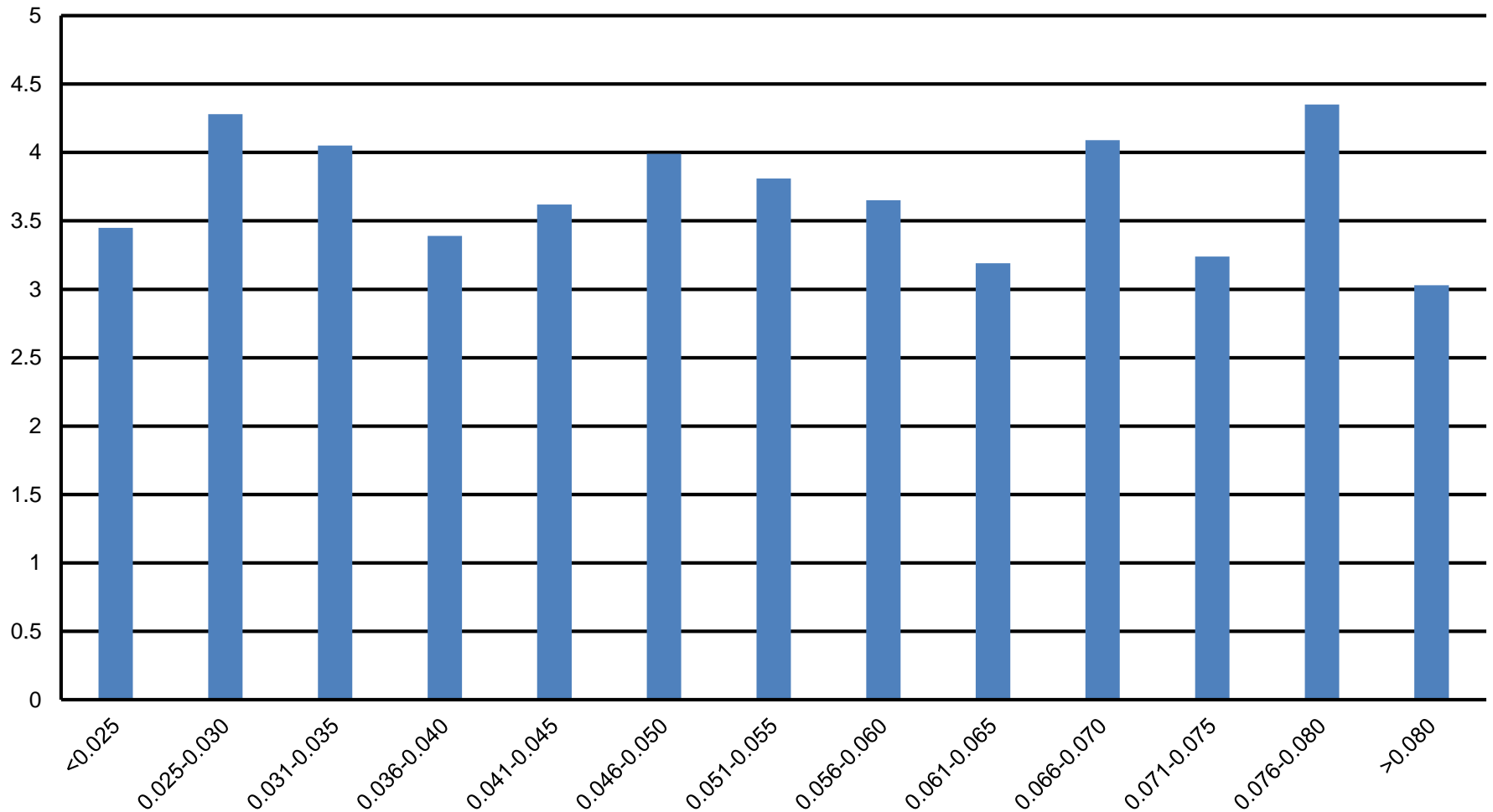


- This study looks at number of people hospitalized per day for asthma from 2012-2016 in Marion County.
  
