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## Review Article

# The Profound Impact Of Air Pollution On Human Health

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### ABSTRACT

Air pollution has impacted climate trade and the increasing costs of illness and mortality, it reasons, air pollution is one of the largest problems facing society today. An extensive range of pollution contributes considerably to human disease. Among those is Particulate rely (PM), which can be tiny debris of various sizes that can be inhaled into the respiratory gadget and might cause breathing, different illnesses, cancer, and problems with the reproductive, cardiovascular, and vital neurological systems in the stratosphere, ozone affords protection from UV radiation; nevertheless, immoderate concentrations of ozone under the surface can be risky and feature destructive consequences at the breathing and cardiovascular structures. While absorbed into the human frame, heavy metals like lead can result in both acute poisoning and long-term intoxication, relying on the diploma of exposure. The public of the breathing device illnesses delivered using the materials listed above consist of asthma, bronchiolitis, lung cancer, cardiovascular activities, abnormalities of the important worried device, and skin situations. Finally, the geographic distribution of many infectious illnesses is motivated by the aid of herbal disasters and weather changes. The most effective approach to deal with this hassle is through public recognition campaigns and a multidisciplinary technique from medical professionals; national and worldwide corporations need to cope with the growing danger posed by this difficulty and offer sustainable solutions because of air pollution, millions of human beings international are managing serious health problems. The World Fitness Corporation estimates that the bad fitness results of air pollutants result in four million fatalities each year, which helps this claim. The USA Environmental Safety Employer states that mitigating elements, including advancements in diesel engine generation, may bring about fewer preventable deaths. The present evaluation divides into 3 important regions of discussion: (i) the relationship between air pollutants and respiration situations; (ii) proof helping the

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the idea that decreasing air pollutants should usefully resource in disease prevention; and (iii) the ability poor impact on population fitness because of authorities-led initiatives to lessen air pollution.

## INTRODUCTION

Air pollutants has accelerated substantially in recent many years, posing a honest dangerous threat to the environment and the human health. there are numerous exceptional reasons of pollutants, from smoking large amounts of cigarettes and natural occasions like volcanic bursts to large quantities of pollutants from motors and commercial activities. Air pollutants are the collective period for any detrimental outcomes of any source that bring about environmental degradation or atmospheric pollution. The long-time period consequences of air pollutants on the onset of illnesses which includes most cancers, coronary heart issues, and respiration infections and inflammations are widely recognized. therefore, thousands and thousands of fatalities globally arise due to air pollution every 12 months. A current look at located a connection between male infertility and air pollution [5]. Maximum Europeans live in areas where air pollution may be extreme, in particular in towns. both quick- and long-term exposure to air pollutants can result in some of diseases, which includes lower respiratory infections, exacerbations of bronchial asthma, lung, trachea, and bronchus cancers, stroke, and continual obstructive pulmonary ailment. Research provided by the World Health Organization (WHO) has shown a connection between dementia, Alzheimer's disease, weight issues, type 2 diabetes, and systemic infection and air pollution exposure. One of the main causes of cancer, according to the International Agency for Research on Cancer, is air pollution, specifically PM<sub>2.5</sub>. A recent global analysis suggests that prolonged exposure can affect all frame organs, which complicates the control of current scientific scenarios [6]. Within the 27 ECU member states in 2020, PM<sub>2.5</sub> publicity is anticipated by way of

the EEA to have contributed to approximately 238,000 premature deaths. compared to 2005, the ecu-27 skilled a forty five % reduction in untimely deaths associated with first-rate particulate depend exposure in 2020[6,7]. Many of the maximum crucial issues going through our day is air pollution. This problem stems now not only from its function in contributing to weather exchange, however additionally from its negative consequences on public and individual health, which boost the occurrence of ailment and mortality. a multitude of contaminants are key contributors to human disorder. amongst them, Particulate rely (PM) is inhaled into the breathing device and reasons disorders of the heart and lungs, disturbances of the reproductive and vital frightened systems, or even cancer. PM is made of minute particles that have distinct sizes [7]. In 2020, the primary supply of particulate matter was electricity utilization in homes, groups, and establishments. Agriculture was a similarly big source of PM<sub>10</sub> as did the producing and mining industries. Particulate remember emissions, specially PM<sub>2.5</sub> and PM<sub>10</sub>, reduced by means of 32% and 30%, respectively, among 2005 and 2020. "A measure of the situation of air relative to the requirements of one or extra biotic species or to any human need" is how Johnson outline the air first-class index (AQI). The AQI is separated into numbered ranges, with shade codes applied to each variety. The wide variety indicates the diploma of health threat linked with air first-rate, ranging from a totally risky stage of over three hundred to a wholesome fashionable level of zero. Typically used to resource in chance evaluation, the Pollutant fashionable Index (PSI) is a numerical range and indication of contaminants. it's far a range of with a number 0 to 500.[19] Thom and Ott first proposed the PSI reporting trendy for air satisfactory in 1974[20]. Consequently, this would offer a way to assess the relative contribution of each pollutant to overall risk.21] The PSI is



determined by counting the amount of the five main air pollutants in the atmosphere: carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter (PMs), and ozone (O<sub>3</sub>)[8]. Despite the fact that ozone affords a guard in opposition to UV light within the higher surroundings, ground degree quantities of this gas are dangerous to the respiration and cardiovascular systems. similarly, air pollutants which can be dangerous to human fitness consist of dioxins, sulfur dioxide, nitrogen oxide, risky organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs). high quantities of carbon monoxide can reason toxicity that manifests speedy. depending at the degree of exposure, heavy metals like lead can cause either on the spot poisoning or chronic intoxication after they enter the frame. The illnesses because of those compounds particularly gift as respiration disorders, along with lung most cancers, cardiovascular activities, central nervous machine malfunctions, and skin ailments, similarly to allergies, bronchiolitis, and persistent Obstructive Pulmonary disease (COPD). it's important to understand that climate change introduced on by way of environmental degradation additionally affects the spread of different infectious sicknesses and interacts with natural screw ups to shift the geographic distribution of those illnesses. Worldwide requirements on thresholds and limitations for most important air pollutants that reason fitness concerns are provided by using the WHO international Air excellent requirements (AQG). these hints are the end result of an open, evidence-primarily based decision-making manner, and they showcase exquisite methodological great. The WHO global Air exceptional hints consist of meantime objectives in addition to the rule of thumb values to facilitate a clean transition from high to lower concentrations [9]. Similarly, the guidelines offer qualitative recommendations on fine practices for coping with

precise styles of particulate matter (PM), such as ultrafine particles, black carbon/elemental carbon, and debris from sand and dirt storms, for which there aren't sufficient quantitative records to determine proper particulate remember concentrations (AQGs).

