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In Pakistan, the Transport and Urban Air Pollution Impacts on Human Health and Practical Steps to Avoid Them: A Review

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Abstract

Air contamination has come to be a major global concern, with serious toxicological special effects for human health and the environment. Although there are several emission sources, the majority of air pollution is caused by industrial processes and motor vehicles. Ground-level O3, particle pollution, CO, SO, NO, and Pb are 6 main air pollutants, according to the WHO. Long and short-term exposure to air-borne toxicants has a variety of toxicological impacts on human's health including lung and cardiac disease, neuro-psychiatric problems, eyes irritation, skin problems, and Pulmonary diseases like cancer. Air contamination is an environmental risk factor for diseases like, lung cancer, asthma, AD and PD, autism, fetal development, and low birth weightiness, amongst others. We wanted to cover the toxic of main air pollutants, their sources of release, and their influence on human's health in this review article. We have also offered some practical techniques for Pakistan to minimize air pollution.

Keywords: *human's health, cardiovascular diseases, toxicology, atmosphere, respiratroy tract diseases, Air contamination*

1. Introduction

Particle pollution, ground-level ozone, CO, SO,NO, and Pb are all reported by the (WHO). All aspects of the environment, including groundwater, soil, and air, can be harmed by air pollution. It also poses a significant threat to biological beings. In this regard, we're particularly interested in these contaminants because they're linked to more widespread and serious health and environmental issues. Acid rain, global warming, the greenhouse effect, and climate change all have significant environmental consequences for air pollution (Wilson *et al.,* 1997). A multitude of pollution-related ailments, including as Pulmonary, Cardiac disease, COPD, stroke, and lung cancer, are all linked to air pollution.

