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Impacts of Climatic Changes and Air Pollution on Public health and Environment

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Abstract

Air pollution is an emerging highlight in developing countries in changing climate, it is considered one of the greatest concerns of public, individual, and environmental health. The rate of mortality and morbidity seems to increase due to air contamination. There are many types of air pollutants, some of the major air pollutants are particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and lead (Pb). PM are minute suspended particles that can inhaled while breathing and cause cardiovascular and respiratory disorders, nervous system diseases, and cancer. High levels of CO inhalation cause poisoning in humans. Nitrogen oxides are latent greenhouse gases with high global warming potential and deplete the ozone layer. SOx causes intoxication when absorbed by the human body. When lead is absorbed by the human body by inhalation it may cause toxicity, chronic obstructive pulmonary disease, asthma, and lung cancer. Thereafter air pollution and changing climate lead to the spread of many infectious diseases. Hence, the way to manage this problem of air pollution is to make the public aware of impacts and management practices. The scientific and medical experts should conduct multidisciplinary research at the national and international level to sort out this problem in a sustainable way.

Keywords: Air Pollution, Climate change, Disease, Public Health, Environment.

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1. Introduction

The human's interactions with their surroundings have been widely studied, as every human activity effects the environment. The combination of the biotic (living creature) and the abiotic (non-living things) is known as environment.

The induction of any unwanted substance which is harmful for humans and living organisms is known as pollution. These may be solid, liquid or gaseous form of pollution which harms the life and effects and deteriorate the quality of environment.

Ecosystem is affected adversely because of the pollution cause by human action. Excessive amount of air pollutants generated due to industrial revolution causing severe damage to public health, undoubtedly environmental pollution become multilateral public health concern on international level. The air pollution issue is significantly linked to social, economic, and legal issues as well as choices of lifestyle. Without a doubt, universal urbanization and industrialization are intensifying to previously unheard-of and unsettling levels in our day and age. Air pollution by human activities considered as one of the biggest public health concern, as estimated about 9 million fatalities annually.[1]

Public have been effected by air pollution in different ways. Even the sensitive peoples are get infected by mild air pollution. Wheezing, cough, respiration problems and asthma will be caused due to short term exposure of air contamination whereas the condition become more chronic when exposed for longer period of time, it cause serious health injuries like cardiac disorder and mortality, chronic asthma and pulmonary inefficiency. The recent studies have find out that long-term exposure to polluted air may leads to diabetes.[3] Additionally, it appears that early-life exposure to air pollution causes a variety of harmful health outcomes like respiratory, heart, mental, and perinatal illnesses in adults and babies which may leads to death.[4,2].

Large metropolitan areas are the main victims of air pollution, as vehicular emanations being the main cause of the declining of air quality. Additionally, due to the risks causes by industrial mishaps, in which the local inhabitants could perish due to the blowout of a toxic cloud. Numerous factors influence the dispersion of contaminants, but atmospheric stability and wind speed are the most important ones.[4] The problem will be huge with increasing industrialization, overpopulation and uncontrolled urbanization in developing countries. This leads to bad weather conditions, especially in countries where inequality and lack of knowledge about sustainable environmental management exist. Due to low income, the use of fossil fuels like wood oil or electric fuel to meet the family's needs causes bad, polluted air in people's homes. In fact, 3 billion people worldwide use this resource for heating and cooking every day.[5, 6]

The incidence of lung cancer witnessed in China is connected with fine aerosols.[12] It is mentioned before, long-standing trauma can have damaging effects on the cardiac system.[7,3] But it's important to remember that heart disease is more common in high-income countries than in low-income countries and average recipients exposed to life-threatening weather conditions.[8] Pollution, particularly sulfur dioxide and smog accumulation of up to 1,500 mg/m_3, caused further deaths in London in December 1952 (4,000 deaths) and in New York City (400 deaths) in 1963.[9]
It is clear that different types of strategies need to be adopted depending on the severity of the public health problem. In particular, it is reported that pollution control in the region is successful and efficient. Assess the location and nature of emissions and their impact on health and the environment and take appropriate action. Climate control means reducing to acceptable levels or possibly eliminating pollutants in the atmosphere that affect our health or the ecosystems around us. Private and public institutions and organizations work to ensure clean and healthy air quality.[10] World health organizations and environmental protection agencies set emission standards for different pollutants from various sources which are used as air quality mitigation tools.[1,11]
In this article, we concern with the sources of air pollution affecting public health, presenting some solutions and interventions that may benefit people's environmental legislation and policy makers.

