

Team: Bad Air ➡ Bad Health

Title : Air Pollution and Cancer

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Abstract

Background

The cancer research community has been studying the impacts of increasing air pollution on human health across the world.

Aim

To gather some useful information from the studies and share the impacts of air pollution on the risk of cancer.

Methods

Use data from the different research/studies conducted across the globe and the awareness raised by the IARC and WHO.

Conclusion

We all as citizens need to work together in spreading awareness and reduce pollution to make our planet a healthier place.

Outdoor Air Pollution Causes Cancer

- International Agency for Research on Cancer (IARC) classified outdoor air pollution as a carcinogen that causes lung and bladder cancer.
- Pollution sources
 - Secondary power generation,
 - Industrial/agricultural emissions
 - Residential heating/cooking
- Carcinogens in air
 - Engine exhaust
 - Metals
 - Solvents
 - Dust
 - Particulate matter
- Pollution increases the risk for respiratory/heart diseases
- Exposure to pollution = Increase in industrializing countries.

Studies of Cancer Risk

- Studies suggest that Air pollution is a small cancer contributor in Western industrialized countries when compared to tobacco smoke.
- The population can still get unavoidably affected by carcinogenic factors and increase the power of cancer so we should keep air pollution to a minimum. [1]
- Some methods of risk estimation are occupational studies, extrapolation and animal experiments.

Studies of Cancer Risk

- Researchers do cancer risk studies in the urban areas such as ecological studies, cohort studies, and case-control studies. [1]
- The studies from different countries show that most people got lung cancer from smoking. The smoking risk in the urban areas Vs. the countryside areas that is higher by a factor of 1.5. Another cause for lung cancer, heavy emissions from the industries like non-ferrous smelting. [1]

Air Pollution and types of Cancer

- Air pollution is linked with many types of cancer.
- Some of the common sources of air pollution are smoking, tobacco, engine exhaust, solvents, particulate matter and carcinogens.
- Particulate matter is a mixture of gases that come from transportation and power generation.
- Air pollution might spark **defects in the DNA**.

Air Pollution and types of Cancer

- In the digestive organs, pollution could affect the gut microbiota and develop cancer.
- Dr. Thach cautioned that pollution is just one risk factor for cancer, and others - Diet and exercise, may be more significant and more modifiable risk factors. This study follows a review by the IARC that determined that there is enough evidence to say that outdoor air pollution can cause cancer in people. [2]

Air Pollution and The Skin – UV Rays

Solar UVR has 3 spectral areas:

UVA (95% of UVR that reaches Earth)

UVB (5% of UVR that reaches Earth)

UVC -mostly absorbed by Ozone layer and Oxygen in atmosphere[3]

UVR induces gene alterations and/or immune suppression

1% decrease to Ozone => 2% UVB irradiance => 2% increase in Skin Cancer

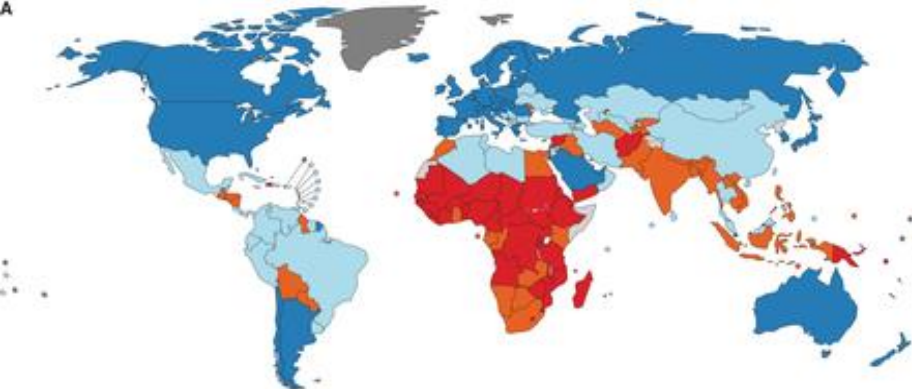
UVA	UVB	Both
Skin aging(Photoaging)	Absorbed by epidermal cellular components (proteins and DNA)	Cutaneous immuno suppression
Penetrates into basal layer of the epidermis and dermo fibroblasts		Skin cancers: malignant melanoma, basal cell carcinoma (BCC), squamous cell carcinoma (SCC)(photocarcinogenesis)

