Environmental Health: Issues and Impact

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Overview and outline of the lecture

Environmental Health and Healthy People 2020 goals

- Air pollution
  - Indoor and Outdoor
- Toxics and Waste
- Global Climate Change and Air Pollution
- Summary key points
Environmental Health- what exactly do we mean?

The World Health Organization defines Environmental Health as:

“Environmental Health addresses all the physical, chemical, and biological factors external to a person, and all related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing diseases and creating health supportive environments...”
Healthy People 2020 Goals and Objectives:
The Healthy People 2020 Environmental Health objectives focus on 6 themes, each of which highlights an element of environmental health:

- Outdoor air quality
- Surface and ground water quality
- Toxic substances and hazardous wastes
- Homes and communities
- Infrastructure and surveillance
- Global environmental health

Creating health-promoting environments is complex and relies on continuing research to understand more fully the effects of exposure to environmental hazards on people’s health.
Healthy People 2020 objectives highlighted for today’s lecture

**Air Quality**
- EH-1 Reduce the number of days the Air Quality Index (AQI) exceeds 100, weighted by population and AQI
- EH-3 Reduce air toxic emissions to decrease the risk of adverse health effects caused by mobile, area, and major sources of airborne toxics

**Toxics and Waste**
- EH-8 Reduce blood lead levels in children
- EH-8.2 Reduce the mean blood lead levels in children
- EH-9 Minimize the risks to human health and the environment posed by hazardous sites
- EH-20 Reduce exposure to selected environmental chemicals in the population, as measured by blood and urine concentrations of the substances or their metabolites

**Global Environmental Health**
- EH-24 Reduce the global burden of disease due to poor water quality, sanitation, and insufficient hygiene

**Emerging Issues in Environmental Health**
- **Climate Change**: Air and Water pollution and Public Health Risks for specific Populations
- **Vulnerable Populations**: To acquire an awareness of the increased risk of environmental pollution to certain populations.
Why Is Environmental Health Important?

The WHO estimated in 2006 that nearly 25 percent of all deaths and the total disease burden globally can be attributed to environmental exposures.

Poor environmental quality has its greatest impact on people whose health status is already at risk.

Therefore, environmental health must address the societal and environmental factors that increase the likelihood of exposure and disease.
Improving Human Health and the Environment

Source: Adapted from Moeller, D. W.
Part 1: Air Pollution

EH-1 Reduce the number of days the Air Quality Index (AQI) exceeds 100, weighted by population and AQI

EH-3 Reduce air toxic emissions to decrease the risk of adverse health effects caused by mobile, area, and major sources of airborne toxics
Air Pollution

In 2014 the World Health Organization (WHO) released new estimates of premature death linked to air pollution.

“WHO reports in 2012 around 7 million people died— one in eight of total global death as a result of air pollution.

This doubles previous estimates

Confirms that air pollution is the world’s largest single environmental health risk.”

(WHO, 2014)
Causes of death from air pollution, reported by the WHO

Specifically this reveals a stronger link between both indoor and outdoor air pollution exposure:

- Cardiovascular disease
- Stokes, ischaemic heat disease
- Cancer
- Respiratory diseases
  - Acute respiratory infection
  - Chronic obstructive pulmonary disease
Indoor Air Pollution
What is a Healthy Home?

Goal is to ensure that our housing stock is safe, healthy, decent and affordable for all citizens AND To eliminate substandard housing conditions that threaten health and safety

Especially important for vulnerable populations such as children and the elderly, who spend more time in the home

Research in how specific housing conditions are related to injury and disease has improved our knowledge

Defined by Housing and Urban Development Department (HUD)
Healthy Homes: Environmental Hazards

Asthma triggers - indoor and outdoor air pollution

- Lead exposure
- Injury hazards
- Carbon monoxide exposure
- Radon exposure
- Environmental tobacco smoke
- Mold and mildew
- Pesticides
Environmental Triggers for Asthma

Indoor Air Pollution

- Environmental tobacco smoke (ETS)-
  - Each year, 443,000 people die of tobacco related illness and exposure to secondhand smoke in the U.S -- more than 1,200 a day. This costs Americans $193 billion in healthcare costs and lost productivity every year.

