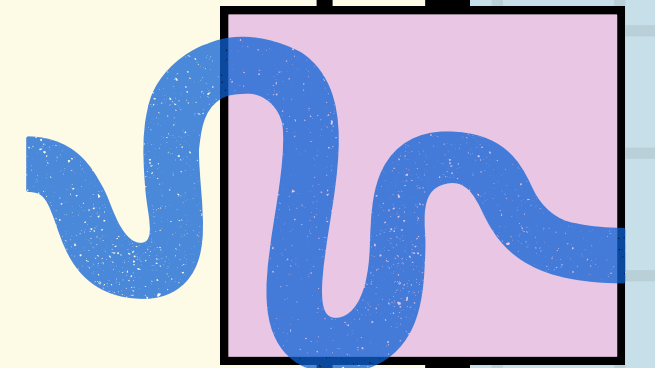
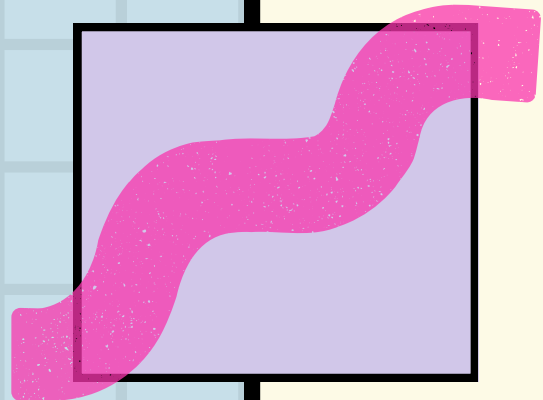
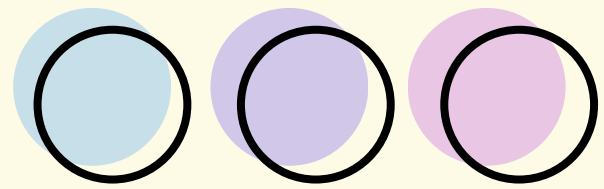


PAGE 01

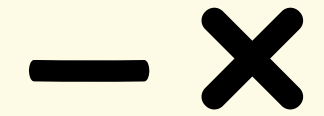
Effect of Air Pollution on Respiratory Health

WRITTEN BY SAHAJ SATANI

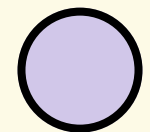




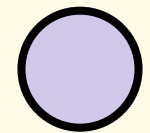
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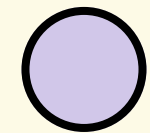
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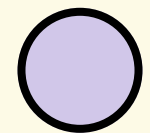
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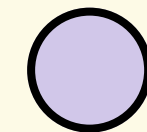
Learning Goals



