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Review Article

Role of air quality index in maintaining ecological sustainability in areas affected by low air quality

Shivam Dubey  ¹*

¹Rani Durgavati Vishwavidyalaya, Jabalpur, Madhya Pradesh, India



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ABSTRACT

In the current scenario, numerous ecological and biological imbalances have arisen because of poor air quality. The primary driver of air contamination is supposed to be businesses and autos. The air quality is getting worse in the areas, which have a shorter life expectancy and a significant threat to the existing biodiversity. Air contamination is currently completely recognized to be a critical general medical condition, liable for a developing scope of well-being impacts that are proven and factual from the consequences of a broad examination exertion led in numerous locales of the world.

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1. Introduction

While there is no question that fast urbanization implies that we are currently presented with undesirable fixations and a more different assortment of surrounding air poisons, palaeopathological research recommends the issue, as smoke, torments our most seasoned progenitors. It mostly affects people who live in big cities, where road emissions are the biggest cause of poor air quality. There is likewise a risk of modern mishaps, where the spread of a harmful haze can be deadly to the populaces of the encompassing regions. Numerous factors, most notably atmospheric stability, and wind, influence the dispersion of pollutants.¹ Air pollution has a vast range of ill effects on our health. Even on days with low levels of air pollution, vulnerable and sensitive individuals' health can be affected. Cough, shortness of breath, wheezing, asthma, respiratory disease, and high rates of morbidity are all closely linked to short-term exposure to air pollutants. Chronic asthma, pulmonary insufficiency, cardiovascular diseases, and cardiovascular mortality are the long-term effects of air pollution. Long-term exposure

to air pollution appears to cause diabetes, according to a Swedish cohort study.² In addition, air pollution appears to cause respiratory, cardiovascular, mental, and perinatal disorders,³ which can lead to infant mortality or chronic illness in adulthood.¹ The United Nations Climate Change Committee's 2016 Paris Agreement is a more recent international agreement that is crucial to the fight against climate change. Numerous nations belonging to the United Nations and the European Union ratified this most recent agreement. As a result, parties should advocate for initiatives that improve a variety of aspects related to the topic. According to the Paris Climate Change Agreement (2016), some of the relevant actions for maximizing the opportunities to achieve the targets and goals on the crucial issue of climate change and environmental pollution include boosting education, training, public awareness, and participation. Most assuredly, mechanical upgrades make our reality more straightforward and it appears to be challenging to decrease the destructive effect brought about by gas discharges, we could restrict its utilization by looking for solid methodologies.

* Corresponding author.

E-mail address: shivamdubey20@gmail.com (S. Dubey).

2. Discussion

In India, air contamination is at an untouched high where the air quality arrives at unsafe levels, and perilous air contamination is recorded. One of the primary habitats of dirtied air in India is the National capital, New Delhi. Due to the diminished visibility caused by air pollution, flights into and out of New Delhi International Airport (also known as Indira Gandhi International Airport) are frequently postponed. Due to the rapid industrialization, urbanization, and rise in the use of motorcycle transportation, pollution is occurring in both rural and urban areas of India. In any case, biomass burning related to warming and cooking needs and practices is a significant wellspring of family air contamination in India and Nepal.^{4,5} As per few investigations, there is spatial heterogeneity in India because areas with varying populations, education levels, and climatological conditions produce varying indoor air quality. For example, North Indian states have been found to have higher levels of PM_{2.5} (557–601 g/m³) than Southern Indian states (183–214 g/m³). This may be primarily due to the cold climate of North India, where people spend longer periods at home and require more heating than in the tropical climate of Southern India.^{6,7} In India, household air pollution has a significant impact on health, particularly for pregnant women and young children who spend more time indoors. Women are more likely to suffer from chronic obstructive pulmonary disease and lung cancer, while young children under the age of five are more likely to suffer from acute lower respiratory disease.⁸ Without a doubt, kids are especially defenceless against air contamination, particularly during their turn of events. Air contamination antagonistically affects our lives in a wide range of regards. Due to absences from productive work and school, diseases caused by air pollution have an impact not only on the economy but also on society. A successful solution could be envisioned as a close collaboration between authorities, bodies, and doctors to regularize the situation, despite the difficulty of eliminating the problem of anthropogenic environmental pollution. To successfully control the problem's emergence, governments need to disseminate sufficient information, educate citizens, and involve professionals in these issues. In addition to the well-documented effects on respiratory and cardiovascular health, a growing number of studies have explored the possibility that PM air pollution could harm several new health outcomes. We currently have proof connecting long-haul openness to PM_{2.5} with unfavourable birth results, while rising information proposes potential impacts of long-haul PM_{2.5} openness on diabetes, neurodevelopment, and mental capability. The increasing number of studies that link maternal exposure to air pollutants, including particulates, during pregnancy to a variety of birth outcomes is particularly intriguing due to the crucial period of biological development and the potential for long-term

