São Paulo School of Advanced Science on Atmospheric Aerosols: properties, measurements, modeling, and effects on climate and health

Air pollution and its adverse health effects

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- Air Pollution Effects on Health and the Environment
- Environmental and Health Costs
- United Nations' Statement
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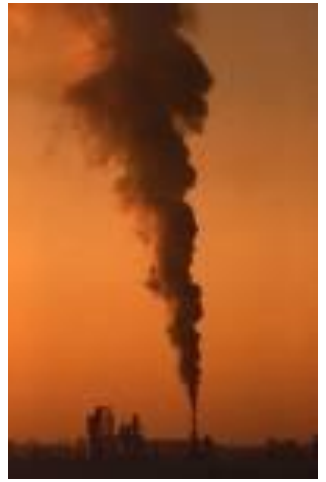
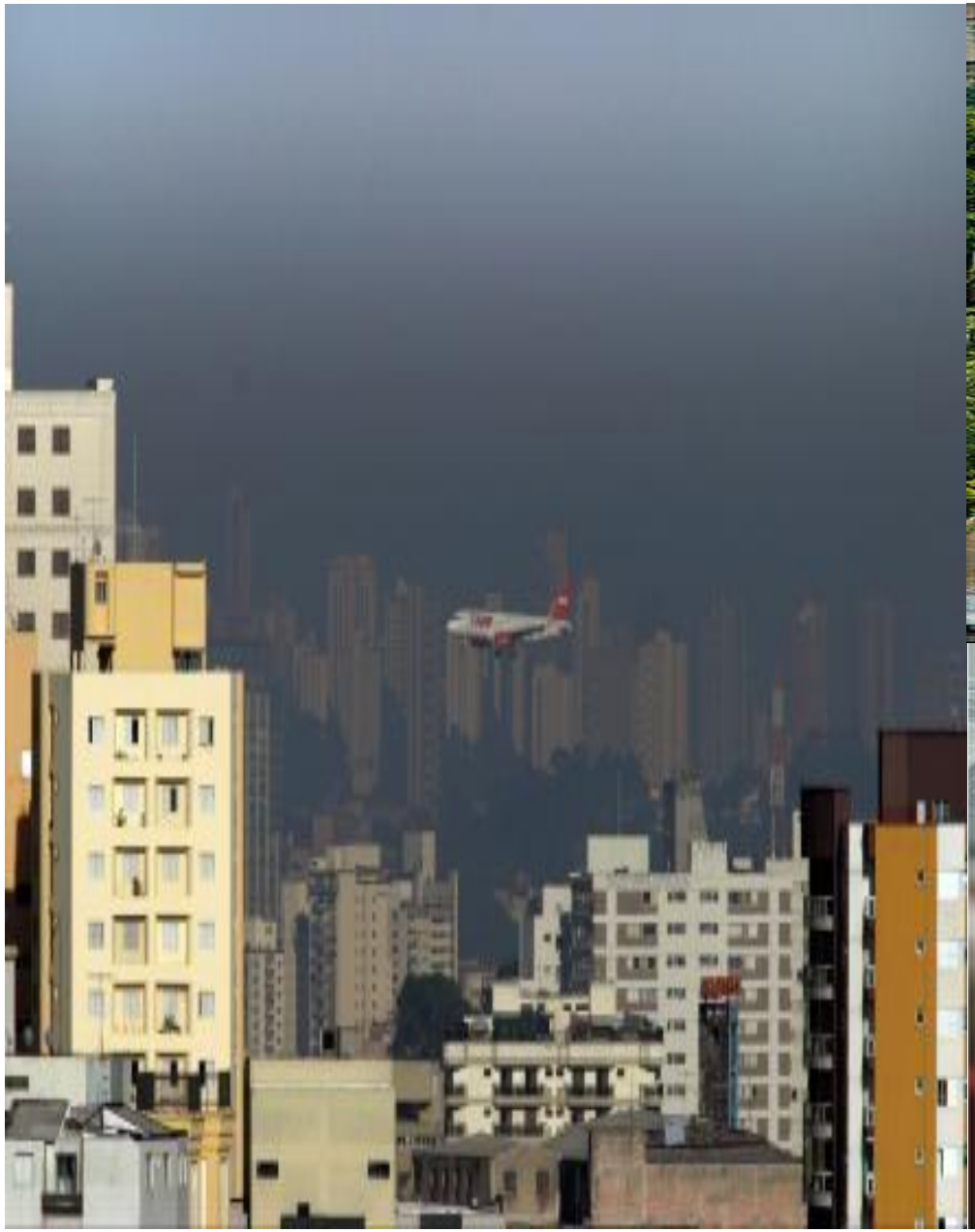
Present Scenario

- Air pollution is a problem in urban centers:
  - Increasing number of vehicles;
  - Reduced capacity of the streets;
  - Reduced investments in public transportation.



- Economic activity in urban centers >> increase in power purchase >> acquisition of private vehicles >> high traffic congestion

