

Environment, health, and safety

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What kind of role does environment play in people's health?





Health ecological model





Environment & health

Environment can affect health in two ways



24% of the world's disease burden and 23% of all deaths can be attributed to environmental factors (WHO, 2006)





- Accidents between motor vehicles, bicycles and pedestrians (particularly children and young people)
- Pollution from burning fossil fuels
- Noise from transportation
- Psychosocial effects such as severance of communities by large roads and the restriction of children's movement
- Increased the odds of spread of infection(Vector borne diseases)
- Climate change due to CO₂ emission
- Improved physical activity from cycling or walking
- Increased access to employment, shops and medical establishment
- Recreational uses of road spaces
- Contributes to economic development



Environment & doctors

- Helping patients *interpret* environmental risks about which they are concerned.
- Exploring the possibility of environmental (occupational) causes of disease in patients by performing case histories and physical examinations that are environmentally sensitive.
- Reporting diseases that might have been caused by the environment to public health agencies

Clinician needs to know

- ① What environmental hazards patients are likely exposed to,
- ② How they are potentially exposed,
- ③ and how the exposure threatens their health.



Environmental health by WHO

- All physical, chemical, and biological factors external to a person
- The assessment and control of environmental factors that can potentially affect health targeted towards preventing disease and creating health-supportive environments
- This definition excludes the social and cultural environment





This class

- Environmental agents that matter to health and health care
- Health impact of the environment
- Mechanism of health impact of environment
- Transmission of environmental agents
- Setting of environmental health risks
- Environmental health specifics



The environment

Agents

- (Micro)biologic agents
- Chemical agents
- Physical source

Transmitters

- ♦ Air
- ♦ Soil
- Water

Settings

- ♦ Home
- School
- Worksite



Classification environmental agents

Environmental agent	Description and examples
Biological	Comprises all flora and fauna, including pathogenic parasites (e.g. schistosoma), viruses (e.g. enteroviruses), and bacteria (cholera, typhoid).
Physical	Geological, geographical, climatic and meteorological characteristics. Noise, vibration, motor vehicles and other means of transport.
Chemical	Organics and inorganic chemicals, drugs, alcohol, dust.
Social	Lifestyle characteristics such as smoking or diet / economic development, population, government policy, war



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DISEASES WITH THE LARGEST ENVIRONMENTAL CONTRIBUTION





Diseases with largest burden attributable to environment

- Diarrhoea. An estimated 94% of the diarrhoeal burden of disease is attributable to environment, and associated with risk factors such as unsafe drinkingwater and poor sanitation and hygiene.
- Lower respiratory infections. These are associated with indoor air pollution related largely to household solid fuel use and possibly to second-hand tobacco smoke, as well as to outdoor air pollution. In developed countries, an estimated 20% of such infections are attributable to environmental causes, rising to 42% in developing countries.



Diseases with largest burden attributable to environment

- Other' unintentional injuries. These include injuries arising from workplace hazards, radiation and industrial accidents; 44% of such injuries are attributable to environmental factors.
- Malaria. The proportion of malaria attributable to modifiable environmental factors (42%) is associated with policies and practices regarding land use, deforestation, water resource management, settlement siting and modified house design, e.g. improved drainage.



Environmental disease burden by region, 2002





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Routes of environmental hazards

- Routes of entry:
 - Skin
 - Lungs:

Lung is esp. sensitive to airborne microbes, smoke, chemical aerosols, fumes, dusts, and allergens

– Gastrointestinal tract



Health effect of environment

Exposure (dose) ------> health effect vulnerability



Factors affecting susceptibility

Fitness mental and physical fitness may be protective

Nutrition e.g. poor nutrition weakens a persons ability to fight infection and exacerbates the spread of diarrheal disease. Over-nutrition contributes to heart disease, immobility, diabetes and some cancers.

Lifestyle includes personal preferences such as smoking, alcohol and drug misuse; occupation, deprivation and residence.



Age the young and the old age more vulnerable to the effect

Sex male and female react differently to some chemicals. For example dioxin accumulates in fat and is therefore more of a hazard to female than male.

Disease those with preexisting disease and the immunocompromised are especially susceptible.

Genes e.g. genetic predisposition to cancer



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- (Psycho)social source + food

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Exposure to agents through:

- ♦ Air
- Water
- ♦ Soil
- Food: poisoned / toxic









Public concern

- Concern focuses on hazards such as chemical toxins (e.g. dioxin), radiation, radon, sick buildings and other "high-tech" environmental & occupational hazards.
- Little attention for hazards that we are familiar such as noise, dust, though these may be more dangerous to our health



What substance are you specifically concerned about in your environment?