health effects.

Even though air quality has improved in the past, a lot of people in urban areas still breathe air that does not meet European standards or the World Health Organization's Air Quality Guidelines. It ought not be astonishing subsequently that the wellbeing impacts of PM — one of the poisons considered generally risky to well-being — are indisputable. The topic of airborne particulate matter (PM) has been the subject of extensive research and debate all over the world for several decades. As a result, the body of evidence supporting the connection between short- and long-term PM exposure and cardiopulmonary mortality and morbidity has grown significantly. Considering the well-established links between ambient PM and adverse health effects, a significant effort has been made to determine the components of ambient PM that have an impact on health. This information will help policymakers decide how to best legislate for cleaner air. Throughout the past few years, several critical reviews have been written on relative toxicity. Despite this, the general conclusion that can be drawn from the current database of experimental and epidemiologic studies is that it is impossible to identify specific characteristics or sources as being crucial for toxicity.

Numerous research fields, including population exposure, observational epidemiology, controlled exposure studies, animal toxicology, and in vitro mechanistic work, have found that modern-day ambient pollutants not only have a greater impact on established health endpoints but are also associated with a wider range of disease outcomes over the past ten years. This brief review article draws on findings from international projects,^{9,10} Health Effects Institute research reports,^{11–13} authoritative reviews,¹⁴ and significant individual publications to summarize the increased health risks that have emerged from PM air pollution research in recent years. We have also discussed about the connection between the growing body of risk evidence and the level of public awareness and comprehension of the issue at hand. For sure, engaged schooling and proceeding with the development of complex data frameworks can accomplish a sturdy change in open mentality and conduct, in a way that works on individuals' well-being as well as the nature of the air they relax. Understanding, perception, and vested interest are likely to be factors governing individuals' awareness of the quality of their air and potential repercussions for their health, in addition to the availability of sufficient information, which will be discussed in the following section. Due to a lack of comprehension of the complex science, individuals may choose not to be concerned about air quality. Overall air quality encompasses several primary pollutants as well as secondary products resulting from atmospheric transformation, in contrast to other environmental risks that are frequently communicated, such as ultraviolet light

and heat. Provincial regions for instance are frequently viewed as protected spots to escape from contamination. However, due to the lower concentrations of nitrogen oxides used to sequester rural O₃, O₃ concentrations can sometimes be as high as or higher than in urban areas. Because they are less likely to have any personal experience of the benefits that reducing pollution and/or increasing medication may bring, "healthy" people may also lack a vested interest in the subject. To be sure, where exploration has shown that people know about air quality alerts and make responsive moves, bigger reactions were noticed for additional vulnerable gatherings or carers thereof.^{15,16} 31% of adults in a cross-sectional study of 33,888 adults who took part in the Behavioural Risk Factor Surveillance System in 2005 had asthma, while 16% had not altered their outdoor activity in response to media alerts.¹⁶ According to Shooter and Brimblecombe,¹⁷ attitudes and behaviours can be influenced by a person's own understanding and immediate locality rather than accurate data generated by monitoring sites and communicated via an advisory service. Perception is another factor influencing the public's understanding of the importance of healthy air. A few examinations have researched the connection between saw and estimated outside air quality given by checking stations and while certain investigations tracked down a huge relationship between the impression of air quality and explicit air toxins,¹⁸ others have tracked down practically no affiliation.¹⁹ Relevantly, Semenza et al.²⁰ not only reported a low level of behavioural change during an air pollution episode—between 10 and 15 percent—but also that the response was driven more by the individual's perception of poor air quality than by the advisory service. Self-reported health status has also been linked to perceived air pollution rather than measured air pollution, according to some epidemiological researchers.^{21–23}