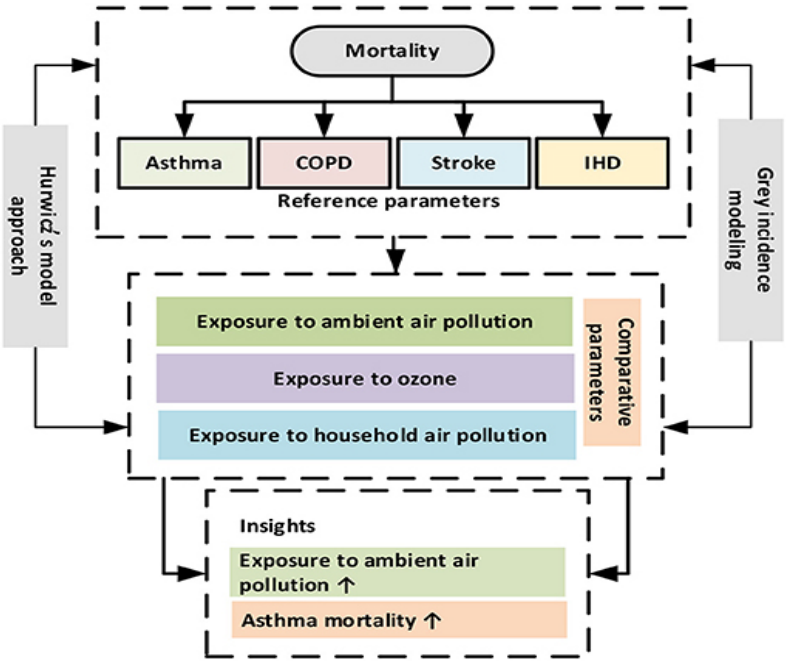

Figure 1: Impact of Environmental Degradation on Human Health

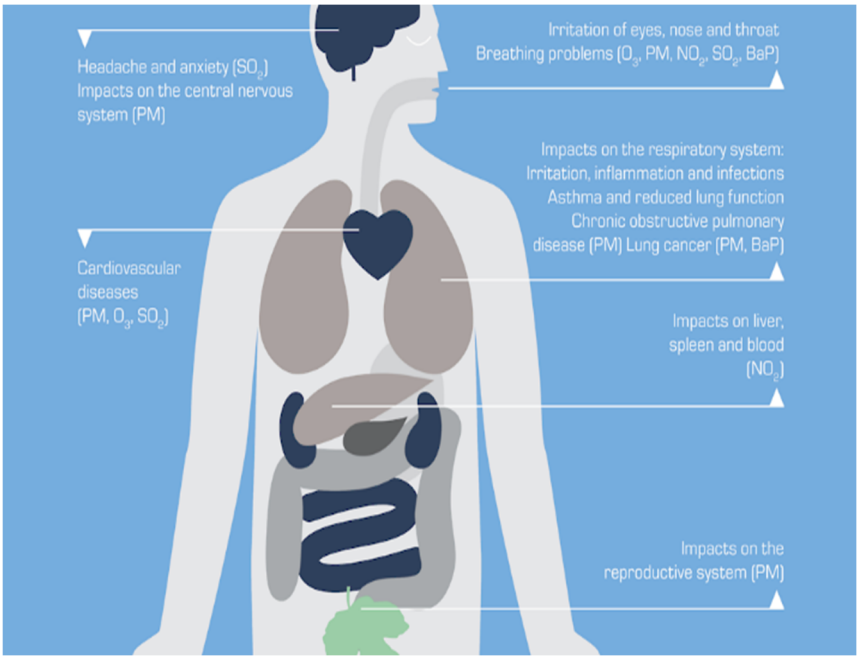

Figure 2: Potential health impacts of major sources of air pollution

2. Definitions

Air pollution refers to any negative consequences of any sources that add to the pollution of the atmosphere and/or the degradation of the atmosphere. Both human activity and natural processes contribute to air pollution. It contains a wide range of pollutants, including solids, liquids, and vapors substances (Vallero *et al.,* 2007). This post will not go into great length about indoor air pollution. The Pollution Standard Index is a numerical value and indicator of contaminants that is commonly used to facilitate evaluations. It's a number between 0 and 500 (U.S. Environmental Protection Agency *et al*.,1996). As a result, it would provide a way to compare each pollutant's relative contribution to total risk. The Pollution standard index is calculated using the concentrations of five primary air pollutants in the atmosphere: particulate matter, Ozone, carbon monoxide, Sulphur dioxide and Nitrogen Oxide. "Air quality index is defined as a measure of the state of air relative to the requirements of one or more biotic species or to any human need," according to Johnson *et al.,* 1997.The AQI is divided into ranges, each of which is numbered and labelled with a colour code. It gives a number ranging from zero to over three hundred to represent the amount of health risk connected with air quality. AQI is categorized into six major indices based on Pollution Standard Index, each of which is denoted by a colour code that correlates to a particular level of health concern. Green is a colour that indicates good air quality,

whereas red, purple, yellow, orange, , and maroon represent moderate, un-healthy for sensitive group's, , very un-healthy, and risky air pollution, correspondingly (Johnson *et al.*, 1997).

2.1 Air Pollution Toxicology

The impacts of air pollution on living beings will not be limit to animal and human health, but will also have an effect on the environment. Various geographical locations, worldwide climatic changes, and environmental variances have an impact on health and the atmosphere, as well as animal lifetime.

2.2 Environmental Effects

By contaminating groundwater, soil, and air, air pollution has the potential to affect the environment (Lovett *et al.,* 2009; Mellouki *et al.,* 2016). It also poses a serious threat to the diversity of life. According to studies on the relationship between air pollution and reduced species variety, toxic compounds have a detrimental effect on the extinction of many species and productivity of crops. (Camargo *et al*., 2006). As a consequence of environmental toxins, animals may have fertility problems (Catcott *et al.,* 1961; Veras *et al.,* 2010). Acid rain, temperature change, and worldwide climatic change produced by greenhouse gases carbon dioxide into the atmosphere are all important biological impacts of air pollution. (Schneider *et al*., 1989).

Figure 3: Environmental Damages

2.3 Pollutants in the Air and Their Toxicity

Every substance in the atmosphere that has the potential to adversely affect people's health or have a substantial effect on the atmosphere is categorized as just an air contaminant. According to the EPA, the six principal air pollutants that harm human health and the ecosystem are particles contamination, ground level ozone, carbon monoxide, SO, NO, and (lead) (WHO). At high concentrations, many pollutants in the air, such as dust, gases, smoke, mist, toxic gases, petrochemical products, polycyclic aromatic hydrocarbons (VOCs), aromatic compounds (PAHs), and halide derivatives, make people vulnerable to a variety of ailments, including cancer. (Loomis *et al*.,2014;Kjellstrom *et al*.,2006; Rodopoulou *et al.,* 2014;Carugno *et al*., 2016).