#### **Assets of air pollution:**

- **Carbon Monoxide:**

according to Enger & Smith), breathing air containing 0.001% carbon monoxide for a few hours may be lethal because CO has a long-lasting binding affinity for hemoglobin, even in small concentrations, and accumulates to lower hemoglobin's potential to carry oxygen. CO from moving vehicles in congested regions can also bring about headaches, impaired vision, and sleepiness.

- **Ammonia (NH<sub>3</sub>):**

studies have revealed that ammonium chloride is the supply of the aerosolized liquid water that gives Delhi its "haze"-like situations.

- **Lead (Pb):**

Paints, steel, diesel, and gasoline emissions, as well as different sources, are the main lead sources. Mining and smelting, burning coal and wood, convalescing batteries, and trash incineration. However now that lead-unfastened gasoline is convenient to be had, lead emissions from gasoline have reduced. The plains of Punjab and Haryana had stagnant air and aerosols from burning biomass, which affected the whole countrywide Capital location (NCR). The PM<sub>2.5</sub> concentration became 142 µg/m<sup>3</sup> prior to the excessive air pollution episode (SAPE), expanded to 563 µg/m<sup>3</sup> for the duration of the prevalence, and then reduced to 240 µg/m<sup>3</sup> following it. From an ecological standpoint, air pollution can severely damage the air, soil, and groundwater. It poses an intense threat to the sort of lifestyles as well. research on the connection between declining species range and air pollutants amply demonstrates the poor consequences of



environmental pollutants on the extinction of plant and animal species. Air-dispersed toxicants may have an adverse effect on animal reproduction. Acid rain, temperature inversions, and changes in the global climate brought on by greenhouse gas emissions into the atmosphere are additional significant ecological repercussions of air pollution. Air pollution are any materials in the air which can have a negative impact on the surroundings or human fitness. the arena fitness corporation (WHO) lists the six fundamental air pollution which can be dangerous to each human fitness and the ecosystem: lead (Pb), nitrogen oxides, sulfur oxides, floor-stage O<sub>3</sub>, CO, and particle pollution. Many suspended cloth pollutants, which includes dirt, fumes, smokes, mists, gaseous pollutants, hydrocarbons, volatile natural compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and halogen derivatives, are present in the air at excessive concentrations, making humans more susceptible to a spread of ailments, consisting of cancer [10]. The Air first-rate Index (AQI) in India, like in many other nations, is a numerical scale used to communicate how polluted the air is. It commonly levels from 0 to 500 or higher, with specific categories indicating unique ranges of fitness subject. here is a trendy mathematical illustration of the AQI in India: Let, C represent the attention of a specific pollutant (along with PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO, or O<sub>3</sub>) within the air.

Then, the AQI is calculated the usage of the following method:

$AQI = \frac{C - C_{low}}{C_{high} - C_{low}} \times (I_{high} - I_{low}) + I_{low}$   
The AQI is then rounded to the closest integer to offer an easy representation of air first-rate. The ensuing integer is associated with a particular AQI class, indicating the level of health issue, along with good, mild, bad, Very bad, or hazardous.

For example,

Let's use the PM<sub>2.5</sub> particle as an example. This is a common pollutant that is measured by the Air Quality Index.

- $C_{low} = 0 \mu\text{g}/\text{m}^3$  (micrograms per cubic meter)
- $C_{high} = 50 \mu\text{g}/\text{m}^3$
- $I_{low} = 0$  (corresponding to the "Good" category)
- $I_{high} = 50$  (corresponding to the "Good" category)

Now, let's say the current concentration of PM<sub>2.5</sub> is  $C = 35 \mu\text{g}/\text{m}^3$ .

We can use the formula:

$$AQI = \frac{I_{high} - I_{low}}{C_{high} - C_{low}} \times (C - C_{low}) + I_{low}$$

Plugging in the values:

$$AQI = \frac{50 - 0}{50 - 0} \times (35 - 0) + 0$$

$$AQI = 1 \times 35$$

So, the AQI for PM<sub>2.5</sub> concentration of  $35 \mu\text{g}/\text{m}^3$  would be 35, which falls into the "Good" category. This indicates that the air quality is considered good, with little or no health risk associated with PM<sub>2.5</sub> pollution at this level.

#### Figure 1: Calculation of air quality index. RESULT AND DISCUSSION

Any unusual suspended item in the air that interferes with an organ's capacity to function typically is taken into consideration an air toxicant when it comes to health risks. primarily based on present day records, The primary objectives of air pollution publicity are the respiratory, cardiovascular, ophthalmologic, dermatologic, neuropsychiatric, hematologic, immunologic, and reproductive systems. on the other hand, through the years, the toxicity to cells and molecules can also purpose a number of malignancies. Conversely, it's been demonstrated that even minute concentrations of air toxicants pose a hazard to inclined populations, which includes youngsters, the aged, and those with respiratory and cardiovascular conditions. The maximum commonplace air pollutants are particulate rely



(PM) and ground-level ozone. There are major styles of air pollutants: ambient air pollutants outside and indoor air pollution interior, which comes from burning home fuels. folks that are exposed to excessive quantities of air pollution have a spectrum of health troubles, from minor to excessive. these fitness effects, that have various effects on properly-being, are divided into two classes: quick-time period and long-term. folks who belong to prone categories together with the elderly, children, diabetics, and people with heart or lung issues consisting of bronchial asthma have to pay more attention to fitness precautions [11].