- This is compared to values for that day, the day before and two days before for:
  - Ozone Level
  - Temperature
  - Relative Humidity
  - Temperature plus Relative Humidity
  - PM-2.5 Levels



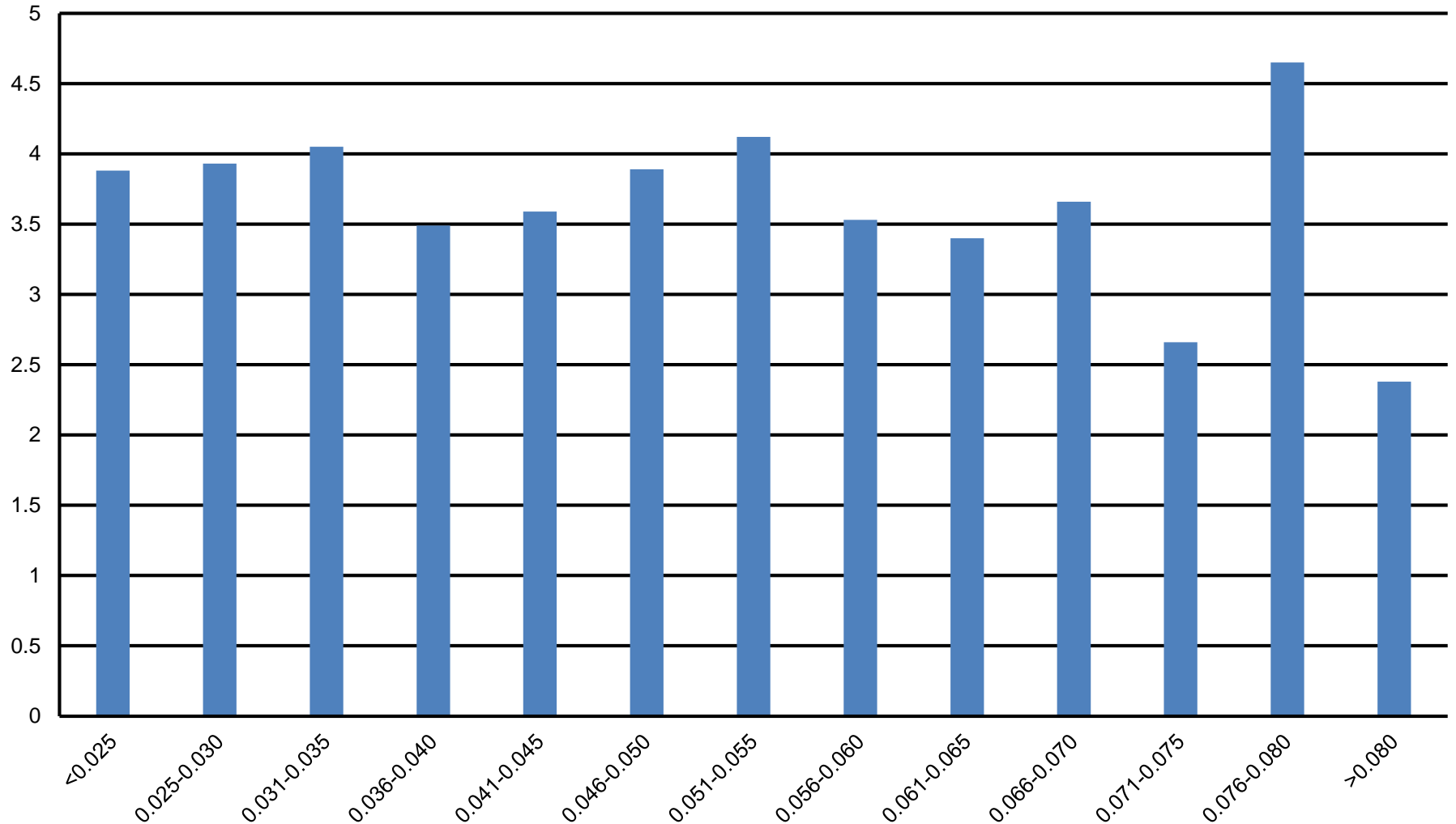


# Hospital Asthma Admissions versus Maximum 8-Hour Ozone Levels - Day Of



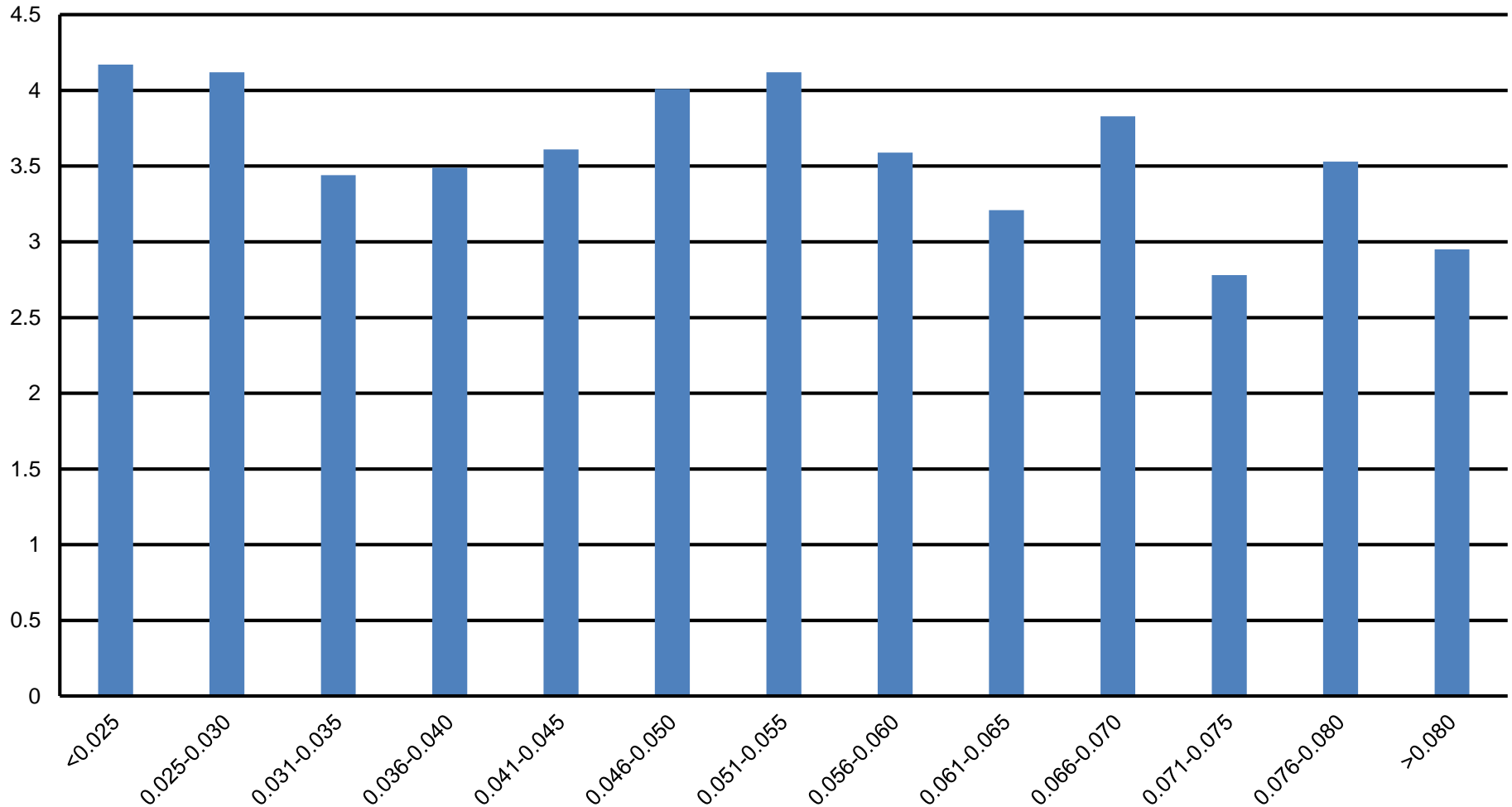


# Hospital Asthma Admissions versus Maximum 8-hour Ozone Levels - Day Before





# Hospital Asthma Admissions versus Maximum 8-Hour Ozone Levels - Two Days Before





## Results of Linear Regression Asthma Admissions

- No statistically significant relationship between ozone and hospital admissions.
- No statistically significant relationship between PM-2.5 and hospital admissions.
- Best relationship is with number of hours of temperature greater than 95°F (Day of).



