GE-International Journal of Management Research
ISSN (O): (2321-1709), ISSN (P): (2394-4226)
Vol. 8, Issue 9, September 2020 Impact Factor: 5.779
www.aarf.asia,**Email** : editoraarf@gmail.com

A STUDY OF ENVIRONMENT POLLUTION AND IT'S AN EFFECT ON THE HUMAN IN INDIA

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ABSTRACT

Pollution of the environment is a worldwide issue that has significant repercussions for individuals and communities all over the world. The overexploitation of fossil fuels, reckless dumping of sewage, and excessive use of pesticides in agricultural production are all examples of human activities that have contributed to the progression of environmental pollution, which is a worldwide issue that has become more severe. A comprehensive literature review was carried out in order to assess the current state of environmental contamination on a global scale and the impact that it has on the health of individuals. Pollution has been related to a number of adverse health effects, including but not limited to cancer, cardiovascular disease, respiratory ailments, mental disorders, and diarrhea. There are approximately 7 million deaths that occur annually as a result of air pollution, and an additional 1.6 million people die as a result of illnesses that are related to water pollution. It is becoming increasingly clear that pollution in the environment is a significant contributor to human illness and death all across the world, particularly in nations with poor incomes. In light of the fact that pollution levels are rising in the present day, it is of the utmost need for all nations and institutions that are pertinent to the issue to collaborate in order to lessen the impact that pollution has on both the environment and the health of people.

Keywords: *pollution, air, pesticide, human health*

INTRODUCTION

The public's attention has been drawn to this global issue for a number of reasons, one of which is the terrible long-term impact that environmental pollution has on human health. It is referred to as environmental pollution when substances (whether they are solid, liquid, or gas) or energy (such as heat, sound, or radioactivity) are discharged into the environment at a rate that is greater than their capacity for dispersion, dilution, breakdown, recycling, or harmless storage. The World Health Organization (WHO) defines poisoning as "the presence in or introduction into the environment of substances or agents (including microorganisms) that may cause harm to human health or the living environment." Poisoning can occur when substances or agents are introduced into the environment. This indicates that any system is going away from a state of equilibrium and toward a state of disequilibrium. This is the case for any system. Alterations in the composition of the environment's water, air, and soil have been occurring over the course

of the past twenty years as a result of a wide range of pollution sources. Intentionally or unintentionally, humans emit a wide range of substances into the environment. These substances include hazardous metals, organophosphorus compounds, gasses, dust, silt, biological creatures or products, and physical substances such as heat, radiation, sound waves, and so on. Air pollution, water pollution, and soil and land pollution are the three most frequent types of pollution that put ecosystems, species, and all forms of life on Earth in jeopardy.

Pollution is currently the most significant health concern that the world is facing, despite the fact that it has been around for a considerable amount of time. The direct cause of death for approximately 9 million individuals each year is pollution; this accounts for one in every six fatalities that occur worldwide. In addition, countries with lower median incomes are more likely to be affected by environmental contamination. The majority of deaths and economic losses that are attributed to pollution occur in nations with low and middle incomes, with South and Southeast Asia suffering the brunt of this crisis. The percentage of accidents and deaths caused by pollution is roughly 92%. The Global Biodiversity Disaster Risk Factors Collaborators (GBDRFC), (2020) is the source of this information. It is estimated that air pollution is the only known cause of death in Nepal, and it is responsible for more than 54,000 deaths annually. Over the same time period, agriculture is the primary source of income for fifty percent of the world's population. Unfortunately, the use of agricultural chemicals such as pesticides, fertilizers, and herbicides is on the rise, which is putting a strain not only on the health of agricultural workers but also on the health of the environment.

Within the context of this situation, not all of the persons concerned have a complete comprehension of the several types of pollution and the damage that they cause to human health. People are becoming increasingly unaware of the situation, which is contributing to the constantly increasing amount of pollution, which is becoming a huge threat to human health. Therefore, the purpose of this study is to analyze the various types of environmental pollution and the damage that they cause to human health by evaluating the research articles and data that are pertinent to the topic. The findings may be of assistance to the relevant authorities in taking the right actions to mitigate the losses that are brought about by a deteriorating environment.

METHODOLOGY

This evaluation analyzes primary evidence from academic and professional researchers on pollution and health. We searched Academic Search Premier, PubMed, and Sci-Hub for particulate matter, sickness, pollution, health, death, and morbidity papers. No date was set for our search. The 350+ titles and abstracts selected include journal articles, conference papers, master's theses, and doctorate dissertations. The only search parameters were document names and keywords, which usually comprised study themes. Articles that met our criteria: 1. Peer-reviewed journal publication. 2. Pollutant exposure was included. 3. They considered respiratory, reproductive, prenatal, cancer, and cardiovascular health outcomes. 4. They examined pollutant-health impacts relationships. Articles that were not in English, did not address pollution health concerns, or did not involve human participants were excluded. The review used 139 articles after screening for inclusion and exclusion.

