
Airborne Environmental Threats to Health & Wellness-An Integrated Overview

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ABSTRACT

Background: The environmental pollution is a growing world problem specifically in developed & developing countries. In these areas G.I.T disorders & diarrheal diseases have replaced by airborne environmental disorders.

Methods: Literatures was reviewed on the subject to find out the knowledge regarding Environmental threats of air pollution & its effects on the health of human body. Data and details have been located, selected, extracted and synthesized from different national & international Journals, websites, Proceedings, books, google scholar etc.

Result & Conclusion: Changes are taking place in air regularly. Different pollutants are being created from different sources. Indoor air pollution is common among underdeveloped & developing nations. To improve health situation different professional, have to play their roles. Effects of air pollution are sometimes general in nature otherwise may be immediate or delayed. Leading causes of death is cardiovascular diseases like IHD are now being declared as airborne. Emergent airborne diseases are more than 30 like COVID 19 only result in 43.6 lakhs death so far. Toxic & hazardous chemicals are present in air in the form of allergens, neurotoxin, mutagen, carcinogen etc. Air pollutants are carbon monoxide, nitrogen oxides, Benzene, Ozone, Lead, sulphates, SPM etc. Meteorological effects on health are also related with air including season, atmospheric pressure, heat, cold etc. Indoor air pollutants have also specific health effects.

KEYWORDS: Environment, Health, Air Pollution No Conflict Of Interest.

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INTROCUCTION

The “environment” was originated from Latin word ‘Environner’ means “to surround / to encircle”. Environment defined as external condition which surrounds, act upon and influence around or its part.

Components of Environment are as follows:

- Physical
- Chemical
- Biological - plants & animal
- Social – physic - social / psychosocial / bio-social

Air is one of the most important components of physical environment which may be polluted and effect the health of a person.

AIR POLLUTION

Definition: presence of 1 / > contaminants / combination of contaminants in such a quantity and duration which may prove injurious to human, plants, animal life or property and interfere with comfort and enjoyment of life, property and conduct of business

CHANGES IN AIR

The changes in air are of two types (i) normal i.e., seasonal or (ii) abnormal

Abnormal changes are of 2 types

1. Qualitative changes

Which is either extreme condition in a particular season or reverse condition

2. Elemental changes

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In which composition of air disturbed and external material added and cause air pollution, infection, affect heart and humor and may result in death.

AIR POLLUTANTS & SOURCES

<u>Pollutants</u>	<u>Sources</u>
Oxides of sulfur	burning combustion of fossil fuel, petroleum, coal, oil, use of chemicals in smelters refineries and power plant
Oxides of Nitrogen	power plants, motor vehicles, and other industrial & commercial sources
Lead & Manganese	automobiles & smelter
Calcium, Chlorite, Silicone, Cadmium	soil particulate & industrial emission
CO	automobiles, fuel burning appliances - gas water heater, fire places, wood stoves, gas stoves, yard equipment
CO ₂	lung exhale, chemical industries, combustion of fossil fuel, deforestation, volcano eruption (40%)
H ₂ S	industries, coke production, rayon production wastewater treatment plant, wood pulp production, sulfur extraction process, oil refining, tanning industry, livestock, liquid manure
O ₃	chemical reaction in air
HC & PHC	incineration, combustion of coal, wood, processing & use of petroleum, Combustion of fuel, automobile, jet planes, power plants, manufacturing unit, industries, marine vessel, burning of wood, aerosol spray, nuclear weapon, carbonization, biomass fuel, automobiles
Organic substances	petrochemical solvent & vapors
Particulate matters	aerosol, combustion particles, metal vapour, crustal material, fugitive dust, dust storm, power plants, industrial process, vehicular traffic, domestic coal burning, industrial incinerator

INDOOR AIR POLLUTANTS

<u>Air pollutant</u>	<u>Sources</u>
Radon	Building material, water & soil
Formaldehyde	Insulation, furnishing, tobacco smoke
Asbestos, mineral wool & synthetic Fiber	Acoustic, thermal, electric insulation
Organic substances	Adhesive, solvent, cooking & cosmetics
Aerosol of nicotine & other organic Substances	Tobacco smoke
Mercury	Fungicide, thermometer breakage & dental care
Aerosol of various compositions	Consumer products
Viable organism	Infected organism
Allergen	House dust & animal debris
Suspended particulate matter	Soot, condensed vapour from automobile, combustion, burning of waste, dust, smelting process

ENVIRONMENTAL FACTORS AFFECTING HUMAN HEALTH

Effects may be in both ways i.e. positive and negative.