## What is missing?

- For the asthma study, I hoped to include pollen count data, but there are no official pollen count stations in Indiana.
- Other researchers looking into this issue are encouraged to include pollen count data where available.



# PM-2.5 Analysis versus Chronic Lower Respiratory Disease Death

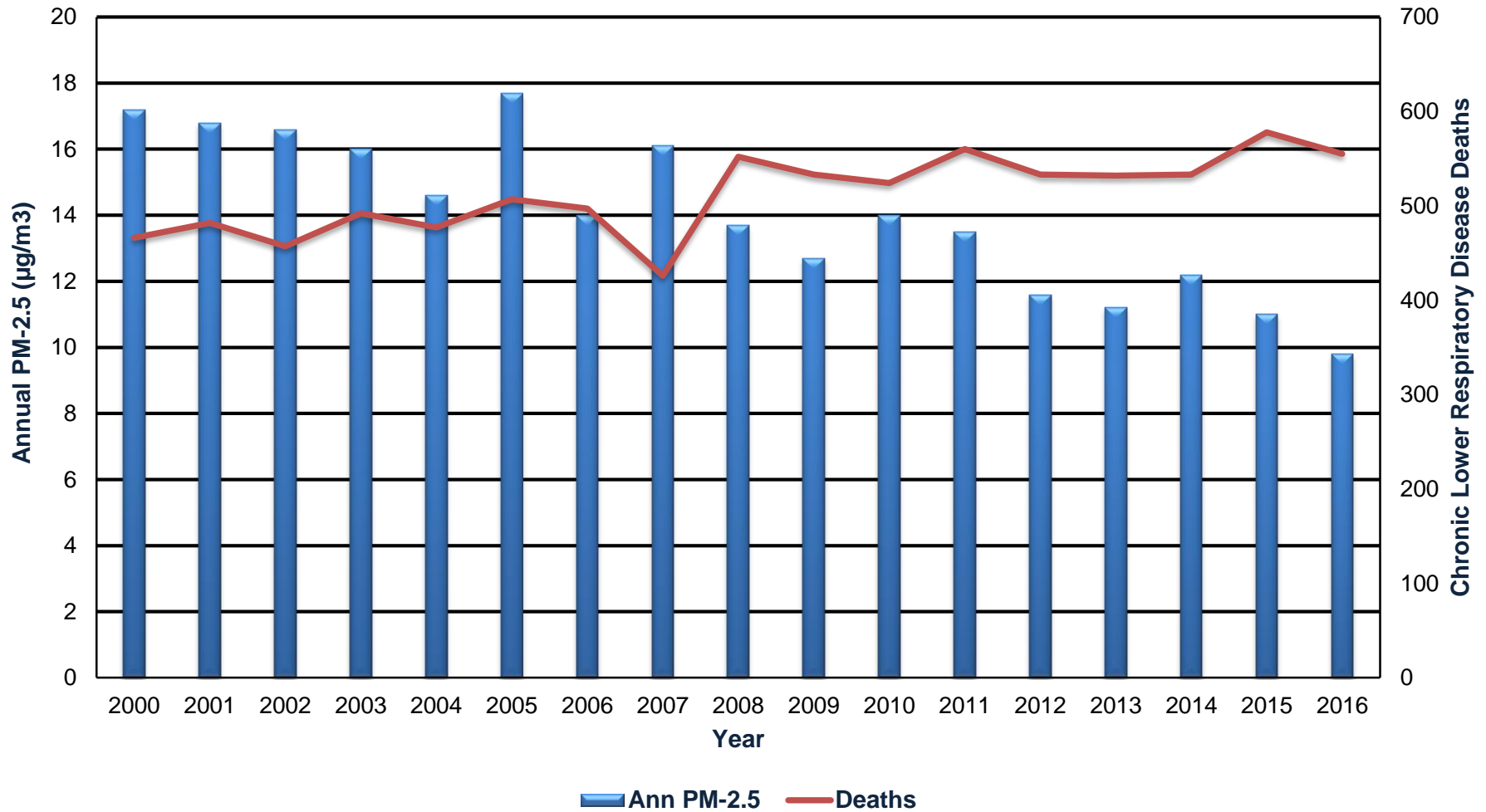
Study looks at number of deaths per day for Marion County from 2000-2016 for deaths from chronic lower respiratory disease.