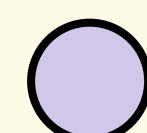
Introduction



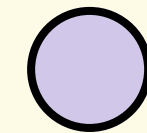
Objectives



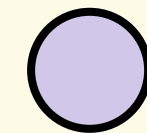
Key Terms



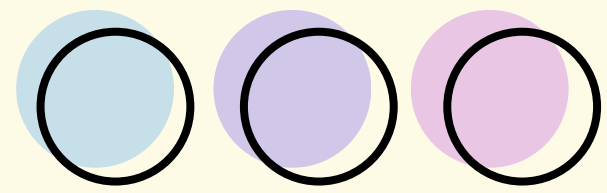
REVIEW



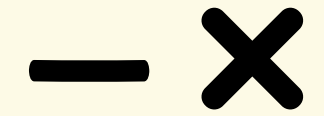
Summary



References

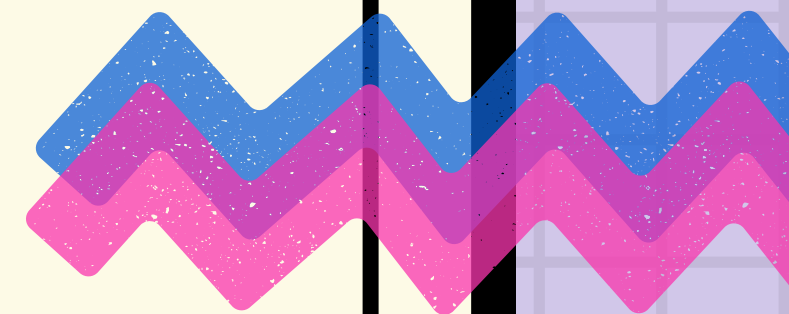


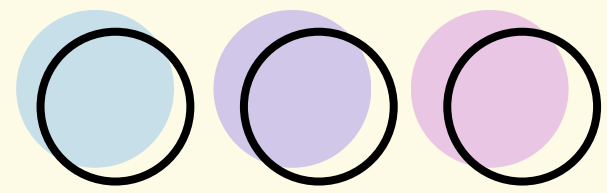
Target Audience



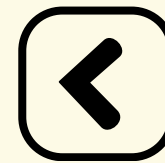
PAGE 03

- All ages.
- Those who want to live in urban areas.
- Those who already live in urban areas.
- All people – to learn the risks and harm of pollution.



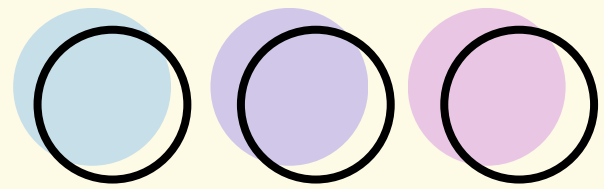


Learning Goals

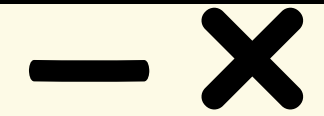


PAGE 04

- Gain a broad understanding of what air pollution is.
- Gain a broad understanding of what diseases and health effects are caused by air pollution.
- Be able to recognize the implications of air pollution and its effects on humans.
- Be able to realize the importance of plans of action to be undertaken as steps towards reducing air pollution and its harm for humans.



Introduction



PAGE 05

Topic #1

A leading cause of death, particularly in rising years with rapidly growing industrialization, is air pollution. We will be investigating today what causes air pollution and its major sources.

Topic #2

Air pollution has many negative effects on the environment, animals, and humans. We will focus on what diseases and how they are caused by air pollution.



Objectives



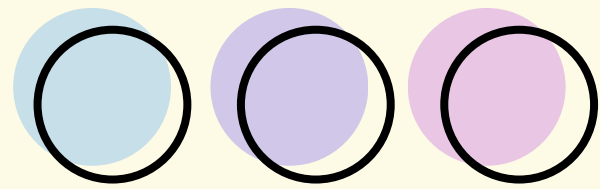
01

Be able to define what pollution and pollutants are, list some major examples of pollutants, and how they contribute to air pollution.

02

Be able to understand how air pollutants and pollution cause disease, and which specific diseases are caused by it.





Key Terms



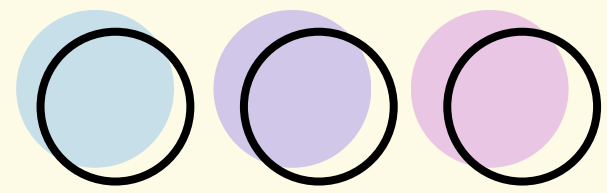
PAGE 07

Pollution

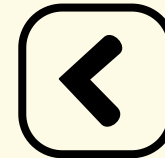
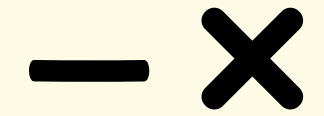
the introduction into
environment of substances
harmful to humans + other
living organisms

Pollutants

harmful solids, liquids, and
gasses produced in higher than
usual concentrations that
reduce quality of environment