3. Conclusion

Due to its impact on climate change and public and individual health due to rising morbidity and mortality, air pollution is one of the greatest threats of our time. Numerous pollutants significantly increase the risk of disease in humans. In general, ambient concentrations of ground-level ozone and particle pollution are the main global drivers of ambient air quality and the Air Quality Index. Estimating the quantity of emissions from pollution sources and, more precisely, the total number of pollutants in the air can be used to estimate the quality of the air at any location. Variations in weather patterns, time of day, location, and season can all affect air quality. One of the main constituents of air pollution is particulate matter, which enters the respiratory system through inhalation and has a variable but extremely small diameter. It causes cardiovascular diseases, reproductive and central nervous system dysfunction, and cancer. In the stratosphere, ozone

shields against ultraviolet light, but when it is present in high concentrations at ground level, it can also harm the respiratory and cardiovascular systems. In addition, it cannot be denied that dioxins, polycyclic sweet-smelling hydrocarbons, nitrogen oxide, sulphur dioxide, unstable natural mixtures, and other air pollutants pose a threat to human health. When taken in at significant levels, carbon monoxide could cause harm by direct ingestion. Significant metals like lead, when consumed into the human body, can provoke direct hurting or consistent intoxication, dependent upon receptiveness. In addition to cardiovascular events, central nervous system malfunctions, cutaneous diseases, and respiratory conditions like C.O.P.D., asthma, bronchiolitis, and lung cancer, the substances primarily cause these conditions. Finally, the geographic distribution of numerous infectious diseases is affected by both natural disasters and climate change caused by environmental pollution. The emergence of this threat must be addressed and sustainable solutions must be proposed by international and national organizations. The only way to address this issue is through public awareness and a multidisciplinary approach by scientists. People's daily activities and mobility will also affect their exposure and inhalation of air pollution, which can change a lot in a short amount of time and over short distances. Air quality warnings, like the Air Quality Index, are used in many industrialized nations to notify the public when air quality is expected to have an impact on the health of vulnerable people, such as those with complex heart and lung conditions. Additionally, several studies have found that children are more vulnerable than adults to the negative impacts of air pollution. Any location should maintain its Air Quality Index to counter these impacts. It is a simplified nationwide communication platform for air quality forecasting and measurement. Additionally, the Air Quality Index data should be used to inform the public about air pollution. This index creates a composite overall index for locations and times by representing the integrated data of chosen contaminants. The index's algorithm produces a spectrum of values and colour classifications that represent the public's efforts to reduce the risks of air pollution and the likelihood of health hazards. This makes it possible for people to take proactive measures to safeguard their health and encourage active living. Patients can anticipate their exposures based on activity and location with the use of the index. It does not, however, provide recent data on the toxicity or composition of chemicals. Therefore, to improve the algorithm, policymakers might also think about including a toxicity matrix of tiny particles, such as oxidative potential. Moreover, contrary to the AQI's recommendation, the risk is typically expressed in numerical form rather than colour. The Air Quality Index is a useful tool for advising high-risk patients to cut back on or reschedule their vigorous outdoor activities to minimize exposure to air pollution and associated health risks.