Cities, Transportation and Pollution



Unsustainable Scenario

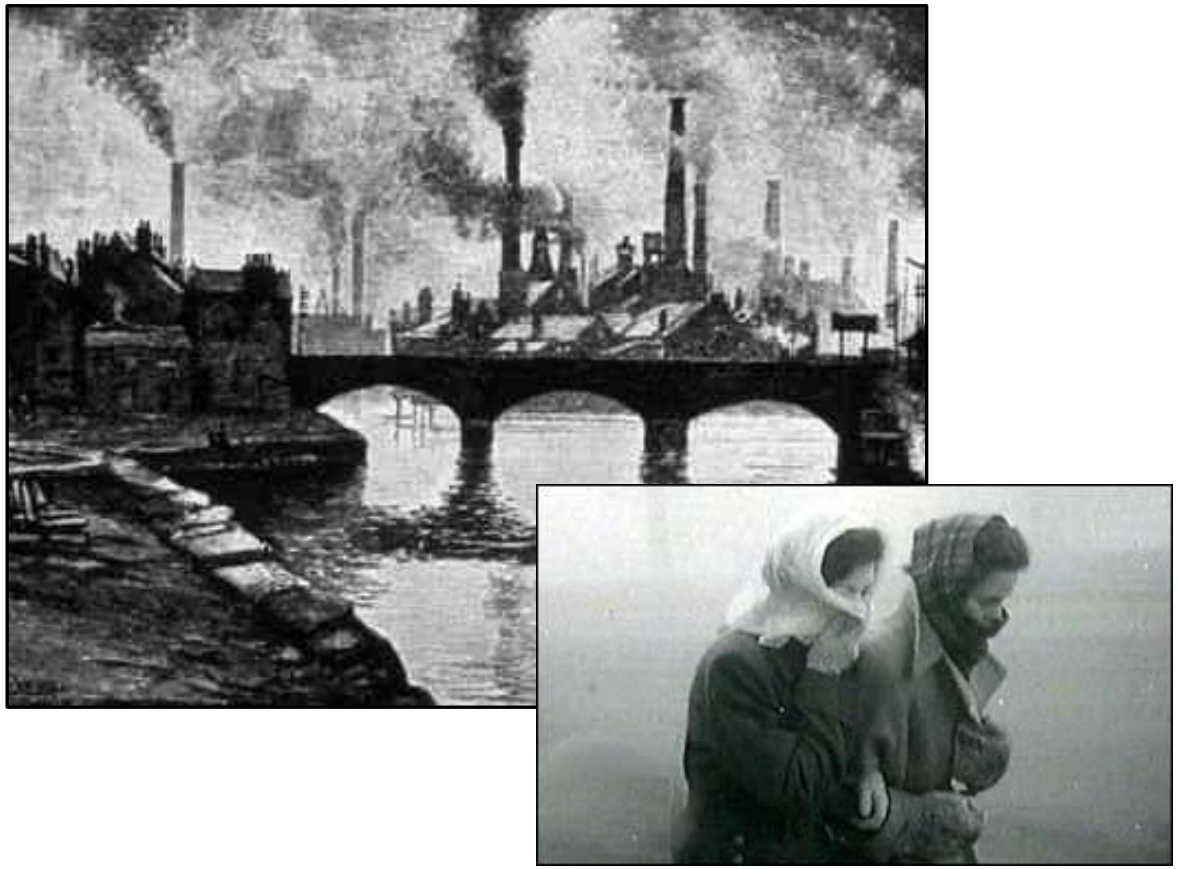
- **Increasing of Motorization and Industrialization (Mobility problems)**
- **Atmospheric Pollution**
- **Social Costs**

What are air pollution health effects?

