Vital Strategies

Clean Air Solutions to Promote Health in Indore

CAC Workshop For Medical Professionals

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Clean Air Catalyst Indore

PARTICIPANT REFERENCE

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Reference 1: Air Pollution Fact Sheet

Air pollution is the biggest global environmental health risk, responsible for more than 6 million premature deaths each year. This disease burden falls disproportionately on vulnerable populations, especially women and children living without access to clean household energy and on people living in low- and middle-income countries where development and urbanization has brought increased emissions from many sources, including heavy industry and motorized transport, outpacing air pollution control measures.

WHAT IS AIR POLLUTION?

Air pollution is a complex mixture of gases and aerosols (suspended solid and liquid particles).

	WHO Air Quality Guidelines (Annual mean)	India National Ambient Air Quality Standard (Annual Mean)
$PM_{2.5}$	5 µg/m³	40 µg/m³
PM_{10}	15 µg/m³	60 µg/m³

Particle pollution (PM): The most important and most frequently measured pollutant of concern is particle pollution or particulate matter (PM), which manifests as dust, soot, smog, or smoke. Chemical components of PM vary, depending on the source. Sources of PM include household fuel combustion, especially from solid fuels, tobacco smoke, power generation, especially from coal, open burning of trash, agricultural waste and forests, and motor vehicles, especially from diesel engines. PM is emitted directly from fuel combustion and formed from reactions in the atmosphere. Health risks from PM depend on particle size.

Particles below 2.5 microns ($PM_{2.5}$) are most harmful because they penetrate deep into the small airways and air sacs of the lungs; the smallest particles can even pass into the bloodstream. Larger particles, between 2.5 and 10 microns in diameter are deposited in the larger airways.

Other common air pollutants include:

Nitrogen dioxide (NO_2)
Formed by fuel combustion for heating, power generation, and in engines in vehicles and ships
Sulfur dioxide (SO_2)
Formed by combustion of sulfur-containing fossil fuels for domestic heating, power generation, ships and motor vehicles
Ground-level Ozone (O_3)
Formed by photochemical reactions (reactions in the sunlight) between emission from vehicles and industry (e.g., nitrogen oxides, volatile organic compounds)

Outdoor Air Pollution

Outdoor or ambient air pollution refers to the air pollution existing outside of homes and buildings. Each year, outdoor air pollution causes about 4.2 million deaths while about 91% of the world population was living in areas with air pollution above the World Health Organization (WHO) guideline levels. Outdoor air pollution comes from a variety of man-made and natural sources:

Traffic-related air pollution results from a mixture of tailpipe emissions (like NO_x, CO, CO_2, SO_4, volatile organic compounds, black carbon, PM) from the combustion engines of motor vehicles, with diesel engines being among the most polluting. Particles from brake, tire, and road wear also contribute to traffic-related air pollution.

Power generation and industry that rely on solid fuel or diesel generators to meet energy needs introduce significant levels of particulate matter and black carbon into the atmosphere.

Municipal and agricultural waste incineration in open fires or in outdated incineration facilities contribute significantly to outdoor air pollution.

Natural sources of air pollution include wind-blown desert dust, salt from sea spray, volcanic eruptions, and forest and grassland fires.

Forest fires and resulting haze in Southeast Asia have been occurring since the 1980s, with significant episodes in 1997, 2002, 2006, and 2013. The most recent severe haze episode occurred in 2015 and is estimated to have caused more than 100,000 deaths in the region. While the impacts are most dramatic during the major haze "episodes," burning makes a substantial contribution to air quality throughout the year.

Household Air Pollution

About 3 billion people, many of whom are living in low- or middle-income countries, rely on poor-quality fuels like biomass (wood, animal dung, crop waste), charcoal, coal or kerosene for cooking, heating, and lighting in their homes. These polluting fuels combined with open fires, simple stoves, and poor ventilation are largely responsible for the elevated levels of air pollution inside people's homes, reaching up to 100 time higher than the acceptable levels for particulate matter, and resulting in about 2.6 million deaths and contribute to 25% or more of outdoor pollutions in parts of Africa and Asia.

WHAT ARE THE HEALTH EFFECTS?

Regardless of the source, air pollution as a clear and devastating impact on human health. Exposure to elevated levels of particulate matter has a strong relationship with increased death and disease, both daily and over longer periods of time. Additional particle pollution at very low concentrations has been shown to have adverse health effects; there exists no pollution threshold under which no negative health effects occur. The major health effects of air pollution include:

RESPIRATORY ILLNESS		
Respiratory irritation (coughing, wheezing), airway inflammation	Chronic obstructive pulmonary disease (COPD)	Lower respiratory infection (pneumonia)
Decreased lung function and lung growth	Asthma	Lung cancer
CARDIOVASCULAR ILLNESS		
Stroke	Heart disease	Hypertension
OTHER HEALTH RISKS		
Low birth weight	Nasopharyngeal cancer	Diabetes
Tuberculosis	Laryngeal cancer	Stunting
Cataract	Decreased cognitive ability	

Damage begins before birth and continues throughout life.