This is compared to values for that day, the day before and two days before for:

- PM-2.5 levels
- Temperature
- Relative humidity

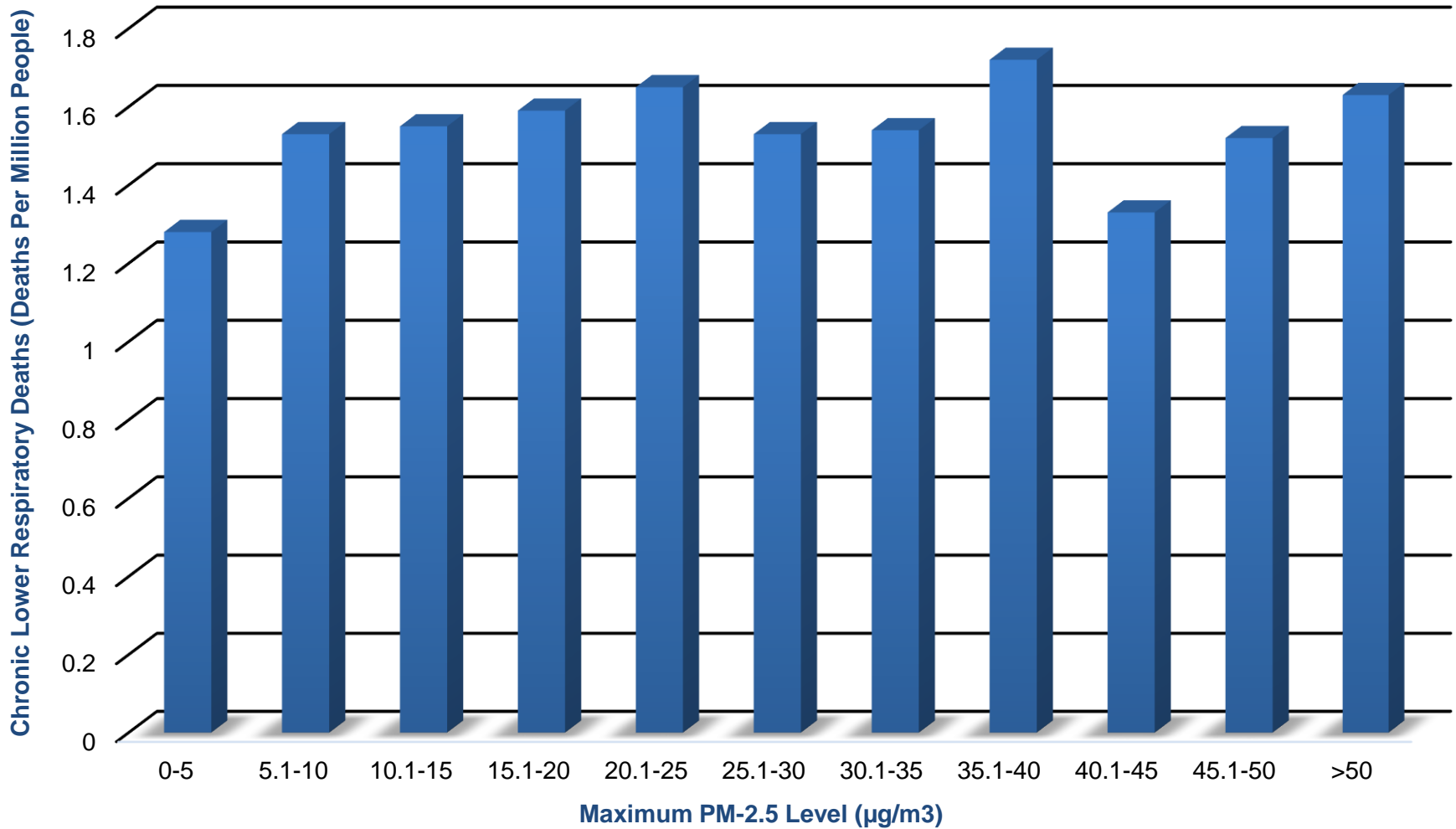