Historic

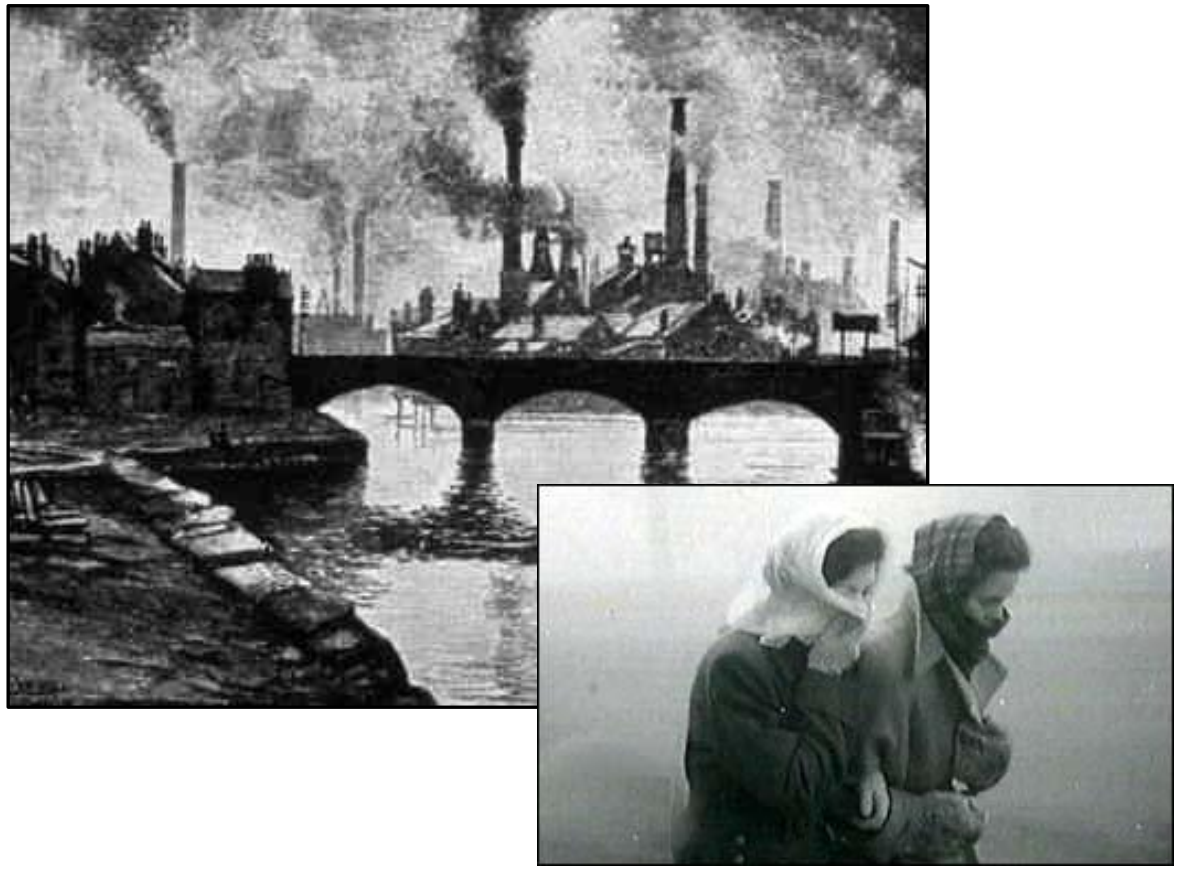
Health Effects

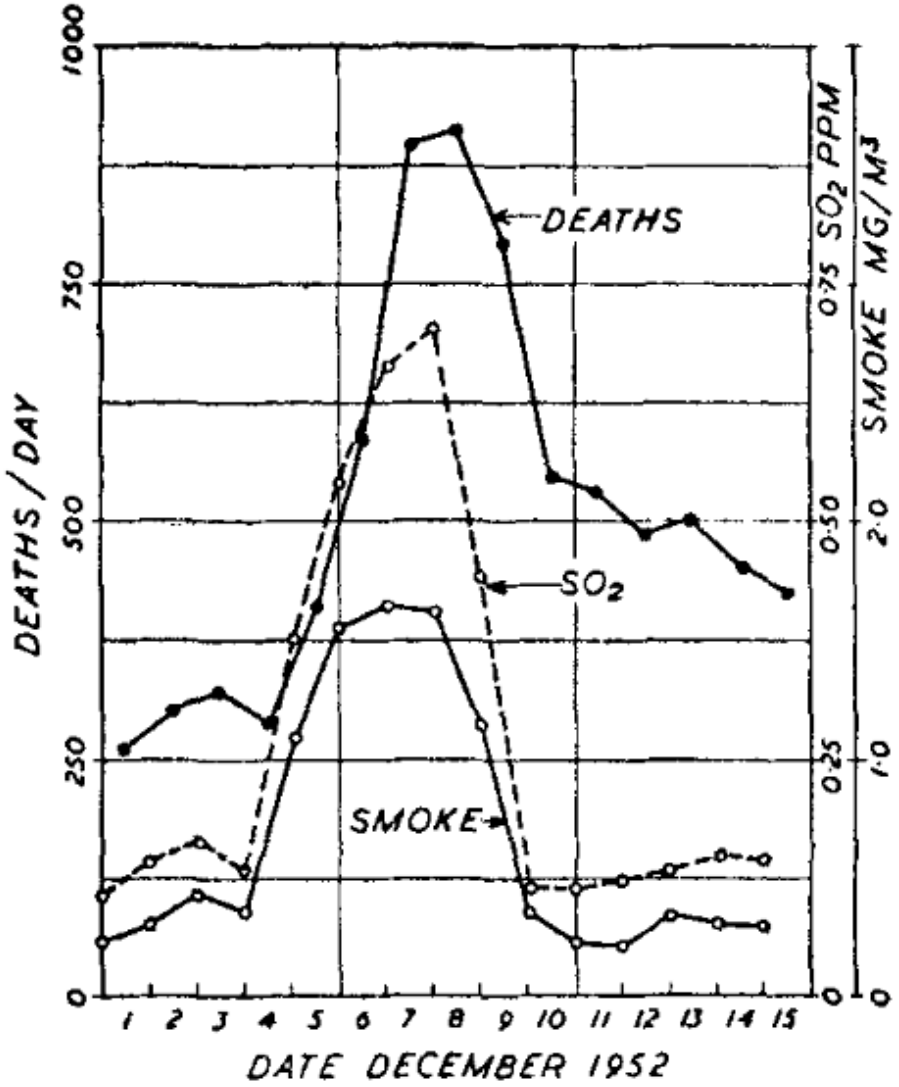
London, December, 1952



Historic
Health Effects

London, December, 1952





AIR POLLUTION - ENVIRONMENTAL AND HEALTH EFFECTS

Environment

- Acid rain
- Intensification of the greenhouse effect
- Oceans' acidification
- Visibility reduction

Health

- Medicines' consumption
- Hospital emergency visits
- Hospital admissions
- Deaths

Damage to Historical Patrimony

Medicines' use

Hospital admission

What are air pollution health effects?

Cough?

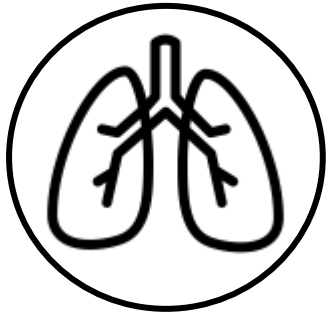
Shortness of breath?

Eye irritation?

