Course: **Environment Economics**

Econ 2508ID

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- ■ Research Title: Is there a relationship between respiratory hospitalizations due to PM 2.5 and poverty rates by neighborhood?
- ■ Introduction

Air pollution is a major issue in urban areas. It is the result of development in the industrial sector and increasing urbanization and automobile practices. It also badly affects human health and land surface environments. PM2.5 is a largely known factor that defines air quality and it measures the level of pollution. In my research I used these variables.

PM 2.5 is a type of air pollutant that can cause various respiratory problems when inhaled. These particles are so small that they can penetrate deep into the lungs and even enter the bloodstream, leading to serious health issues like asthma, bronchitis, and other respiratory diseases.

Neighborhoods with higher poverty rates often have higher levels of PM 2.5. This is because these areas are more likely to be located near sources of pollution, such as factories, highways, or power plants. People living in poverty are also more likely to lack access to quality healthcare, making it harder for them to manage and treat respiratory conditions. This can lead to higher rates of hospitalization.

For my research I used the NYC Health Environment Data Portal to gain access to the data.

Is there a relationship between respiratory hospitalizations due to PM 2.5 and poverty rates by neighborhood?

COUNTA of Rate Rate of Porvety (x)				
Rate of PM 2	high	low	medium	Grand Total
high	31.25%		9.52%	16.67%
low	18.75%	80.00%	38.10%	35.71%
medium	50.00%	20.00%	52.38%	47.62%
Grand Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

- The Rate of Respiratory hospitalizations due to PM2.5 exposure by neighborhood poverty rate.
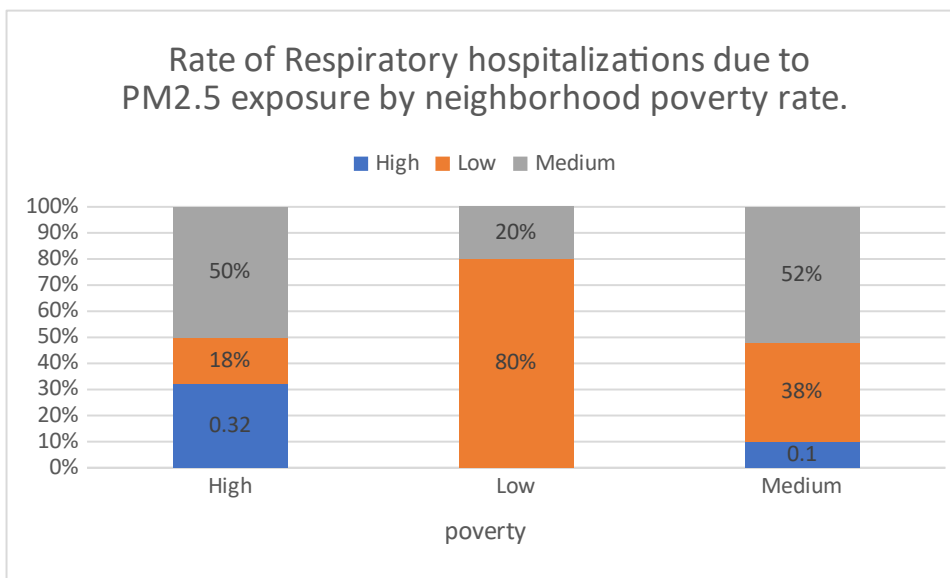
Poverty rate instead of PM 2.5

POVERLY

Rate of P.H. of PM 2.5	High	Low	Medium	Grand Total
High	32%		10 %	16%
low	18%	80%	38%	36%
Medium	50%	20%	52%	48%
Grand Total	100%	100%	100.00%	100%

The percentage of households with incomes below the federal poverty level
High= more than 20% Med= 9.1-20%, low =less than 9%
Respiratory hospitalizations due to PM 2.5 Estimated annual rate per 100,000 adults.
high= more than 20% Med= 9.1-20%, low =less than 9%
Source: NYC Health and Environnment https://a816-dohbesp.nyc.gov/IndicatorPublic/b
x= independent variable and Y= Dependent Variable

Rate of Respiratory hospitalizations due to PM2.5 exposure by neighborhood poverty rate.

In neighborhood where the measure of PM 2.5 was low ,80% had a low poverty rate. 20 % of neighborhoods had a medium rate of poverty. and 0% of neighborhoods had a high rate poverty.

In neighborhoods where the percentage of measure of PM2.5 rate is HIGH 18% of neighborhood had a low poverty rate. 50% of neighborhoods had a medium rate of poverty. and 32% of neighborhoods had a high rate of poverty.