- Irritant chemicals and fumes: formaldehyde, VOCs, pesticides, phthalates, etc.

- Products from combustion devices (CO, NO2, Particulate matter, SO2)
Environmental Triggers for Asthma con’t

Indoor Air Pollution: Biologic allergens

- Cockroaches—more in urban, low-income
- Dust mites—more in rural or suburban
- Animal dander: strongest reaction to cats
- Mold and mildew
- Pests: mice and rats—in 95% of inner-city homes
Environmental Tobacco Smoke

- Most common and most important indoor irritant
- Increases risk of respiratory tract illness in infants and children
- ETS is a risk factor prenatally and postnatally for asthma
- Avoid any smoking in the home
- Refer to smoking cessation programs
Pediatric Asthma Statistics

- Increased incidence and mortality in US and other industrialized countries; pediatric mortality has doubled

- US prevalence in children 9.6% (2001-2009 data); vs. 7.7% in adults; 13.5% in poor children; 17% in Black children

- Total all ages: 8.2% or 24.6 million

- Leading cause of hospital admission for urban children

- Many environmental triggers: some induce allergy, some are irritants

REF: MMWR 2011
### Asthma Prevalence and Mortality: US and PA

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Pennsylvania</th>
<th>Adults with asthma</th>
<th>White adults</th>
<th>Black adults</th>
<th>Hispanic adults</th>
<th>Deaths all ages</th>
<th>Age-adjusted mortality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>17.3 M</td>
<td>771,871</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Prevalence</td>
<td>8.1%</td>
<td>7.6%</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>8.7%</td>
<td>12.8%</td>
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</tr>
<tr>
<td></td>
<td>5.6%</td>
<td>10.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>3816</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REF: NCEH/CDC, 2008 (www.cdc.gov/asthma)
Interventions to Reduce Exposures

Multifaceted comprehensive approach most effective

Multifaceted integrated home interventions have been shown to be effective in improving asthma outcomes
  - Should focus on education of patient/caregiver

School setting important environment for inhalant allergen exposures
Allergen Avoidance Interventions

• Dust Mites
  – Allergen covers for mattress and pillow
  – Wash sheets and blankets weekly, >130 degrees F
  – Decrease humidity <40%; A/C during warm weather
  – Remove carpet from bedroom
  – Remove upholstered furniture
  – Decrease stuffed animals and other dust collectors

• Cockroaches, Mice, Pests
  – Integrated pest management
  – Focus on barriers, low-toxicity prevention

• Animals
  – Remove animal from environment
  – Out of bedroom and door closed
  – Remove upholstered furniture and carpet
  – Wash pet weekly
  – Role of HEPA cleaners
Outdoor Air Pollution
Outdoor Air Pollution

Outdoor Air Pollution: linked to asthma exacerbations and hospitalizations

Four Criteria Air Pollutants

- Ozone (O3)
- SO2
- NOX
- Particulate matter < 10 microns (PM10) and particulate matter < 2.5 microns (PM2.5)

AIR QUALITY INDEX (AQI)-communicates health information about daily ambient levels of pollutants
Health Effects
Other Air Pollutants

Oxides of Nitrogen (NOx)
- Respiratory disease admissions in children aged 1-4 and 5-14 years associated with NO$_2$ concentrations

Particulate matter
- ↑ emergency room visits by asthmatic children
- ↓ lung function
- ↓ lung function growth in children
Health Effects of Ground-Level Ozone

- Severe coughing, SOB, pain when breathing
- Lung, eye irritation
- Increased risk of hospital admissions & ER visits for asthma
- Increased risk of cardiovascular complications in at-risk populations
- Communities with high ozone conc. - rel. risk of developing asthma in children playing 3 or more sports = 3.3 (95% CI 1.9-5.8) compared with children playing no sports
What is particle pollution?