2.4 Particle pollutants

O3 causes a range of negative effects on people and experimental animals in quantities present in many urban areas (Lippmann *et al.,*1989). Side effects include morphologic, functional, immunological, and metabolic alterations. Although a large amount of inhaled O3 goes deep into the lungs due to its weak water solubility, the nasal passages of resting rats and humans wash out around 17 percent and 40% of its reactivity, respectively. (Hatch *et al.,* 1994; Gerrity *et al.,*1985). In terms of the environment, O3 can prevent plants from absorbing carbon, leading to deforestation, which could have long-term consequences for world food security. (Fares *et al.,* 2013; Wilkinson *et al*., 2012).

2.5 Carbon monoxide

is an odorless and colourless gas produced by fossil petroleum, particularly when combustion is inefficient, like when coal and fire wood are burned. Carbon monoxide has a 250-fold higher affinity for haemoglobin (a protein that transports O2 throughout the body) than O2. Depending on the Carbon monoxide concentration and duration of exposure, can range from mild to severe. Carbon monoxide poisoning causes vomiting, headaches, nausea, weakness, dizziness and eventually loss of consciousness. Other conditions with symptoms that are similar to this one include contaminated food and viral infections. CO exposures that result in COHb levels of more than 5% can also lead to cardiovascular problems. The Health Effects Institute conducted a series of studies on cardiovascular disease in the early 1990s to examine if COHb levels of 2–6% increased the risk of unstable angina (Allred *et al.,* 1989). Early angina can occur in these situations, although the risk of cardiac arrhythmia is uncertain, according to the research. As a result, among persons who are sensitive to CO, reducing ambient CO can reduce the incidence of cardiovascular disease.

Figure 4: Carbon Mono Oxide Co

2.6 Sulfur dioxide

Sulfur dioxide is a colourless, highly reactive gas that is a significant pollutant in the environment. It is generally released as a result of fossil fuel combustion, natural volcanic activity, and industrial operations. Sulphur dioxide is severely harmful to the health of plants, animals, and humans. Those with respiratory disease, children, the elderly, and those who are more exposed to Sulphur dioxide are more likely to develop skin and lung diseases. The main health risks connected to high Sulphur dioxide concentrations include respiratory irritation and dysfunction, as well as exacerbation of underlying cardiovascular disease.

Mouth breathing, as opposed to nose breathing, allows more Sulphur dioxide to enter the lungs. As a result, those who exercise in polluted air breathe more Sulphur dioxide and are more likely to become irritated. When sulphur dioxide builds up in the airway, it dissolves as sulfite or bisulfite in the surface lining fluid and travels freely throughout the body. The sulfite appears to interact with sensory organs in the airways to cause both locally and centrally refereed Broncho-constriction.

Figure 5: Sulphur dioxide gas

2.7 Nitrogen oxide

Nitrogen oxides are a type of pollutant prevalent in the environment that can cause respiratory problems (Chen *et al.,* 2007). They are classified as traffic-related pollutants in the atmosphere since they are primarily produced by vehicle engines. They are powerful lung irritants that, if inhaled in large concentrations, can cause pulmonary edoema.Despite the high amounts of nitrogen dioxide, epidemiological studies reveal that it has an influence on the occurrence of Lung problem in children. The most common side effects include coughing and wheezing. Bronchoconstriction and pulmonary edema are also possible. Another study found that nitrogen oxide levels of 0.2 to 0.6 parts per million (parts per billion) are safe for people. (Hesterberg *et al.,* 2009).