In neighborhoods where the percentage of measure of PM2.5 rate is medium 10 % of neighborhood had a low poverty rate. 52% of neighborhoods had a medium rate of poverty. and 38% of neighborhoods had a high rate of poverty.

My data show there is a correlation between high levels of PM 2.5 and increased rates of respiratory hospitalizations, particularly in areas with high poverty rates.

- Jones, Rena R. study October 2014 "Respiratory Hospitalizations in Association with Fine PM and Its Components in New York State. This study investigated the association between daily ambient PM2.5 species concentrations and respiratory hospitalizations in New York State (NYS) using 24-hr average PM constituent concentrations estimated by combining CMAQ outputs with available observations. The author objective was to characterize the relationship between ambient PM species and respiratory hospitalization in a large, age-diverse, and racially/ethnically diverse population using a case-crossover approach. A secondary objective was to determine whether certain fine PM constituents modify the PM2.5–respiratory disease association. concludes that ambient concentrations of PM2.5 and secondary aerosols including sulfate, ammonium, and nitrate were positively associated with respiratory hospitalizations, although patterns varied by season. Exposure to specific fine PM constituents is a plausible risk factor for respiratory hospitalization in New York State.

- Weber, Stephanie A. November 2016 "Assessing the Impact of Fine Particulate Matter (PM2.5) on Respiratory-Cardiovascular Chronic Diseases in New York City. The general approach for research designed to analyze health impacts of exposure to PM2.5 is to use concentration data from the nearest ground-based air quality monitor(s), which typically have missing data on the temporal and spatial scales due to filter sampling schedules and monitor placement, respectively. To circumvent these data gaps, this research project uses a Hierarchical Bayesian Model (HBM) to generate estimates of PM2.5 in areas with and without air quality monitors by combining PM2.5 concentrations measured by monitors, PM2.5 concentration estimates derived from satellite aerosol optical depth (AOD) data, and Community-Multiscale Air Quality (CMAQ) model predictions of PM2.5 concentrations. She found that Exposure to PM2.5 can trigger asthma attacks in people who already have the condition and can also contribute to the development of asthma in people who previously did not have it. And she concludes that This is particularly a concern in urban areas like New York City, where PM2.5 levels can be high due to pollution from traffic and other sources.

- Stafoggia, Massimo (September 2013) aimed to estimate the association between daily concentrations of fine and coarse particles with hospitalizations for cardiovascular and respiratory conditions in eight Southern European cities, within the MED-PARTICLES project. He found significant associations between all PM fractions and cardiovascular admissions. They concluded that PM2.5 and PM2.5–10 was positively associated with cardiovascular and respiratory admissions in eight Mediterranean cities.

Information on the short-term effects of different PM fractions on morbidity in Southern Europe will be useful to inform European policies on air quality standards.

In conclusion, I found out that PM 2.5 is a type of air pollutant that can cause various respiratory problems when inhaled and definitively, there Is a connection form my own research and the finding research study, because and the others study, PM 2.5 cause serious health problem like asthma and other respiratory diseases. Mostly in neighborhoods where poverty level is so high the rate of respiratory hospitalization is so high. Their findings were not similar but some types of way.

Addressing the issue of PM 2.5 (fine particulate matter) in neighborhoods with high poverty levels requires a multi-faceted approach. Here are some recommendations:

Implement stricter air quality regulations: Governments should enforce stricter regulations on industries and vehicles, which are major contributors to PM 2.5. This could include setting lower emission standards and regularly monitoring industrial sites. Promote clean energy: Encourage the use of clean and renewable energy sources like solar and wind power. This can reduce reliance on fossil fuels, which are a major source of PM. Improve waste management. Urban greening: Planting trees and creating green spaces can help absorb PM 2.5 and improve air quality. This can also provide recreational spaces for residents. Improve access to healthcare: High levels of PM 2.5 can lead to health problems. Ensuring access to healthcare for these communities can help manage and prevent these issues.