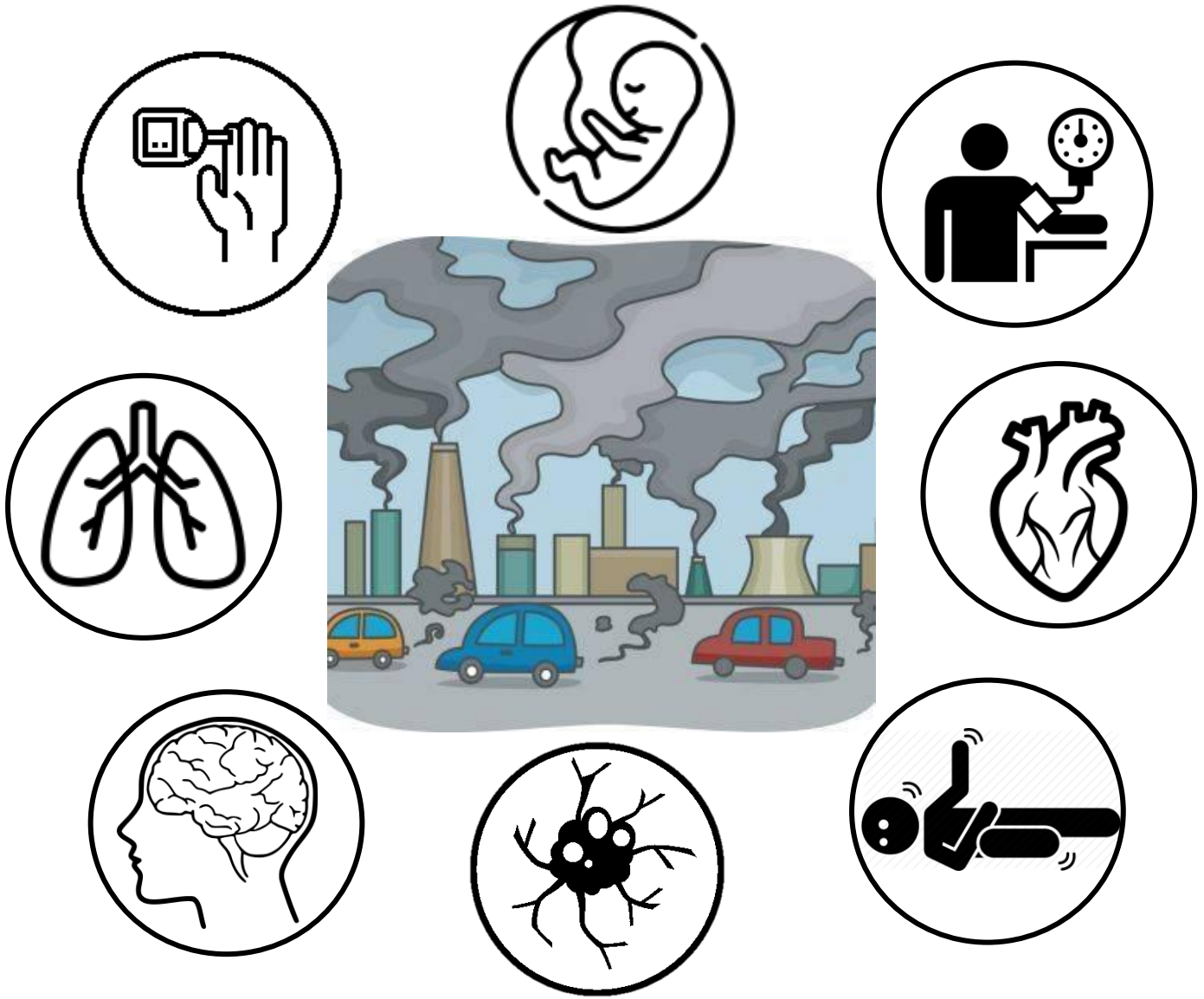
Atmospheric pollutants

Pollutant	Origin / Formation	Adverse Health Effects
$PM_{2,5}$	Solid or liquid particles up to 2.5 μm in diameter without a specific chemical composition. They have diverse origins	Penetrate the respiratory system to the alveoli and may cause mutagenic diseases and serious respiratory problems
PM_{10}	Solid or liquid particles between 2.5 μm and 10 μm without a specific chemical composition. They have diverse origins	Limited penetration to upper respiratory tract and, in general, can cause aggravation of existing respiratory diseases
O_3	Secondary pollutant formed from nitrogen oxides, which are mainly emitted by vehicles	It penetrates deep into the airways and has an oxidant and cytotoxic effect
CO	Released in the atmosphere when there is incomplete combustion of organic compounds	Is associated with hemoglobin, impairing the transport of oxygen to the body
SO_2	Mainly resulting from the burning of fossil fuels	Absorbed in the upper airways and its acid character causes inflammation of the respiratory tract
NO_2	Released in the atmosphere primarily by the automotive fleet and industries that perform combustion at high temperatures	Reach peripheral portions of the lung and has toxic effect

Health Effects



Health Effects



Susceptibility to Air Pollution

- All the population is affected, but the risk is higher to fetuses, children (< 5 years) and elderly (> 65 years).

Atmospheric pollution health effects in São Paulo Metropolitan Region (SPMR)