1 Respiratory health

Pollution is strongly associated to respiratory disorders. Vehicles and factories emit carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, heavy metals, and particle pollution. Pesticide-, heavy metal-, and plastic-polluted water and soil harm lung health. Exposure to these pollutants can cause pneumonia, bronchitis, COPD, and phlegm coughing. Inhaled contaminants and gases enhance epithelial permeability, diminish mucociliary clearance, and limit macrophage function, compromising lung defenses. Studies on humans, animals, and in vitro organisms show that neutrophils, T lymphocytes, macrophages, and mast cells are attracted and activated more often. Intracellular oxidative stress is caused by cytokines, chemokines, free radicals such superoxide, hydrogen peroxide, and hydroxyl radicals, and decreased antioxidant and enzyme defenses. The mitogen-activated protein kinase pathway and redox-sensitive transcription factors nuclear kB and activator protein-1 are modulated, causing inflammation (Fig. 1).Some population groups are more susceptible to pollution. Exposure to contaminants, notably sulfates and particulates, increases death rates. These groups are vulnerable because their biological defenses are less than the overall population. Smoking and air pollution are linked. Smokers have 30% less lung capacity than nonsmokers of the same age. Bagassosis is caused by organic dust, while asbestosis and mesothelioma are caused by asbestos.Pesticide exposure can cause asthma, coughing, chest tightness, dry or sore throat, airway inflammation, and shortness of breath. Pesticide workers at bottling plants are more likely to have respiratory issues like persistent cough in women, according to a research. Pesticide workers reported worsening coughing, wheezing, chest tightness, throat discomfort, and dryness throughout the shift. Some research have demonstrated that environmental pesticides can cause asthma attacks in children, but adult data is few.A Tanzanian study found that lambda-cyhalothrin exposure caused stuffy noses, coughing, and throat irritation. A Spanish study linked organochlorine pesticides to recurrent lower respiratory tract illnesses in newborns. Asthmatics are more likely to develop symptoms, impaired lung function, and possibly greater airway responses after being exposed to pesticide aerosols, however the specific mechanism is uncertain.Incinerating plastic bags releases hazardous gasses that cause multiple health issues, including chronic lung illness, asthma, and emphysema. When burned, polyvinyl chloride chlorine can irritate human lungs. A prospective birth cohort study linked asthma risk to urine bisphenol A (BPA) levels. Lead and cadmium in cigarette smoke cause emphysema and COPD in generations. Fumes from Cd induce chemical pneumonitis. The lungs absorb Cd faster than the digestive system. Cadmium-rich maternal cigarette smoking impacted the manganese (Mn)-child blood pressure relationship. Smoking during pregnancy may accelerate placenta Cd development, according to research. A study found a link between pulmonary functioning and urine Mn levels in young people.