Short-term outcomes encompass mild discomfort, along with eye, nose, pores and skin, and throat irritation, together with coughing, wheezing, chest tightness, and respiration difficulties. they could worsen and result in extra severe illnesses like bronchitis, pneumonia, asthma, and coronary heart and lung issues. the quick-term effects of air pollutants may additionally encompass complications, nausea, and vertigo. These problems can get worse if publicity maintains over a prolonged time frame. lengthy-term exposure to pollution can damage the reproductive, neurological, and respiration structures, promote the boom of most cancers, and in extreme instances, even bring about loss of life. Chronic lengthy-term consequences can even result in death and endure for years or a lifetime.

#### **Health-AIR pollutants-environment**

The World Fitness employer (WHO) estimates that at some stage in the preceding 3 a long time, trends in warm temperatures and precipitation added approximately through anthropogenic climate exchange have claimed the lives of 150,000 humans yearly. not unusual human health problems, which include accelerated cardiovascular mortality and respiration ailments added on by using heatwaves and other causes, were made worse via those climate-prompted changes. The dispersion of air pollutants in phrases

of area and time is substantially inspired by weather dynamics. the 2 essential drivers of weather exchange are stratospheric ozone depletion and greenhouse warming. adjustments in the climate have the capability to affect air pollution concentrations and boost up the synthesis of secondary pollutant chemicals [12]. In addition, terrain, urban making plans, atmospheric variables, and climate all work together to steer how pollution unfold, accumulate, and exchange inside the ecosystem. continual bronchitis, allergic reactions, asthma, and emphysema are many of the respiration conditions that may result from the spread of these airborne pollution.

#### **RESPIRATORY DISEASE**

For the reason that the general public of air pollutants enter the body via the airlines, the breathing gadget performs a primary role inside the initiation and improvement of disorders related to air pollution. The diploma of damage that inhaled pollutants produce to the breathing system varies depending on their dosage and the way lengthy they stay in target cells. The initial consequence within the upper breathing tract is irritation, in particular within the trachea, which causes dysphonia. one of the main environmental chance elements for a number of respiratory conditions, which include lung cancer and allergies, is air pollution. The breathing system is severely harmed by way of air pollution, specially particulates depend (PMs) and other compounds which might be respirable, like dirt, O<sub>3</sub>, and benzene, Air toxicant [13]



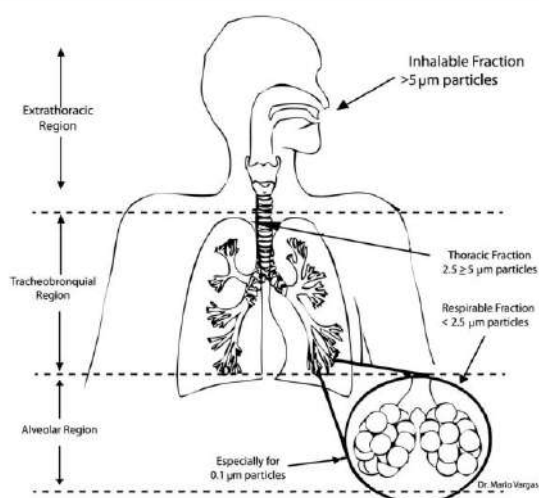


Figure 2: Respiratory disease.

## MECHANISMS OF LUNG DAMAGE

### Oxidative stress

Principal techniques with the aid of which air pollutants damage people's fitness is oxidative pressure. Furthermore, after being exposed to debris, the lungs produce reactive nitrogen species. Tyrosine residues on proteins begin to nitrate when superoxide anion radicals and nitric oxide, which is generated by means of inflammatory cells, integrate to form peroxynitrite. These adjustments aid within the disease's development. Conversely, the natural pool of H<sub>2</sub>O<sub>2</sub> generates highly reactive metabolites

(hypochlorous acid) via reactions with certain enzymes like myeloperoxidase. Children exposed to air pollutants showed a decrease in superoxide dismutase interest (antioxidant defence) and a boom in malondialdehyde concentrations. In addition, black carbon and PM<sub>2.5</sub> exposure had been linked to improved plasma concentrations of reactive chemical compounds that cause thiobarbituric acid. The plasma degrees of those chemicals were similarly higher in people who lived in infected environment [14]. Whilst mice get PM intratracheally, their serum degrees of cytokines such interleukin-6 substantially upward thrust. 53 while human macrophages come into touch with debris, they launch a spread of cytokines, consisting of granulocyte macrophage-colony stimulating issue, interleukin-6, interleukin-1b, macrophage inflammatory protein-1-a, and tumor necrosis issue-a. Nuclear factor kappa B and/or activator protein are activated by these cytokines. Additionally, nuclear factor kappa B is activated by ultrafine black carbon through protein kinase C. PM's metal content can set off a chain of redox events that damage DNA oxidatively [14,15].

Table 1 Presents degree of penetration of pollutants in the human respiratory system according to particle-size.

| Particle size | Penetration degree in Human respiratory system    |
|---------------|---|
| >11 μm        | Passage into nostrils and upper respiratory tract |
| 7-11 μm       | Passage into the nasal cavity                     |
| 4.7-7 μm      | Passage into larynx                               |
| 3.3-4.7 μm    | Passage into trachea-bronchial area               |
| 2.1-3.3 μm    | Secondary bronchial area passage                  |
| 1.1-2.1 μm    | Terminal bronchial area passage                   |
| 0.65-1.1 μm   | Bronchioles penetrability                         |
| 0.43-0.65 μm  | Alveolar penetrability                            |

### CARDIOVASCULAR DISORDER

Numerous epidemiological and experimental research have established a hyperlink among air pollutants exposure and issues connected to the heart. Modifications in white blood cellular counts

are also connected to air pollution, which may additionally have an impact on cardiovascular fitness. However, a study carried out on animal fashions revealed a sturdy link among publicity to air pollutants and hypertension. Air pollution from

traffic, specifically exposure to elevated NO<sub>2</sub> degrees, has been linked to each left and proper ventricular hypertrophy. other than the antidote therapy available for a constrained variety of cardiotoxic chemical compounds which includes CO, popular treatment for cardiovascular ailments must be administered.