Consequently, fixed-site monitoring stations will always have a limited range of A.Q.I. and alert system locations, spacing, and density. Until recently, researchers evaluating individual exposures in vulnerable groups like cyclists,²⁴ and asthmatic children²⁵ used personal pollution monitors primarily in industries with high occupational exposures. According to Austin,²⁶ the use of inexpensive, portable, and straightforward personal monitoring devices is beginning to increase. Even though the information generated by such sensors is currently not of a quality that is robust enough to complement data for official monitoring networks, there is unquestionably a requirement for more dynamic measures of time-activity patterns about exposures. This is the case even though there is a need for them. To better understand the effects of harmful air pollutants in real-time, the US Environmental Protection Agency awarded a \$100,000 prize to the creators of a low-cost wearable breathing analysis tool that calculates the amount of polluted air a person breathes and transmits the data to any Bluetooth-enabled device, such as a mobile phone.²⁷ Most people could benefit from dynamic, spatially, and temporally more precise exposure measurements if low-cost air quality sensors were integrated into smartphone technology. These phones have unparalleled penetration in demographics, geographic coverage, acceptance, and everyday presence in addition to their widespread technology.²⁸ Because of this, it is now possible to communicate individual exposure and activity data tailored to commuter and residence locations. In the biological investigation setting, novel phone-based programming that records a population's turns of events and dynamic work levels in the metropolitan environment and is composed of spatial-transient aids of air pollution is at this point being made to redesign tremendous extension air tainting transparency data grouping in a wise, exact unobtrusive way.²⁹ It is sure that different sorts of intercessions should be thought about because of the greatness of the effect on general well-being. There have been reports of achievement and adequacy in controlling air contamination, especially at the nearby level. Considering the nature and wellspring of the emanation, as well as its impact on well-being and the climate, satisfactory mechanical measures are utilized. The significance of controlling air contamination from both point sources and non-point sources was talked about by Schwela and Köth-Jahr.³⁰ A comprehensive inventory of emissions requires the recording of every source in each region. In addition to the sources and their nature, topography, and meteorology should also be taken into consideration. The evaluation of control strategies and policies is frequently extrapolated from the local to the regional and then global levels. Pollution in the air can spread from one region to another, which is further away. Air contamination across the board refers to the reduction to safe levels or possible elimination of air pollutants whose presence in the air has an impact

on our health or the ecological biological system. To ensure the quality of the air, private and public entities as well as experts carry out activities.³¹ Standards and guidelines for air quality for various pollutants were established by W.H.O. and E.P.A. as a means of controlling air quality.^{32–35} According to the National Research Council, these principles should be contrasted with the norms of the outflow stock to identify the hazardous regions. Most of the time, inventories are based on a mix of direct estimates and outflows.³⁶ Raising public awareness necessitates the most efficient monitoring, forecasting, and reporting of air pollution. As per Kelly et al.³⁷ numerous countries have air quality observing organizations that are coordinated around every country's administrative commitment to report checked air quality information and displayed forecasts.

A Public Air Quality Record is also created using yield from estimated contamination groups, air quality displaying systems and meteorological information. By national legislation, an A.Q.I. indicates the probable levels of pollution and adverse health effects on the day or days following the index's description. General society and associations, (for example, well-being administrations and legislatures) utilize this information to diminish the adverse consequences of anticipated air contamination on well-being. People who are susceptible to high levels of pollution may be prompted to take actions (reduce exposure and/or increase the use of inhaled reliever medication) to reduce their symptoms during times of poor air quality. For instance, the public may be encouraged to take public transportation rather than private vehicles during times of poor air quality. Accessible air pollution alert services, such as the London Air Quality Network and the City of London, provide registered users with real-time data and proactive alerts of upcoming pollution events via a computer or tablet (via websites, email, social media, and apps) or smartphone. Users can sign up for user groups (such as cyclists, joggers, businesses, and at-risk) and be notified when pollution levels at a site or sites reach their desired levels. These are becoming increasingly interesting and informative. While checking, deciding, and uncovering air quality have become continuously refined and exact, the future use of more individualized transparency assessments holds fundamentally more potential. For the current approaches to improving air quality, an estimation of the economic value of the benefits derived from the proposed programs is required. The guidelines and programs that these public authorities have proposed must be followed. International cooperation in research, development, administration policy, monitoring, and politics is necessary for effective pollution control at this point. Regulation concerning air contamination should be refreshed and adjusted, and policymakers should recommend the plan of an amazing asset for safeguarding well-being and the climate. Consequently, the main idea of this essay is that we should

develop local structures that encourage experience and practice to develop effective international policies for the sustainable management of ecosystems. If people are aware of variations in the quality of the air they breathe, the health effects of pollutants, concentrations that are likely to have negative effects, and actions to reduce pollution, changes in individual behaviour and public policy are more likely to occur. This mindfulness, thus, can prompt a better populace and a cleaner climate.

4. Source of Funding

None.

5. Conflict of Interest

None.

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Author's biography

Shivam Dubey, Research Scholar  <https://orcid.org/0000-0002-2704-4260>

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