Figure 6: Nitrogen Oxide

2.8 Lead

Lead is a very toxic heavy metal used in a variety of manufacturing. Pb pollution can originate both within and externally. It is released by auto-motive engines, mostly those that use lead tetraethyl gasoline. Smelters and battery factories, and irrigation water well's and waste waters, are further sources of Lead pollution in the environment (Balali *et al.,* 2010; Mousavi *et al.,* 2013). According to a study that looked at blood Pb levels in traffic cops, pollution could be a source of Pb exposure (Manuela *et al.,* 2012). Lead is extremely hazardous to a pregnancy and children at even low amounts (Farhata *et al*., 2013). Lead is existing in the body's blood, bones, and soft tissue. Lead is difficult to eliminate, it can affect the nervous system, kidneys, liver etc. Farhat *et al.,*2005 Particle concentration and size determine the quantity of Pb absorbed by the lungs. Around 90% of Lead particles inhaled from the environment are too small to be retained. Lead poisoning occurs when it is absorbed through the alveoli. Pb toxicity can harm many parts of the body, including the heart, kidneys, and reproductive system, but the nervous system is the most vulnerable (Kianoush *et al.,* 2013).

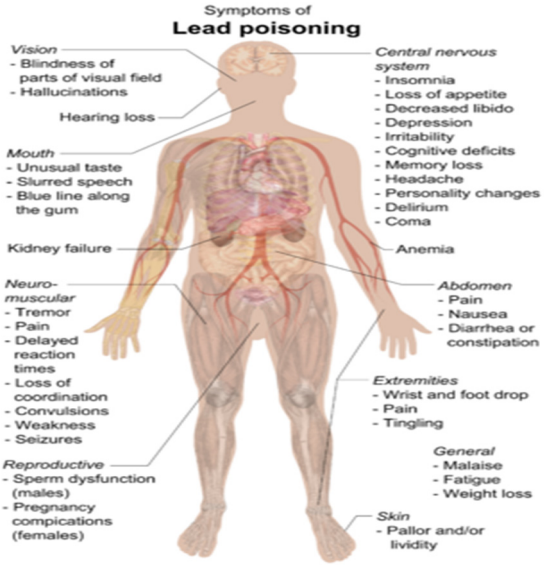

Figure 7: Lead Poisoning

2.9 Other air pollutants

The majority of air pollution is caused by the use of fossil fuels, as is clear. Air pollutants are classified into two categories based on their source of emission: anthropogenic and natural. Anthropogenic activities such as energy acquisition and transportation, agricultural

fertilizers, and others contribute to air pollution. Natural pollutants are released from a range of sources, such as volcanic activity, forest fires, and sea water (Harrison *et al.,* 2006; Hewitt *et al*.,2007). In terms of health concerns, air toxicants are any odd airborne element in the air that interferes with the normal working of human organs. According to published studies, air pollution exposure has the most detrimental impacts on the lungs, cardiac, diagnostic, dermatological, neurological, haematological, immunological, and reproductive systems. Long-term molecular and cell damage, on the other hand, can lead to a variety of cancers (Nakano *et al*.,2013; Kampa *et al.,* 2008). However, even little quantities of air toxicants have been shown to be detrimental to susceptible.

2.10 Respiratory disorders

The lung system is the first line of defence in the beginning and progression of diseases induced by air pollution since most chemicals enter the body through the airways. Voice disruptions can be caused by a variety of circumstances. Air pollution is a significant environmental risk factor for a variety of lung diseases, including asthma and lung cancer (Weisel *et al*.,2002; Brunekreef *et al*., 2009). Air pollutants, particularly PMs and other respirable compounds such as dust, O3, and benzene, harm the respiratory system severely (Valavanidis *et al*., 2013; Tam *et al.,* 2012; Beelen *et al*.,2008; Bahadar *et al*.,2014; Johannson et al.,2014; Kelly *et al.,* 2003). Asthma is a lung disease that can develop as a result of exposure to air pollutants (Stoner et al., 2013). According to certain studies, air pollution from traffic and/or industry is linked to an elevated risk of COPD (Chung *et al*.,2011; Zeng *et al.,*2012; Ko *et al*., 2012).

2.11 Cardiovascular dysfunctions

A direct association between air contamination exposure and heart disease has been proven in numerous experimental and epidemiologic studies (Nogureira *et al*., 2014; Snow *et al*.,2014; Brook *et al.,*2008; Andersen et al.,2012). Air contamination has been associated to changes in white blood cell counts (Steenhof *et al*., 2014), which may affect cardiovascular functions. In contrast, an animal model study found a connection between hypertension and air contamination exposure (Sun et al., 2008). Right and left ventricular hypertrophy have been linked to traffic-related air pollution, notably high levels of NO2 (Leary *et al*., 2014; Van *et al*., 2009). Antidote therapy, which is only available for a few cardiac hazardous chemicals like CO, should be used in addition to standard cardiovascular disease treatment.

