

Integrated Effects of Air Pollution on Health and Environment: A Newspaper Based Review Study

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ABSTRACT

Bangladesh has the most polluted air in the world and Dhaka is considered the second most polluted capital city. Greenpeace and Air visual declared the Indian capital New Delhi, is the world's most polluted city which ranks Dhaka 17th in that category. Air pollution will cause around 7 million premature deaths globally and have a major economic impact. Dhaka, the capital of Bangladesh, often finds its place among the most polluted cities in global indices. Brick kilns and vehicles run on fuel with a higher level of sulfur have been identified as the major sources of air pollution in the country. It was a systemic review study regarding the integrated effects of air pollution on health and the environment. We gather different types of newsletters related to the impact of air pollution on health and the environment using different search portals. After proper review, suitable newsletters which were related to this study were taken for this systemic review purpose. As one of the most densely populated countries in the world, Bangladesh has been struggling with air pollution for a long time. Dhaka continuously ranks among the world's most polluted cities. Brick kilns, vehicles run on fuel containing higher levels of Sulphur, as well as construction work, have all been identified as major sources of air pollution. Making the air quality around us better will improve overall human health and reduce the impact of air pollution on the environment. A few changes to our daily routine can help us breathe better.

Keywords-

Integrated Effects of Air Pollution, Health, Environment.

I. INTRODUCTION

Bangladesh has the most polluted air in the world and Dhaka is considered the second most polluted capital city. Greenpeace and Air visual declared the Indian capital New Delhi, is the world's most polluted city which ranks Dhaka 17th in that category¹. Air pollution will cause around 7 million premature deaths globally and have a major economic impact. Bangladesh has been struggling with air pollution for a long. Dhaka, the country's capital, often finds its place among the most polluted cities in global indices. Brick kilns and vehicles run on fuel with a higher level of sulfur have been identified as the major sources of air pollution in the country. According to the report, four of the five most polluted countries in the world are in South Asia. Bangladesh is followed by Pakistan, India, Afghanistan, and Bahrain¹⁻³.

The quality of air in Iceland, Finland, and Australia is among the healthiest. PM_{2.5} refers to particulate matter (ambient air borne particles) which measure up to 2.5 microns in size and has a range of chemical makeup and sources. Due to its small size PM_{2.5} can penetrate deep into the human respiratory system and from there to the entire body, causing a wider range of short- and long-term health effects. In a report by the US-based Environmental Protection Index (EPI) on the environmental performance by the government of 180 countries, Bangladesh ranked 179, having

slipped down by 40 places from the year 2010 to 2018. According to the DoE and the World Bank, brick kilns make up 56 percent of the country's air pollution². The government had enacted a law in 2018 to make these kilns environment friendly, but a recent report indicated that of the 7,772 brick kilns in the country, 2,123 have not converted to the more modern and environment-friendly technology. According to the special rapporteur's UN environmental annual reports, air pollution is present both inside homes and outside and is responsible for the premature death of seven million people each year, including 600,000 children³⁻⁷.

II. MATERIALS AND METHODOLOGY

It was a systemic review study regarding the integrated effects of air pollution on health and the environment. We gathered different types of newsletters related to the impact of air pollution on health and the environment using different search portals. After proper review, suitable newsletters which were related to this study were taken for this systemic review purpose.

AQI OF DHAKA

Bangladesh's capital Dhaka has ranked as the most polluted city in the world. Dhaka scored 193 in the US Air Quality Index (AQI) on April 2021. The air was classified as "unhealthy." The index was developed by the Environmental Protection Agency for reporting the daily air quality of any city or country. Pakistan's Lahore and Nigeria's Port Harcourt followed Dhaka with individual scores of 171 and 162 respectively, according to data obtained from Air Visual, a mobile application that shows the real-time air pollution index of any city²⁻⁸. Brick kilns, vehicles run by fuels with higher level Sulphur, as well as construction works have been identified as major sources of air pollution^{5,8}. The air quality further declines during the dry months from October to April but improves in the monsoon. The situation is very serious, experts say, pointing out that five of the top 10 causes of death in Bangladesh are related to air pollution. The United States Environmental Protection Agency (EPA) developed the Air Quality Index to report air quality. This AQI is divided into six categories, indicating increasing levels of health concern⁹⁻¹¹. An AQI value over 300 represents hazardous air quality and below 50 the air quality is good. The index is based on the five criteria pollutants regulated under the Clean Air Act—ground-level ozone, particulate matter, carbon monoxide, Sulphur dioxide, and nitrogen dioxide. The AQI debuted in 1968 when the National Air Pollution Control Administration undertook an initiative

to develop an air quality index and to apply the methodology to Metropolitan Statistical Areas¹⁰.