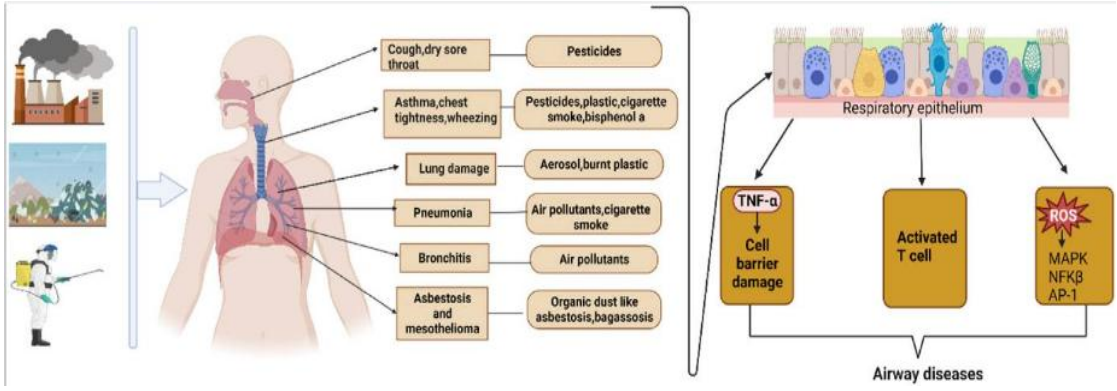

Fig. 1 Impact of environmental pollutants on the respiratory system

2. Reproductive and prenatal health

Reproductive health

When the environment is contaminated, it has a detrimental impact on their ability to reproduce. Even low levels of pollution can have a significant impact on the reproductive systems of both human and animal species. The synthesis of antioxidant enzymes including catalase, glutathione peroxidase, and superoxide dismutase is decreased by environmental toxicants, which also increase the level of oxidative stress in environmental environments. The end result is the production of reactive oxygen species (ROS), which are responsible for the damage that occurs within cells to DNA, lipids, proteins, and carbohydrates. The majority of the time, oxidative stress-related abnormalities in germ cells and apoptosis are the root causes of infertility in men. One of the potential outcomes is an early miscarriage, as well as other developmental problems that may arise as a result of the sperm's capacity to transmit genetic harm to the developing fetus. The antioxidant capacity of the reproductive organs is reduced when pregnant women or mothers who have been exposed to PM2.5 during pregnancy are exposed to the substance. It is responsible for the production of reactive oxygen species (ROS), which contribute to a decrease in reproductive function and the oxidative stress response.Both granulocytes and oocytes have the potential to experience mitochondrial malfunction, activation of the apoptotic pathway, and induction of apoptosis when they are exposed to PM2.5. Testicular cells go through a process of necrosis and death when they are subjected to acute toxicants. In the public sector, chronic exposure that is not fatal is the norm. When particulate matter 2.5 enters the bloodstream, it causes the synthesis of chemokines and proteins that promote inflammation. Free radicals and cytokines are produced in greater quantities by inflammatory cells, which in turn leads to an increase in damage and sets off a chain reaction that ultimately results in systemic immunological and inflammatory responses of the body. DNA methylation levels in non-coding repetitive portions of the genome can change in response to PM2.5 and other environmental factors. In addition to contributing to oxidative damage, inflammation, and other health problems, this change has an effect on genomic instability or gene expression.