Positive environmental factors sustain health, and promoting them is preventive medicine. They include:

- Air quality;
- Ozone layer (protection from UV, cancers, etc.); &

- Space for exercise and recreation;
- Negative** environmental factors are mostly human changes that create conditions favoring disease;
- disturb and release noxious levels of previously bound chemicals (e.g., mercury released)

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- becomes poison) or biota (e.g., methane released contributes to climate change);
- create temporary, intense, life-threatening heat islands (e.g., urban heat waves exacerbated by climate change);
- result from nuclear, biological or chemical warfare or terrorism;
- Recently, the World Sustainable Development Summit, the annual flagship event of The Energy and Resources Institute (TERI) was held. The theme of the 2021 Summit was ‘Redefining our common future: Safe and secure environment for all’.
- India’s Stand at the Event:
 1. Emphasis on Climate Justice: “Climate justice” is a term, and more than that a movement that acknowledges climate change can have differing social, economic, public health, and other adverse impacts on underprivileged populations. As per India, ‘climate justice’ is inspired by a vision of trusteeship - where growth comes with greater compassion to the poorest. It also means giving the developing countries enough space to grow.
 2. Reassurance to Climate Mitigation Efforts: India reassured commitments to its targets under the Paris deal to reduce emissions intensity of GDP by 33 to 35 percent from 2005 levels. India’s steady progress on its commitment to Land Degradation Neutrality and setting up of 450 gigawatts of Renewable Energy generating capacity till 2030 was also highlighted. Initiatives of India under International Solar Alliance were also discussed.
 3. Commitment to Enhancing Disaster Resilience: To enhance India’s disaster management capabilities, commitments to Coalition for Disaster Resilient Infrastructure (CDRI) were assured.
- Coalition for Disaster Resilient Infrastructure (CDRI): A multi-stakeholder global partnership of country governments, UN agencies, multilateral banks, private sector and knowledge institutions that aims to build resilience into infrastructure systems to ensure sustainable development.

KEY PLAYERS TO VARIOUS HEALTH PROGRAMS

The key players to numerous health related programs are

- Medical universities and researchers- environmental factors affecting health, and exploring the space for better environmental monitoring efforts;
- Federal and provincial/territorial health agencies - exploring downstream health expenditure;

- World Health Organization - environmental factors are perceived and dealt with through public policy;
- Medical and hospital associations;
- Nutritionists;
- Emergency preparedness and response organizations
- NGOs; and
- Medical, environmental, and general media.

AIR & HEALTH

EFFECTS OF AIR POLLUTION ON HEALTH

General effects of air pollution on human health are as follows:

- Air pollution is top concern among environmentalist & conservationist
- More than 100 of laws have been framed or aimed.
- Unani (Greek) physician also invented numerous detoxifications and cleaning solution.
- Doctors, researchers uncovered several diseases caused by air pollution (like Asthma, COPD, Emphysema, Heart attacks, Lung CA, Bronchitis,
- Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death worldwide, causing 3.23 million deaths in 2019.
- Over 80% of these deaths occurred in low- and middle-income countries (LMIC).
- Crude estimates suggest there are 30 million COPD patients in India. India contributes a significant and growing percentage of COPD mortality which is estimated to be amongst the highest in the world; i.e. more than 64.7 estimated age standardized death rate per 100,000 amongst both sexes.

IMMEDIATE effects are on respiratory system and even death by suffocation

DELAYED effects are Chronic bronchitis, Lung CA, Bronchial Asthma, Emphysema, Respiratory allergies
Social & Economic aspect of air pollution are like it destroy plants and animal life, corrosion of metal, damage building, cost of cleaning and maintenance and decrease visibility.

