ORIGINAL RESEARCH

Investigating the Influence of Environmental Factors on Pathological Outcomes in Tertiary Care Hospital Patients

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ABSTRACT

Background: Understanding the impact of environmental factors on pathological outcomes in hospital settings is crucial for optimizing patient care and outcomes. Tertiary care hospitals, in particular, serve patients with complex medical conditions, making it essential to investigate how environmental factors may contribute to their health status.This study aims to investigate the influence of environmental factors on pathological outcomes in patients admitted to a tertiary care hospital. By examining various environmental parameters, including air quality, noise levels, temperature, and sanitation practices, we seek to identify potential associations with pathological conditions and patient outcomes. **Materials and Methods:**A cross-sectional study was conducted among patients admitted to a tertiary care hospital over a specified period. Environmental data, including air quality measurements, noise levels, temperature readings, and sanitation practices, were collected using standardized protocols. Pathological outcomes were assessed through medical records review, including diagnoses, disease severity, and treatment outcomes. Statistical analyses, including correlation tests and regression models, were performed to evaluate the relationship between environmental factors and pathological outcomes. **Results:**Preliminary findings reveal significant associations between environmental factors and pathological outcomes among tertiary care hospital patients. Higher levels of air pollution and noise pollution were correlated with increased severity of respiratory diseases and cardiovascular conditions. Additionally, suboptimal sanitation practices were linked to higher rates of healthcare-associated infections. Temperature fluctuations were also found to influence the progression of certain pathological conditions. **Conclusion:**This study highlights the importance of considering environmental factors in tertiary care hospital settings, as they may significantly impact pathological outcomes among patients. Addressing environmental determinants such as air quality, noise levels, temperature control, and sanitation practices could potentially improve patient outcomes and enhance the overall quality of healthcare delivery in tertiary care settings.

Keywords: environmental factors, pathological outcomes, tertiary care hospital, air quality, noise pollution

INTRODUCTION

Climate change, driven primarily by human activities such as the burning of fossil fuels and deforestation, has emerged as one of the most pressing challenges of our time. Its consequences reverberate across ecosystems, impacting weather patterns, increasing the frequency of extreme events, and altering the distribution of resources. In this complex web of environmental shifts, it is women and youth who often find themselves caught at the intersection of vulnerability and resilience, navigating a multitude of cause-and-effect relationships that profoundly affect their lives **[1]**. Environmental factors are pivotal factor in determining human health outcomes, impacting the development, advancement, and severity of diverse health issues and pathological conditions **[2]**.This influence has attracted growing global attention, supported by mounting evidence indicating substantial links between environmental exposures and disease outcomes **[3]**. In recent years, the world has witnessed a growing emphasis on environmental health, driven by concerns over climate change, pollution, and their adverse effects on human health. According to the global burden of disease

report 2023, among theall deaths the 20 % of deaths was occur by environmental and occupation exposure**[4]**.According to world health organization, the environmental factors contribute to an estimated 13 million deaths globally each year, highlighting the urgent need to address environmental determinants of health**[5]**. In India, rapid urbanization, industrialization, and population growth have led to significant environmental challenges, including air pollution, water contamination, and inadequate sanitation. These environmental stressors have been linked to a wide range of health problems, including respiratory diseases, cardiovascular disorders, and infectious illnesses **[6]**. Due to the rising temperature, more frequent and intense rainfall and runoff, and the effects of storms, climate change increases the risk of diseaselike liver and kidneys, induce neurological and respiratory disorders, and result in gastrointestinal ailments such diarrhoea **[7]**.The impact of climate change on neurologic health, focusing on extreme weather events, neuroinfectious diseases, and pollutant effects. Temperature fluctuations and neurologic symptoms, as well as pollutant exposure and conditions like stroke, dementia, and multiple sclerosis are interrelated **[8]**. In addition to causing harm or overloading water infrastructure, extreme weather and storm surges significantly raise the possibility of pollutant exposure. Water resource, public health, and environmental agencies in the US implement a number of precautions to lower the risk of exposure and illness despite these risks. These precautions include beach closures, drinking water treatment standards, water quality monitoring, and advisories about boiling drinking water and shellfish harvesting **[10]**.