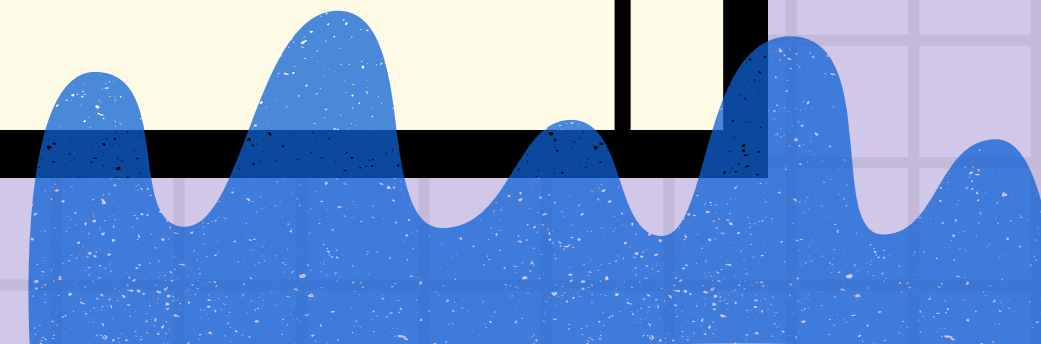


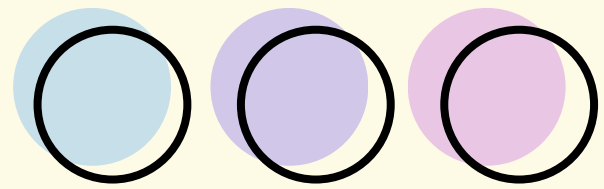
Types of Pollution



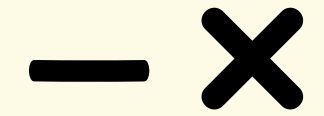
PAGE 08

- Air pollution – when there is a presence of pollutants in the air in large quantities for long periods of time
- Radioactive and nuclear pollution – releases radioactive and nuclear pollutants into the air during nuclear explosions/accidents, through nuclear weapons, and more
 - Several radioactive substances like radium and uranium concentrate in bones and can cause cancers
- Noise pollution – caused by machines, vehicles, traffic noises, and musical installations that are harmful to hearing



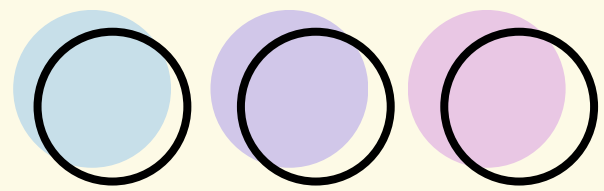


Pollutants

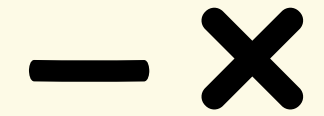


PAGE 09

- Can be split into primary pollutants (produced by pollution sources) and secondary pollutants (emitted as by-products of primary pollutants)
- Can be biodegradable or non-biodegradable; can be of natural origin or anthropogenic (originating in human activity)
- Origin can be unique source (point-source) or dispersed sources (multiple)
- Have differences in physical + chemical properties, meaning differences in capacity for producing toxic effects



Particulate Matter



PAGE 10

01

Particulate matter (PM) are small particles that penetrate the respiratory system through inhalation.

02

It is usually formed in atmosphere as result of chemical reactions between different pollutants

03

It is a subset of air pollutant that can be comprised of both primary and secondary pollutants. It is made up of both solid and liquid droplets.

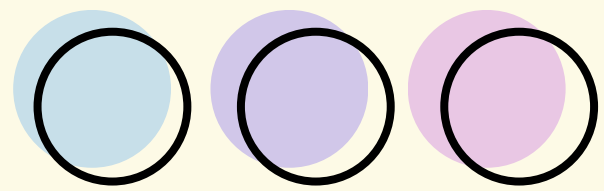
Table 2

Types and sizes of particulate Matter (PM).

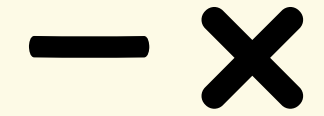
Type		PM diameter [μm]
Particulate contaminants	Smog	0.01–1
	Soot	0.01–0.8
	Tobacco smoke	0.01–1
	Fly ash	1–100
	Cement Dust	8–100
Biological Contaminants	Bacteria and bacterial spores	0.7–10
	Viruses	0.01–1
	Fungi and molds	2–12
	Allergens (dogs, cats, pollen, household dust)	0.1–100
Types of Dust	Atmospheric dust	0.01–1
	Heavy dust	100–1000
	Settling dust	1–100
Gases	Different gaseous contaminants	0.0001–0.01

PAGE 11

A chart of various types of PMs and their sizes. The smaller the particle means the easier for it to penetrate the lungs and cause respiratory illnesses.