1. Jones, Rena R., et al. "Respiratory Hospitalizations in Association with Fine PM and Its Components in New York State." Journal of the Air & Waste Management Association (Taylor & Francis Ltd), vol. 65, no. 5, May 2015, pp. 559–69.
2. Weber, Stephanie A., et al. "Assessing the Impact of Fine Particulate Matter (PM2.5) on Respiratory-Cardiovascular Chronic Diseases in the New York City Metropolitan Area Using Hierarchical Bayesian Model Estimates." Environmental Research, vol. 151, Nov. 2016, pp. 399–409.
3. Stafoggia, Massimo, et al. "Short-Term Associations between Fine and Coarse Particulate Matter and Hospitalizations in Southern Europe: Results from the MED-PARTICLES Project." Environmental Health Perspectives, vol. 121, no. 9, Sept. 2013, pp. 1026–33.
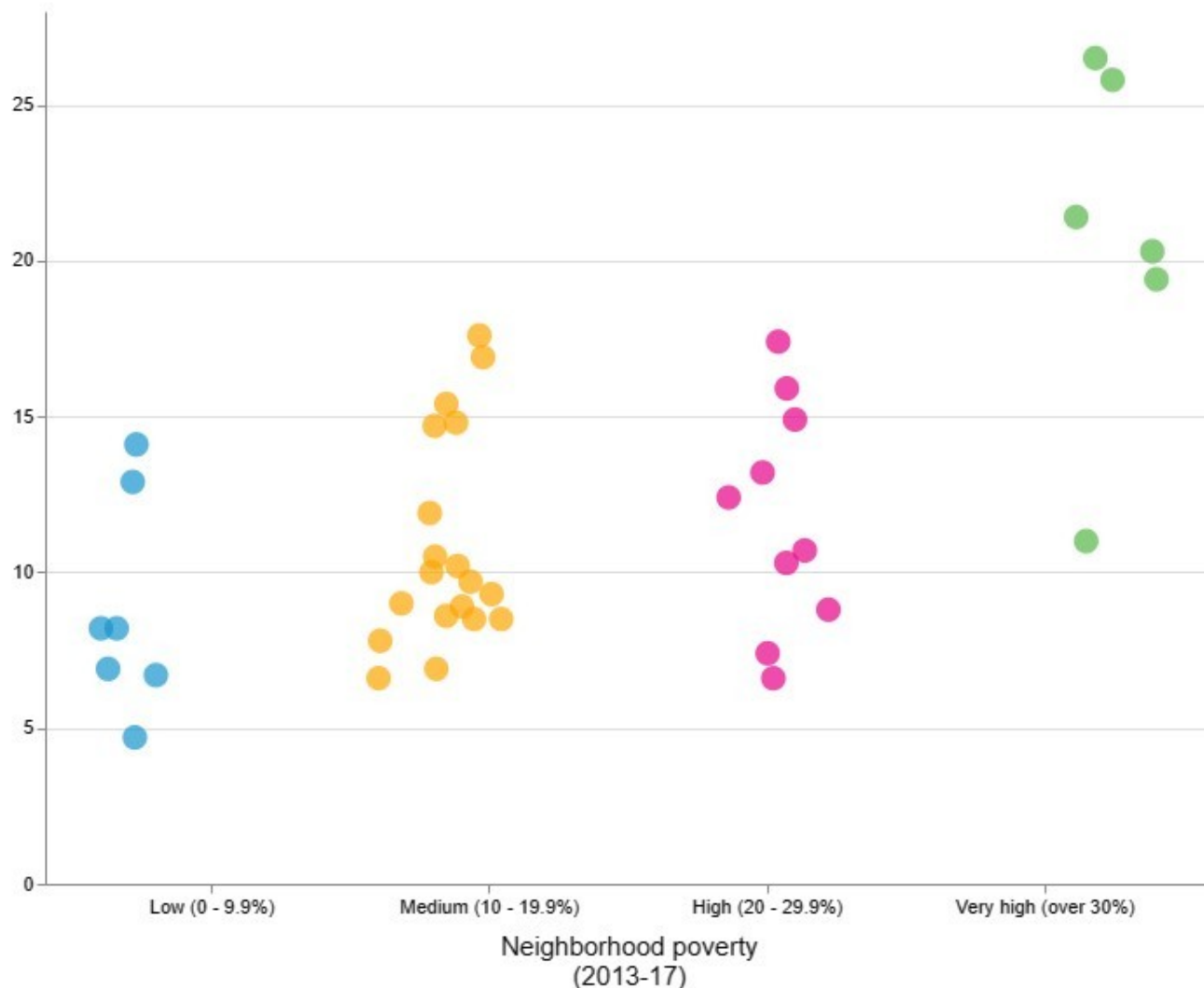
Respiratory hospitalizations due to PM2.5 (age 20+)
Estimated annual rate per 100,000 adults (2015-2017)

Neighborhood poverty
Percent (2013-17)