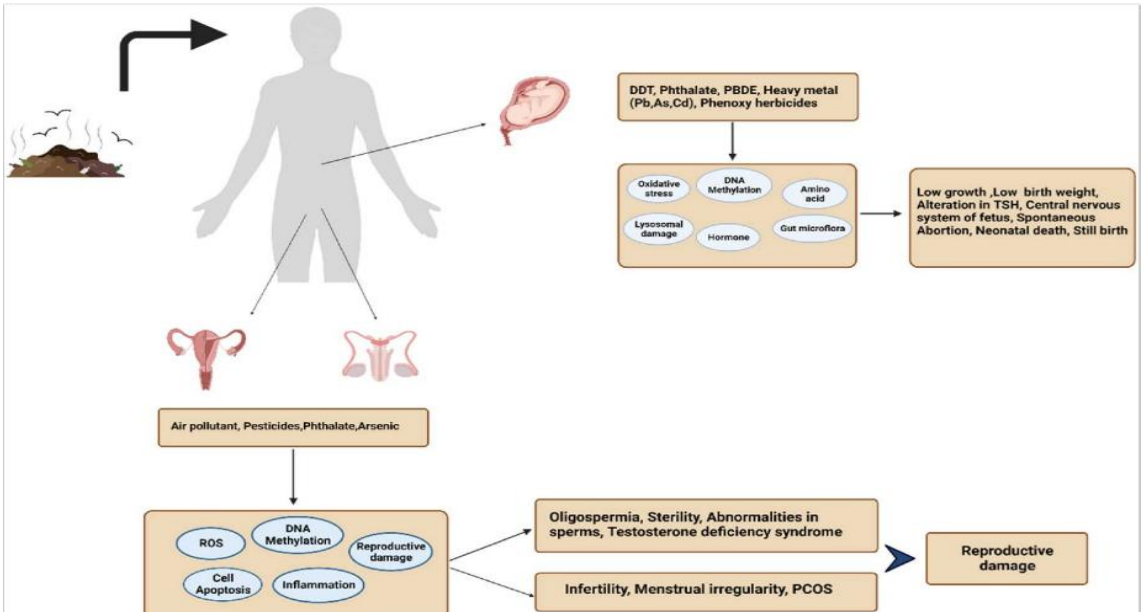

Fig. 2: Effect of environmental pollutants on reproductivity and prenatal health

According to the findings of numerous scientific research, inhaling particulate matter has a negative impact on gametogenesis and, as a result, a person's fertility. Each of these parameters has an impact on the amount and quality of gametes.According to the findings of a cross-sectional study that utilized census data, researchers in Barcelona discovered a significant correlation between the increasing levels of air pollution caused by traffic and a commensurate decrease in the number of people who conceived. Oligospermia and decreased sperm motility were found in a small sample of highway toll collectors, according to the results of sperm testing. There are specific amounts of chemical exposure that are associated with an increased risk of sperm abnormalities, infertility, spontaneous abortion, congenital malformations, and developmental delays in children. The presence of chromosomal abnormalities in germ cells was detected in cotton field workers who were exposed to pesticides. These abnormalities manifested themselves in the form of stillbirths, miscarriages, neonatal deaths, and congenital malformations. According to the findings of many studies, there is a positive correlation between occupational pesticide exposure and higher rates of fetal mortality. According to the findings of a recent study, exposure to phenoxy herbicides in agricultural homes was found to result in pregnancy terminations that occurred spontaneously. To a certain extent, exposure to phthalates can have a detrimental effect on the male reproductive system. The liver is responsible for producing mono-ester metabolites, which are the root cause of the majority of reproductive issues. The human condition known as testosterone deficiency syndrome (TDS) is brought on by exposure to phthalates. In addition to low testosterone levels, cryptorchidism, hypospadias, and testicular cancer are all symptoms of this condition. Workers who are employed in the plastics industry are subjected to a wide range of chemicals, both new and old forms of these substances. According to the findings of a study conducted on women who work in the plastics industry, these women have a higher vulnerability to experiencing miscarriages, infertility, and poor reproductive outcomes. Inorganic substances' toxic consequences Because exposure can have both short-term and long-term effects on genes, development, and reproduction, it is important to consider both types of effects.

Prenatal health

Environmental pollutants harm pregnant women. Environmental contaminants like nitrogen dioxide, cigarette smoke, and particle matter harm developing babies, according to research. Human pollution increases redox activity, glutathione depletion, and heme oxygenase-1 activation, which may cause mitochondrial malfunction and epigenetic genetic effects. These mechanisms may affect placental hemodynamics during pregnancy, reducing oxygen and nutrition availability. Human oxidant damage and pro-inflammatory reactions result from pollutant-induced relative oxygen species. Additionally, mitochondrial damage reduces ATP production. Organic pollutants cause oxidative reactions in the lung epithelium and chemically harm subcellular cells. Cytotonic mechanisms that restrict protein transcription include protein aggregation, fibrillation, unfolding, conformational disruption, lysosomal degradation, DNA methylation, histone modification-dependent chromatin remodeling complexes, and noncoding RNA. Figure 2. Protein expression changes or reductions during pregnancy can affect organ, cell, and system development like genetic mutations. Ultrafine particles and membrane proteins may reduce placental growth factor receptor activity. Chronic particulate matter exposure causes oxidative damage that causes subclinical pulmonary and systemic inflammation. Ultrafine particles may increase blood viscosity and coagulation, affecting endothelial and vascular function and placental perfusion.

Fetal head circumference decreases in the third trimester, when the mother is most susceptible to environmental toxins. Chinese studies linked maternal DDT exposure to low birth weight. DDT, beta HCH, and HCH residues in the mother's blood and cord affect the unborn child's thyroid hormone levels through the placenta, according to researchers. Pesticide exposure during pregnancy induced perinatal death.PBDEs have been discovered in breast milk, adipose tissue, and serum in numerous studies. The liver and cord blood of human fetuses contain PBDE, indicating prenatal exposure. Human fetal liver and umbilical cord blood samples showed prenatal PBDE exposure. By the conclusion of the second trimester, PBDE levels caused cancer, endocrine malfunction, reproductive and developmental problems, and CNS damage. Near an electronic waste dump, TSH and serum levels were much higher. Pregnancies can terminate in miscarriages, stillbirths, or fetal abnormalities. Environmental pollutants like heavy metals may worsen this. The father or mother may be exposed. Developing countries have most of these cases. The placenta can deliver arsenate, cadmium, and lead to the fetus. Heavy metal levels in the bloodstream complicate pregnancy. Mercury and thalidomide cross the placenta and accumulate in newborn tissues. People keep lead longer. The mother's bones absorb more lead (Pb) to fulfill the growing fetus's needs due to a change in calcium (Ca) levels during pregnancy. According to Aylward and colleagues, Bangladeshis have greater urine arsenate levels. Milton and coworkers studied As-induced stillbirth, spontaneous abortion, and neonatal mortality. Stillbirth, spontaneous abortion, and infant mortality were higher in women exposed to As above 50 micro g/L and lower in those exposed to lower doses. Some studies have linked As exposure to pregnancy issues such diabetes, high blood pressure, stillbirth, spontaneous abortion, and infant mortality.