Changing Climate and Air pollution

Air pollution is strongly interlinked with climate change.[12] Contaminants like black carbon, methane, tropospheric ozone and aerosols can affect solar radiation. As a result, the Earth's temperature is increasing, causing melting of ice and glaciers. In this case, climate change will affect the emergence and occurrence of enduring and imported diseases in Europe. Climate and climate affect the timing, duration and severity of epidemics and change the global epidemic map.[13] Parasitic diseases or mosquito-borne diseases are sensitive to climate because temperature first increases the incubation period of the disease and secondly changes the range of vectors. Similarly, hot water in the body after climate change will cause more infections. Recently eliminated diseases cholera, polio, tick-borne encephalitis, and malaria in Europe have been introduced by immigrants.[14] Epidemic diseases are allied with climate change which occur more rapidly now days.[15] Malnourishment and immunodeficiency are also connected with emerging diseases that impact public health.[16] Chikungunya virus spread “by plane” from the Indian Ocean to Europe, with outbreaks in Italy[17] and local cases in France.[18]

Some Major Air pollutants and their health impacts

The Particulate matter (PM), carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x) and lead (Pb) are considered as major air pollutants by World Health Organization (WHO). Air pollution can cause serious damage to all areas of the environment. It also poses a serious risk to living beings.

Particulate Matter

Particulate matter (PM) often forms in the air due to the chemical composition of diverse pollutants. The permeability of particles is associated to their size.[19] The US EPA defines PM as the term particle.[20] Particulate matter pollution includes air pollutants with a diameter of, for example, 10 micrometers (μm) or small (so-called PM_{10}) as well as very fine (e.g., mostly 2.5μm or small diameter). PM includes minute solid and liquid droplets that cause serious health issues when inhaled.[21] Less than 10μm in diameter size (PM_{10}) particles when inhaled can expose to lungs and enter in the bloodstream. As well $PM_{2.5}$ cause greater health risks.[22]

Carbon Monoxide (CO)

When fossil fuels are burned incompletely, carbon monoxide is produced. Symptoms of carbon monoxide poisoning include headache, dizziness, weakness, nausea, vomiting, and eventually unconsciousness. Carbon monoxide has a greater affinity for hemoglobin as compare to oxygen. So, the people exposed to high level of CO for longer time period have high chances of serious health problems. Hypoxia, ischemia, and heart disease have been observed due to lack of oxygen due to competition with carbon dioxide. Carbon dioxide affects greenhouse gases closely related to global climatic changes. This will increase the global temperature and frequency of extreme weather events.[24] However, it has been shown to promote plant growth in experimental and field trials.[25]

Nitrogen Oxide (NO_2)

Oxides of nitrogen are pollutant that linked with traffic because it is emitted from car engines.[26, 27] It affects the respiratory system because it penetrates deep into the lungs and when inhaled in high amounts can cause breathing problems, cough, asthma, shortness of breath, bronchospasm and even

pulmonary edema. Concentrations above 0.2 ppm appear to produce these adverse effects in humans, while concentrations above 2.0 ppm affect T lymphocytes, especially CD^{8+} cells and NK cells that form the immune system.[28] Exposure for a long time period to nitrogen dioxide can cause bad breath.[28] However, non-respiratory systems may also be affected due to symptoms such as irritation in eyes and throat and nasal congestion being reported.[28] High concentrations of NO_2 are harmful to agricultural crops as they have been shown to reduce crop production and plant development. Additionally, oxides of nitrogen can decrease visibility and cause discoloration.[28]

Sulfur Dioxide (SO_2)

Sulfur dioxide (SO_2) is the most common pollutant emitted from industrial activity and burning of fossil fuels and the annual emission standard set for SO_2 is 0.03 ppm.[29] It affects the life and environment of earth. Vulnerable groups include people with respiratory problem, the elderly and children at high risk. The key diseases and health problems linked with emissions of sulfur dioxide in areas where industry working are mucus production, respiratory irritation, bronchitis, and bronchospasm, as it is an irritant that penetrates deep into the lungs and is converted to bisulfite, which interacts with sensory receptors to cause sulfur dioxide emissions. bronchoconstriction. In addition, skin redness, eye damage (tearing and corneal clouding), and exacerbation of existing heart disease are also observed.[28]. The most prominent environmental factors are acidification of soil and acid rain events because of SO_2 emissions.[30]

Lead (Pb)

Lead is used in various manufacturing facilities and is discharged from some gasoline engines, batteries, incinerators, and wastewater.[31] In addition, metals are one of the main sources of air pollution. Lead poisoning is harmful to humans, animals and the environment, and threatens public health. Exposure to lead can occur by breathing and immersion by skin. It has also been reported that lead is transported through the placenta because lead does not cross the placenta.[32] The smaller the fetus, the greater the risk. Lead poisoning observed as cause of fetal edema or swelling in the brain.[33] Once inhaled, lead can enter the blood, tissues, bones, heart, nervous system, and tumors. Additionally, muscle and joint pain, as well as attention and memory disorders, have been observed in the elderly.[32, 33] Children and infants are most vulnerable to even the smallest amounts of lead because lead is a neurotoxic that can cause learning disabilities, memory loss, ADHD, and even mental health impairment.[34]

Air pollution and public health impacts

People exposed to excessive amounts of air pollution experience symptoms and conditions that vary in severity. These effects are divided into short and long-term health effects. Groups that should pay attention to health precautions include the old age, children, diabetic's patients and people with problem of heart and lungs. As previously mentioned, the relative importance of short and long-term impacts due to differences in transmission and errors has not been clearly demonstrated.[23] New models have been proposed for the successful evaluation of human trauma data in the short and long term.[23] Therefore, in this section we report long and short-term health effects, but there are concerns about both types of effects because these effects depends on upon environmental exposure, dosage, and perception.

