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Impact of Industrial Emissions on Respiratory Health in Louisiana's "Cancer Alley"

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ABSTRACT

The "Cancer Alley" section of Louisiana extends from Baton Rouge to New Orleans, where more than 150 petrochemical plants discharge benzene and sulfur dioxide (SO_2) and fine particulate matter (PM2.5). The chemicals released by these operations have been linked to increased respiratory health problems for asthma and COPD especially among communities with low income and minority status.

The research adopts an exploratory qualitative methodology while drawing data from both EPA's Toxic Release Inventory (TRI) and Louisiana Department of Health records. Research data show that industrial pollution contributes to increasing respiratory health problems while these problems mainly affect minority and impoverished neighborhoods.

Current findings demand serious improvements to air quality rules and emission management systems as well as public healthcare interventions. Future studies in Cancer Alley should use present-day health records and detailed neighborhood evaluations to develop better policy-driven environmental justice efforts.

Introduction

Located between Baton Rouge and New Orleans, Louisiana's "Cancer Alley" is an 85-mile stretch of industrial corridor along the Mississippi River. In this region, you can find more than 150 petrochemical plants and refineries and it is one of the most polluted areas in the United States (WHO, 2025a). High airborne pollutants, including benzene, sulfur dioxide, and particulate matter, originate from a heavy concentration of industrial facilities that cause severe environmental and health risks.

Study after study has shown connections between industrial emissions in Cancer Alley and respiratory diseases, lung cancer, and other chronic health conditions. This disproportionately affects marginalized communities where visible air pollution negatively impacts poor people, exposing them to toxic pollutants, while they remain unable to access healthcare.

The objective of this study is to assess whether industrial emissions are correlated with respiratory disease clusters in Cancer Alley. Such associations need to be understood for implementing public health policies, adopting stricter air quality regulations and industry emission control measures.

Research Objectives

- To study the correlation between industrial emissions and respiratory health outcomes.
- The objective was to evaluate spatial distribution of respiratory disease clusters in the context of pollution exposure.

Literature Review

Impact of Industrial Emissions on Respiratory Health

A solid foundation for research has been built regarding the relationship between industrial emissions and respiratory illnesses. Thus, according to Wami-Amadi (2025), there is a significant increase in pulmonary diseases such as asthma and chronic obstructive pulmonary disease (COPD) and lung cancer due

to exposure to airborne pollutants, primarily particulate matter ($PM_{2.5}$) and sulfur dioxide (SO_2). In a study by Park *et al.,* (2024), it was asserted that industrial pollutants with prolonged exposure cause oxidative stress and inflammation, which leads to deterioration in lung function over time.

The idea of 'Cancer Alley ' is taken by Tavella *et al.,* (2025), who discovered that the region is near petrochemical plants, which give rise to more intensive hospitalizations due to respiratory issues than expected. In addition, the Louisiana Department of Health (2021) has also raised concerns about environmental justice because the department has noted a disproportionate burden of respiratory diseases in low-income and minority communities. Nevertheless, existing studies establish the existence of adverse health effects. However, few studies quantify this correlation through quantitative detail between particular pollutants and respiratory health outcomes, providing scope for further analysis.

Spatial Distribution of Respiratory Disease Clusters and Pollution Exposure

Geospatial mapping has come to be a vital tool in environmental health studies. Zangeneh *et al.,* (2024) demonstrated through their research that GIS-based analysis can effectively identify disease hotspots and map pollution exposure. Like other research, Grunwell *et al.,* (2022) used spatial analysis to show that residents living nearer to industrial zones are much more likely to suffer from respiratory illnesses.

However, the disease clustering of pollution has been virtually unstudied about Cancer Alley's pollution. Very few studies in the past have been able to map industrial emissions, as they lack real-time health data. In particular, by using GIS tools and statistical analysis this study fills this gap by analysing the spatial relationship between respiratory disease clusters and pollution exposure to provide new insights into the field of environment health (Niculita-Hirze *et al.,* 2024).

Literature Gap

Past studies show that industrial smoke causes respiratory diseases, however, few have established a link between specific pollutants and the degree of respiratory health degradation in the communities of Cancer Alley. Additionally, real-time health data integration is also usually lacking in existing research as well as the details of disease clusters mapped on a spatial scale. These gaps are addressed by this study, which uses GIS techniques and statistical analysis to study the respiratory disease distribution about pollution levels, providing fresh insight into the public health policies and the environmental justice policy.

Methodology

Study Design

A qualitative, exploratory approach was adopted by this study, which uses inductive analysis of the relationship between industrial emissions and respiratory health in Louisiana's Cancer Alley. The study employs epidemiological and environmental health analysis to evaluate the spatial distribution of respiratory disease clusters with its exposure (Balasubramani *et al.,* 2022). The study attempts to shed light on how industrial emissions impact public health, mainly in communities of low income and minorities most affected by pollution.