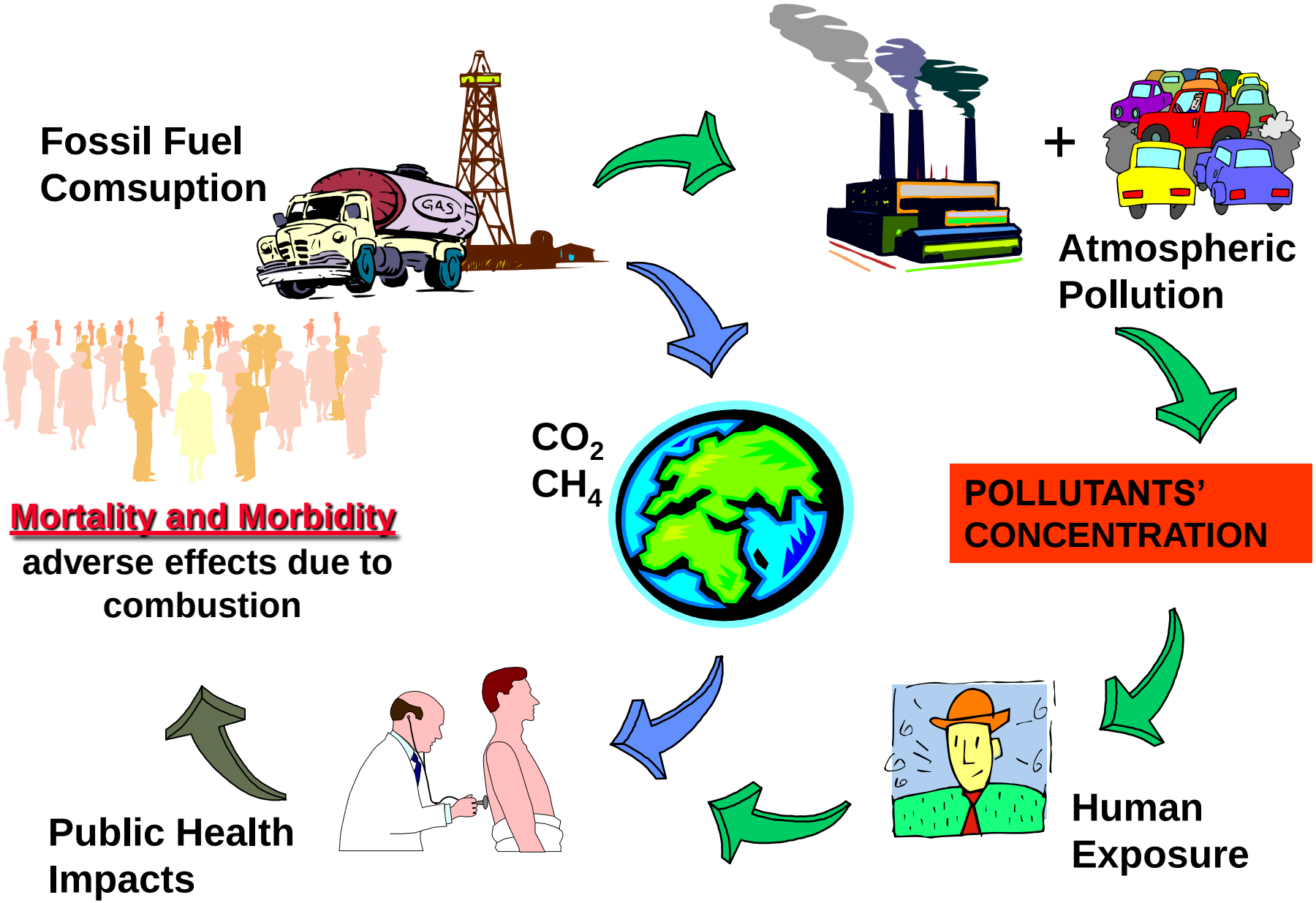
Acute Effects	
Lin et al., 1999	Emergency respiratory visits in **children**
Martins et al., 2002	Hospital admission in the **elderly** with influenza and pneumonia
Gouveia et al., 2006	Hospital admissions in asthmatic **children** and **elderly** with symptoms of chronic obstructive pulmonary disease and heart disease
Costa et al., 2017	Deaths due to non-accidental causes in the **elderly**

Long Term Effects	
Saldiva et al., 1994	Deaths due to cardiorespiratory diseases in **children**
Pereira et al., 1998	**Intrauterine** mortality
Miraglia et al., 2005	**28.212 years of life lost and lived with disability**

Atmospheric pollution health effects in São Paulo Metropolitan Region (SPMR)

Professionals exposed to high levels of air pollution	
CHIARELLI et al., 2011	**Traffic guards:** Increase in blood pressure in work outdoors
RODRIGUES-SILVA et al., 2012	**Traffic guards:** Positive association between absenteism and low air quality
FERREIRA et al., 2009	**Motoboys:** Positive relationship between lower lung capacity and intensity and time of exposure to pollutants atmospheric

Global Impacts of the Pollutants in Public Health



A LEADING KILLER ACROSS THE GLOBE

The loss of life due to air pollution is causing human suffering and reduced economic development.