- Particle pollution is a complex mixture of extremely small particles and liquid droplets.
- Some of these particles - called fine particles - are just 2.5 micrometers in diameter. That’s 40 times smaller than the average grain of table salt!
- The size of particles is directly linked to their potential for causing health problems.
- Particle pollution also contributes to reduced visibility, or haze.
Particle pollution affects your lungs

You are exposed to particle pollution simply by breathing polluted air.

Exposure increases when you exercise, because you breathe more vigorously and deeply than usual.

People exposed to particles may experience a number of respiratory symptoms, including:

- airway irritation;
- cough;
- phlegm;
- decreased lung function;
- airway inflammation;
- asthma attacks; and
- chronic bronchitis
And particle pollution affects your heart

Particle pollution has been linked to changes that indicate your heart isn’t as healthy as it should be. Those include:

- **Arrhythmias and changes in heart rate.**
- **Changes in the variability of your heart rate.** Your heart rate should increase, for example, when you run and return to normal when you sit quietly. Decreased variability is a risk factor for heart attacks.
- **Blood component changes** that signal inflammation, and increased likelihood of potential blood clots, which can lead to heart attacks.

Some studies have shown that particle exposure causes **heart attacks**. And particles are linked with **death from heart disease**.
Some groups are at greater risk

- **People with heart or lung diseases** are more vulnerable to particle pollution because of their conditions (such as congestive heart disease, coronary artery disease, asthma, or chronic obstructive pulmonary disease.)

- **Older adults** also are considered at risk, because they are more likely to have heart and lung disease. (Sometimes that disease hasn’t been diagnosed yet.)

- **Children** are at risk (primarily from chronic exposure), because they are more likely to be active, they breathe more air per pound of body weight than adults, and their bodies are still developing.
Check AQI forecasts to protect your health

• You can take **simple steps to protect yourself** from particle pollution.

• **Get in the habit** of checking your local Air Quality Index forecast *every day*.

• When particle pollution levels are predicted to be high, **change your plans** to reduce the amount of pollution that gets in your lungs.

AQI forecasts tell you whether particle levels are expected to be high – and suggests steps you can take to protect yourself.

Those steps vary, depending on whether you’re in one of the groups more at risk from particle exposure.
Who needs to protect themselves? How?

<table>
<thead>
<tr>
<th>AQI color code</th>
<th>Who is affected?</th>
<th>What is the significance?</th>
<th>What action should people take?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>--</td>
<td>Air quality is good</td>
<td>Enjoy activities</td>
</tr>
<tr>
<td>Yellow</td>
<td>People who are unusually sensitive to air pollution</td>
<td>Air quality is a concern for people who are unusually sensitive to air pollution</td>
<td>People unusually sensitive to air pollution: Plan strenuous activities when air quality is better</td>
</tr>
<tr>
<td>Orange</td>
<td>People with heart or lung disease (including asthma), older adults, and children</td>
<td>Air quality is unhealthy for people in sensitive groups</td>
<td>Sensitive groups: Cut back or reschedule strenuous activities</td>
</tr>
<tr>
<td>Red</td>
<td>Everyone, especially people with heart or lung disease (including asthma), older adults, and children</td>
<td>Air quality is unhealthy for everyone</td>
<td>Everyone: Cut back or reschedule strenuous activities Sensitive groups: Avoid strenuous activities</td>
</tr>
<tr>
<td>Purple</td>
<td>Everyone, especially people with heart or lung disease (including asthma), older adults, and children</td>
<td>Air quality is very unhealthy for everyone</td>
<td>Everyone: Significantly cut back on physical activities Sensitive groups: Avoid all physical activities</td>
</tr>
</tbody>
</table>

The table at left recommends taking protective actions at different levels of particle pollution.

These messages apply to particle pollution only.

For information about protecting yourself from ozone, or a combination of ozone and particles, go to [www.epa.gov/airnow/](http://www.epa.gov/airnow/)