3. Cancer

Several environmental contaminants can induce cancer and mutations. Environmental contaminants cause 70–80% of malignancies. The scientific community has paid less attention to pollution-related cancer molecular pathways. Many inverse models demonstrate pollution affects cancer and cell proliferation. A meta-analysis validated DNA adducts' nonlinear dose-

response relationship with air pollution. PM2.5-exposed human epithelial cells hypomethylate and activate numerous microRNAs and genes during transcription, altering cancer signaling pathways. Cancer development depends on gene mutation and silence, which affect tumor suppressor genes. Carcinogenesis begins, promotes, and advances. Although the effects of pollutants on cancer cell transformation have been widely studied, individual and time-dependent doses still alter them. Specific carcinogens and their combinations trigger energetic dysregulation, chromosome instability, somatic cell proliferation, apoptosis inhibition, chromosome inactivation, TSG inactivation, and oncogene activation.

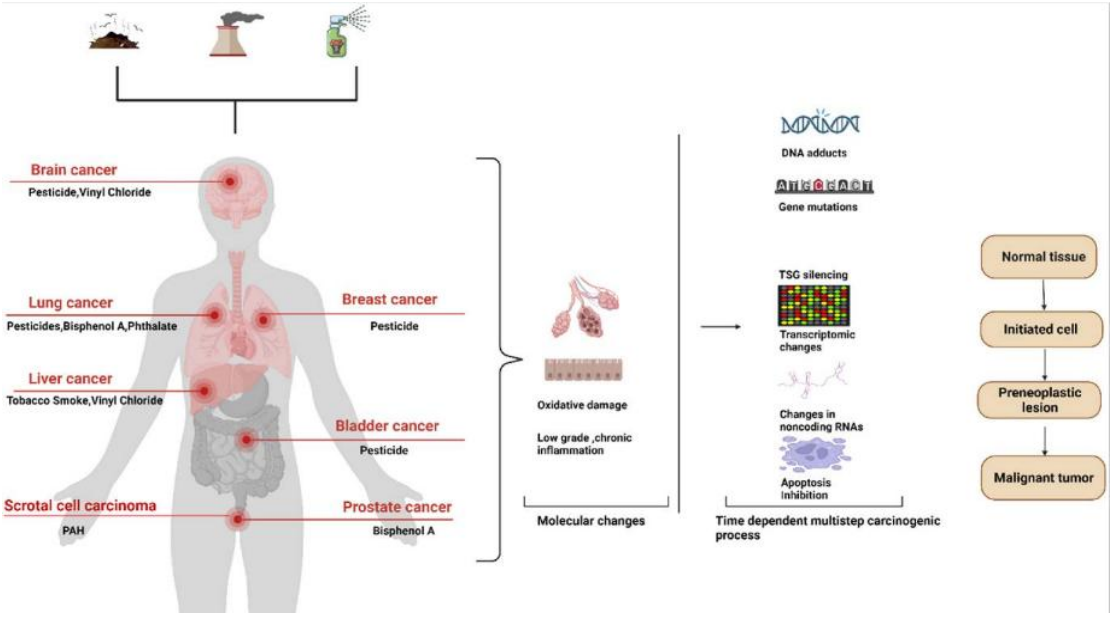

Fig. 3 Environmental pollutants causing cancer in humans

A recent study found that fossil fuel byproducts increase lung cancer risk. Combustion, coking, pyrolysis, and other coal preparation processes release PAH, a major organic contaminant. Urban particulate matter absorbs PAH when it settles. Lloyd and colleagues discovered that coal combustion workers with low, medium, or high exposure had a higher lung cancer risk. In 1775, coal smoke caused scrotal cell cancer in British sweeps. PAHs caused cancer. Pesticide applicators who use herbicides like imazaquin developed bladder cancer, according to US researchers.A research in Egypt indicated that occupational and environmental farming increases the risk of urinary bladder squamous cell carcinoma or urothelial cell carcinoma. Women who "ever noticed" pesticide spray wafting from farms had a greater breast cancer risk, according to an Australian study. A US study of North Carolina and Lowa pesticide applicators indicated that acetochlor users had a higher lung cancer risk than nonusers. Bisphenol A, a plastic component, has been related to metabolism abnormalities, endometrial hyperplasia, sterility, polycystic ovary syndrome, recurrent miscarriages, and breast and prostate cancer. Pthalates and BPA can be introduced to babies through the mother's pregnancy, development, and nursing. A comprehensive study found a negative association between female breast cancer and phthalate metabolites MBzP and MiBP. DEHP is a carcinogen. Airborne exposure increases cancer risk. Plastics workers have higher breast cancer rates. Whether directly or indirectly exposed, heavy metals influence intracellular activities via a complex mechanism. Pathway study revealed genes and processes shared by As, Cd, Cr, and Ni's detrimental impacts. These steps may indicate heavy metal-induced cancer.