Data Collection

The air pollution levels and the prevalence of respiratory disease are studied through secondary data sources.

Air pollution data were obtained from the EPA's Toxic Release Inventory (TRI) and ambient air monitoring stations containing records of industrial emissions containing benzene, sulfur dioxide (SO_2), and particulate matter (PM2.5).

Health data was obtained from hospital records in Louisiana, focusing on respiratory illnesses, hospitalization rates, and mortality trends, including Cancer Alley.

Additional sources of secondary information included peer-reviewed articles, textbooks, and environmental agency reports which provide context on industrial pollution and its impact on public health.

Analytical Techniques

Geographic Information Systems (GIS): Geographic Information Systems (GIS) are used to map disease clusters and determine where these centers are in relation to industry pollutant sources (Quddoos *et al*., 2024). It aids in finding hot spots with high levels of pollution exposure and its prevalence in chronic respiratory diseases.

Thematic Correlation Analysis: A rigorous qualitative thematic approach of putting pollutant exposure patterns with health outcomes.

Results

The analysis identifies several high-risk areas for respiratory disease in Louisiana's Cancer Alley. Asthma, chronic obstructive pulmonary disease (COPD), and lung infection clusters are found using GIS mapping in regions around petrochemical plants and refineries, particularly in St. James Parish, St. John the

Baptist Parish, and East Baton Rouge Parish. Residential addresses within these areas also have a higher-than-average hospitalization rate for respiratory illnesses usually associated with pollution hotspots (Samuels *et al.,* 2022).

The correlation analysis between the industrial emissions and respiratory health outcomes indicates that higher level of benzene, sulfur dioxide (SO_2), and fine particulate matter (PM2.5) are related to increase respiratory morbidity (WHO, 2025b). Higher pollutant concentrations are associated with increased emergency room visits and hospitalization for respiratory illnesses among communities exposed to the highest industrial emission concentrations, which appears to imply a direct relation between industrial emission and public health.

The study also finds that how an environmental threat like smoking, drinking, and exposure to carcinogens impacts low income and minority populations, further raising environmental justice concerns (Smith *et al*., 2022). People who otherwise would never be exposed to toxic air pollutants live in historically marginalized communities, disadvantaged regarding their access to legally secured healthcare, often for prolonged periods. Thus, these results underscore the need for immediate adoption of stronger environmental regulations, emission control policies and public health interventions that could reduce the future health risks from industrial pollution in America's Cancer Alley.

Discussion

This study finds, as past research has suggested, that industrial emissions are significant risk factors for respiratory health. The results align with findings of Grunwell *et al.,* (2022) and Samuels *et al.,* (2022) that the closer one resides to petrochemical plants, the higher the rates of asthma, COPD and other respiratory illnesses. The structure of the given sentence is the same as Tavella *et al.,* (2025) in that the geospatial mapping of disease clusters indicates that residents tend to have higher morbidity rates near pollution hotspots.

The public health and environmental justice implications of these finding are substantial. Low-income and minority communities in Cancer Alley are overburdened in terms of health because they have less access to healthcare and inadequate environmental protection. However, the limitation of the study is its reliance on secondary data. The available health and pollutions data lack real time exposure measurements and with no individual level health tracking. Furthermore, hospital records may also be biased against groups that are not well served publicly with regard to healthcare (Keister *et al.,* 2021). Longitudinal studies, real-time air monitoring, and community-based participatory research should be included in future research because they will enhance the precision of the exposure assessment and the support of policy-driven environmental justice initiatives and, at the same time, will help us to prevent health risks due to air pollution.

Conclusion

Industrial emissions are shown to have a strong association with respiratory disease clusters in Louisiana's Cancer Alley, and areas of high risk near petrochemical plants have seen high rates of asthma, COPD and lung infections. The study also highlights the disproportionate health burden individuals and communities of color and communities experiencing poverty.

To mitigate these risks, stricter air quality regulations and controls over industrial emissions must be implemented. Enhanced environmental monitoring, stricter strategies for emission reduction and better access to healthcare for the affected population are the recommendations of policy. Future research needs to aim at real-time air quality data and dedicated long-term health studies and also find solutions to these important public health challenges in the community.

Future Research Directions

Future research should be based on long term studies on the chronic impact of industrial emissions on respiratory health in Cancer Alley. The incorporation of real time air quality monitoring and individual health tracking will lead to getting more accurate exposures. Furthermore, community based participatory research can inform health risk local to particular populations and develop specific interventions. Ideas for the further studies include policy driven technologies such as emission reduction, stricter environmental regulation and improvement of healthcare accessibility. Additionally, susceptibility to pollution related illnesses can be investigated regarding the effects of genetic and socioeconomic factors on these illnesses to further the efforts in public health planning and environmental justice initiatives.

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