Major Pollutants



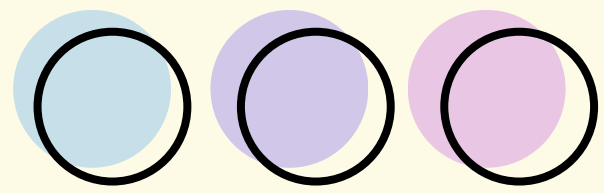
PAGE 12

Ozone

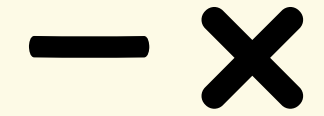
Gas formed from oxygen under high voltage electric discharge, arises in stratosphere; can travel to distant areas from initial source. Uptake usually occurs by inhalation, affecting upper layers of skin and tear ducts. Due to the low water-solubility of ozone, inhaled ozone has capacity to penetrate deeply into lungs.

Carbon Monoxide

Produced by fossil fuel when combustion is incomplete. Symptoms of poisoning through inhalation include headache, dizziness, weakness, nausea, vomiting, loss of consciousness. The affinity of carbon monoxide to hemoglobin is greater than that of oxygen, so serious poisoning can happen to those who are exposed to high levels of it for long period of time. It causes a loss of oxygen as result of competitive binding of carbon monoxide, so it can cause hypoxia, ischemia, and cardiovascular disease. Can get direct poisoning from carbon monoxide if present at a high enough level.



Major Pollutants



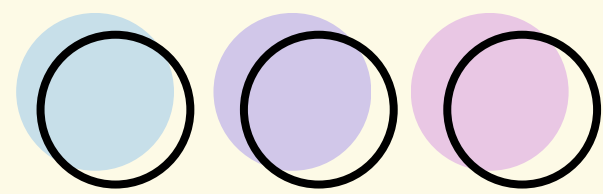
PAGE 13

Nitrogen Dioxide

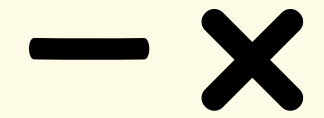
Emitted from automobile motor engines. An irritant of the respiratory system as it penetrates deep in the lung, causing respiratory diseases, coughing, wheezing, when inhaled at high levels. Long term exposure at high levels can impair sense of smell and cause chronic lung disease.

Sulfur Dioxide

Emitted mainly from fossil fuel consumption or industrial activities. Causes respiratory irritation as it is a sensory irritant. Penetrates deep into the lung and is converted into bisulfite, interacting with sensory receptors and causing bronchoconstriction. Causes skin redness, damage to the eyes and mucous membranes, and the worsening of pre-existing cardiovascular diseases.



Major Pollutants



PAGE 14

Lead

Neurotoxicant (toxic for brain) and heavy metal used in different industrial plants, emitted from motor engines, batteries, and so forth. Sources are metals, ore, and piston-engine aircraft. When inhaled, accumulates in blood, soft tissue, liver, lung, bones, and in the cardiovascular, nervous, and reproductive systems. Causes a loss of concentration, memory, muscle, and joint pain. Children and newborns especially susceptible to it because of its status as a neurotoxicant. Heavy metals absorbed into body can lead to direct poisoning or chronic intoxication depending on exposure.