# Annual PM-2.5 versus Chronic Lower Respiratory Disease Deaths Marion County 2000 - 2016





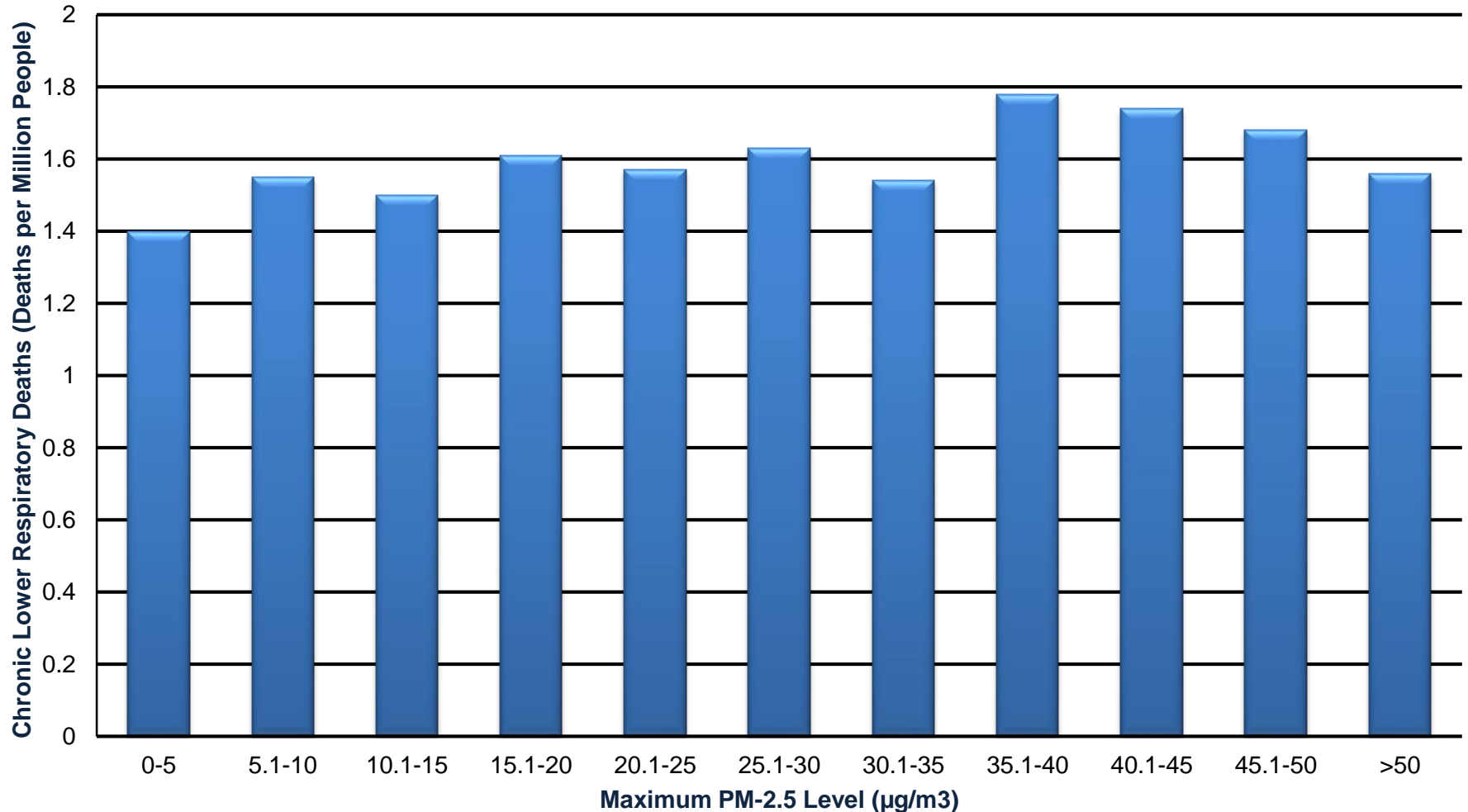
# Chronic Lower Respiratory Deaths versus Daily Maximum PM-2.5 Levels - Day Of