4. Neural health

Environmental pollutants cause many neurological diseases. Environmental pollutants include pesticides, industrial waste, laboratory waste, automobile exhaust, and terrestrial waste combustion produce most neurotoxicity.PM2.5 can enter the brain and bloodstream through the alveolar area.Ultrafine particulate matter (UFPM) enters the brain through the olfactory nerves and crosses the blood-brain barrier to the cerebellum and central cortex. These particles can stimulate neurons, microglia, and astrocytes' immunological responses in the central nervous system. ROS from this response worsen neuroinflammation and lipid peroxidation in several brain areas. Almost all neurological diseases involve blood-brain barrier disturbance, protein aggregation, oxidative stress, mitochondrial dysfunction, and DNA damage.

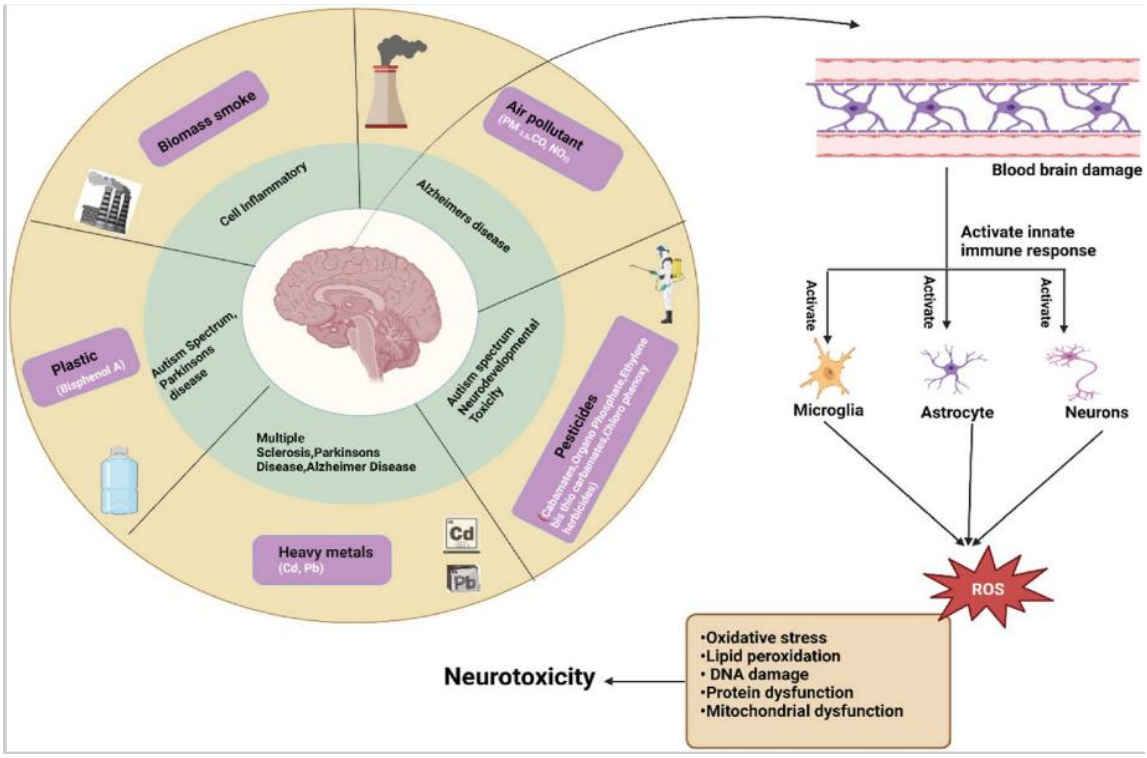

Fig. 4 Environmental pollutants and neural health

Particulate matter exposure increases the incidence of neurological illnesses including Alzheimer's, according to epidemiological studies. In vitro studies show biomass smoke from cow dung burning. This increases serious cell inflammation risk. Most agricultural pesticides target pests' CNS. Because pesticides and humans have comparable neurochemical reactions, pesticide exposure causes neurotoxicity. Learning impairments, ADD/ADHD, autism spectrum disorders, developmental delays, behavioral challenges, and other neurodevelopmental abnormalities are widespread. Pesticides include cyanophos, organophosphates, chlorophenoxy herbicides, ethylene bis thiocarbamates, and carbamates can harm neurodevelopment. A recent study found that 17% of toddlers and adolescents under 18 had developmental issues. Many industrial chemicals cause neurotoxicity, even at low levels that are safe for adults, according to animal studies. Only five of 201 pesticides listed as nervous system-harmful have been proven thus. Reflex abnormalities were detected in California newborns delivered to mothers with increased organophosphate metabolites in their urine during pregnancy. Neurodevelopment was unrelated to chlorpyrifos- and malathion-specific metabolites. The