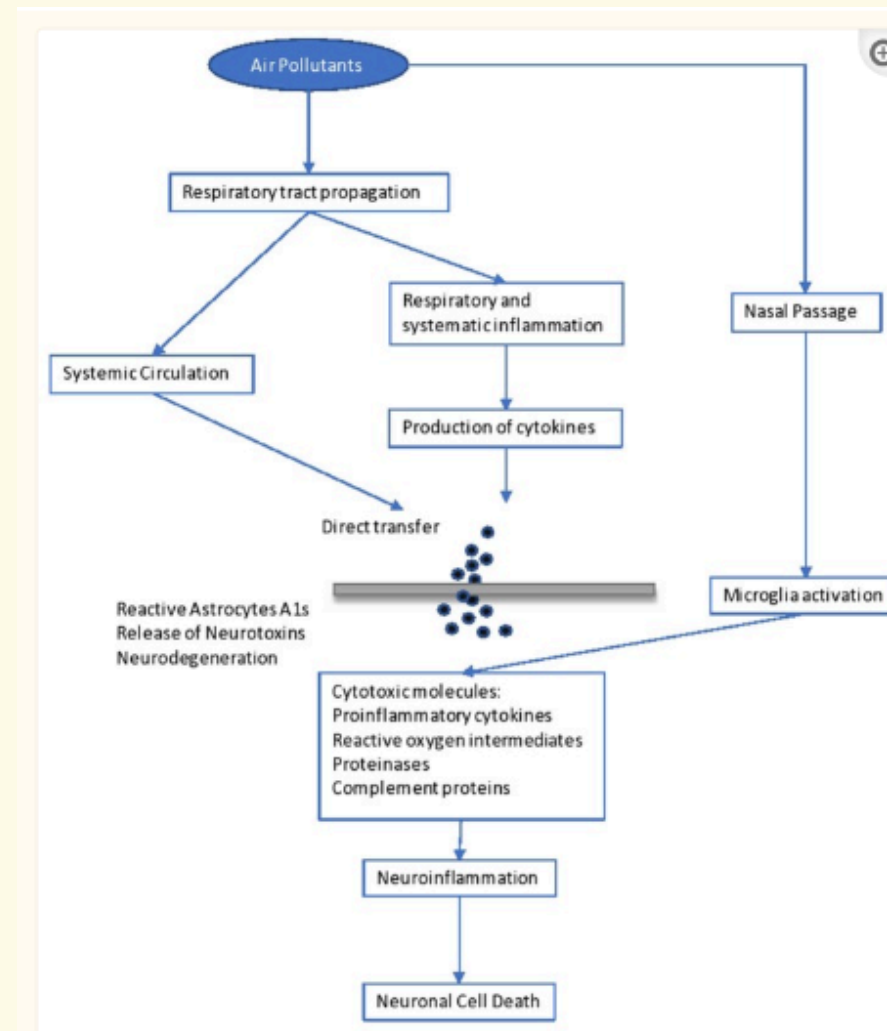
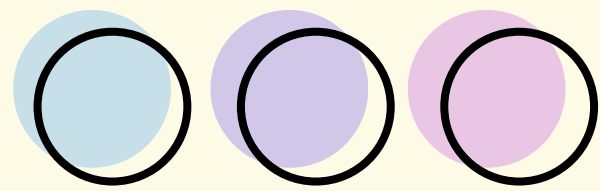
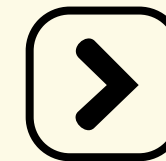
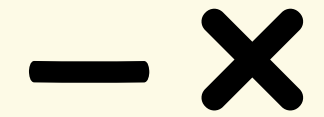


Diagram of the impact of air pollutants (like lead) on the brain.



How do pollutants get into the body?



PAGE 15

01

Through inhalation of pollutants, which are released by pollution from industrialization, urbanization, and human activity.

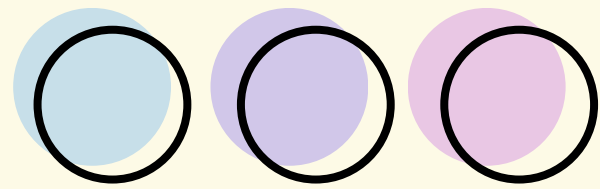
02

They vary in size and depending on its size, can penetrate the lungs as seen in the diagram to the right. The more deeply they penetrate, the more severe and rooted the disease will be.

Table 1

Penetrability 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 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



Case Studies



PAGE 16

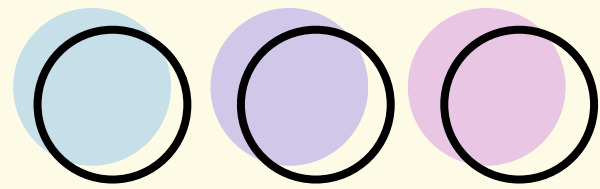
Study #1

Results showed an association between the effect of air pollution exposure and respiratory diseases. Increased concentrations of all atmospheric pollutants have been associated in 70% of studies to phlegm and cough, 35% to asthma symptoms, and 30% to increase of days spent in hospital from pre-existing respiratory diseases. Showed an increase in sensitivity to pollen-induced allergies, and an increase in frequency of asthma exacerbations + respiratory infections.

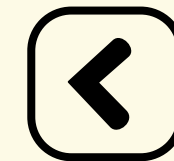
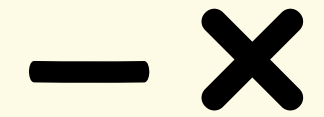
Study #2

Showed that a 1% increase in urbanization caused reduced mortality in general (reduced mortality 0.05%, under-five mortality 0.04%, infant mortality 0.04%), and increased life expectancy by 0.01 year. In contrast, also showed that air pollution undermined positive impacts of urbanization on health.

Additional statistic: Anthropogenic air pollution is one of biggest public health hazards worldwide – accounts for about 9 million deaths per year.



