JARED

Joint Action on REspiratory Diseases

Reducing individual exposure to air pollution: practical guidance

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Key message

Individuals can significantly reduce their exposure to air pollution through informed daily choices in both outdoor and indoor environments. While effective air quality improvement requires systemic action at local, regional and national levels, personal actions can play an important role in reducing exposure and supporting a healthier environment.

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1. Introduction

The air we breathe plays a crucial role in determining our health. Air pollution is a major environmental health risk, responsible for millions of premature deaths worldwide each year. It affects both outdoor and indoor environments, impacting respiratory, cardiovascular, and neurological health. Addressing air pollution requires coordinated action at multiple levels, including governments, municipalities, industry, and communities, but individuals can also take meaningful steps to reduce their exposure.

This document provides practical, evidence-based recommendations to help individuals reduce their exposure to air pollution and, where possible, minimize their contribution to it.

2. What is outdoor air pollution?

Outdoor air pollution refers to the presence of harmful substances in the air outside. These pollutants originate from various sources, including vehicle emissions, residential heating, agriculture, industrial activities and natural events such as wildfires or dust storms.

2.1 The major air pollutants

- Particulate matter (PM_{10}, $PM_{2.5}$ and ultrafine particles): Tiny airborne particles that can penetrate deep into the lungs, and the smallest ones can even enter the bloodstream.
- Nitrogen dioxide (NO_2): Mainly produced by traffic and other combustion processes.
- Sulfur dioxide (SO_2): Released when fossil fuels, especially coal, are burned.
- Ozone (O_3): A secondary pollutant formed when sunlight reacts with other pollutants like nitrogen oxides and volatile organic compounds.
- Carbon monoxide (CO): A toxic gas produced by incomplete combustion of fuels.

2.2 The health effects

The health effects of outdoor air pollution can be serious and wide-ranging. Short-term exposure may cause irritation of the eyes, nose, and throat, coughing, and shortness of breath. During episodes of high pollution (e.g. smog events), exposure - particularly to particulate matter – can increase the risk of serious cardiovascular events such as thrombosis, myocardial infarction, and stroke. Long-term exposure can lead to chronic respiratory diseases (e.g. asthma and bronchitis), cardiovascular and neurological problems, and an increased risk of lung cancer. Air pollution is particularly harmful to children, the elderly, and people with pre-existing health conditions.

2.3. How can we reduce the impacts?

Be informed

Be aware of the air you breathe by identifying potential sources of pollution and understanding how they may affect your health. Individuals who are sensitive to changes in air quality should regularly consult air quality indices, forecasts, and publicly available information from environmental agencies and other relevant institutions. Use this information to plan outdoor activities and adjust daily routines accordingly. Mobile applications and online platforms can support this by providing real-time air quality data and alerts during periods of elevated pollution.

Reduce the level of exposure

Avoid intense outdoor physical activity when pollution levels are high. Air quality may vary throughout the day and is influenced by multiple factors. Pollution levels are often highest during the morning rush hour and in areas with heavy traffic, especially near major roads. It is also advisable to avoid outdoor activities during the evening rush hour, when returning traffic and - in many places - residential heating with fossil fuel increases pollution levels again. Streets with lower traffic volumes generally have lower concentrations of air pollutants.

Climatic conditions such as temperature inversions can trap pollutants close to the ground, leading to elevated exposure levels. These conditions are more common in winter and may be intensified during periods of fog, posing increased risks for individuals with respiratory diseases.

In sunny weather, higher concentrations of ground-level ozone can form through photochemical reactions involving sunlight and precursor pollutants. Ozone is an irritant gas that may cause respiratory symptoms, particularly in sensitive individuals.

Recommendations for sport activity, pedestrians and cyclists.

- Exercise during periods when traffic is lighter, such as early morning or later in the evening, when exposure levels may be lower.
- Walk or cycle on routes with less traffic. Avoid busy intersections and high-congestion roads where pollutant concentrations are typically higher.
- Green spaces such as parks and tree-lined streets can help reduce exposure by lowering air pollution levels, noise, and heat.
- If air pollution levels are very high, consider avoiding outdoor exercise. If exposure cannot be avoided, the use of well-fitted particulate respirators (e.g. FFP2 or FFP3) may reduce inhalation of fine particles.