● Bronx ● Brooklyn ● Manhattan ● Queens ● Staten Island
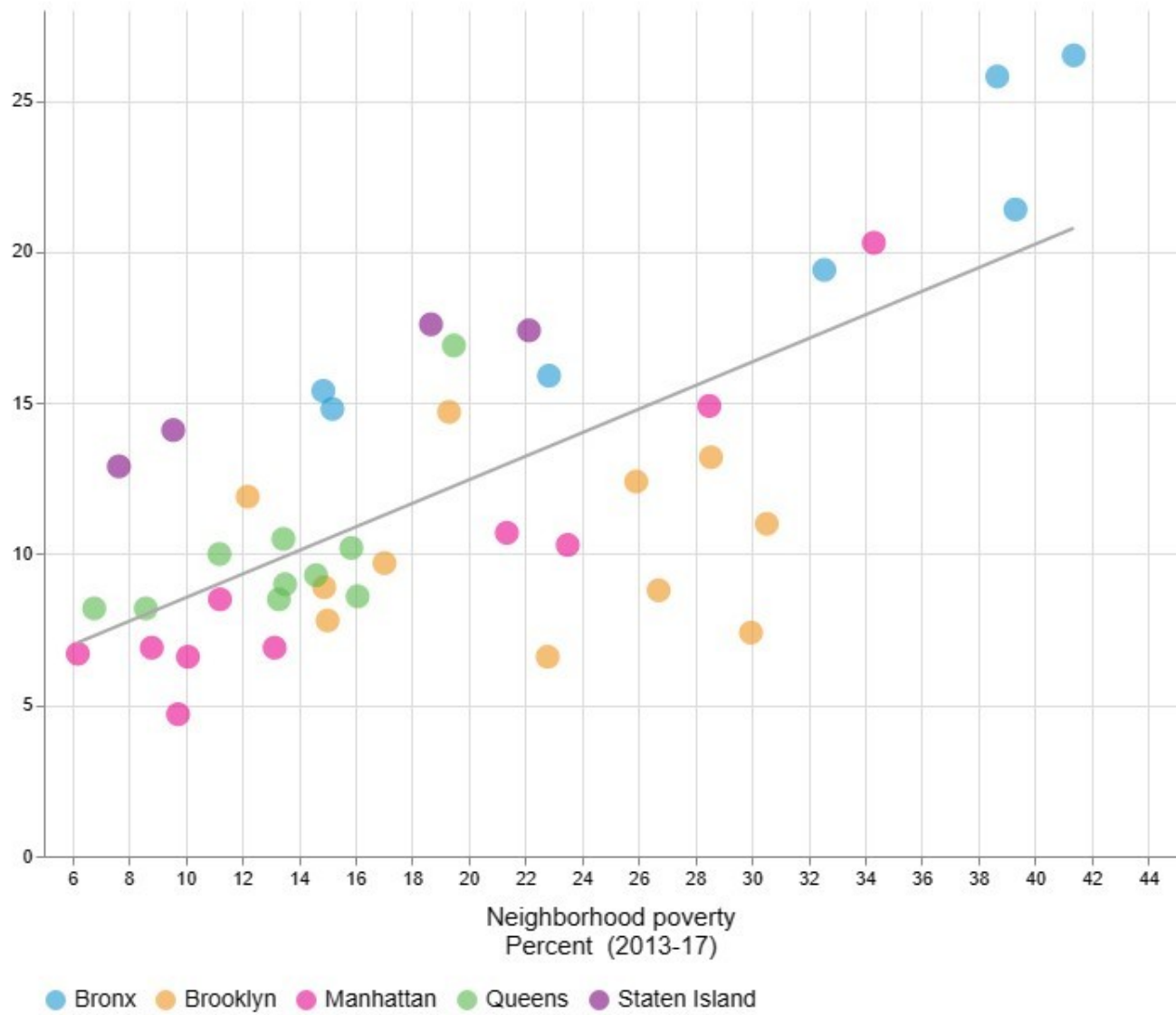
Respiratory hospitalizations due to PM2.5 (age 20+)
Estimated annual rate per 100,000 adults (2015-2017)

However, it's generally observed that there is a positive relationship between the two. This means that as poverty rates increase in a neighborhood, the rate of respiratory hospitalizations due to PM 2.5 also tends to increase.

Yes, there are disparities by borough, if we look on the specific data for each borough. It's likely that there would be disparities, as different boroughs can have different levels of industrial activity, different poverty rates, and different levels of access to healthcare. For example, a borough like Queens with a high poverty rate and a lot of industrial activity has a higher rate of respiratory hospitalizations due to PM 2.5 than a wealthier borough like Manhattan with less industrial activity.