1 IN 10 DEATHS WORLDWIDE IS ATTRIBUTABLE TO AIR POLLUTION EXPOSURE.

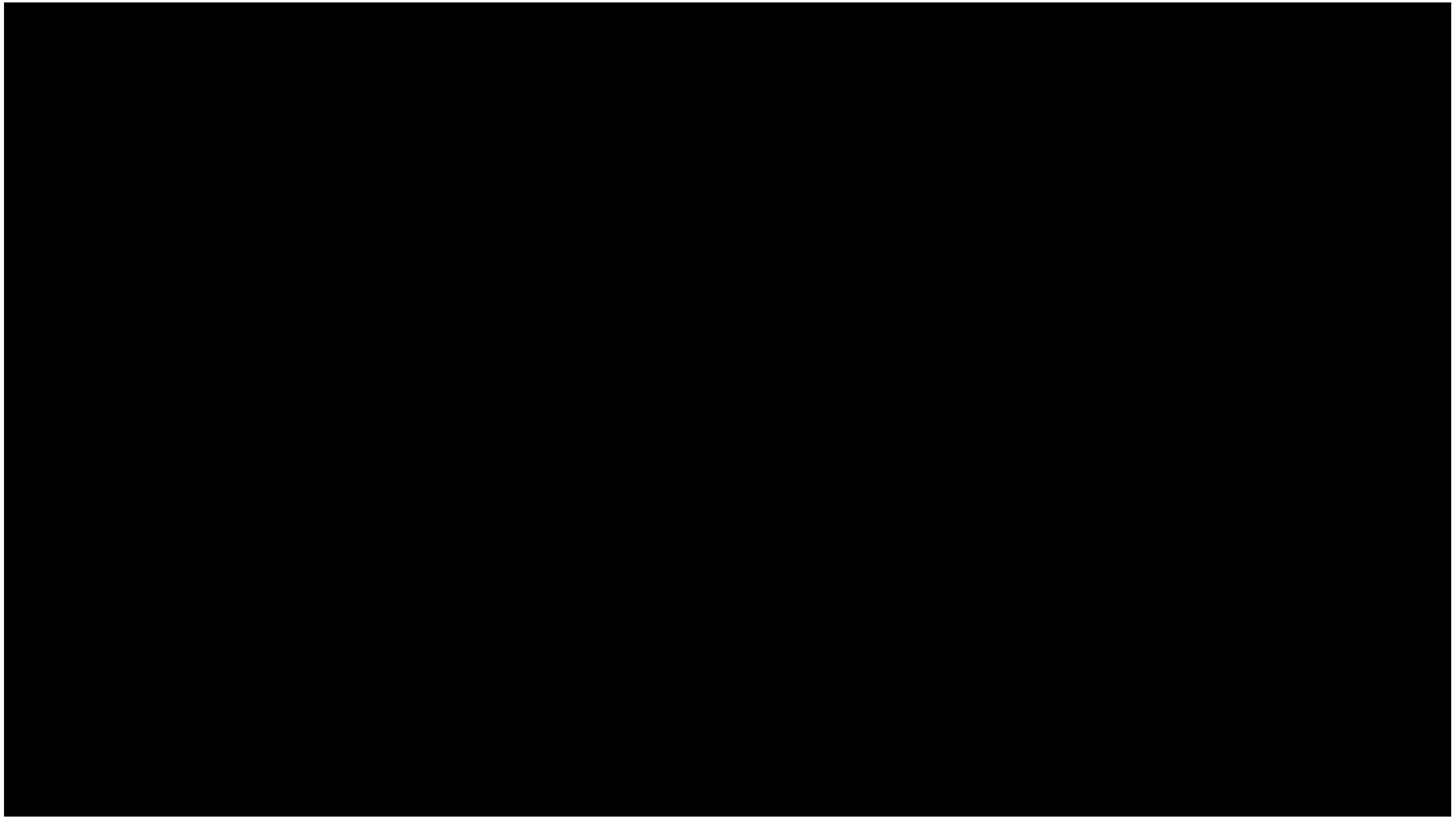
PERCENTAGE OF ATTRIBUTABLE DEATHS GLOBALLY IN 2013, BY RISK FACTOR:

Exposure to air pollution is now the fourth leading risk factor for deaths worldwide behind metabolic risks, dietary risks, and tobacco smoke.

*Metabolic risks include excess body fat around the waist, high blood pressure, high blood sugar, and abnormal cholesterol.

IT'S A BIGGER RISK THAN YOU THINK. MORE THAN **6X** AS MANY PEOPLE DIE FROM AIR POLLUTION EACH YEAR THAN FROM MALARIA, AND MORE THAN **4X** AS MANY DIE FROM AIR POLLUTION THAN FROM HIV/AIDS.

AIR POLLUTION – ENVIRONMENT AND HEALTH EFFECTS



IndiaToday.in

New Delhi, October 20, 2016 | UPDATED 14:47 IST

Delhi's air quality worsens, says SAFAR: What's Delhi's air pollution doing to your lungs?

In another 10 years, Delhi might record world's largest premature deaths. Know about the air pollution and how it affects when you are exposed to it.

Air pollution

RELATED STORIES

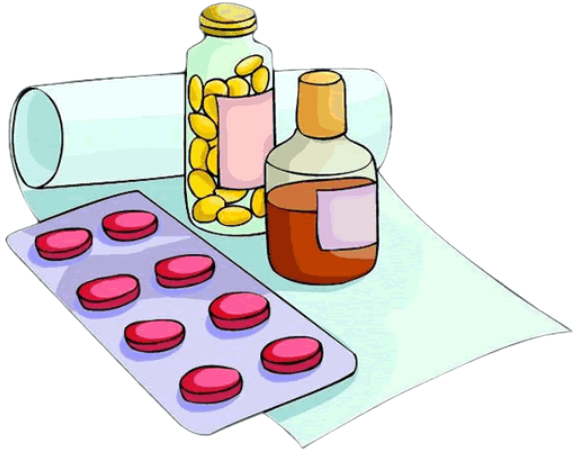
- Now, Kashmir's Red Stag on critically endangered species list: 7 critically endangered species
- India-China war of 1962: How it started and what happened later
- Fact of the day: Picasso produced an estimated 50,000 artworks
- Remembering the 'Father of Nuclear Physics', Ernest Rutherford
- Streptomycin, an anitibiotic against TB, was discovered today: Life before the discovery

A comparison between a relatively healthier lung (left) to that of lung of a person (right) staying in Delhi

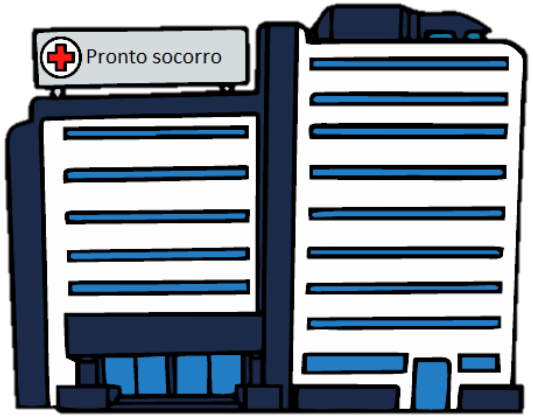
http://indiatoday.intoday.in/education/story/air-pollution/1/544274.html

Air pollution costs are adequately addressed?

