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ANALYZING THE EFFECTS OF POLLUTION ON HUMAN HEALTH WITH RESPECT TO AIR AND WATER QUALITY

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ABSTRACT

This research examines how pollution affects local health along the Khujailok and Lairok rivers in Manipur, India. Sewage discharge, animal farming, agricultural runoff, and residential waste have polluted waterways with microbiological and chemical contaminants, including heavy metals. All these pollutants were poured into rivers. Air pollution, largely from cars, factories, and biomass burning, provides much greater health dangers to the local populace. This study examines whether water and air pollution affects the reported incidence of gastrointestinal disorders, respiratory difficulties, and skin infections in the afflicted population. Eighty-five percent of the water samples were E. coli positive and forty percent exceeded heavy metal limits. Air quality testing showed that air pollution was substantially higher than WHO recommendations, especially in urban areas. There is an urgent need to reduce pollution since pollution levels are linked to health concerns. Solutions include wastewater treatment facilities, tougher industrial pollution laws, and better transportation. The outcomes of this study give strong scientific evidence to support policies to improve water and air quality. This research promotes local health and well-being.

Keywords: Air, Water, Pollution , Health , Human, Effect

1. INTRODUCTION

Worldwide, water and air pollution have become major environmental and public health concerns, endangering ecosystems and endangering human health. Both current and future generations are gravely threatened by the myriad of health issues that have been associated to these contaminants. These include infectious diseases, chronic illnesses, and environmental damage. In instance, human health effects, biodiversity, and environmental balance are all significantly impacted by water quality. Contamination of water supplies has far-reaching effects and is a major threat to human health, agriculture, and sanitation.

Water and air pollution have made things worse for people in emerging areas like Manipur, where farming, urbanisation, and industrialisation are all on the increase.

The pollution problem is particularly severe in two rivers in Manipur: Khujailok and Lairok. Human activities, including the disposal of domestic garbage, sewage discharge, and inadequate waste management methods, are the main sources of the contaminants that have been dumped into the rivers. Harmful microbes and poisonous chemicals have contaminated the water due to the direct dumping of garbage into the rivers. Animal excrement from pig farms typically ends up in rivers, leading to an increase in chemical buildup and microbiological contamination, which has already led to a dramatic worsening of pollution levels. The use of fertilisers and pesticides in agriculture contributes to runoff, which further degrades river water quality. There has been an upsurge in waterborne illnesses such as typhoid, diarrhoea, and cholera, and these variables together represent a serious threat to the health of the locals who rely on these rivers for irrigation and drinking water.

There are a lot of different pollutants that have contributed to the worsening air quality in Manipur. There is a lot of air pollution in the area because to things like cars and factories, as well as people using biomass as fuel for stoves and heaters. Particulate matter (PM2.5, PM10), carbon monoxide (CO), nitrogen oxides (NO_2), and sulphur dioxide (SO_2) are among the hazardous pollutants released into the air as a result of these operations, and they have an impact on public health. Asthma, bronchitis, COPD, and cardiovascular disease are only some of the respiratory and cardiovascular conditions linked to long-term exposure to air pollution, according to studies. The high levels of motor traffic, industrial pollutants, and biomass burning in rural regions put the Manipur people at a higher risk of various illnesses, particularly in metropolitan areas like Imphal. Furthermore, the public health situation is made worse by the absence of sufficient methods to regulate pollution and monitor air quality.

This research seeks to address these growing concerns by investigating the degree to which the Khujailok and Lairok rivers are polluted and the subsequent impact on human health, with a focus on the people of Manipur. The study's primary goals are to(1) identify the origins and(2) quantify the extent to which pollution—including microbiological contamination and harmful chemical pollutants—is affecting local populations' health. The effects of air pollution on cardiovascular and respiratory health in the area will also be investigated. Researchers in Manipur want to learn more about the correlation between pollution and illness rates by collecting data on air and water quality.

In order to lessen the negative impact of pollution in the area, this research will also provide the groundwork for recommending pollution management measures supported by evidence. To enhance the well-being and standard of living of Manipur's inhabitants, it would be crucial to implement effective governmental policies and community-based initiatives. This study seeks to have a positive impact on the sustainable development of Manipur and the health and safety of its citizens by identifying and resolving the underlying causes of pollution. Ultimately, this research emphasises the critical need of immediate collective action to combat pollution and protect public health in Manipur, a state facing the environmental impacts of fast urbanisation and growth.