ECONOMIC LOSS DUE TO AIR POLLUTION

The economic cost of the deaths and disability in terms of labor output has been estimated at \$1.4 billion in all urban areas of Bangladesh and 310 million in Dhaka city alone, equivalent to 0.6 percent and 0.1 percent of the country's GDP in 2015. Given the growing environmental challenges that Bangladesh cities face, the World Bank analyzes the impacts and causes of pollution levels and degradation of natural resources in Dhaka and other rapidly growing cities¹¹⁻¹². Over the past three decades, Bangladesh has experienced a dramatic increase in pollution linked to urbanization. The rapid growth of the ready-made garment industry and increase in urban population from less than 40 million in 2006 to more than 55 million in 2015 had been key factors in exposing the growing urban population to environmental hazards¹².

HEALTH IMPACTS OF AIR POLLUTION

Indoor and outdoor air pollution led to 1.23 lakh deaths in Bangladesh in 2017, according to a new study on global air pollution. It says the life of a South Asian child will be shortened on average by 30 months as they grow up in current high levels of air pollution¹²⁻¹³. The State of Global Air 2019, which used data from the period 1990 to 2017, observed that life expectancy in Bangladesh would have seen the highest expected gain of nearly 1.3 years if air pollution levels met the World Health Organization (WHO) guidelines. Air quality in Asia remained stubbornly poor, especially in Bangladesh where the entire population has remained exposed to PM_{2.5} levels above 35 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) since 1990, and said the third annual State of Global Air report. The major sources of pollution are household solid fuels, dust from construction, coal power plants, brick production, transportation, and diesel-powered equipment, among others¹²⁻¹⁴. In that year, annual PM_{2.5} exposures were highest in South Asia, with Nepal at 100 $\mu\text{g}/\text{m}^3$, India 91 $\mu\text{g}/\text{m}^3$, Bangladesh 61 $\mu\text{g}/\text{m}^3$, and Pakistan 58 $\mu\text{g}/\text{m}^3$. Particulate matter (PM) is the sum of all solid and liquid particles suspended in air, many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets. 3.6 billion people (47% of the global population) were exposed to household air pollution from the use of solid fuels for cooking in 2017¹⁵. These exposures were most common in sub-Saharan Africa, South Asia, and East Asia. Long-term exposure to outdoor and indoor air pollution contributed to nearly five million deaths

from stroke, diabetes, heart attack, lung cancer, and chronic lung disease in 2017¹⁵⁻¹⁷. Building on a fundamental understanding of how air pollution affects health, researchers quantify the burden of disease from air pollution by calculating how air pollution exposures translate into numbers of deaths and years lived with disease or disability. Air pollution is responsible for more deaths worldwide than many better-known risk factors such as malnutrition, alcohol use, and physical inactivity. Each year, more people die from air pollution-related diseases than from road traffic injuries or malaria¹⁶. Air pollution reduces average life expectancy by almost as much as active tobacco smoking does. Type-2 diabetes is a major health risk of air pollution. In 2017, about 1.5 million people died in Bangladesh, India, Nepal, and Pakistan due to air pollution-related reasons, the study said. Nearly half of the world's population (3.6 billion people) was exposed to household air pollution in 2017¹⁶⁻¹⁸. Air pollution may be damaging every organ and virtually every cell in the human body. Fertility, fetuses, and children are affected by toxic air. The systemic damage is the result of pollutants causing inflammation that then floods through the body and ultrafine particles being carried around the body by the bloodstream. The impact of different pollutants on many ailments remains to be established, suggesting well-known heart and lung damage is only "the tip of the iceberg." There is now overwhelming evidence that air pollution results in serious harm not only to the lungs but also to the heart¹⁸. Strokes, dementia, and reduced intelligence are all conditions affecting the brain that have been linked to air pollution. Perhaps the most disturbing impact of toxic air is the damage to reproduction and children. Fertility is reduced and miscarriages are increased by exposure to air pollution. The unborn are also affected, with a recent study finding pollutants in the placentas that nourish fetuses. As many as 2,087 of the kilns are being operated around Dhaka city^{10,17}. During the dry season, 58 percent of the city's total air pollution is caused by brick kilns. Although previous drives against illegal brick kilns had failed, experts believe it would be different this time around as there is an alternative to traditionally-used bricks in green bricks. According to a report of the Asian Development Bank (ADB) in 2016, the country produces 22.71 billion pieces of bricks a year^{19,20}. According to a World Bank report, the brick kiln sector also consumes 3.5 million tons of coal and 1.9 million tons of firewood, emitting 9.8 million tons of greenhouse gas annually^{11,20}.