Associated Costs



Medicines

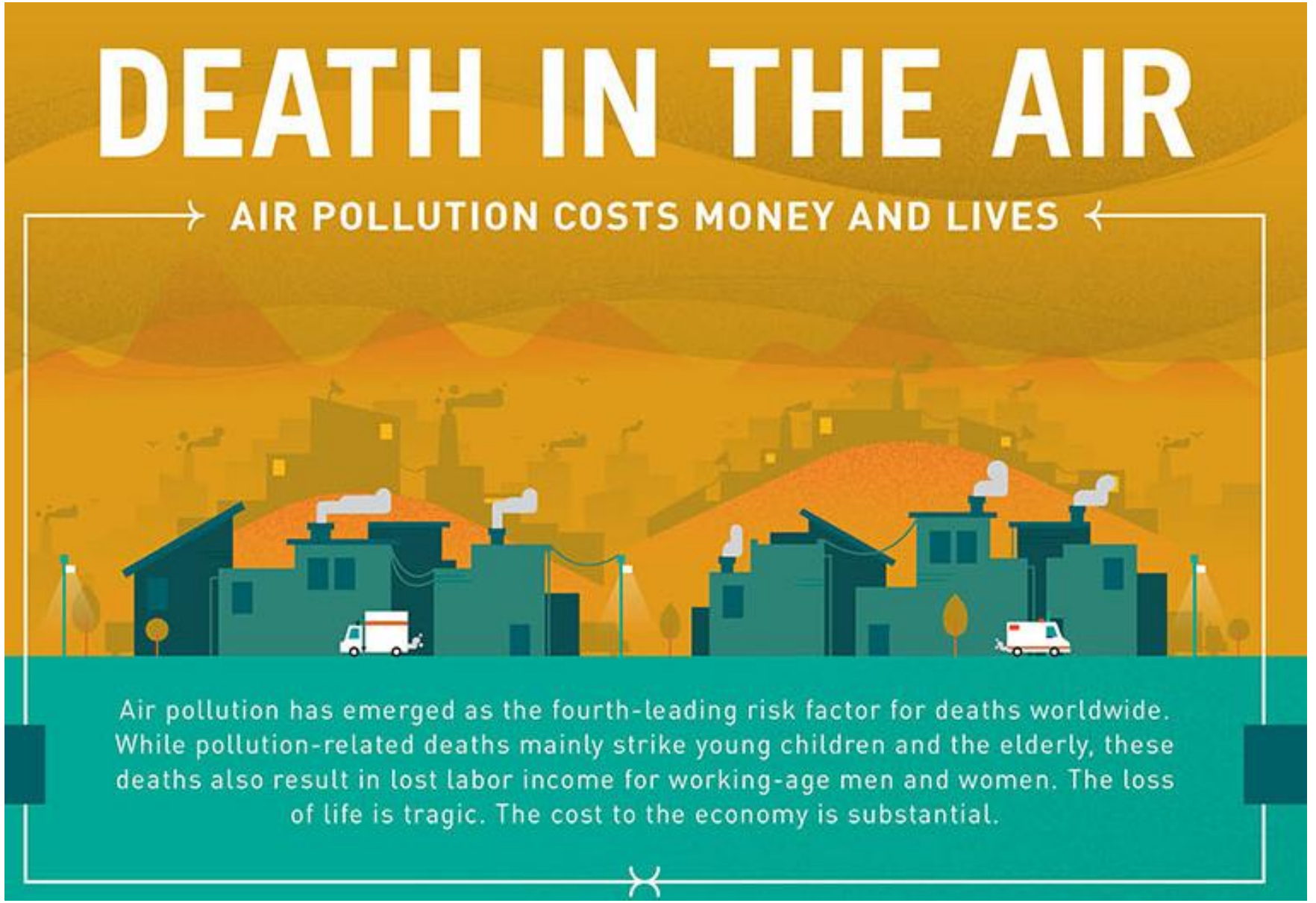


Emergency Room Visits

Hospital Admissions

Absenteeism

Human Life



http://www.worldbank.org/content/dam/infographics/780xany/2016/sep/WB_cost-of-pollution-infographic

PRESS RELEASE

Air Pollution Deaths Cost Global Economy US$225 Billion

September 8, 2016

This page in: English | Español | Français | 中文

WASHINGTON, DC September 8, 2016— Air pollution has emerged as the deadliest form of pollution and the fourth leading risk factor for premature deaths worldwide. Those deaths cost the global economy about US$225 billion in lost labor income in 2013, a new study finds, pointing toward the economic burden of air pollution.

The Cost of Air Pollution: Strengthening the economic case for action, a joint study of the World Bank and the Institute for Health Metrics and Evaluation (IHME), seeks to estimate the costs of premature deaths related to air pollution, to strengthen the case for action and facilitate decision making in the context of scarce resources. An estimated 5.5 million lives were lost in 2013 to diseases associated with outdoor and household air pollution, causing human suffering and reducing economic development.

MEDIA CONTACTS

In Washington
Flore de Preneuf
Tel : (202) 473-5844
fdepreneuf@worldbankgroup.org

RESOURCES

REPORT: The Cost of Air Pollution: Strengthening the Economic Case for Action

INFOGRAPHIC: Death in the Air: Air Pollution Costs Money and Lives

GLOSSARY: Air Pollution Costs for Non-Economists

Public Health

Volume 125, Issue 3, March 2011, Pages 157-164

Original Research

Monetary burden of health impacts of air pollution in Mumbai, India: Implications for public health policy

A.M. Patankar [a], P.L. Trivedi [b]

Show more

https://doi.org/10.1016/j.puhe.2010.11.009

Valuation	Results
Costs of non-hospital operations	Personal + Government + Social Costs
Hospital evaluation cost (per day)	US$ 113.080.000 >> increase in 50 µg/m³ of PM_{10}
Activity restriction (absenteeism)	US$ 218.100.000 >> increase in 50 µg/m³ of NO_2

United Nations STATEMENT

- Motivation
- Launch Event
- Working group
- Highlights

Motivation

- ✓ Air pollution is a preventable problem;

- ✓ However, without a diligent action, exposure to air pollution will continue to be one of the biggest causes of mortality in the world;

Given the urgency of this issue, leading researchers from South Africa, Germany, Brazil and the United States draw up a political-scientific statement, calling leaders of governments, businesses and citizens to act urgently to reduce air pollution around the world

Launch Event

- ✓ On June 19th 2019, the statement was presented at the United Nations Headquarters in New York;
- ✓ Call for intensified funding and action under a new global compact to tackle air pollution;
- ✓ The launch event was transmitted online for all community.