### **NEUROCOMPLICATION**

It has lengthy been debated whether publicity to airborne suspended risky chemicals influences the apprehensive device. on the other hand, it is now notion that these toxic compounds damage the anxious gadget. Air pollution has a damaging impact at the nervous machine that may cause intellectual fitness issues and neurological problems. Devastating results are viable from neurological dysfunction, specially in toddlers[15].

### **PSYCHIATRIC DIFFICULTY**

However, competitive and delinquent behaviours are added on by way of psychiatric issues. Air pollution has been connected in recent research to neurobehavioral hyperactivity, crook interest, and age-irrelevant conduct. research has additionally tested a hyperlink between air pollution and an accelerated chance of neuroinflammation, which includes Parkinson's and Alzheimer's sickness. consistent with several studies, there may be an instantaneous correlation among high levels of air pollution in megacities and anxiety and hostility.

### **SKIN DISORDER**

In idea, breathing in harmful air pollution or soaking up them via the pores and skin can damage inner organs. Hepatocarcinogen compounds are among those contaminants. Empirical evidence has proven the effect of air pollutants, particularly visitors-associated air pollution, on the superiority of autism and associated problems in youngsters and foetus. it's been recommended that one capability mechanistic pathway for autism or other neurological issues is the disruption of endocrine characteristic by using chemical elements of

pollutants. Air pollution-associated fitness problems are a serious subject, particularly for growing Indian towns. In 2020, there were about 0.62 million premature extra demise instances in India due to outside air pollution, making it the sixth maximum not unusual purpose of loss of life in the back of high blood pressure, interior air pollutants, terrible nutrition, and tobacco smoking. Human health is related to quick-, medium-, and long-time period effects from air pollutants. concerning the fast-term health affects of exposure to air pollutants, severa studies had been finished. long-term effects of air pollutants encompass lung cancer, heart-related problems, chronic respiratory illnesses, or even damage to the brain, liver, kidneys, or nerves. brief-term consequences encompass irritation of the eyes, throat, and nose as well as diverse respiration infections which include pneumonia and bronchitis [16]. In step with Burnett and Yang, there may be a full-size correlation among greater airborne concentrations of gaseous and particulate depend and untimely mortality as well as hospitalizations for respiratory and put up-respiration disorders in city areas. consistent with researches, tiny debris deposited closely inside the pulmonary place, whilst coarse debris showed a greater mass deposition fraction within the greater thoracic region. Human beings vary in how air pollutants influences them; for instance, some people are more susceptible to air pollution than others. Pregnant ladies, the aged, and kids are in particular susceptible to the fitness worries related to air pollution. in keeping with research, children who are uncovered to air pollutants suffer extra than adults do on the grounds that their lungs are not fully grown at start and don't paintings well until they're between the ages of 6 and eight. Moreover, there is a extra likelihood that folks who have already got health troubles—including coronary heart ailment, lung infection, bronchial asthma, and so on.—can have further hardships. furthermore, as research carried



out inside the metropolis of Agra suggests, the length of exposure and the awareness of air pollution decide the level of harm. Maintaining public health calls for addressing air pollutants, the second one-maximum threat aspect for noncommunicable ailments.

### **DIGESTIVE DISORDERS**

According to Kimbrough, dioxins cause damage to liver cells, as seen by elevated blood levels of certain enzymes (refer to the section on the underlying cellular modes of action), in addition to liver and gastrointestinal cancer.

### **URINARY DISORDERS**

Increased excretion of low molecular weight proteins, which leads to a decrease in the glomerular filtration rate (GFR), is one way that heavy metals can cause harm to the kidneys. They also raise the chance of developing stones or nephrocalcinosis [17].

### **Cellular mechanisms involved in air pollutants actions**

Unfastened radicals are constantly produced in eukaryotic cardio species, such as humans, during regular metabolism as well as in reaction to exposures to external environments (inclusive of radiation, cigarette smoke, metals, and ozone). Oxidative pressure is a condition that arises while the attention of free radicals rises because of an organism's defenses being beaten. numerous degenerative illnesses, which include atherosclerosis, coronary heart attacks, stroke, rheumatoid arthritis, cataracts, primary nervous device issues (which include Parkinson's and Alzheimer's ailment), age-related disorders, and most cancers, have all been connected to this oxidative country. Metals building up and disrupt the operation of cellular organelles. as an example, it's been stated that lead buildup in mitochondria causes a number of changes, which include a rapid launch of stored  $Ca^{2+}$ , a lower in transmembrane potential, an obstruction of  $Ca^{2+}$  absorption, and the oxidation of pyridine nucleotides.

Proteins that bind nucleic acids are also implicated, and it has been verified that metals can bind to DNA and have an effect on gene expression. To result in carcinogenesis, nickel, as an instance, enters the nucleus, interacts with chromatin, and silences the expression of genes. Such tumor suppressor genes (Costa et al., 2003). finally, a few metals can motive neurotoxicity via interfering with unique ligand- and voltage-gated ionic channels [17,18].

### **HERBAL PROTECTION**

The human body is equipped with drug or xenobiotic metabolizing enzymes (DMEs or XMEs) to help defend against potentially harmful environmental insults. These enzymes are important for the biotransformation, metabolism, and/or detoxification of xenobiotics and foreign compounds, such as various types of pollution. Drug or xenobiotic metabolising enzymes (DMEs or XMEs) are crucial for the biotransformation, metabolism, and/or detoxification of xenobiotics and foreign compounds, consisting of numerous pollutants, that the human body wishes to defend itself towards doubtlessly dangerous insults from the environment. Many evidently going on materials, along with polyphenols and the nutrients C, E, and A that are present in most plant-based diets, can scavenge or intrude with the awareness of reactive oxygen species (ROS) within cells, shielding the frame from the dangerous outcomes of oxidative strain. indeed, our organization's research has tested that, while compared to a regular eating regimen, the antioxidant hobby of plasma turned into increased in people who consumed a weight loss plan high in end result, greens, and olive oil.