CHILDREN'S PSYCHOLOGICAL IMPACTS OF

AIR POLLUTION

Air pollution may affect our physical and psychological health in the long run as children who are exposed to a high level of air pollution while growing up, have an increased risk of developing schizophrenia. Schizophrenia is a chronic and severe mental disorder that affects how a person thinks, feels, and behaves²¹. "The risk of developing schizophrenia is also higher if someone has a higher genetic liability for the disease. The association between air pollution and schizophrenia cannot be explained by a higher genetic liability in people who grow up in areas with high levels of air pollution²¹⁻²². Though the results demonstrate an increased risk of schizophrenia when the level of air pollution during childhood increases, the researchers cannot comment on the cause. Instead, they emphasize that further studies are needed before they can identify the cause of this association^{3,19}.

OZONE: AN EMERGING AIR POLLUTANT IN DHAKA CITY

Several sporadic scientific studies were carried out in the last 25 years to characterize the composition of air pollutants of Dhaka city²³, emphasizing on concentration and composition of particulate matter and some gaseous pollutants like Sulphur dioxide and nitrogen oxides. Meanwhile, the air pollution scenario has started to change in the cities of countries with comparable patterns of urban growth. China, India, and Pakistan have been facing severe photochemical smog problems in recent years. This type of air pollution is associated with sunlight-driven chemical reactions, and ozone is a primary ingredient of photochemical smog²³⁻²⁴. Ozone pollution is a quite neglected field of interest in our country. Even, having air polluted cities like Delhi in India and Peshawar in Pakistan, there are few papers on ozone pollution and its impacts published in the context of South Asia. An interesting feature of ozone is its dual nature²⁵. The "good ozone" is located in the stratosphere layer (i.e. 16-50 km above the ground) that saves the ecosystems and humans from the harmful fraction of ultraviolet radiation from the sun²⁴⁻²⁶. On the other hand, ground-level ozone or ozone in the troposphere (i.e. 0-16 km above ground) is considered "bad ozone" because of its various negative effects on human health and the environment. According to a report by California Air Resources Board (2016), it is high time for people to think about ozone pollution along with other gaseous pollutants, for instance, carbon dioxide, carbon monoxide, Sulphur dioxide and nitrogen oxides because of its effects on the health of humans and the environment. For instance, it

can damage the tissues of the respiratory tract, cause inflammation of lungs and result in symptoms like coughing, chest tightness and worsening of asthma symptoms. Ozone causes substantial damage to crops, forests and ecosystems^{20,26}.

According to American Geophysical Union (2014), ozone pollution in India damaged millions of tons of the country's major crops just in one year, caused losses of more than a billion dollars, and destroyed food enough to feed tens of millions of people living below the poverty line. Ozone can cause substantial damage to a variety of materials, such as rubber, plastics, fabrics, paint and metals through oxidation. Damage from ozone exposure can result in significant economic losses as a result of the increased costs of maintenance, upkeep and replacement of these materials. Generally, ozone is formed in the troposphere by nitrogen oxides reacting with volatile organic compounds (VOCs) in the presence of sunlight²⁵. Nitrogen oxides are released into the atmosphere as a by-product of any combustion like from automobiles, coal-fired power plants, different industries and biomass burning. VOCs also come from man-made sources, such as cars, service stations, dry cleaners and factories. Although precursors of tropospheric ozone often originate in urban areas, winds can carry nitrogen oxides hundreds of kilometers, causing ozone formation to occur in less polluted regions as well. Ozone pollution poses a formidable risk, especially for Bangladesh for some unique reasons. Due to its geographic position, Bangladesh receives a high amount of solar radiation, which is a precondition for building up ground-level ozone. Bangladesh lacks in emission control of carbon dioxide, carbon monoxide, Sulphur dioxide, nitrogen oxides and volatile organic compounds (VOCs), which are the major precursors of tropospheric ozone. Ozone pollution can become a great risk for a country like Bangladesh shortly. Therefore, the unique environmental situation of Bangladesh makes it a very suitable "automated cooking station of ground-level ozone" by supplying the required ingredients from air and making up the required temperature to create ground-level or tropospheric ozone.