2.12 Neuropsychiatric complications

The relationship between hazardous airborne chemicals and the neurological system has long been questioned. it is currently thought that these dangerous chemicals have

deleterious effect's on the CNS. The impacts of air pollution on the Central nervous system include nervous problems and psychiatric ailments. Nervous disabilities, particularly in neonates, can be lethal. Psychiatric diseases, on the other hand, lead to antisocial behaviour and antagonism. They cause varying degrees of lung injury based on the amount of pollutants inhaled and their accumulation in target cells. The first effect is irritation in the upper respiratory system, especially in the trachea, where studies have linked air pollution to neuro-behavioral hyper-activity, criminal activity, and age in-appropriate behaviours (Newman et al., 2013; Haynes et al., 2011). According to research, air contamination has been associated to an increased risk of neuro-inflammation, AD, and PD (Calderon et al., 2008). Excessive levels of air pollution have been related to aggression and anxiety in megacities, according to multiple studies (Rotton et al.,1979; Evans et al.,2003; Jones et al., 1978).

2.13 Air pollution in Pakistan

Pakistan faces a major challenge in the form of smog. Punjab's province and the city of Lahore are the hardest hit. Smog is a mixture of fog and smoke that results from people burning waste items, and it can be caused by car emissions, agricultural waste burning, and other factors. As a result, it causes a slew of problems for citizens. Smog-related deaths are occurring on a daily basis in Punjab. Air contamination is a severe public welfare Problem in Pakistan, according to the Global Alliance on Health and Pollution, with an estimated 128,000 people dying each year from pollution-related illnesses. Analysts, on the other hand, allege that the administration has been downplaying the severity of the crisis for years, using skewed data to shift blame to India. Indeed, the environmental protection agency of Punjab, the province that surrounds Lahore, has not changed its air quality rating on its website in several weeks, reporting it at 166 - a level of fine PM in the air that the WHO considers dangerous US Environmental Protection Agency considers "unhealthy" but that the Pakistani government considers "satisfactory."The Punjab Sectoral Emission Inventory shows that the transportation sector is responsible for the majority of air pollution emissions, accounting for 43% of total emissions (power, industry, transport, and crop burning residue). Industry is the second most significant pollutant, accounting for 25% of the total, Agriculture accounts for 20% of the total. Power, industry, and transportation are the primary sources of air pollutants and emissions, accounting for 80% of total emissions and pollution and contributing to Punjab's photochemical haze.

2.14 Air Pollution Control

The following are the steps to take to reduce air pollution:

Avoid Using Vehicles

Shorter distances should not be covered by vehicles. People should instead take

public transportation to get from one place to another. This not only reduces pollution but also saves electricity.

Energy Conservation

A large amount of fossil fuels are used to generate energy. As a result, when not in use, remember to turn off all electrical devices. As a result, you can contribute to environmental preservation on a personal level. Using energy-efficient gadgets like CFLs reduces pollution as well.

Use of Clean Energy Resources

Solar, wind, and energy geothermal all help to reduce air pollution. Several countries, most notably India, have accepted the use of these resources to reduce pollution.

Other air pollution control measures include:

1. By decreasing and minimizing the usage of fire and fire-related goods.
2. Because industrial emissions are a main source of air contamination, pollutants can be decreased at the source by managing or treating them. If a raw material's reactions produce a pollutant.
3. Using alternative fuels is another way to reduce pollution. In many places of India, CNG-powered vehicles are replacing petrol and diesel-powered vehicles. Automobiles that do not have fully functional emission engines frequently employ these. Despite the fact that India has a plethora of procedures aimed at improving air quality, the most of them are either forgotten or improperly implemented. There are still a lot of automobiles on the road that haven't had their emissions tested.
4. Altering and maintaining existing equipment to reduce pollutant emissions is another way to lessen air pollution caused by industry.
5. Pollutants cannot always be controlled at their source. Process control devices can be utilised to reduce pollution in this case.
6. Air pollution can be reduced by diluting contaminants in the atmosphere.
7. The final and most effective approach of reducing the detrimental effects of air contamination is tree planting. Plants , trees remove a large number of pollutants in the air. In principle, planting trees in areas with high pollution levels will be highly effective.