This growth is by and large due to polyphenols, that have a selection of organic activities, together with antiviral, anti-tumorigenic, and anti-mutagenic effects ordinarily due to their antioxidant features and capacity to impede fundamental cell methods. it's far proper that





polyphenols have a shielding impact against cancer, and this effect can be partly explained by way of their capability to regulate the enzymes that either prompt or degrade environmental cancer causing agents [18].

### **AIR POLLUTION AND CLIMATE-CHANGE MITIGATION**

Climate trade might also cause ranges of environmental pollutants, which includes PM<sub>2.5</sub> and O<sub>3</sub>, to boom. for instance, extra O<sub>3</sub> and photochemical smog are created whilst temperatures upward thrust. The findings confirmed that O<sub>3</sub>-associated deaths passed those because of warmness. moreover, O<sub>3</sub> concentrations increased dramatically within the summer time of 2003, peaking at a hundred elements according to billion.seventy two forest fires, which might be caused by dry situations and different climatic phenomena like El Niño, may also make a contribution to an boom in ambient particle concentrations. In 1998, forest fires related to El Niño in Indonesia uncovered approximately 20 million people in South East Asia to risky smoke-borne pollutants. Growing the performance of fossil fuels for industrial processes and power generation, moving to renewable electricity sources (solar, wind, and wave energy), enhancing building insulation, and growing new technology are some of the planned techniques to mitigate weather trade. discern three indicates pollution in 37 towns selected from 91 international locations, as mentioned by means of the sector fitness business enterprise (WHO). When particulate depend (PM)<sub>10</sub> degrees exceed 20 mg/m<sup>3</sup>, there can be health dangers to carbon sequestration, forests, and nuclear strength. it is widely stated that at the same time as moves in all 3 areas may additionally stop contemporary warming from increasing, they might not forestall it altogether [19]. Both person and governmental action are needed to reduce the impact of pollutants on breathing health. man or woman level

interventions can include lowering publicity by using fending off exercise or cycling near busy roads and improving ventilation in families that use biomass fuels. furthermore, engineering innovations that drastically reduce emissions from vehicles and cooking stoves might be mandated or endorsed through public policies. Experiments like the ones conducted in Beijing during the Olympics have proven how these modifications may want to have an effect on human beings's fitness. when taken into consideration collectively, these findings mean that reducing air pollution stages will have a great effect on health, particularly at the fitness of those laid low with breathing conditions. Therefore, a good way to safeguard the fitness of the present and destiny generations, quick cuts in emissions from the burning of fossil fuels are required if stepped forward modeling studies continue to forecast growing O<sub>3</sub> concentrations with changing climate. there may be proof to reveal that decreasing present tropospheric O<sub>3</sub> concentrations lowers morbidity and death at the same time as also saves a vast amount of cash on medical prices [18,20].

#### **Global Burden of Air Pollution:**

Children are definitely more vulnerable to the effects of air pollution, especially in their formative years. Air pollution negatively impacts many facets of our existence. In addition to having a substantial financial cost, the diseases associated with air pollution have broad societal repercussions as well, including absenteeism from both productive employment and educational settings. Even though eliminating anthropogenic environmental contamination is an enormous task, authorities, agencies, and medical experts operating collectively intently can find a workable technique to standardize the scenario. To successfully stop the issue from bobbing up, governments should provide loads of facts, train the general public, and contain experts in addressing these issues. technology that purpose to



lessen air pollution at its source have to be developed and broadly carried out in strength plants and enterprise. a main milestone become set through the Kyoto Protocol of 1997, which aimed to lessen GHG emissions with the aid of more than 5% by using the 12 months 2012 (123). A comparable line of movement became maintained in the course of the 2009 Copenhagen summit (Copenhagen climate trade conference (UNFCCC) 2019) and the 2011 Durban summit. many nations have prevalent the Kyoto convention and its comply with-up variations, with China being one of the important proponents of this critical conference for the "health" of the worldwide environment and climate. Given its rapid expanding economic system, China is predicted to have a huge GDP by 2050—the 12 months that the treaty for decreasing greenhouse fuel emissions is meant to dissolve [20]. In conclusion, on the way to efficaciously cope with the health outcomes related to air pollution, a comprehensive worldwide preventative coverage must be developed to fight anthropogenic air pollution. To efficiently manipulate this assignment, studies-based totally insights and the adoption of sustainable development strategies are important. so that it will successfully alter pollution, global cooperation inside the areas of studies, development, administrative policies, monitoring, and politics is currently critical. Harmonizing and updating air pollutants legal guidelines is vital, and legislators need to develop effective strategies for safeguarding the surroundings and public fitness. accordingly, the primary thesis of this newsletter emphasizes the importance of growing nearby frameworks to sell enjoy and alertness, increasing those subjects [21].

#### **Environmental Justice and Air pollution:**

The public's fitness is negatively impacted via those intense weather situations, that could lead to environmental loss as nicely. know-how how rising temperatures affect dwelling things will