But due to the absence of any baseline information, the people of Bangladesh do not know that ozone does exist in their surrounding air, and exceeding a certain level, it can become a very dangerous pollutant²⁷.

ENVIRONMENTAL IMPACTS OF AIR POLLUTION

At a country level, the new report says

weighted by population, Bangladesh emerges as the most polluted country in the world. Gurgaon, a suburb of the Indian capital New Delhi, is the world's most polluted city. According to the report, air pollution will cause around seven million premature deaths globally next year and have a major economic impact. Bangladesh, one of the most densely populated countries in the world, has been struggling with air pollution for long. Dhaka, the country's capital, often finds its place among the most polluted cities in global indices. Brick kilns and vehicles run on fuel with higher levels of sulfur have been identified as the major sources of air pollution in the country²⁸. The AQI, an index for reporting daily air quality, tells people how clean or polluted the air of a certain city is, and what associated health effects might be a concern for them. There is no denying that air pollution has reached menacing proportions in the city which has become virtually unlivable. Urban air in the city is thick with fumes; water either in the rivers, ponds or tubewells, is polluted, and the land is poisoned. Unchecked dumping of waste, a lot of toxic, noxious emissions from vehicles and the pesticides used in farmlands are the main causes. Although the city did fare well in terms of reducing pollution, the situation is still alarming, posing serious health hazards for city dwellers^{20,27}. Things get worse in dry season as air, thick with particulates, becomes a prevalent cause of chest and respiratory diseases. According to the Department of Environment (DoE), the density of airborne particulate matter (PM) has reached 247 micrograms per cubic meter (mcm) in Dhaka which is nearly five times the acceptable level of 50 PM per mcm set by the National Ambient Air Quality Standard (NAAQS) of Bangladesh²⁶. Airborne particulates are considered more harmful when they are 10 micrometers or smaller in diameter and in Dhaka the density of PM which is 2.5 micrometers or smaller is 9.0 times higher than the NAAQS recommendation. Ambient air in the city becomes extremely polluted between October and March every year when rain is scarce and when thousands of brick kilns become operational, burning used automobile and rickshaw tires, low-grade coal and in many cases fuel-wood.

WHO recommends a maximum tolerable PM level of 20 mcm compared to Bangladesh standard of 50. Towns with 70 mcm are considered extremely contaminated. Lead present in air is the most awful of the harmful PMs. Clinicians advise exposure to such a volume of air pollution may cause early deaths and also numerous illnesses including pulmonary,

respiratory and neurological illnesses. Air pollution has also an adverse consequence on all other life forms including plants²⁵. Price of sustaining building structures in the urban areas also rises meaningfully due to such air pollution. Patients with different chest and respiratory diseases admitted in the hospitals are on the rise. If this tendency of air pollution remains, people of Dhaka city will become exposed to sicknesses specified above and also other difficulties. The mental health of children will be harmfully affected by lead pollution, which can affect the central nervous system and cause renal damage and hypertension. Brick kilns, old buses, fleets of trucks and thousands of other poorly serviced vehicles contribute highly to the pollution. Dust from roads and construction sites and toxic gasses from manufacturing sites crack the air quality situation even poorer. Manufacturing wastes are responsible for 60 percent of the outward water contamination in and around Dhaka city while home-based wastes contribute to the remaining pollution. Diesel-run automobiles account for more than 80 percent of their pollution as most of them fail to fulfill with the emission standard²⁰⁻²². Lead concentration in urban children to be 5.8 to 21.6 micrograms per deciliter and urban slum children's lead level ranged from 9.6 to 38.9 microgram per deciliter, three times more than the acceptable level. In most cases, infesting automobiles drive away releasing deleterious fumes in the existence of the law enforcement staff without being held up or booked. Old and dilapidated vehicles disappear from the roads during special drives by the law enforcers only to return after the drive comes to an end²⁵. In the past, attempts to prohibit plying of old vehicles in Dhaka city streets failed either for political reasons or in the face of resistance by transport owners and their employees. But if the neighboring countries can improve air quality of their cities by banning use of old vehicles and also relocating some of their polluting industries, authorities in Bangladesh can also do the same²⁸. It is thus time to point out old and black smoke releasing vehicles from city roads as our right to live in healthy environment largely depends on it. Bangladesh is one of the few countries that face extreme hazards due to environmental degradation and resource depletion. The deficiency of the environment has been highlighted in various forums because of its universal potential for chaos and disorder. Environmental problems faced by Bangladesh are far too many though largely caused by factors, which are teleological because of its geographical position. The environmental hazards of pollution and resource depletion pose a

potentially disastrous threat to Bangladesh. The problems should be high on the agenda of the government as well as political parties. The government should, in the conditions, take the environmental threats seriously, and create public awareness and undertake action-oriented programs²⁹.