3. Literature Review

Ullah *et al.,* 2021was decided that air pollution had a negative influence on the respondents' bodily and psychosomatic wellbeing, causing them to change their behaviour. Before the air becomes even more polluted and life-threatening, public awareness, a solid mitigation strategy, appropriate management, and rigorous environmental legislation are recommended.

Khwaja *et al.,* 2012 studied found shows, as expected, extremely high Particulate

matter 2.5 concentrations in Karachi, Pakistan, are connected to significantly increased rates of hospital admission and, to a lesser extent, ER visits for cardiovascular disorders.

Nandasena *et al.,* 2010 Only a few epidemiological studies have looked into the health effects of air pollution in Sri Lanka, according to one source. According to study findings and reported air quality standards, air pollution may be considered a neglected public health problem in Sri Lanka.

Ilyas *et al.,* 2007 According to the paper, the study provides insights and lessons based on recent Pakistan experience for better understanding and controlling the transportation air pollution problem in Pakistan and similar countries, while keeping local requirements, capabilities, and restrictions in mind.

4. Result and Discussion

Air pollution is a huge problem in today's globe, with serious health and environmental repercussions. Humans are exposed to toxicants in the air for a variety of causes, including respiratory and cardiovascular problems, neurological conditions, eye irritation, skin problems, and long-term chronic diseases such as cancer.

Turk *et al.,* 2011 reported APCs have been linked to respiratory illnesses. Furthermore, a study indicated that Sulphur dioxide levels in Trabzon grew between 1994 and 2000, notably throughout the wintertime months. The other two studies, which were conducted in Trabzon at dissimilar times, and this study are complementary and relevant since they show that air pollution in Trabzon vary. Sulphur dioxide and PM levels grow throughout the winter months, according to the aforementioned research and our own.

Matz *et al.,* 2019 showed that traffic-related air pollution (TRAP) is one of the most common forms of exposure in cities, and that it has been connected to a variety of detrimental human being health impacts. The aim of this scoping evaluation is to construct a suggestion map of the epidemiological literature on the human health impacts of TRAP exposure so that Health Canada can better plan future evaluations and assessments.

Follinsbee *et al.,* 1993 Air pollution have been related to reversible changes in breathing difficulties and lung function, as well as changes in airway responsiveness and inflammation, structural remodelling of the pulmonary airways, respiratory host defense impairments, and increased respiratory morbidity and mortality.

Sillmann *et al*., 2021 reported that Alterations Reversible changes in respiratory problems and lung function, as well as increased breathing morbidity and mortality, have all been linked to changes in airway reactivity and inflammation, structural remodelling of the pulmonary airways, and deficiencies in respiratory host defences.

4.1 Air Contamination effects lungs

Kurt *et al*., 2016 studied that The current research contains the most up-to-date information on the health effects of particular air pollutants and their impact on asthmatic, Lungs.

4.2 Air Pollution effects the Skin

Puri *et al*., 2017 investigated that It's also linked to Skin allergy diseases including eczema and atopic dermatitis. Extrinsic skin ageing, pigmentation, malignancies, and acneiform eruptions are all linked to polyaromatic hydrocarbons. Atopic dermatitis has been linked to volatile organic chemicals.

4.3 Air contamination impacts on the Brain

De prado *et al*., 2018 studied The special effects of TRAP on the human brain in vivo were studied using a mix of environmental epidemiology and magnetic resonance imaging.

4.4 Air contamination effects on the eyes

Klopfer *et al*., 1989 one of the information Air pollution's impacts on the eyes will be discussed. There are suggestions for treating air pollution-related eye problems.

5. Conclusion and Recommendations

Air contamination has a substantial impact on human being health, activating and causing a wide range of diseases with high morbidity and mortality rates, especially in developing countries like Pakistan. As a consequence, air contamination control is essential and should be a government priority. Legislators and representatives in these countries must update all policies and legislation dealing with air contamination. The partnership of numerous departments concerned with air pollution must be led by a powerful environmental protection agency. For an effective environmental protection agency, funding levels for administration, research, development, monitoring, and overall environmental protection, including air contamination, should be sufficient.

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