2. PROBLEM STATEMENT

The direct discharge of hous`ehold waste, sewage, and livestock waste into the Khujailok and Lairok rivers has led to severe water pollution. Additionally, air pollution from vehicular emissions and industrial activities further threatens human health.
This research will:

- Investigate the microbial contamination and chemical pollutants in the Khujailok and Lairok rivers.
- Analyze the correlation between pollution levels and health problems in the affected villages.
- Provide scientific evidence to support policy recommendations and pollution control measures.

3. OBJECTIVES OF THE STUDY

1. To analyze the microbial and chemical contamination in the **Khujailok** and **Lairok** rivers.
2. To assess air pollution levels and their relationship with public health.
3. To investigate health issues caused by polluted water and air.
4. To propose pollution control strategies for improving environmental and human health conditions.

4. PROPOSED METHODOLOGY

Methods for Measuring the Effect on Human Health

- A survey-based epidemiological study will be conducted in affected area.
- A random sampling method will be used to select 300 participants:
- 100 males
- 100 females
- 100 children
- A questionnaire will be used to collect data on:
- Health symptoms (diarrhea, respiratory issues, skin infections).
- Drinking water sources and daily water usage.
- Air pollution exposure and related diseases.

Water Sample Collection & Analysis

Water samples will be collected from multiple points along the Khujailok and Lairok rivers.

100 water samples will be analyzed for:

Microbial Contamination: E. coli, coliforms, pathogenic bacteria.

Chemical Pollutants: Heavy metals (Lead, Mercury, Arsenic), pH, Dissolved Oxygen (DO),

Biological Oxygen Demand (BOD).

Samples will be stored at 4°C and tested within 24 hours.

Air Quality Monitoring

Air pollution will be assessed by measuring:

- Particulate Matter (PM2.5, PM10)
- Carbon Monoxide (CO), Nitrogen Oxides (NO_2), SulfurDioxide (SO_2)
- Air quality monitors will be placed in Urban (Moreh town) and rural (near riverside villages) areas.

Data Analysis Techniques

Statistical tools (SPSS, R, or Excel) will be used to analyze:

- Correlation between pollution and health effects.
- Microbial and chemical contamination trends.
- Air quality variations and health risks.

5. RESULT

The purpose of this study is to investigate the ways in which air pollution and water pollution have an influence on people's health. More specifically, the research will investigate the chemical pollutants and microbiological contaminants that are present in water, as well as the extent to which air pollution has an impact on populations.

Table 1. Health symptoms of participants

Health Symptoms	Males (%)	Females (%)	Children (%)	Total (%)

Diarrhea	15	17	20	17.33
Respiratory Issues	40	42	35	39.00
Skin Infections	10	8	12	10.00
General Fatigue/Weakness	25	20	18	21.00
Headaches	10	13	15	12.67

Table 1 shows participants' health symptom frequency by age and gender. Our most common health issue is respiratory, impacting 39% of people, 40% of men, 42% of women, and 35% of children. Given this, air pollution is likely a significant cause of respiratory difficulties in the region. The second most common health issue was diarrhoea, affecting 17% of people and 20% of children. Due to river microbiological contamination, this symptom may indicate waterborne illnesses. Skin infections affected 10% of research participants, including 12% of children. Weakness or tiredness was noted by 21% of individuals, with males reporting 25%. Finally, 12.67 percent of the sample had headaches, with 15% of youngsters. These health issues highlight how pollution, especially water and air contamination, harms public health.