HEALTH HAZARDS OF AIR

The effects of polluted air are

- Infectious organism
- Morbidity & quality of life
- Emergent diseases and environmental changes
- Emergent ecological diseases
- Antibiotic / Pesticide resistant
- Toxic chemical
- Endocrine hormone disruptor
- Diet

Leading causes of death globally

At a global level, 7 of the 10 leading causes of deaths in 2019 were noncommunicable diseases. These seven causes accounted for 44% of all deaths or 80% of the top 10.

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However, all noncommunicable diseases together accounted for 74% of deaths globally in 2019.

<u>Disease or Group</u>	<u>Million/year</u>
i. Ischemic Heart Disease	8.4
ii. Stroke	6.1
iii. Chronic Obstructive Pulmonary Diseases	2.6
iv. Lower Respiratory Infections	2.4
v. Neonatal diseases	2.0
vi. Trachea, Bronchial & lung Cancers	1.8
vii. Alzheimer's disease & other dementia	1.7
viii. Diarrheal diseases	1.6
ix. Diabetes mellitus	1.8
x. Kidney disease	1.3

The world's biggest killer is ischaemic heart disease, responsible for 16% of the world's total deaths and now considered as air borne by WHO.

AIR BORNE EMERGENT DISEASES

Definition: - Disease that is never known before / absent since last 20 years

- Air pollution result in approximately 30 infectious diseases
- Largest loss of life in 1981 - Influenza epidemic - war refugees and soldiers spread the virus
- 30 - 40 million suffered in a year
- 43.6 lakhs lost life in 2020 & 2021 by COVID-19
- 4.3 lakh in India

TOXIC / HAZARDOUS CHEMICAL

- Hazardous effects are - flammable, explosive, irritant, sensitizer
- Acid & Caustics - when diluted becomes harmless
- Toxic chemicals - kill cell and harmful even after dilution

Allergens

activated immune system, sometime act as antigen/allergens e.g., formaldehyde used in wood product, insulation, glue and fabrics

Sick building syndrome (indoor more severe)

Clinical features are

- headache, allergies & chronic fatigue

Indoor air contaminated by molds, CO, NO, formaldehyde which are released by carpet, insulation, plastic, building material

Poor indoor air quality cost 60 billion dollar for absenteeism, reduced productivity

Neurotoxin

Attack nerve cells

- Heavy metals like lead, mercury kill nerve cells and cause permanent neurological damage
- Anesthetics, chlorinated hydrocarbon (DDT, Dieldrin) - disrupt nerve cell membrane for nerve action

- Organophosphates (malathion), carbonates - inhibit acetylcholine - signal effected between nerve cells and tissue / organ
- a total of 850 compounds act as neurotoxin

Mutagens

- Chemicals and radiation damage DNA which mostly led birth defects

Carcinogen

- causes cancer

- Rate increased in industrialized countries
- Worldwide, ambient PM_{2.5} air pollution was estimated to have contributed to 265,267 lung cancer deaths (95% uncertainty interval [UI], 182,903-350,835 lung cancer deaths) in 2017, or 14.1% (95% UI, 9.8%-18.7%) of all lung cancer deaths.
- Environmental pollution is now a global phenomenon, and its impact is evident in several regions globally. Now, after more than quarter of a century, the environmental pollution will show its impact in the rising number of cancer cases in the country. In India, 1.6 million new cancer cases are detected each year.
- Lung cancer is the most commonly diagnosed cancer worldwide and is the leading cause of cancer death, with an estimated 2.1 million new cases and 1.8 million deaths occurring in 2018, representing 11.6% of all new cancer diagnoses and 18.4% of all cancer deaths.¹⁵ Rates of lung cancer incidence and mortality vary substantially within and between countries, depending largely on historical patterns of cigarette smoking, with long latency periods of up to approximately 30 years between the start of the smoking epidemic and the rise of lung cancer incidence. The highest incidence rates for lung cancer among men are currently observed in Micronesia/Polynesia, Eastern Asia, and Eastern Europe and, among women, in North America, Northern and Western Europe, and Australia/New Zealand. In several European countries, lung cancer incidence rates are beginning to converge in men and women as increasing rates in women are approaching declining rates in men.
- Other causes of cancer are - life style, - smoking, sunbathing, drinking alcohol
- Prostate CA in females
- Lung CA in females