In addition, the toxicity of many pollutants can cause cancer in the long term.[35] These effects are common in people predisposed to the illness. Voice changes will occur after serious injuries when the respiratory tract becomes contaminated with pollutants. Air pollution can cause morbidity and mortality by causing chronic obstructive pulmonary disease (COPD).[36] Various cardiovascular observed because of exposure to air pollution.[37] Heart disorders has been observed because of blood cell changes following longer exposure to contaminated air. Long-term exposure to radiation has been reported to cause atherosclerosis and short term exposure leads to high blood pressure, stroke, myocardial infarction, and heart failure. [38]

Brain damage has been observed in dogs exposed to highly polluted areas in Mexico.[39] In adults, inflammatory markers (IL-6 and fibrinogen) have been shown to increase in response to IL-6 levels in immediate response to PNC, which may leads to greater protein production.[40] The development of oxidative stress and atherosclerosis is a process that causes damage to the nervous system because of poor air quality. Inflammation is secondary to oxidative stress and appears to be associated with poor growth affecting many organs.[39, 41]

Air pollution impacts on climate change and environment

Global climate change is an important problem affecting humanity. As we all know, the "greenhouse effect" increases global temperature. Unfortunately, human activities produce large amounts of greenhouse

gases, causing temperatures to rise, and global warming continues, endangering social health, livestock, plantations, wildlife and the aquatic life. One report elucidate that global warming increases health risks for the poor.[43]

Air pollution not only effects the health of human but also our living environment.[42] Some of the prominent environmental effects are acidic rain is wet form or dry (substances and gases) precipitation that contains nitric and sulfuric acids which are cause of acid rain. These rains destroy our environment by acidifying water and soil in our surroundings damage of buildings, sculptures, plants and statues. Smog occurs when small dispersed particles in atmosphere mixed with precipitation and reduce transparency. It is because of gases released into the atmosphere from factories, power plants, road traffic.

People residing in low quality buildings in tropical countries are more prone to heath related health problems.[43] Wildlife is affected by pollution from air, soil or water ecosystems, and as a result, high levels of pollution can effects the animal's health. Eutrophication occurs when an increase in nutrients phosphorus and nitrogen, they encourages the proliferation of algae, leading to imbalances in fish diversity and fish mortality.

Discussion

At the first meeting of the WHO Global Conference on Climate and Health held in 2018, DG of WHO called air pollution on the radio "a public health crisis" and "the new smoking".[44] There is no doubt that children are especially affected by pollution, especially as they grow up. Air pollution affects our lives in many ways. Diseases due to bad weather conditions not only affect the economy, but also create social effects such as the inability to work and go to school.

Technology that will reduce environmental pollution should be developed and applied to all industrial units and power plants, As decided in Kyoto protocol to reduce the GHGs emission to less than 5% by 2012.[45] This was followed by the Copenhagen Summit in 2009 (46) and the Durban Summit in 2011 and it was decided to maintain the same attitude. Many countries have been ratified the Kyoto Protocol and subsequent protocols developed to overcome air pollution problems.[47] China is one of the leaders who have adopted this important policy for the world's environmental and climate "health".[2] As we all know, China is a rapidly growing economy and its GDP (gross domestic product) is expected to be very high by 2050.

Although it is difficult to eliminate the problems of the man-made environment, it can be a good solution for authorities, organizations and doctors to cooperate to control the situation. To effectively manage the problem, the government needs to publish sufficient information, educate people, and collaborate with experts on these issues.

In summary, international protection policies should be developed to prevent anthropogenic pollution in support of the management of the negative effects of air pollution on health. In order to solve problems effectively, sustainability practices should be used as well as scientific data. Currently, international cooperation in research and development, policy makers and monitoring firm should focus to develop policies essential for air pollution control. Laws and regulations for air pollution should be revised and reformed, and policymakers should propose the creation of strong tools to protect the environment and health. Therefore, the main recommendation of this article is that the focus should be on supporting local organizations to develop effective policies for ecosystem management, promote experience and practices and disseminate them worldwide.

Authors Contribution

All authors in this article made a substantial and intellectual contribution while write-up of this article and approved it for publication in this journal.

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