become crucial whilst studying the fitness repercussions of immoderate warmness. Weather trade-associated temperature will increase are a prime purpose of warmth-associated ailments in urban settings. these illnesses include pores and skin cancer, heatstroke, heart troubles, diarrhea, and higher death poor effects of warmth on fitness additionally encompass dehydration, cramping inside the warmness, warmness exhaustion, heatstroke, fluid loss, warmness injuries, and ailments of the eyes and skin. The city heat island (UHI) effect, which increases temperatures in metropolitan areas, is one critical effect of climate exchange. The soreness this prevalence reasons metropolis people has been mentioned in more than one Indian cities. moreover, because cooling retailers cause the air nice to become worse, this impact is connected to respiratory troubles. moreover, heatwaves and different frequent weather phenomena are strong signs of the outcomes of weather alternate on jap India. In India, heatwaves on my own claimed about 2000 lives in 1998 and 2015. kind of 1,625 human beings died from heatwaves between 1978 and 1999, normally in Rajasthan, then bihar. This quantity accelerated to a few,442 warmness-related deaths among 1999 and 2003 A have a look at carried out in 2013 by way of Dutta and Chaurasia determined that over six hundred deaths in India were attributed to heatwaves, with nearly 1,400 deaths going on in Andhra Pradesh in 2002 as a result of a high ambient temperature of fifty°C [20]. similarly, extra severe climate occurrences which include cyclones, floods, tsunamis, and droughts are added on with the aid of climate alternate and feature a terrible effect on public fitness. Human properly-being is not directly impacted with the aid of urban droughts and floods due to weather shifts, that may bring about either excessive or insufficient rainfall. physical results from floods consist of trauma, hypothermia, and drowning. In India, extreme droughts which have



precipitated a shortage of meals have led to an extraordinary range of famine deaths. In a similar vein, heavy rains that cause flooding ruin crops, which results in a lack of food and subsequently exacerbates public health issues and malnutrition. In India, malnutrition is a serious problem that affects approximately 47% of children, according to a 2009 World Bank report on the subject [22].

### **Environmental Impact of Air Pollution**

In addition to endangering human health, air pollution also negatively impacts the ecosystem in which we live. The following are the main influences of the environment. When precipitation with dangerously high concentrations of nitric and sulfuric acids is dry (particulates and gas) or wet (rain, fog, and snow), it is referred to as acid rain. These entities possess the ability to demolish trees and plantations, alter the pH of water and soil, and cause damage to buildings, outdoor sculptures, and statues. Haze is the result of microscopic particles dispersing throughout the atmosphere, which reduces the transparency of the atmosphere. Gas emissions from cars, trucks, power plants, and industrial facilities into the atmosphere are the cause of it. As mentioned before, there is ozone in the Earth's atmosphere at both the surface and the topmost layer, known as the stratosphere. Our protection from the Sun's harmful ultraviolet (UV) rays comes from the stratosphere's ozone layer. However, ground-level ozone is a pollutant that poses a health risk to people. Regrettably, substances that deplete ozone, such as chemicals, pesticides, and aerosols, cause the stratosphere's ozone to gradually disappear. thinning stratospheric ozone layer: UV radiation can reach Earth and damage human health, including skin cancer, as well as crops. Plants' stomata close when ozone enters them, preventing CO<sub>2</sub> from being [20,21]. Worldwide weather alternate is a critical issue that issues mankind. As is known, the "greenhouse impact" continues the Earth's temperature stable. Unhappily, anthropogenic

activities have destroyed this shielding temperature impact by producing massive amounts of greenhouse gases, and worldwide warming is mounting, with harmful results on human health, animals, forests, flora and fauna, agriculture, and the water environment. A record states that global warming is including to the fitness dangers of poor people. Toxic contaminants from the air, soil, and aquatic ecosystems burden wildlife, and when exposure to high concentrations of pollutants occurs, animals may experience health issues. There have been reports of birth defects and reproductive failure. Elevated nutrient concentrations, particularly nitrogen, can induce the blooming of aquatic algae, leading to eutrophication. This can cause fish mortality and disequilibratinghe in their species. The ability of an ecosystem to neutralize acidity is unquestionably linked to a critical concentration of pollution that it can withstand without collapsing. This load was set by the Canada Acid Rain Program at 20 kg/ha/yr [22,21]. People who live in shoddy buildings in nations with warm climates are more likely to suffer from health issues related to heat when temperatures rise. Therefore, both soil and water are negatively impacted by air pollution. There have been suggestions made regarding PM's impact on crop output and food productivity as an air contaminant. Fish productivity and the ability of residing species to survive are linked to its effects on aquatic bodies. It is shown that plants exposed to ozone suffer from a deficiency in photosynthetic rhythm and metabolism. Acid rain is caused by sulfur and nitrogen oxides, both of which are toxic to plants and marine life. Not to be overlooked, though, is the fact that lead and other metals can be extremely hazardous, as mentioned previously. [23].

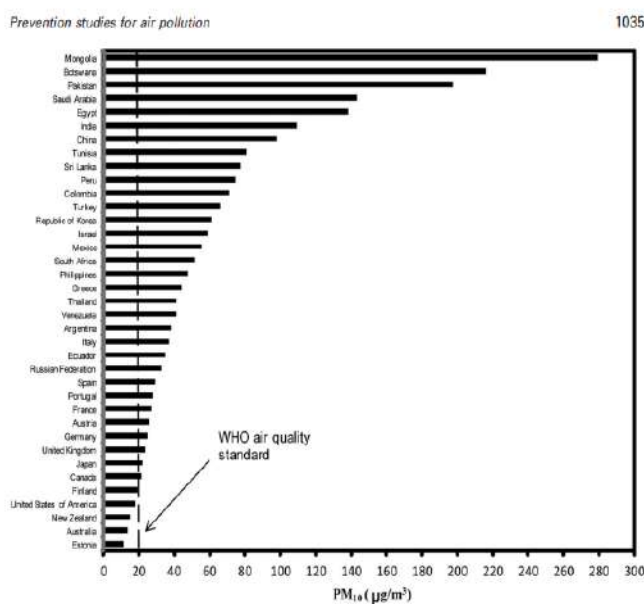
### **PREVENTION OF AIR POLLUTION**

Decreasing pollutants has an excellent impact on health, mainly for people who are touchy, as it is