CORONAVIRUS OUTBREAK AND AIR POLLUTION

Dhaka the densely populated capital of Bangladesh preserves topping the list of cities with the poorest air pollution. Worries about health risks due to contaminated air have been raised before, but now the threatening ring louder as global experts have opined that health damage caused by continued exposure to high stages of air contamination in cities can theoretically upsurge the decrease rate from coronavirus infections. Proof from prior outbreaks also demonstrates that those exposed to polluted air are more at risk³⁰. Primary research on Covid-19 has suggested smokers and former smokers are more susceptible to the virus. Any connection between air pollution and growing fatality risk of coronavirus. Likely, people who are exposed to more air pollution and who are smoking tobacco products are going to fare worse if infected with than those who are breathing cleaner air, and who don't smoke. This is not good news, because air quality in Bangladesh was the worst in the world last year and Dhaka was the 21st most polluted city, according to 2019 World Air Quality Report. A report published in paper on March 15, highlighted the level of dust accumulation on roadsides and trees in this city. A study showed that every single day 436 tons of dust are accumulated on the trees. Overall, Bangladesh's response to the handling of coronavirus has not been consistent with the enormity of the danger. And for a disease, that has no known cure yet, prevention, early testing, and awareness could be the difference between life and death. Dhaka, it appears, is especially in a precarious position, considering its population breathes in the city's hazardous air day-in, day-out²⁸⁻³⁰.

PROTECTION FROM AIR POLLUTION

Air pollution is a combination of different dense particles and gases that are released in the air in the form of pollutants that are detrimental to human health. The risks of air pollution can range from higher diseases to increase in temperatures²¹. Poor air quality has detrimental effects, it kills people. Poor air quality caused an estimated 4.2 million premature deaths in the year 2016. One may think that outdoor air pollution poses a major threat to human health. However, indoor smoke is an ongoing health threat

approximately 3 billion people who cook and heat their houses by burning biomass, kerosene and coal, in India 65.53 percent of the population belong to rural areas and are therefore dependent on either of the mentioned materials. 29 percent of all deaths and diseases from lung cancer, 17 percent of all deaths and diseases from acute lower respiratory infection, 24 per cent of all deaths from stroke, 25 per cent of all deaths and diseases from ischemic heart disease, 43 per cent of deaths and diseases from chronic obstructive pulmonary disease. Both in children and adults, short- and long-term exposure to air pollution may lead to reduced lung functioning, respiratory infection, and aggravated asthma¹⁸. When a pregnant woman is exposed to air pollution it may pose severe threats like low birth weight, pre-term births and small gestational air births. Therefore, one needs to understand how to protect themselves from air pollution. Take these precautions to protect from the harmful effects of pollution: Checking the pollution levels daily through weather reports before stepping out the house, When pollution levels are high, avoid outdoor exercises or walks, There may be certain high traffic areas around us, one must avoid exercising or walking in those areas, Avoid using energy sources in your homes that causes air pollution; renewable sources of energy can be used instead that reduces air pollution. This will help in improving the air quality and curb greenhouse gas emissions, Walking, using a bicycle, using public transport, or carpooling can reduce the amount of gases released by vehicles, Do not burn wood or trash, it produces soot which is harmful to human health, Do not encourage smoking indoors²¹⁻²⁷.

III. CONCLUSIONS

As one of the most densely populated countries in the world, Bangladesh has been struggling with air pollution for a long time. Dhaka continuously ranks among the world's most polluted cities. Brick kilns, vehicles run on fuel containing higher levels of Sulphur, as well as construction work, have all been identified as major sources of air pollution. Air quality further declines during the dry months, from October to April, but improves during the monsoon. Making the air quality around us better will develop human health and decrease the influence of air pollution on the environment. A few alterations to our day-to-day routine can help us breathe better.

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