Air Pollution and The Skin – PAHs

- PAHs(Polycyclic Aromatic Hydrocarbons) are widespread organic pollutants and with UVA significantly increases photodamage in skin[3]
- The main sources are: Residual wood burning, Automobile exhaust fumes(especially from diesel engines), Smoke from the combustion of organic material(incl Cigarette smoke)
- Bound to the surface of suspended PM (Particulate Matter) in air in urban areas
- Long term exposure to PM-bound PAHs leads to oxidative stress and skin aging
- Activated PAHs produce compounds that bind with DNA and initiate cutaneous carcinogenesis

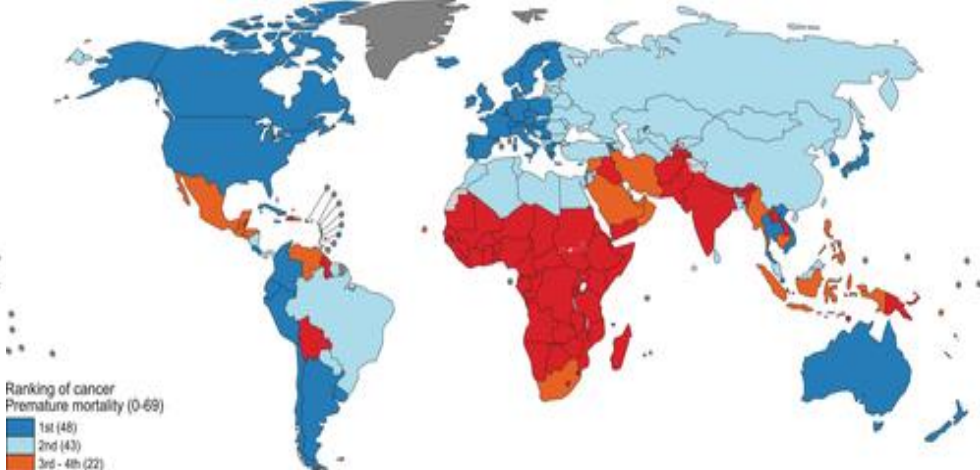
Air Pollution and The Skin - VOCs

- VOCs(Volatile Organic Compounds) originate from the use of organic solvents in paints, varnishes, tobacco smoke, exhaust from cars and emissions from industrial facilities[3]
- VOCs cause summer photochemical smog to form
- VOCs may induce skin lesions in rats
- VOC exposure increases cytokines that could then develop inflammatory and/or allergic reaction as atopic dermatitis or eczema



Human Development Index (% of population)

Very High HDI (18.0%) High HDI (32.3%) Medium HDI (36.2%) Low HDI (13.5%)



Ranking of cancer
Premature mortality (0-68)

1st (46)
2nd (43)
3rd - 4th (22)
5th - 10th (59)

No data Not applicable

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data source: GHO
Map production: CSU
World Health Organization



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B



World area (% of population)

Americas (13.3%) Africa (16.9%) Europe (9.8%) Asia (59.5%) Oceania (0.5%)

Americas: Northern (4.8%), Central (2.3%), Caribbean (0.6%), South (5.6%)
 Africa: Northern (2.1%), Western (5.0%), Middle (2.2%), Eastern (5.7%), Southern (2.9%)
 Europe: Western (2.6%), Northern (1.4%), Southern (2.0%), Eastern (3.8%)
 Asia: Western (3.5%), South Central (25.7%), Eastern (21.7%), South-Eastern (8.6%)
 Oceania: Australia/New Zealand (0.4%), Melanesia (0.1%), Micronesia/Polynesia (0.02%)

No data Not applicable

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Data source: UNCP
Map production: IARC
World Health Organization



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These are maps of Global Lung Cancer Burden. These maps are from World Health Organization, also known as WHO[4]

Impact of Air Pollution - A Burden on India

- Air pollution is a major planetary health risk with India estimated to have some of the worst levels globally.[5]
- It is estimated that if the air pollution level in India were less than the minimum causing health loss, the average life expectancy in 2017 would have been higher by 1.7 years (1.6–1.9), with this increase exceeding 2 years in the North Indian states of Rajasthan, Uttar Pradesh and Haryana.