Diseases

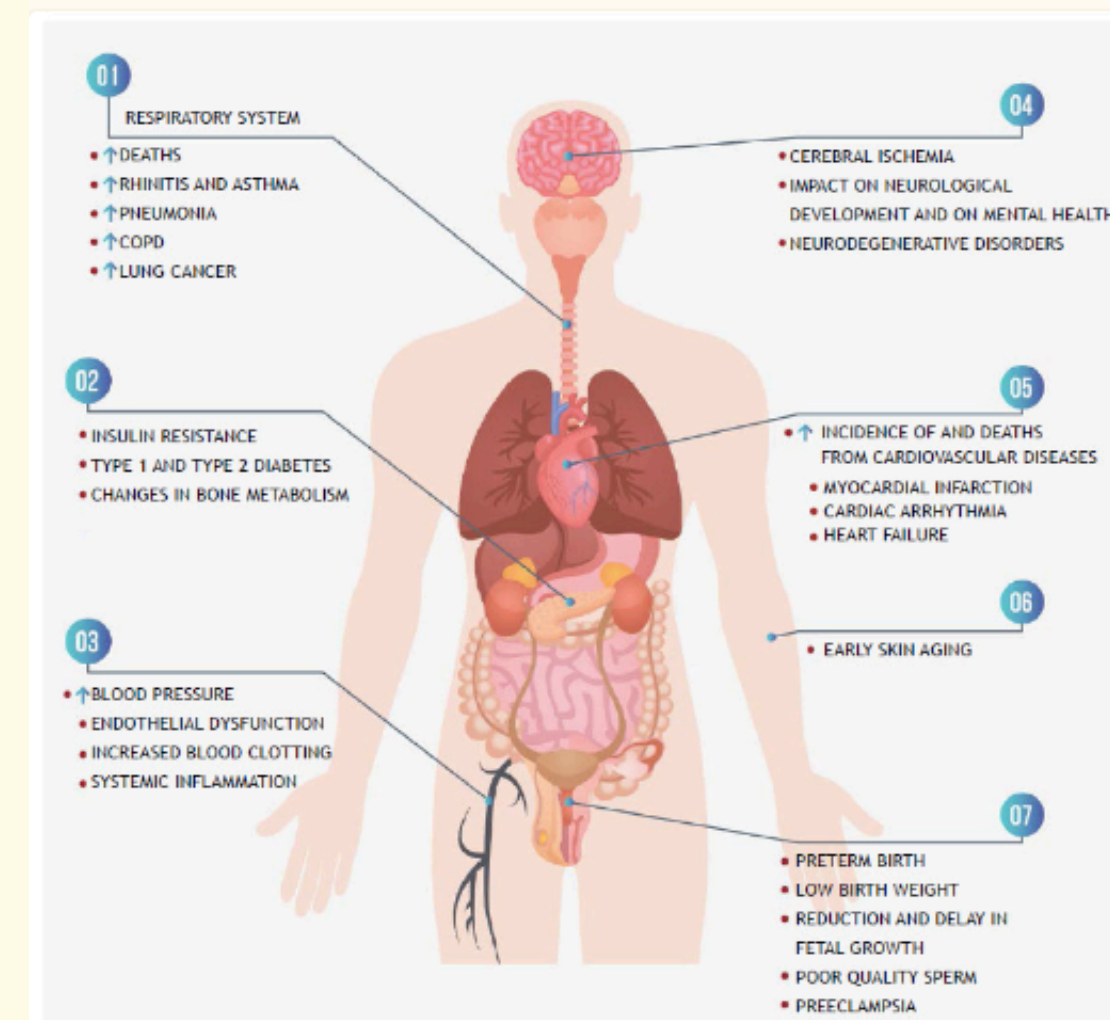


PAGE 17

Estimates of deaths and disease burden associated with air pollution: global data for 2017 according to the Global Burden of Disease 2017 Risk Factor Collaborators.⁵