Health-damaging exposure to air pollution can start in the womb, when pregnant mothers are exposed. Exposure continues after birth, throughout childhood and into adulthood. Babies born to mothers exposed to high levels of pollution during pregnancy are more likely to experience reduced growth while in utero, low birth weight, and be delivered preterm. These early life effects also increase the risk of health problems throughout life, including cardiovascular disease, type 2 diabetes, and obesity.

Exposure to air pollution throughout infancy and childhood is associated with negative respiratory effects, including greater vulnerability to acute lower respiratory infections like pneumonia as well as more severe childhood asthma. Half of pneumonia deaths are linked to air pollution. Childhood exposure to air pollutants is also associated with decreased lung growth and function, which are sustained through the child's lifetime.

Long-term exposure to air pollutants are also linked to chronic respiratory effects in adulthood like COPD (chronic obstructive pulmonary disease) and lung cancer as well as cardiovascular disease, cerebrovascular disease, and death.

IMPACT OF AIR POLLUTION AT DIFFERENT LIFE STAGES			
Prenatal	**Birth**	**Early Childhood**	**Life Long Impacts**
Reduced Growth	Preterm birth and low birth weight	Decreased lung growth, reduced lung function, lower respiratory infections, including pneumonia, and developmental effects	Chronic respiratory and cardiovascular disease

Reference 2: Clinical Guidance for Air Pollution Risk: Cardiovascular Health

Medical studies show that air pollution can trigger heart attacks, strokes, and irregular heart rhythms—especially in people who are already at risk for these conditions. For people with heart failure, air pollution can further reduce the ability of the heart to pump blood the way that it should. Very small particles are the pollutants of greatest concern for triggering these effects. Particle pollution is found in haze, smoke, and dust—and sometimes in air that looks clean.

ARE YOUR PATIENTS AT HIGHER RISK?

Older adults and people with risk factors for heart disease or stroke may be at greater risk to the effect of air pollution. Your patients may be at greater risk if they:

- Have had a heart attack, angina, bypass surgery, angioplasty with or without a stent, a stroke, blockages in the neck or leg arteries, heart failure, heart rhythm problems, diabetes, or chronic obstructive lung disease.
- Are 55 years or older.
- Have a family history of stroke or early heart disease.
- Have high blood pressure or high cholesterol.
- Are overweight or not physically active.
- Smoke cigarettes.

PROTECTING YOUR PATIENTS' HEALTH

Regular exercise is important for staying healthy, especially for those with heart disease. By adjusting when and where they exercise, patients can lead a healthier lifestyle and help reduce their risk of heart problems or stroke triggered by air pollution. To help protect your patients' cardiovascular health from air pollution, encourage them to:

- Know where and when particle pollution levels may be unhealthy. This might include near busy roads, at rush hour, or near industrial areas.
- Plan activities when and where pollution levels are lower. When particle levels outdoors are unhealthy, delay the activity until the air is cleaner or move the activity indoors.
- Change the activity level to something less intense when the air is highly polluted to reduce how much pollution you breathe. For example, go for a walk instead of a jog.
- Reduce the overall risk of heart disease or stroke with lifestyle changes like healthy eating, routine exercise, and not smoking.
- Know the warning signs of a heart attack and stroke. If they feel symptoms, even if they go away, stop the activity and seek medical help immediately!

Source: Adapted from airnow.gov

Reference 3: Clinical Guidance for Air Pollution Risk: Asthma

Air pollution can make asthma symptoms (coughing, wheezing, chest discomfort, burning feeling in the lungs) worse and trigger attacks. Two key air pollutants can affect asthma: ozone and particle pollution ($PM_{2.5}$, PM_{10}). Studies show that when ozone and particle pollution are in the air, adults and children with asthma are more likely to have symptoms.