widely known that pollution has a significant bad impact on fitness. America undertook the first population-primarily based look at to demonstrate a good sized development in existence expectancy in reaction to reductions in PM<sub>2.5</sub> concentrations. The examine discovered a clear correlation among lifestyles expectancy and reductions in great-particle concentrations. This finding turned into supported through a cohort take a look at of adult Swiss topics, which confirmed a correlation between drops in ambient PM<sub>10</sub> levels and a reduction in respiratory symptoms. There are numerous techniques to decrease air pollutants tiers, and governments may be essential players in this process. The PM<sub>10</sub> ranges in several of the maximum polluted nations are displayed in parent 3. As an example, the Chinese language authorities changed into able to control air pollution throughout the 2008 Olympic video games.<sup>64</sup> As a result, compared to earlier than the games commenced, the common number of outpatient visits for allergies reduced via 41.6% at some stage in the Olympics. Before, in the course of, and after the Beijing Olympics, a specific take a look at together with 36 Beijing college students inside the fourth grade revealed that fractional exhaled nitric oxide (FeNO) tiers have been significantly lower all through the event

and expanded by using sixteen.6% within the preliminary hours following exposure, suggesting [22,23]. Here may be developing evidence that oxidative stress-related gene polymorphisms notably have an impact on an character's vulnerability to O<sub>3</sub>. 68–70 section II enzymes, including glutathione S-transferases (GST), NAD(P)H:quinone oxidoreductases, and acetyltransferases, are encoded by means of those genes and are involved inside the cleansing and excretion of dangerous substances. The enzymes that have been investigated the maximum include GSTM1 and GSTP1. In children from Mexico exposed to high levels of O<sub>3</sub>, a observe discovered a link between the onset of allergies and polymorphisms within the GSTM1 gene, that is associated to oxidative pressure. It's exciting to word that youngsters with the GSTM1-null genotype were extra at risk of O<sub>3</sub>'s outcomes [23,20]. Long-term supplementation with D- $\alpha$ -tocopheryl acetate, a natural vitamin E antioxidant, was found to inhibit oxidant pressure inside the airlines in mild cases of atopic allergies exposed to segmental allergen venture; improvements in allergic inflammation and bronchial hyperreactivity were referred to previous reviews that covered studies of additional.



**Table 2: Graph representing the air quality index.**

Effect of air pollution on macro and micro climate. Pollution and climate are closely linked, with pollution having a primary impact on how the Earth's weather gadget adjustments. there are numerous remarks loops and mechanisms involved in the complex interaction among the 2. that is how they're associated:

**Greenhouse gasoline Emissions:**

one of the fundamental reasons of climate trade is pollutants, mainly whilst it takes the form of greenhouse gasoline emissions. Methane (CH4), carbon dioxide (CO2), and other greenhouse gases are released into the environment in good sized portions thru industrial sports, deforestation, and the burning of fossil fuels for strength. The "greenhouse effect" that these gases produce traps warmth, inflicting international warming and changes in climatic patterns. Airborne Particulates and Aerosols: pollution like aerosols and particulate remember have an effect on the climate in ways. initially, via reflecting daylight returned into area, they've the direct ability to chill the earth and impact its power stability. 2d, these debris decrease the reflectivity of ice and snow surfaces when they settle, increasing the surface's absorption of daylight and hastening melting.

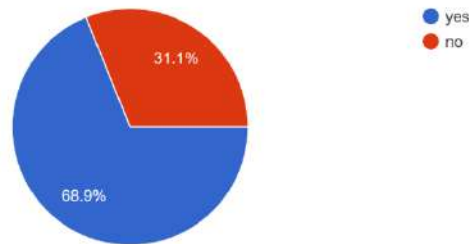
Loops of feedback: The effects of weather trade can be amplified thru comments loops which might be facilitated by way of pollutants. as an instance, methane that had been trapped in ice crystals is released as polar ice melts because of growing temperatures [24]. Ocean Acidification and pollutants: the arena's oceans are impacted with the aid of pollution, which includes an excessive amount of CO2. A large amount of atmospheric CO2 is absorbed by means of the seas, causing ocean acidification. This damages aquatic existence. Ecosystems and the living matters whose skeletons and shells are manufactured from calcium carbonate. The capability of the ocean to absorb carbon dioxide might be hampered by disturbed marine ecosystems, in an effort to further affect the weather gadget. The outcomes of Air nice on health: Greenhouse gases are regularly produced with different pollution that are negative to human fitness, like smog and excellent particulate depend. by using lowering the emissions of each dangerous pollution and greenhouse gases, guidelines focused at lowering these pollutants might also unintentionally make contributions to the mitigation of climate change [25]. The "Urban heat

island" impact, which reasons extra neighborhood temperatures whilst concentrations of pollution soak up and lure warmth, is felt in polluted metropolitan regions. Heatwaves and the need for energy can be made worse by this localized warming, which can also upset regional climatic patterns. Deforestation and Climate Change: Deforestation releases stored carbon and decreases the planet's ability to absorb carbon dioxide due to pollution from activities like forest fires. Because forests absorb carbon dioxide, their disappearance raises atmospheric CO<sub>2</sub> levels and hastens climate change. The Chikungunya virus "took the airplane" from the Indian Ocean to Europe, as

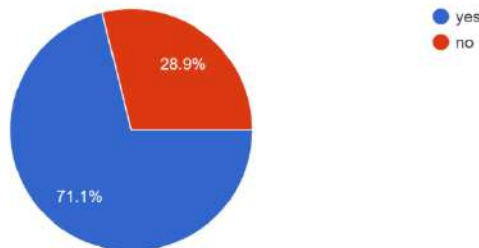
autochthonous cases and outbreaks of the disease were reported in France and Italy. Pollution and climate have a complex and reciprocal interaction. Through the release of greenhouse gases, modification of the energy balance, and interference with feedback processes, pollution plays a role in climate change. On the other hand, changes in weather, precipitation, and air circulation can have an impact on pollution patterns due to climate change. Mitigating the effects of climate change and preserving the ecological balance of the earth require addressing pollution [24,25].