Working Group

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Head of Research Group "Environmental Risks", Institute of Epidemiology, Helmholtz Zentrum München – German Research Center for Environmental Health, Neuherberg, Germany

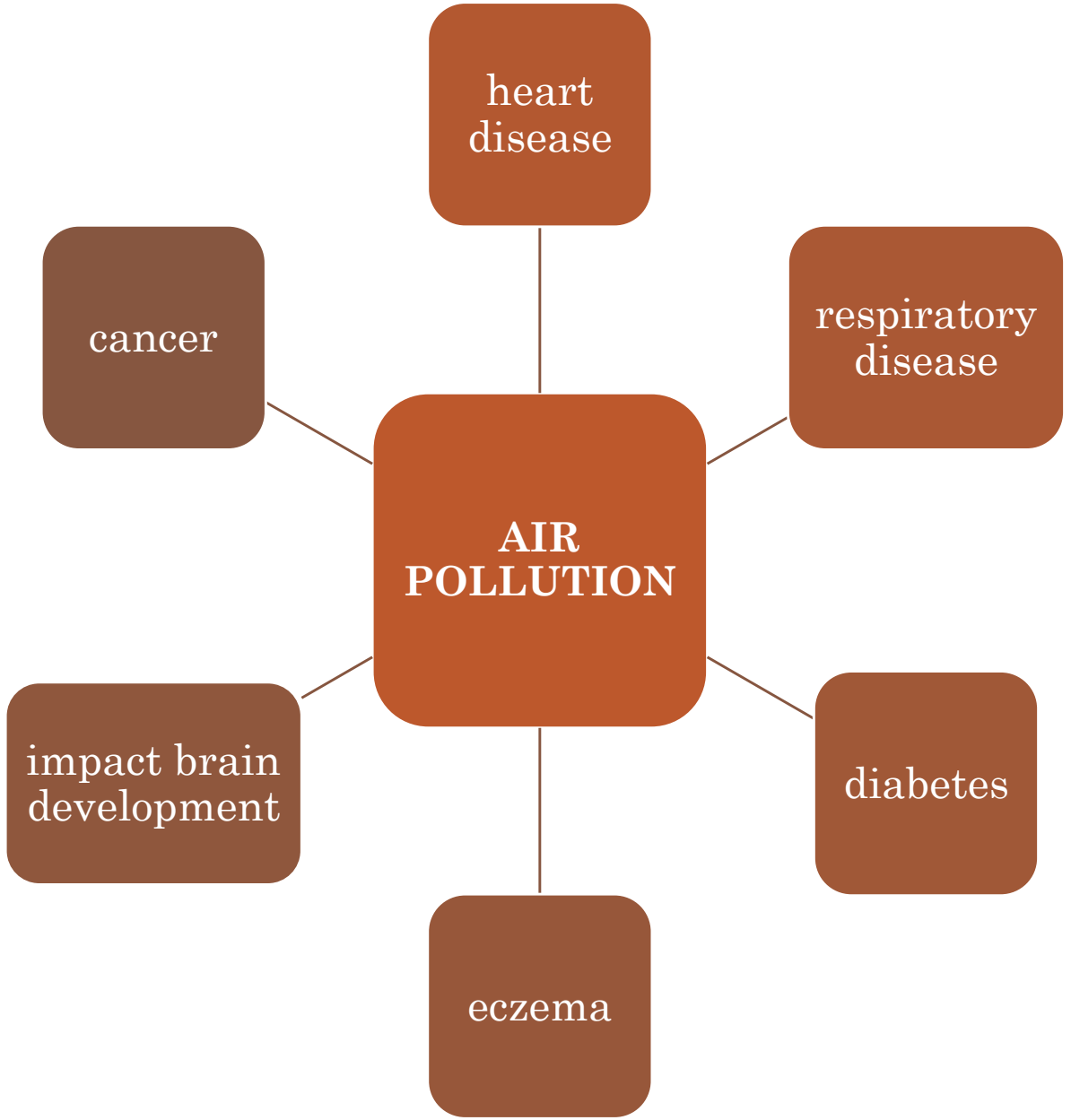
Kirk R. Smith
Professor of Global Environmental Health, University of California, Berkeley, U.S.A. and Director, Collaborative Clean Air Policy Centre, Delhi, India

Highlights

✓ The biggest contributor to air pollution is fossil fuel and biomass combustion >> power-generation, heat and cooking, transport and agriculture

✓ Air pollution from fossil fuels is particularly adverse for humans as it contains large amounts of particulate matter

✓ Air pollution causes at least 5 million premature deaths annually



Highlights

The statement also provides an overview of the cost of air pollution to society from an economic point of view:

absenteeism; lost in productivity

↓

negative impacts on gross domestic product

↓

contribute to existing social inequalities

- ✓ Air pollution-related illnesses cost up to 7% of the national budget for health in developing countries
- ✓ According to estimates made in 176 countries, the global economic costs of these diseases has reached US$ 3.8 million in 2015

Final Remarks

- Health damage (Years of Life Lost) = Costs
- Urgent need in increasing quality of life + resources' savings
- Air pollution reduction and a review of the air quality patterns
- Public policies and actions in order to diminish drastically air pollution concentrations and consequently save lives + $

Thank you!

Profa. Dra. Simone Georges El Khouri Miraglia

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