PROTECTING YOUR PATIENTS' HEALTH

To help protect your asthmatic patients from air pollution, encourage them to:

- Notice their asthma symptoms when they are physically active. Do they happen more often when the air is more polluted and/or days after they have been outdoors in polluted air? If so, they may be sensitive to air pollution.
- Know when and where air pollution may be bad. Ozone is often worst on hot days, especially in the afternoons and early evenings. Particle pollution can be especially bad when the near busy roads, at rush hour, or near industrial areas.
- Plan activities when and where pollution levels are lower. When particle levels outdoors are unhealthy, delay the activity until the air is cleaner or move the activity indoors.
- Change the activity level to something less intense when the air is highly polluted to reduce how much pollution you breathe. For example, go for a walk instead of a jog or jog 20 minutes instead of 30 minutes.
- Stop their activity when they get asthma symptoms when the air is polluted, and switch to a less intense activity.
- Keep a quick-relief medicine on hand when they are active outdoors.
- Consult a health care provider if they have asthma symptoms when the air is polluted, are exercising more than usual, or have symptoms during a certain type of activity.

Source: Adapted from airnow.gov

Reference 4: Clinical Guidance for Air Pollution Risk: Diagnostic Checklist

An individual and their health care professional can collaborate to identify and analyze patterns that may provide clues to a health complaint's link with air pollution. A diary or log of symptoms correlated with time and place may prove helpful. If an association between symptoms and events or conditions in the home or workplace is not volunteered by the individual, answers to the following questions may be useful, together with the medical history.

- ☐ When did the [symptom or complaint] begin?
- ☐ Does the [symptom or complaint] exist all the time, or does it come and go? That is, is it associated with times of day, days of the week, or seasons of the year?
- ☐ (If so) Are you usually in a particular place at those times?
- ☐ Does the problem abate or cease, either immediately or gradually, when you leave there? Does it recur when you return?
- ☐ What is your work? Have you recently changed employers or assignments, or has your employer recently changed location?
- ☐ (If not) Has the place where you work been redecorated or refurnished, or have you recently started working with new or different materials or equipment? (These may include pesticides, cleaning products, craft supplies, et al.)
- ☐ What is the smoking policy at your workplace? Are you exposed to environmental tobacco smoke at work, school, home, etc.?
- ☐ Describe your work area.
- ☐ Have you recently changed your place of residence?
- ☐ (If not) Have you made any recent changes in, or additions to, your home?
- ☐ Have you, or has anyone else in your family, recently started a new hobby or other activity?
- ☐ Have you recently acquired a new pet?
- ☐ Does anyone else in your home have a similar problem? How about anyone with whom you work? (An affirmative reply may suggest either a common source or a communicable condition.)

Source: Adapted from airnow.gov

Reference 5: Air Quality Data Sources, by Pollutant and Scale

		PM2.5 (Ambient)	Household Air Pollution	Ozone	NOx	SO2	VOCs	CO	Source(s)	Converts Conc. to AQI	Scale(s)	Near Real-Time	Direct link to Health Studies
India National Air Quality Index	https://app.cpcbccr.com/AQI_India/									✓	Local	✓	
AirNOW Department of State	https://airnow.gov/index.cfm?action=airnow.global_summary	✓		✓					US Embassies		Local	✓	
OpenAQ	https://openaq.org	✓*		✓*	✓*	✓*	✓*	✓*	Country-Specific		Country dependent		
Real-time AQI Visual Map	http://aqicn.org/map/world/	✓*		✓*	✓*			✓*	Public Monitor	✓	Local	✓	
SPARTAN	http://spartan-network.weebly.com/	✓		✓	✓	✓	✓	✓	SPARTAN		Local		

		PM2.5 (Ambient)	Household Air Pollution	Ozone	NOx	SO2	VOCs	CO	Source(s)	Converts Conc. to AQI	Scale(s)	Near Real-Time	Direct link to Health Studies
State of the Global Air	https://www.stateof-globalair.org/	✓	✓	✓					Public monitor and modeled		Region, Sub-Region, National		✓
Urbanemissions.info	www.urbanemis-sions.info	✓*		✓*	✓*	✓*		✓*	Modeled emissions and air quality data	✓*	National, sub-national	✓	
WHO Global Ambient Air Pollution map	http://maps.who.int/airpollution/	✓							Public monitor, modeled		Region, sub-region, urban		✓
WHO Global Health Observatory	http://www.who.int/gho/phe/outdoor_air_pollution/en/	✓	✓						Public monitor, studies		Region, national, urban		✓
WHO Global Urban Air Pollution Database	http://www.who.int/phe/health_topics/outdoorair/databas-es/cities/en/	✓*			✓*				Public monitor		Urban		✓
Urban AQ: Air Quality and Health in 13,000 cities	https://urbanairqual-ity.online/	✓*		✓*	✓*				Public monitor, modeled		National, sub-national		✓*

✓* = Dependent on country-specific data

Note: Additional local air quality data at the city or state/provincial level may be available from local pollution control boards/environmental management authorities

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