### Statistical Survey Report

Have you ever experienced health issues related to air pollution?  
45 responses

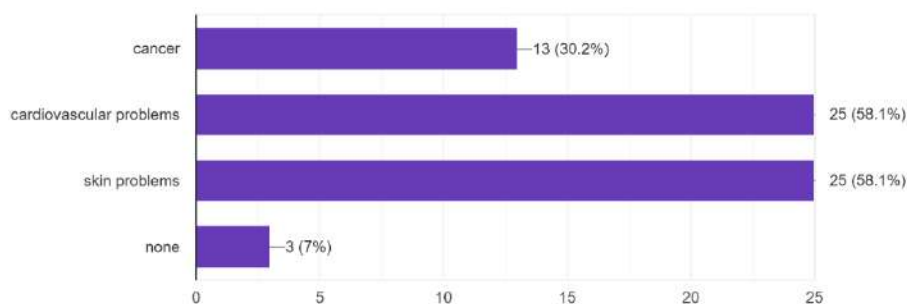


Do you know anyone who has been affected by air pollution-related health problems?  
45 responses



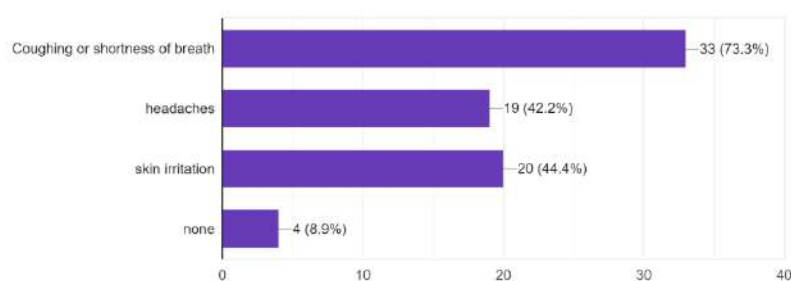
what common diseases have you noticed due to pollution

43 responses



Which of the following health effects have you noticed due to air pollution?

45 responses



## CONCLUSION:

Hundreds of thousands of people are currently impacted by using air pollution in phrases of health. evidence at the impact of pollutants on patients with breathing limitations has been furnished with the aid of us. for example, O<sub>3</sub> and PM can also exacerbate allergies symptoms or motive an early dying, in particular in older people who have already got cardiovascular or respiratory situations. furthermore, pollution sell the discharge of allergenic pollen grains, main to a upward push in the prevalence of bronchial asthma caused by using pollen. consequently, there may be a robust justification for taking action to minimize air pollutants, and there are many one of a kind ways to do that. city planning, technological improvements (including the advent of latest, less-polluting motors), and the enactment of new legal guidelines at the state level are a few of those. lowering O<sub>3</sub> and black carbon stages is predicted to enhance crop yields by way of over 50 million

tonnes every year and preclude over 3 million premature deaths. improvements to cooking stoves would additionally lessen the need for firewood and the quantity of deforestation that takes place in bad nations. Comparably, modern brick kilns utilized in several areas of Asia and Latin the united states devour half the fuel of traditional kilns [26]. Decreasing air pollutants tiers in locations with high site visitors might result in a massive decrease in the superiority of breathing disorders, together with bronchial asthma.28 although it is widely stated that moves taken to reduce air pollutants will forestall extra environmental modifications, they may not prevent the warming that has already come about. apparently, a growing frame of studies indicates that dietary dietary supplements can be a viable means of lowering someone's vulnerability to air pollution and imparting a replacement tactic for offsetting the negative fitness impacts of pollution in people with low antioxidant stages. The useful



air great insights furnished on this assessment for specific megacities in India provide important direction for customizing efficient mitigation plans. This involves pinpointing vulnerable factors in every metropolis. This dataset aids within the estimation of pollutants stages and is a crucial supply of reference for air quality modeling projects. This in turn encourages readiness, flexibility, and methods to reduce issues related to air pollution. because of the great ailment load and mortality related to air pollutants in Indian cities, comprehensive country wide pollution manipulate measures are required. drastically, the outcomes displaying the decrease in pollution throughout the COVID-19 lockdown period suggest that it's far viable to apply such brief limitations so that you can improve air quality and therefore public fitness in lots of Indian towns [27]. The contemporary assessment underscores multiplied levels of air pollutants established across severa predominant towns in India, surpassing ideal thresholds. The continual emissions from both human sports and herbal sources cause heightened concentrations of particulate depend (PM), which in flip have unfavorable results on human fitness. This accentuates the important want for ongoing surveillance of air pollutants at some point of the Indian subcontinent, using both direct measurements and satellite tv for pc records for faraway sensing. In addition, because the evaluation notes, India is a developing u . s . this is going through negative fitness consequences from climate alternate. because of the us of a's rising temperatures because of weather exchange, cities are getting more susceptible to extreme weather activities inclusive of heatwaves, droughts, floods, and heavy rains. forthcoming fitness issues in Indian urban areas can be addressed in element by stepping up fitness surveillance in response to heatwaves, floods, and vector-borne ailments linked to weather exchange.as a result, the evaluation emphasizes how critical it's far to put

into effect mitigation and model plans so as to offset the outcomes that climate alternate is now having and could preserve to have on city health in India [28]. Through examining touchy areas, the essential information on air pollutants stages in India's megacities that is provided on this evaluation can resource within the improvement of green mitigation plans for every metropolis. a good way to effectively put together for, adapt to, and mitigate the consequences of air pollution, the facts can help establish a baseline for air satisfactory modeling research that forecast air pollution levels. To correctly manipulate air pollutant concentration national, attention ought to be paid to the high disorder burden and mortality related to air pollution in Indian cities. similarly, the facts displaying the lower in air pollutants at some point of the COVID-19 lockdown length point to the adoption of comparable transient regulations for pollutants mitigation in numerous Indian towns, enhancing the great of the air and therefore improving human health [29]. To sum up, the application of 5bf1289bdb38b4a57d54c435c7e4aa1c technologies, like satellite tv for pc data mixed with geospatial methods, becomes a effective device for tracking and mapping the spatiotemporal distribution of air pollution and weather trade, as well as the fitness consequences of each. hence, even as growing nations which include India prioritize the introduction of smart towns, careful planning and sustainable practices are vital to create a resilient city surroundings that reduces bad fitness outcomes [30].

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