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http://www.who.int/mediacentre/news/releases/ 2014/air-pollution/en/



Health topics Data	Media centre	Publications	Countries	Programmes	About WHO			
	Medi	a centre						
Media centre	7 mil	lion prema	ature dea	ths annuall	y linked to	air		
 News 	polit	4 3M by indeer air pollution						
 News releases 	News re	3.7M by outdoor air pollution in 2012						
Previous years	25 MAF	RCH 2014 GEN	EVA - In new	estimates release	d today, WHO re	ports that		
 Statements 	in 2012 of air po	 in 2012 around 7 million people died - one in eight of total global deaths – as a result of air pollution exposure. This finding more than doubles previous estimates and confirms that air pollution is now the world's largest single environmental health risk. Reducing air pollution could save millions of lives. 						
 Notes for the media 	confirm Reducir							
Events	New es	stimates						
Fact sheets	In partie	In particular, the new data reveal a stronger link between both indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischaemic heart disease, as well as between air pollution and cancer. This is in addition to air						
Multimedia	air pollu heart di							
Contacts	pollution respirat	pollution's role in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases.						



Outside Air

- Under the Clean Air Act in USA, EPA has established standards or limits for six air pollutants, known as the criteria air pollutants:
 - (1) carbon monoxide (CO),
 - **2** lead (Pb),
 - **③** nitrogen dioxide (NO2),
 - **4** sulfur dioxide (SO2),
 - **(O3)** ozone (O3)
 - **6** particulate matter (PM)
- AQI(air quality index, AQI)





Air Quality Index USA

EPA. Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI), December 2013

O ₃ (ppb)	PM _{2.5} (µg/m³)	ΡΜ ₁₀ (μg/m³)	CO (ppm)	SO ₂ (ppb)	NO ₂ (ppb)	AQI
-	0.0-12.0	0-54	0.0-4.4	0-35	0-53	0-50
-	12.1-35.4	55-154	4.5-9.4	36-75	54-100	51-100
125-164	35.5-55.4	155-254	9.5-12.4	76-185	101-360	101-150
165-204	55.5-150.4	255-354	12.5-15.4	186-304	361-649	151-200
205-404	150.5-250.4	355-424	15.5-30.4	305-604	650-1249	201-300
405-504	250.5-350.4	425-504	30.5-40.4	605-804	1250-1649	301-400
505-604	350.5-500.4	505-604	40.5-50.4	805-1004	1650-2049	401-500



				-	Go
AirNow	,	Local Air Quality Condit	ions	1	And in case of the local division of the loc
		Zip Code: Go	State : Alabama	▼ Go	My Current Location
				100	
AQI Calcula	ator: Conce	entration to	AQI		
	Select a criteria pollutant and concentration in the specified Quality Index and associated calculated below.	l enter the pollutant l units above; the Air information are			-
Select a Pollu	itant				
PM2.5 - Particulate <2.5 mi	icrons (24hr avg) ▼				
Units Required: ug/m3					
Enter the Concentration:	155 Calculate Re	set			
AQI AQI	Category				
205 Very	Unhealthy				
Sensitive Groups	Health Effects Statements	Cautionary Statements			
People with respiratory or heart disease, the elderly and children are the groups most at risk.	Significant aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly: significant increase in respiratory effects in general population.	People with respirator or heart disease, the elderly and children should avoid any outdoor activity: everyone else should avoid prolonged exertion.	y		

AOI Calculator: AOI to Concentration

https://airnow.gov/index.cfm?action=resources.conc_aqi_calc



Air Quality Index China

MEP, Technical Regulation on Ambient Air Quality, February 2012

O ₃ (ppb)	PM _{2.}	₅ (µg/m³)	PM ₁₀ (µg/m³)	CO (ppm)	SO ₂ (ppb)	NO ₂ (ppb)	AQI
160	35	12	50	5	150	100	0-50
200	75	35.4	150	10	500	200	<mark>51-100</mark>
300	115	55.4	250	35	600	700	101-150
400	150	150.4	350	60	850	1200	151-200
800	250	250.4	420	90	-	2340	201-300
1000	350	350.4	500	120	-	3090	301-400
1200	500	500.4	600	150	-	3840	401-500
	25		50			WHO qui	delines 2005



Components air pollutants

- Particulate matter
 - PM10 and PM2.5
- Metal fumes: is gaseous of metal oxides
 - ►Lead PbO₂
- Gas
 - Ozone
 - > Nitrogen dioxide (NO_2)
 - > Sulfur dioxide (SO_2)
 - Hydrocarbons
 - Carbon monoxide (CO)

- Dusts
 - Coal dust
 - silica dust



Serious air pollution

Photochemical smog

- Nitrogen dioxide and Hydrocarbons at summer with strong sunshine and high temperature (over 30°C)
- Smog with blue light and *strong oxidation and irritant characteristics*
- In heavy traffic area
 caused by automobile
 exhaust





Great smog of London

 The Great Smog of 1952, sometimes called the Big Smoke: In the winter of 1952, the cold weather combined with an anticyclone and windless conditions, collected airborne pollutants – mostly arising from the use of coal – to form a thick layer of smog over the city. It lasted from Friday, 5 December to Tuesday, 9 December 1952 and then dispersed quickly when the weather changed.





Government medical reports in the following weeks, however, estimated that up until 8 December, 4,000 people had died as a direct result of the smog and 100,000 more were made ill by the smog's effects on the human respiratory tract. More recent research suggests that the total number of fatalities was considerably greater, about 12,000.