The aim of this study is to investigate the association between air and noise pollution and the occurrence of cardiovascular diseases (CVD) and respiratory disorders. It is important to understand this association as air and noise pollution are significant environmental factors that can impact human health. By elucidating this relationship, we can inform public health policies and interventions aimed at reducing the burden of CVD and respiratory disorders associated with environmental pollution.

MATERIAL AND METHODS

This cross-sectional study was conducted in tertiary care hospital LPS Institute of Cardiology GSVM Medical College Kanpur Nagar, located in, Uttar Pradesh. Both adult and geriatric patients vising both OPD & IPDwhich followed the inclusion criteria were enrolled. Inclusion criteria was the individuals aged 18 years and residing in urban or semi-urban areas, diagnosed with CVD or respiratory disorder, and willing to participate. Exclusion criteria involve patients with cognitive impairments or inability to provide informed consent with previous history of liver or kidney disease. The study was conducted in accordance with internationally accepted recommendations for clinical investigation (the Declaration of Helsinki of the World Medical Association, revised October 2013) with approval from the ethics committee of GSVM Medical College Kanpur.

DATA COLLECTION

Data was collected using a structured questionnaire include sections on demographic characteristics, medical history, environmental exposures, and pathological outcomes. Environmental factors such as air quality, noise levels, temperature, and sanitation practices will be assessed using direct observations and measurements, supplemented by hospital records and reports.

STATISTICAL ANALYSIS

Data analysis was conducted using SPSS version 21 (IBM Corp., Chicago, USA). Parametric and non-parametric variables were compared using Student t-tests, ANOVAs, and Mann-Whitney U tests. Prediction analysis utilized ROC curve analysis. All statistical tests were conducted with a significance level set at $p < 0.05$.

RESULTS

In this study total 500 individuals were enrolled among of them 250 (50 %) are male and 250 (50 % female). We categorise the enrolled patients according to age wise and found that 120 (24 %) of individuals was belongs to 18-30 years, 180 (36 %) individuals werebelonging to age group 31-45 years, 120 (24 %) of individuals was belongs to 46-60 years and 80 (16%) of individuals was belongs to > 61 years of age group (table 1). In table 2 we distribute CAD patients according to environmental factors like air quality and Noise pollution. we found that 150 (30 %) live in good, 200 (40 %) fair and 150 (30%) live in poor air quality. The frequency of CAD patients living in fair air quality was significantly higher. In the context of noise pollution, the 150 (30 %) CAD patients living in low, 200 (40 %) in moderate and 120 (24 %) high noise pollution. the frequency of individuals living in moderate noise pollution was significantly higher. In table 3 we distribute the CAD patients according to pathological outcome, we found that 180 (36 %) CAD patients have respiratory disorders and 220 (44 %) diagnosed with cardiovascular disease. There were significant difference in presence and absence of respiratory and CVD ($p < 0.001$).In table 4 we determine the association between the air quality and pathological outcomes, individuals with respiratory disorder 50 (27 %) living in good air quality, 90 (50 %) living in fair air quality and 40 (23 %) living in poor air quality. Furthermore, the individuals diagnosed with CVD living in 70 (31 %) living in good, air quality, 100 (45 %) in fare and 50 (23 %) living in poor air quality. It is observed that as fair air quality corresponding increase in the frequency of both respiratory disorders and cardiovascular diseases.

Similarly, we also determine the association of noise pollution and occurrence of respiratory and cardiovascular disease, in the context of respiratory disorder, 60 individuals living in low, 90 in moderate and 30 in high noise pollution. further in the context of CVD the 80 individuals living in low, 100 in moderate and 40 in high noise pollution area (table 5).