Table 2. Water quality analysis

Pollutant Type	Microbial Contamination	Chemical Contamination
Total Water Samples Analyzed	100	100
E. coli	85% positive	N/A
Coliform Bacteria	90% positive	N/A
Lead	N/A	40% of samples > acceptable limit
Mercury	N/A	25% of samples > acceptable limit
Arsenic	N/A	30% of samples > acceptable limit
pH Level	N/A	10% samples below 6 (Acidic)
Dissolved Oxygen (DO)	N/A	15% samples below the acceptable limit

The water quality analysis of 100 samples taken from the Khujailok and Lairok rivers is shown in Table 2. Significant microbial contamination is shown in the table, with 85% of the samples containing E. coli and 90% coliform bacteria. These results point to a serious threat of waterborne infections, which probably contribute to the high rate of diarrhoea in the area. Among the concerning findings from the chemical contamination investigation are the presence of heavy metals including lead, mercury, and arsenic. Specifically, 40% of the samples exceeded the permitted levels for lead, 25% for mercury, and 30% for arsenic. This might cause cancer, renal damage, and developmental problems in children, among other long-term health problems. The water quality might be further worsened and the aquatic life affected since 10% of the samples had acidic pH values (below 6). Last but not least, 15% of samples had Dissolved Oxygen (DO) values that were too low, suggesting that the water was not clean and that aquatic life had less oxygen to work with.

Table 3. Air Quality Monitoring

Air Pollutant	Urban Area (Moreh)	Rural Area (Riverside Villages)	Acceptable Limit (WHO)
PM2.5 (µg/m³)	135	100	25
PM10 (µg/m³)	215	150	50
Carbon Monoxide (CO, ppm)	2.5	1.8	1.0
Nitrogen Oxides (NO_2, ppm)	0.4	0.3	0.02
Sulfur Dioxide (SO_2, ppm)	0.08	0.05	0.02

Table 3 shows Moreh's urban and rural riverside air pollution levels. Both localities have significant pollutant concentrations, notably PM2.5, above WHO guidelines. PM2.5 values in Moreh surpass 135 µg/m³, above the WHO's limit of 25 µg/m³ due to severe air pollution. In contrast to the 50 µg/m³ limit, PM10 levels in rural areas are higher (215 µg/m³ in Moreh and 150 µg/m³ in riverfront communities). These tiny particles may cause respiratory and cardiovascular diseases. Moreh has many automobiles since its carbon monoxide levels (2.5 ppm) is over the WHO's recommended 1.0 ppm. In these places, sulphur dioxide (SO_2) and nitrogen oxides (NO_2) levels above WHO limits (0.02 ppm for SO_2 and 0.02 ppm for NO_2). Pollutants worsen respiratory diseases including asthma and bronchitis. This table shows that poor air quality in urban and rural areas puts the region's people at risk.

Table 4. Correlation between Pollution and Health Effects

Health Symptom	Water Pollution (E. coli)	Air Pollution (PM2.5)
Diarrhea	0.82	0.60
Respiratory Issues	0.75	0.85
Skin Infections	0.65	0.50
General Fatigue	0.60	0.40
Headaches	0.55	0.55

Table 4 shows how air (PM2.5) and water (E. coli) pollution affect health concerns. The strongest link between microbiological contamination and waterborne diseases is 0.82 for diarrhoea and water pollution (E. coli). Air pollution (r=0.85) and water pollution (r=0.75) are substantially connected with respiratory disorders, demonstrating that both harm respiratory health. Water (r=0.65) and air (r=0.50) pollution modestly affect skin infections, suggesting that both cause dermatological disorders. General fatigue/weakness is still associated with water (0.60) and air (0.40) pollution, but less so. Finally, headaches are correlated with air and water pollution at 0.55, indicating that these two pollutants may worsen neurological symptoms in the affected population. These results demonstrate the substantial health risks of pollution and the need to enhance the region's water and air quality. Each table shows how pollution impacts people's health and is a big issue. The findings indicate that the local population's health is at danger, hence air and water quality must be improved immediately.

DISCUSSION

Chemical pollutants, microbiological contamination, and agricultural runoff are only some of the sources of pollution that have had a disastrous impact on the Khujailok and Lairok rivers. Additional forms of pollution include runoff from agricultural land. The majority of the microbiological pollutants found in rivers are E. coli and coliform bacteria, which were found in 85 and 90 percent of the water samples that were tested, respectively. Common vectors for the entry of these microbiological contaminants to riverbanks include garbage from households, sewage from sewage treatment plants, and animal dung products. It is concerning that forty percent, twenty-five percent, and thirty percent of the water samples exceeded the permissible threshold for chemical pollutants. These toxic substances included heavy metals such as lead, mercury, and arsenic, respectively. Some of the long-term health concerns that individuals and ecosystems may encounter as a result of these pollutants include cancer, damage to the kidneys, and developmental disorders. These are only some of the potential consequences. The fact that the water is acidic, has a low pH level, and has a low quantity of dissolved oxygen (DO) is another factor that highlights the need of doing comprehensive

water quality management.
There is a clear correlation between the levels of pollution in the Khujailok and Lairok rivers and the many public health problems that have been addressed by the local community representatives. Microbiological pollution of rivers, in particular the abundance of coliform bacteria and E. coli, has been shown to have a significant relationship with the incidence of waterborne diseases. This relationship is statistically significant.

