Asthma and Air Pollution

Health Effects Workshop
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Asthma and Airways

[Diagram showing normal airway versus airway in person with asthma]
Asthma Physiology

* A chronic disease that affects airways.*

- The inside walls of airways are inflamed (swollen).
- Inflammation makes the airways sensitive.
- Airways react strongly to things that are allergic or irritating.
- Airways get narrower, and less air flows to lung tissue.
Symptoms of Asthma

- Wheezing (a whistling sound when you breathe)
- Coughing
- Chest tightness
- Trouble breathing, especially at night and in the early morning
- Life threatening respiratory distress
During an asthma attack...
Less air flows through the airway

- Muscles around the airways tighten up, making the airways narrower
- Inflammation increases, airways become more swollen and narrower.
- Cells in the airways make more mucus, the extra mucus narrows the airways.

These changes make it harder to breathe.
What Causes Asthma?

Inflamed airways may be due to a combination of things.

• Exposure to things like tobacco smoke, infections, and some allergens early in life may increase chances of developing asthma
• Occupations, such as teaching, are associated with higher rates of asthma
• Relocation from rural areas to city increase asthma in progeny
Who Is At Risk for Asthma?

- Asthma is closely linked to allergies but not all people with asthma have allergies.
- Children with a family history of allergy and asthma are more likely to have asthma.
- About 20 million people in US have been diagnosed with asthma - 9 million are children.
- More boys have asthma than girls, but more adult women than men.
- African Americans are more likely to be hospitalized for asthma attacks and to die from asthma
Causes of ATTACKS

Biological Triggers

• Allergens
  – Animal dander (from the skin, hair, or feathers of animals)
  – Dust mites (contained in house dust)
  – Cockroaches
  – Pollen from trees and grass
  – Mold (indoor and outdoor)
Causes of ATTACKS
Non-biological Triggers

• **Irritants**
  – Cigarette smoke
  – Air pollution
  – Cold air or changes in weather
  – Strong odors from painting or cooking
  – Scented products
  – Strong emotional expression (including crying or laughing hard) and stress
Asthma, Traffic and Air Pollution

• CAUSE
  – Diesel emissions: In traffic-choked New York City, children are twice as likely to be hospitalized for asthma as the average American child.

• TRIGGER
  – Factors like dirty air can trigger an attack. Cutting traffic congestion and air pollution is an option
The connection between asthma and dirty air

• Smog and soot trigger attacks.

• There is evidence that ozone in smog and diesel exhaust particles may even cause asthma.

• Other triggers
  – nitrogen oxides
  – formaldehyde
  – environmental tobacco smoke
  – other toxic air contaminants like pesticides are suspected of contributing to asthma attacks but have not been conclusively proven to do so

• Two-thirds of asthmatics live where at least one federal air quality standard is not being met.
Asthma in Atlanta during the Olympics

• To reduce traffic congestion, the city enhanced public transit, closed downtown to private cars.

• Daily peak ozone levels dropped 28% and hospitalizations for asthma fell by almost 20%.

• The Atlanta case demonstrates a link between air quality and the prevalence of asthma attacks.
Mysterious Rise in Prevalence
-Young People-
Mysterious Rise in Prevalence
- Adults -

Asthma Prevalence and Death Rates for Adults 35+ Years, 1960-1995

- . . . . . Age >65 deaths
- . . . . . Age 35-64 deaths
- . . . . . Age 35-64 prev
- . . . . . Age >65 prev
Understanding Causal Factors

Another Asthma Mystery

• If a person moves from a rural area to the city asthma rates increase in the next generation
  – Asia
  – New Zealand
  – Soviet Union
  – South and Central America
Finally if particulate and irritant exposure interact...

- Can measures of single pollutants explain the public health risk?

*No, but approaches that attempt to integrate, rather than reduce, the variability will.*