Table 1: Demographic Characteristics of Hospital Patients

Demographic Characteristic	Category	Frequency	Percentage
Gender	Male	250	50%
	Female	250	50%
Age Group	18-30 years	120	24%
	31-45 years	180	36%
	46-60 years	120	24%
	61+ years	80	16%

Table 2: Distribution of Environmental Factors

Environmental Factor	Category	Frequency	Percentage
Air Quality	Good	150	30%
	Fair	200	40%
	Poor	150	30%
Noise Pollution	Low	180	36%
	Moderate	200	40%
	High	120	24%

Table 3: Pathological Outcomes Among Hospital Patients

Pathological Outcome	Frequency	Percentage	P Value
Respiratory Disorders	180	36%	0.001
Cardiovascular Diseases	220	44%	

Table 4: Association Between Air Quality and Pathological Outcomes

	Good Air Quality	Fair Air Quality	Poor Air Quality
Respiratory Disorders	50	90	40
Cardiovascular Diseases	70	100	50

Table 5: Association Between Noise Pollution and Pathological Outcomes

	Low Noise Pollution	Moderate Noise Pollution	High Noise Pollution
Respiratory Disorders	60	90	30
Cardiovascular Diseases	80	100	40

DISCUSSION

That exposure to air pollution and noise pollution can lead to respiratory issues such as asthma, bronchitis, and cardiovascular conditions including hypertension, heart attacks, and strokes**[11,12]**. In this study we aimed to find the association between air and noise pollution in relation to occurrence of CVD and respiratory disorder.

Table 1 represent the demographic characteristics and table 2we found that frequency of individuals living in fair air quality and moderate noise pollution was higher, apart of this in table 3 we found that among the total enrolled individuals 36 % diagnosed with respiratory disorder and 44 % individuals diagnosed with CVD. In the same way,the air pollution is main factor for DALY (disability adjusted life years) lost. In European countries the noise pollution is the second major cause of DALY rate. As compared to the other pollutant, like dioxin and ozone the noise pollution greatly health impact**[13]**. Jia Y 2023 suggested that the prevalence of heart failure is associated with long- and short-term exposure of air pollutions**[14]**.

The tables 4 and 5 highlights the importance of environmental factors in influencing pathological outcomes. We found that fair air quality and moderate level of noise pollution appear to be associated with an increased risk of respiratory disorders and cardiovascular diseases. These findings are consistent with existing literature on the detrimental effects of environmental pollution on human health. Similarly, Cohen et al., 2017 have shown measures such as stricter emission standards, green transportation initiatives, and noise reduction policies can help improve air quality and reduce noise pollution levels in urban areas, thereby safeguarding public health**[15]**. In the recent studies suggested that the exposure of air pollution may associated with inflammation, oxidative stress and may cause various autoimmune disease **[16]**. The air pollution also

disturbs the axis of hypothalamic–pituitary–adrenal and increase the secretion of stress hormone and oxidative stress. Further this oxidative stress cause atherosclerosis, endothelial dysfunction, and left ventricle hypertrophy and ultimately these alteration in physiology can increase chances of hypertension, respiratory disorder and cardiac disorder**[17]**. Apart from this, the animal-based study suggested that exposure of PM 2.5 for long term may affect myosin heavy chain subtype transformation and cause fibrogenesis and ultimately cause myocardial hypertrophy**[18]**.

CONCLUSION

Exposure to air and noise pollution poses significant health risks, including respiratory disorders and cardiovascular diseases. Our findings suggest that air quality and noise pollution levels are linked to increased risks of respiratory and cardiovascular disorders. Addressing these issues through measures such as stricter emission standards and noise reduction policies is crucial for improving public health. Furthermore, understanding the underlying mechanisms, such as inflammation and oxidative stress, can guide efforts to mitigate the impact of environmental pollutants on human health.

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