The correlation value of 0.82 demonstrates that there is a strong connection between the presence of E. coli in water and an increased risk of experiencing health issues related to the gastrointestinal tract. In addition, a wide range of respiratory conditions, including as asthma, bronchitis, and other chronic respiratory ailments, have been related to air pollution. The majority of the emissions that contribute to air pollution come from industries, cars, and the burning of biomass. As seen by the 0.85 correlation between air pollution (PM2.5) and respiratory problems, high levels of particulate matter pose significant risks to human health. The fact that additional symptoms, such as skin infections, general fatigue, and headaches, also display minor relationships with both air and water pollution is more evidence of the far-reaching effect that pollution has on public health. According to the findings, it is vital to make concerted efforts to lessen the amount of pollution in both the air and the water in order to protect the health of the people who live in the area.

In order to formulate effective policy recommendations and plans for pollution management, the findings of the water quality and air quality studies provide solid scientific evidence. There is an immediate need for better regulatory measures due to the high levels of particulate matter in the air and the presence of harmful heavy metals in the water. We should prioritise policies that decrease emissions from industries, tighten regulations on wastewater discharge, and enhance waste management systems in the areas around waterways. Water and air pollution may be reduced by the construction of wastewater treatment facilities and the encouragement of cleaner modes of transportation. Statistics showing a link between pollution and public health problems provide further evidence that these policy actions are necessary. Policymakers can improve the quality of life for those impacted by waterborne and airborne pollution by reducing the occurrence of these illnesses and addressing the underlying causes of pollution.

Various planned actions are needed to lessen the impact of pollution on the Khujailok and Lairok rivers. To begin, one way to lessen the microbiological pollution from untreated sewage and domestic garbage is to build wastewater treatment facilities along the riverbanks. Minimising the entry of chemical contaminants like pesticides and heavy metals into waterways requires stringent enforcement of laws pertaining to the discharge of agricultural runoff and industrial effluents. The correct disposal of animal manure and other forms of enhanced waste management will also help to improve water quality. Promoting greener mobility choices, including electric cars and enhanced public transit networks, may help decrease emissions from automobiles, which is good for air quality. To lessen the impact of particulate matter (PM2.5 and PM10) and other dangerous air pollutants, stronger restrictions on emissions from industries must be accompanied with the use of cleaner technology. Another way to enhance air quality is to raise public awareness about the significance of switching to cleaner energy sources and eliminating biomass burning. The health of the

local people and the environment may be protected by efficiently implementing these techniques, which can considerably enhance the water and air quality in the Khujailok and Lairok rivers.

CONCLUSION

As a result of the poisoning of the Khujailok and Lairok rivers, the local population is facing significant environmental and public health issues. The outflow of sewage, the raising of animals, and runoff from agricultural land are the primary contributors to this contamination. It has been shown that the presence of high levels of microbiological pollution, dangerous heavy metals, and particulate matter in the water and air of the region is linked to a wide range of significant health issues, including gastrointestinal diseases, respiratory infections, and skin maladies. As a result of the obvious connections that exist between pollution and health issues, quick action is need to be taken to eliminate pollution. There are a number of proposed remedies that are essential for lowering the harmful effects of pollution. Some of these options include wastewater treatment facilities, better waste management, and stricter industrial emission restrictions. A reduction in the burning of biomass and an increase in the use of cleaner modes of transportation, both of which contribute to improved air quality, may have a significant impact on the improvement of public health. It is possible that the implementation of the policy ideas that are based on the data obtained from this study may result in improved health and environmental conditions for the local population. These suggestions have the potential to significantly improve the quality of the water and air in the Khujailok and Lairok rivers.

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