Impact of Air Pollution - A Burden on India

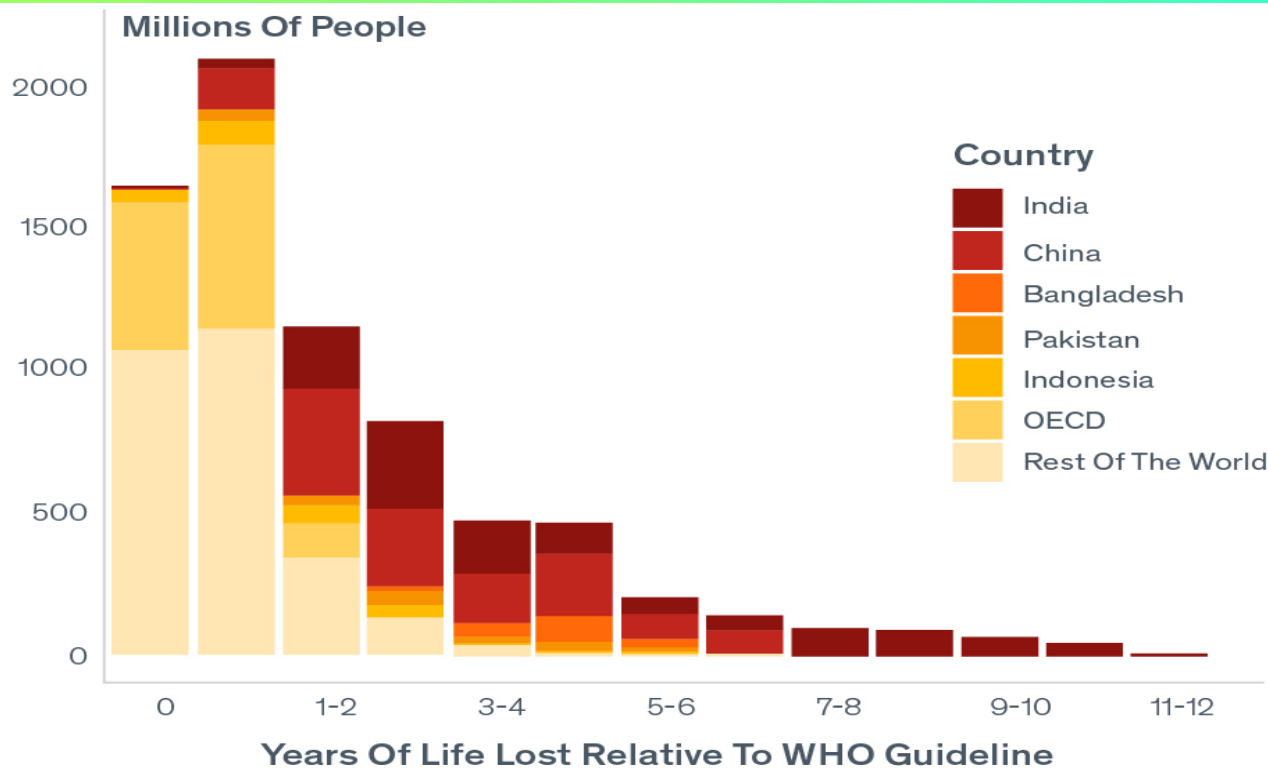
- India has uneven high mortality and disease burden due to air pollution. This burden is generally highest in the low SDI states of north India.[6]
- In India, the major sources of ambient particulate matter pollution are: burning coal for thermal power production, industry emissions, construction activity and brick kilns, transport vehicles, road dust, residential and commercial biomass burning, burning waste, agricultural stubble burning and diesel generators.[6]

Extreme Amounts of Air Pollution in India

- **4X than maximum recommended by WHO-** Amount of pollution in India is 4 times the maximum recommended by the World Health Organization (WHO).
- **5.3 years** - On an average, the lifespan of the people who live in India is cut short.
- **51.4%** - Age of people younger than 70 years of the 1.2 million people who died from air pollution causes.
- **12 Years** – reduced lifespan of People living in the 2 districts East of Delhi - **Hapur and Bulandshahr** because of air pollution[6]

Where Is Particulate Air Pollution Cutting Life Expectancy The Most?

Just like with other public health threats, the burden of air pollution is not borne equally by everyone around the world. Developing and industrializing Asian countries are impacted the most by particulate pollution [8]



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