Indoor air pollution

- Pollutants produced or released indoor
- Sick building syndrome (office tower)
 - high Volatile Organic Compounds, esp. formaldehyde
 - lack of fresh air
 - At risk (but often unnoticed) are white collar workers in service industry
- Environmental tobacco smoke
- Cooking smoke (esp for Chinese cooking)



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Exposure setting

- Home and residential area
 - low dose, long term exposure
 - sensitive population
- Workplace
 - high dose, short-term
 - Healthy Worker effect
- School
 - Dose? long term exposure
 - sensitive population

Commercial and entertainment spaces

- Dose? Duration?
- Population?



Neighborhood environment

- Housing
- Physical environment
 - urban planning (routes & connectivity)
 - green spaces
 - road safety
- Social environment
 - social cohesion & neighborhood social capital
 - social safety (vandalism, crime)
- Area-based initiatives targeting multiple and complex problems in (deprived) neighborhoods



The sick building syndrome

 The sick building syndrome (SBS) comprises of various nonspecific symptoms that occur in the occupants of a building. This feeling of ill health increases sickness absenteeism and causes a decrease in productivity of the workers.



Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796751/



Signs and symptoms of SBS

Physical:

- Headache,
- dizziness,
- nausea,
- eye, nose or throat irritation,
- dry cough,
- dry or itching skin,
- hoarseness of voice,
- allergies,
- cold,

- flu-like symptoms,
- increased incidence of asthma attacks and personality changes.

Psycho:

- difficulty in concentration,
- fatigue,
- sensitivity to odours,



Etiology of SBS

The cause of the symptoms is not known.

Possible factors:

- Chemical contaminants: Outdoor & indoor sources (volatile organic compounds, VOC)
- Biological contaminants: pollen, bacteria, viruses, fungus, molds, etc. (Legionnaire's disease caused by air-conditioning systems)
- Electromagnetic radiation: microwaves, televisions and computers emit electromagnetic radiation, which ionizes the air.



- Psychological factors: work stress, poor interpersonal relationships
- Poor and inappropriate lighting with absence of sunlight, Low-frequency noise, poor ergonomics and humidity may also contribute to SBS



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Dose

- Exposure levels
- Exposure duration
- Effects
 - Acute (high exposure) or chronic (long duration)
 - Latent period
 - Threshold level
 - Threshold limit level
- Dose response relationship



Latent period

= time from exposure till occurrence of first symptom(s) of exposure to environment

Long latent period:

- Low dose
- Long-term effect



Illness

Asymptomatic



Threshold levels

Threshold level:

- a dose below which the human body can adapt successfully and no harm occurs
- Threshold limit value (TLV):
- the maximum allowed concentration of a particular risk factor



Dose-response relationship

Effect on the risk of a defined outcome produced by a given amount of an agent or a level of exposure.

- A dose-response relationship is one in which increasing levels of exposure are associated with either an increasing or a decreasing risk of the outcome.
- Demonstration of a dose-response relationship is considered strong evidence for a causal relationship between the exposure and the outcome.
- The chance of a causal relationship cannot be disregarded, however, even when a dose-response relationship is absent.



Dose-response relationship

- Response within a group of people exposed to environmental risk
- Not effect in one individual
- It's about the proportions of the people occurring symptoms





Hazard and risk

- Hazard describes the potential to cause harm (yes or no)
- Risk is a measure of the likelihood of harm occurring from exposure to a hazard (quantification of the hazard)

How do you view cigarette smoking?

- Hazard appreciated?
- Risk acknowledged?



Assessment of environmental risk

Five steps:

- 1. Identify the environmental agent presumed to be hazard
- 2. Establish diagnostic criteria for the symptoms or illness that is the likely outcome of exposure
- 3. Assess the dose and characterize exposure by number of exposures, duration and intensity of each exposure as well as timing of exposures (to establish cause preceded effect, the causality)
 Outside dose = ∑(concentration exposure * time)
 - Internal dose = bio-material concentration



Assessment of environmental risk

- 4. Determine whether there is a statistical association between the exposure to the presumed hazard and the outcome *= analysis of dose-response relationship* Use methods that control for possible alternative explanations.
- Determine the risks for an exposed individual from known population exposure levels.
 Determine probably impact on population level calculating the attributable fraction.



Discussion topic

What are you concerned about with regard to environmental hazards?



Potential topics for reports

- 1. Outdoor and indoor air pollution and health
- 2. Water pollution and health
- 3. Soil pollution and health
- 4. Food safety and health
- 5. Occupational exposure and health
- 6. Occupational stress and health
- 7. Road safety
- 8. Occupational hazards and safety in hospital

Ten minutes for each speech!



Report components

- Related case report from clinical setting or other sources
 (the (clinical) reason for concern about environment)
- Exposure sources and routes
- Health damage mechanism
- Prevention strategies and measures

Reporting on May 23



The final grade consists of three parts:

- Closed book exam (50%)
- Reports on Environment health and safety, presentation (20%)
- Reports on Health system, presentation (20%) and essay (10%)



Good luck!