Pollutants and diseases	Environmental air pollution: PM _{2.5}		Household air pollution	
	Deaths × 1,000 (95% CI)	DALYs × 1,000 (95% CI)	Deaths × 1,000 (95% CI)	DALYs × 1,000 (95% CI)
COPD ^a	1,105 (583-1,606)	23,070 (13,040-32,800)	362 (248-482)	9,370 (6,480-12,400)
Ischemic heart disease	977 (839-1,120)	21,900 (18,900-25,400)	410 (344-490)	10,200 (8,450-12,100)
Ischemic brain disease	445 (343-552)	10,510 (8,189-13,020)	231 (178-293)	5,761 (4,493-7,417)
Respiratory infections	433 (343-527)	18,500 (14,400-23,400)	459 (367-552)	25,900 (20,300-31,300)
Lung cancer	265 (183-351)	5,860 (4,050-7,730)	85 (60-113)	1,990 (1,410-2,640)
Type 2 diabetes	184 (123-227)	10,500 (6,700-13,900)	92 (63-113)	4,750 (3,110-6,190)
Cataracts	-	-	-	1,440 (732-2,250)
Total	3,412 (2,677-4,168)	147,000 (132,000-162,000)	1,640 (1,400-1,930)	59,500 (50,800-68,900)

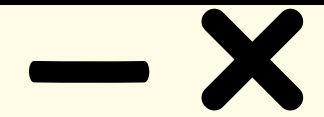
A table of data which estimates the amount of deaths from various diseases that were caused by either environmental or household air pollution.



A diagram of various illnesses caused by air pollution.



Diseases



PAGE 18

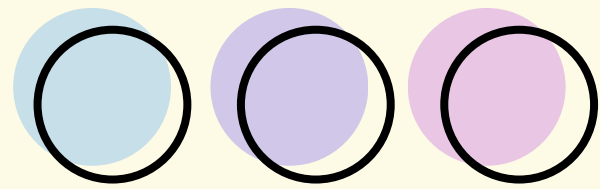
Some of the most common respiratory diseases that may be caused or inflamed by air pollution:

01

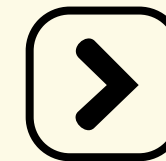
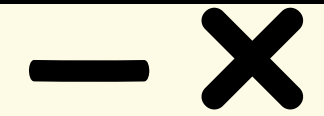
Chronic Obstructive Pulmonary Disease (COPD) - Chronic lung disease that is characterized by long-term respiratory symptoms and airflow limitations.

02

Asthma - air pollution can trigger asthma flares as it inflames and irritates linings and receptors in airways, causing airways to tighten and swell. They also increase airway reactivity to asthma triggers.



Summary



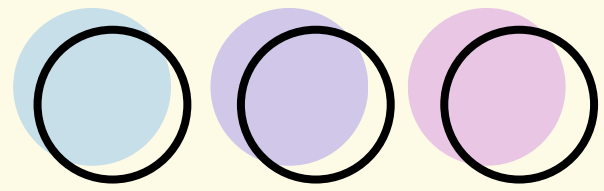
PAGE 19

Air Pollution

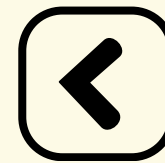
Air pollution is caused by human activities that release pollutants (a mixture of small particles of liquids and solids) into the air at greater levels. A few major pollutants are ozone and carbon monoxide.

Diseases Caused

The smaller the pollutants and PMs are in size, the easier they are to penetrate the lungs and body, and through inhalation of the harmful pollutants, diseases are caused.

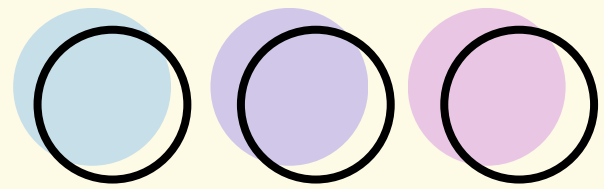


Implications

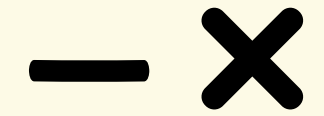


PAGE 20

- There must be steps taken to prevent further air pollution from occurring and harming people.
- Public health is taking a hit, so national policies need to reduce air pollution.
- Air Pollution undermines positive effects of urbanization on health.
- There is a need to develop sustainable urbanization practices to keep positive urbanization growing.
- Change needs to begin with public awareness and through a multidisciplinary approach that covers multiple issues and solutions.



References + Sources



PAGE 21

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- Urbanization and Global Health: The Role of Air Pollution - PubMed (nih.gov).
- Environmental and Health Impacts of Air Pollution: A Review - PMC (nih.gov).
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- Effects of Environmental Emissions on the Respiratory System: Secrets and Consequences | IntechOpen