central nervous system is damaged by organochlorine pesticides. Endosulfan and lindane, GABA antagonists, release neurotransmitters via blocking calcium ion influx and Ca-Mg ATPase. Most research finds developmental neurotoxicity is more common and has serious, long-term effects at low doses. PBDEs during pregnancy impact fetal neurodevelopment. BPA causes multiple sclerosis, amyotrophic lateral sclerosis, and Parkinson's disease in addition to neurodevelopmental problems like ADD/ADHD and autism spectrum disorder. It alters brain function and behavior. BPA affects mouse brain memory and learning. Children 0-12 years old with phthalate metabolite levels in their urine have worse behavioral and cognitive outcomes, including MS, ALS, Parkinson's, Wilson, and Alzheimer's. Inorganic and methylated arsenate affects brain function when it accumulates near brain areas. Lead accumulates in the hippocampus, affecting cognition, language, task execution, following instructions, and memory. Thallium exposure can cause lethargy, hallucinations, numbness, psychosis, changed emotions, crani and nerve damage. Experimental studies show that Pb, As, and MeHg heavy metals harm the central nervous system. Mercury and lead in hair have been linked to cognitive impairment and memory loss in epidemiological studies. During pregnancy, the placenta transfers skeletal lead from the mother's bones to the fetus. Breast milk delivers nutrients from the mother's bones to the newborn. Lead accumulates and hinders prenatal nervous system development.

5. Cardiovascular health

Pollutants cause many illnesses and deaths. This group has around 60% cardiovascular disease cases. These are the leading causes of mortality and disability. Environmental causes of cardiovascular disease kill more people than metabolic, cigarette, and behavioral risk factors combined. Aerosol particles, depending on size, increase cardiovascular disease risk. A. J. NO2, elemental carbon, and PM2.5 and PM10 were linked to cardiovascular disease, stroke, and blood pressure alterations.Ultrafine particles that get through the alveolar epithelium and enter the systemic circulation harm the heart and blood vessels. Inhaled particles settled in respiratory alveoli. ROS production contributes to oxidative stress. Particles impact cardiovascular health by creating ROS and modifying calcium levels. Health and mitochondrial activity are affected by oxidative stress. AP-1 and NF-k transcription factors activated by oxidative stress generate systemic inflammation. This increases inflammatory mediator gene expression. Inflammation, cardiac arrhythmias, and particulate matter-induced oxidative stress characterize ischemia, myocardial infarction, and atherosclerosis. Even in healthy adults, PM inflammation can increase acute phase reactants including C-reactive protein, fibrinogen, and D-dimer, endothelial dysfunction, and blood coagulability, according to the American Heart Association. Thrombosis, plaque formation, venous thromboembolism, and inflammatory mediators allow fine and ultra-fine particles to enter the bloodstream or indirectly affect pulmonary inflammation. Particulate matter reduces aPTT and prothrombin time, promoting coagulation. Metals on particles cause hypercoagulability immediately. Epigenetic alterations affect gene expression without DNA sequence changes. One way PM2.5 causes cardiovascular disease is through inherited gene expression alterations. Particulates fibrillize blood vessels. Heart arrhythmias, which indicate heart illness, can result from cardiac cycle disruption. Growing data suggests that water and soil toxins might harm heart function by causing inflammation and disrupting the body's regular rhythms. Unclean airborne particles threaten human health more than dirt and other contaminants.