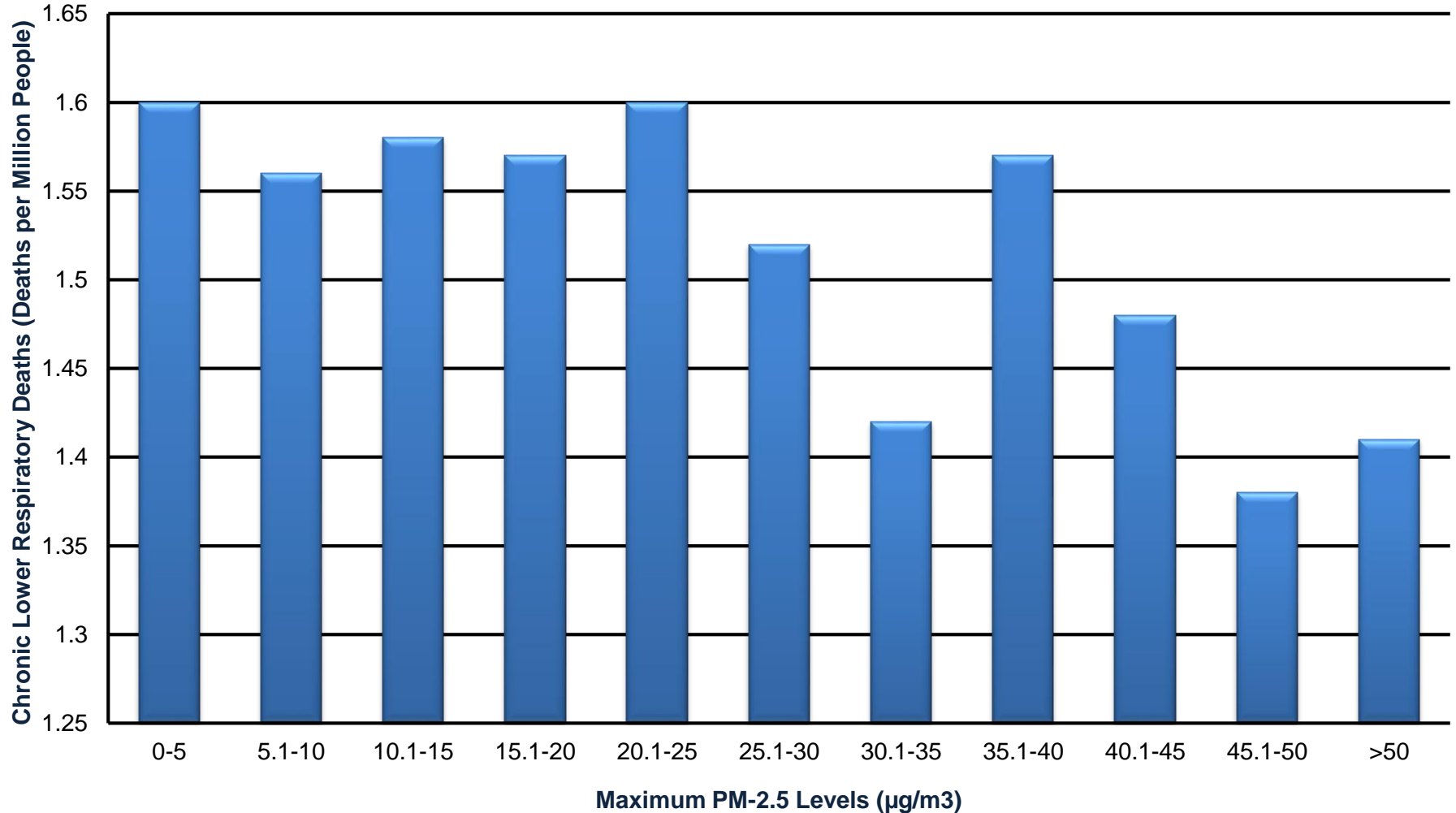


# Chronic Lower Respiratory Deaths versus Daily Maximum PM-2.5 Levels - Day Before





# Chronic Lower Respiratory Deaths versus Daily Maximum PM-2.5 Levels - Two Days Before





## Results of the Linear Regression Chronic Lower Respiratory Disease Deaths

- No statistically significant relationship between PM-2.5 and deaths due to chronic lower respiratory disease.
- Best relationship is with minimum temperature two days before.
- Relationship is an inverse relationship.  
(lower temperatures lead to higher deaths)



# Contact Information

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