AIR POLLUTANTS & HEALTH

Carbon monoxide

- Lethal at high dose

- In low dose (low concentration) causes Neurobehavioral dysfunction, exercise elated heart pain, headache, breathlessness

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- If combine with Hb - result in decrease O₂ flow to brain - cause dizziness, headache & heart stress

Oxides of Nitrogen

- causes asthma, susceptibility to infections, damage lung, eye, skin irritation

Benzene – act as carcinogen

Ozone – causes eye & air passage irritation, increased susceptibility to infection, damage lung, cough, skin irritation, chest pain, fatigue

Lead - dangerous to children - effects brain & CNS – neuropsychological system, loss of IQ, poor school performance, behavioral difficulties, mental & Physical impairment - decreased intelligence

Sulphates, SO₂ - damage lung & eye

Fine particulate material – causes lung ailment

METEOROLOGICAL EFFECTS

SEASON & HEALTH

- During Spring - humor liquefy - activate chronic disorders
 - Diseases activated due to overeating and inadequate exercise in winter
 - General diseases are epistaxis, malaria, hemoptysis, paralysis, arthritis, melancholia
- During Summer - duration of diseases decreased, resolve matter particularly disease matter, weakening, early death in case of fatal diseases
 - if rain - duration of diseases increased, heat shock fever, conjunctivitis, erysipelas,
 - In biliary peoples, dry skin, measles, chicken pox, ascites, dysentery
- During Autumn – causes scabies, taenia, malignant ulcer, rheumatoid arthritis, incontinence, sciatica, tonsillitis, worms, chicken pox
- During Winter - phlegmatic diseases, common cold, coryza, pleurisy, pneumonia, pain, phlegmatic vomiting

ATMOSPHERIC PRESSURE & HEALTH

- Decrease at high altitude
 - Causes acute mountain sickness, pulmonary edema
 - Result in Cough, Cheyenne - stroke breathing, oliguria, mental confusion, hallucination, stupor, seizure, and coma
- Increase at low altitude
 - Increase Nitrogen oxides – causes loss of mental function, consciousness
 - Increase O₂ – result in convulsion & death
 - Causes Caisson's disease

HEAT & HEALTH

- Heat

- Causes heat stroke, hyperpyrexia, exhaustion, cramp & syncope

- Result in GLOBAL WARMING

- Cold

- Causes Frost bite & immersion / trench foot

INDOOR AIR POLLUTION & HEALTH

- Result in acute respiratory tract infection in children (WHO)
- Causes Pneumonia – Chief killing disease in developing countries – 4.5 million death / year – exceed diarrhea (in SEA – 1.4 million)
- In Nepal, Zimbabwe, Gambia, Buines Aires, South Korea, New Delhi – Adverse pregnancy outcome – Low Birth Weight, Neonatal death, still birth cause is Carbon monoxide – from Biomass fuel
- In Guatemala & India – found COPD & Car Pulmonale – cause is smoking a major risk factor
- In Nepal & India – cooking on Biomass stove – causes Cor pulmonale
- Smoking in females is common in India & Nepal
- Cancer – Naso-pharyngeal CA with biomass smoke in Kenya
- In Japan Lung CA is common
- Lung CA associated with coal on open stove is common in China
- Tuberculosis – 90000 cases /year– India – female is using bio fuel
- Result in Blindness – Contact risk – 80 % were using bio-fuel
- WHO – 2.7 – 3 million - premature death – out of 3 million, 2.8 million death from indoor pollution.
- EFFECT is Illness as well as death – from respiratory causes & decrease lung function
- SPECIFIC – If acid aerosol (sulphate and nitrate in presence of high level of SO₂)

INDOOR POLLUTANTS & THEIR DISEASES

Asbestos	- Lung cancer
Radon	- Lung cancer
Particulate matter	- Lung CA
Formaldehyde	- Cough, eye irritation, fatigue, running nose, sore throat sinus irritation, skin rashes, vomiting & headache
Phenol/ solvents / herbicides	- Liver & kidney diseases, eye irritation, skin diseases, respiratory problems,
Microbes	- Infections & allergies

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