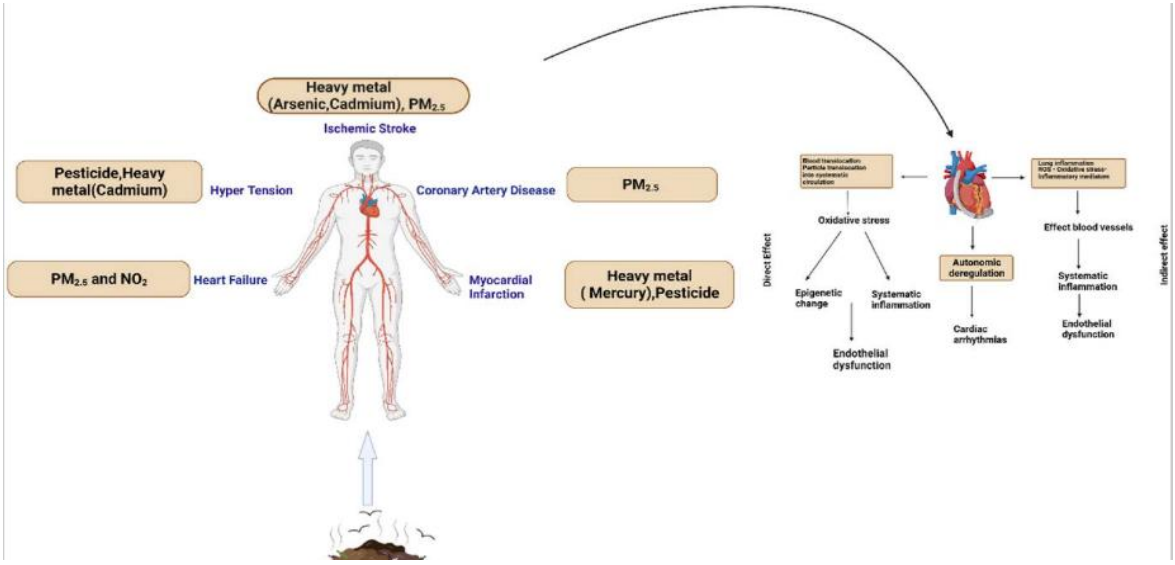

Fig. 5 Effects of environmental pollutants on the cardiovascular system

Chronic nitrogen dioxide and particulate matter exposure has been associated to heart failure in UK cohort studies. A meta-analysis of 35 studies indicated that hospitalization or heart attack fatalities were 2.12% greater on exposure days with PM2.5 values of 10 microg/cm3. Heavy metals can cause cardiovascular issues. Animal models of Pb exposure show hypertension and increased blood pressure, although chelation can reverse it. A recent Chinese cross-sectional study indicated that high blood lead levels increased the risk of cardiovascular disease, including coronary disease, myocardial infarction, stroke, and carotid artery plaques. The national health and nutrition assessment survey found that prolonged physiological stress and blood Pb levels increased cardiovascular mortality. Heavy metal pollution in soil is connected to cardiovascular illness in low- and middle-income countries due to high environmental contaminant exposure (Burroughs Peña & Rollins, 2017).Methyl mercury is known to be neurotoxic. It may dose-dependently increase cardiovascular disease mortality and non-fatal myocardial infarction, according to new research. Type 2 diabetes, heart disease, and peripheral artery disease are linked. Stroke and As exposure are less linked. Lower As exposure reduced cardiovascular disease deaths. Cd increases the risk of stroke and hypertension in Korea, according to NHANES. Long-term air pollution exposure increases the risk of fatal or nonfatal coronary artery disease. Chronic ischemic heart disease, acute ischemia, and heart failure are connected to short- and long-term air pollution. Long-term PM 2.5 exposure increases cardiovascular risk through plaque progression, while short-term exposure increases risk through plaque rupture. A Korean study found that long-term air pollution increases stroke mortality. The Women's Health Initiative found that long-term PM2.5 exposure increased stroke and cerebrovascular disease risk by 86% for 10 mg/m cube in l increment and 35% overall. Acute myocardial infarction, heart failure, and arterial hypertension during pregnancy are strongly linked to pesticide exposure. Note that the included studies are heterogeneous.

CONCLUSION

In addition to being one of the top causes of death on a worldwide scale, pollution has a disproportionately negative impact on countries that have a low income per capita. The processes of industrialization, urbanization, and construction are never-ending processes that

make the situation exponentially worse on a daily basis. Additional challenges that countries like Nepal must contend with include the contamination of water supplies and the pollution of air inside buildings. Pesticides are used without discrimination by Nepalese farmers, who are motivated by the need to increase food production per unit of land. This practice puts the health of both humans and the environment in jeopardy for the long term.

In order to raise awareness about the severity of the problem of pollution in the air and water, there needs to be a campaign. Programs that provide assistance to low-income families in making the transition from conventional cooking stoves to cleaner alternatives should be established in order to reduce the amount of air pollution that is produced in households. The provision of incentives for the utilization of biological and plant-based pesticides, as well as the facilitation of collaboration between various organizations, are also quite important. Organic farming and integrated pest control are two methods that should be supported by advocates in order to limit the amount of pesticides that are required. The formulation and implementation of a comprehensive national and international strategy should be done in conjunction with one another in order to lower the costs of healthcare that are associated with pollution.

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