Recommendations for drivers

- Avoid heavily congested roads where possible. Consider using navigation tools that provide real-time traffic information to select routes with lower traffic volumes.
- Reducing personal exposure to air pollution inside vehicles is important, as pollutants such as $PM_{2.5}$, NO_2, and volatile organic compounds can accumulate inside the cabin, especially during traffic congestion.

How to protect yourself and your passengers?

- Limit the entry of polluted outdoor air by using the air recirculation function (↺), particularly in slow-moving or stop-and-go traffic.
- Periodically switch off recirculation in areas with lower pollution levels or during longer journeys to maintain adequate air exchange and prevent window fogging.
- Keep windows closed in heavy traffic to reduce the ingress of exhaust emissions from nearby vehicles.
- Pay attention to regularly replacing air filters and use filters that are also suitable for removing pollen.Do not smoke in the car.
- When driving in polluted conditions (e.g. behind diesel vehicles), use air conditioning systems rather than opening windows.

3. Pollen exposure

Pollen is made up of tiny grains released by plants (such as trees, grasses, and weeds) as part of their reproductive process. They are carried through the air by wind or insects to fertilize other plants.

3.1 How does pollen affect our health?

For many people, pollen is harmless. However, pollen with high allergenic capacity can trigger allergic reactions in sensitive individuals, commonly known as **hay fever (allergic rhinitis).**

Typical health effects include:
- sneezing and a runny or blocked nose,
- itchy or watery eyes,
- throat irritation and coughing,
- fatigue and headaches.

In people with asthma, pollen can worsen symptoms and may lead to asthma attacks, causing breathing difficulties, wheezing, and chest tightness.

Pollen levels are usually higher during certain seasons (spring, early and late summer) and on dry, windy days, which can increase exposure and symptoms. Important! During or after a thunderstorm - especially in pollen seasons - thunderstorm asthma can occur. This happens because pollen grains can break into much smaller particles that travel deeper into the lungs, causing sudden and severe asthma symptoms in people with asthma.

3.2 Recommendations for people with allergies to avoid the negative effects of pollen

- Follow pollen forecasts using apps or websites. Stay indoors when pollen levels are high, especially in the morning hours when as temperature rise. Plan outdoor activities when levels are lower, typically later in the day or after sunset.
- As pollen grains can easily enter your home, especially during windy days, keep windows and doors closed and use mechanical ventilation instead of natural ventilation, if possible. Proper mechanical ventilation can ensure a consistent supply of filtered fresh air.
- Stay indoors with windows closed during and for some hours after thunderstorms in pollen season.
- Indoor air purifiers with HEPA filters can help remove pollen, dust, and other allergens from indoor air, but they do not replace proper ventilation or the need for fresh outdoor air.
- Change clothes and take a shower after being outdoors, as pollen can stick to your clothes, skin, and hair. Washing your hair is also recommended.
- Clean pets that go outdoors, as they can carry pollen into the home.
- Consider wearing a mask (e.g. FFP2 or FFP3) outdoors, especially near areas with high pollen levels (such as fields with allergenic plants).
- Always carry prescribed asthma medication if you are at risk.

4. Improving indoor air quality

4.1 What is indoor air pollution?

Indoor air pollution refers to the presence of harmful substances in the air inside homes, offices, schools, and other enclosed spaces. Indoor air quality depends on outdoor air, pollution generated indoors, and how well the space is ventilated.

4.2 Major indoor air pollutants

- Particulate matter ($PM_{2.5}$, PM_{10}): Tiny particles from heating, cooking, smoking, burning candles, and from outdoor air entering indoors (infiltration) that can penetrate deep into the lungs.
- Volatile organic compounds (VOCs): Chemicals (e.g. formaldehyde, benzene) released from paints, varnishes, cleaning products, furniture, building materials, air fresheners, and solvents, among others.
- Carbon monoxide (CO): A toxic gas produced by malfunctioning heaters, stoves, or fireplaces.
- Nitrogen dioxide (NO_2): Produced by fuel-burning appliances indoors (such as gas stoves, heaters, and unvented combustion appliances), especially when ventilation is poor.
- Mould and spores: Mould grows in damp and humid environments - especially where moisture builds up and ventilation is limited - and releases spores into the air.
- Pollen, dust mites, and pet dander: Biological particles that can trigger allergies and respiratory symptoms.

4.3 Health effects of indoor air pollution

- irritation of eyes, nose, and throat,
- coughing, sneezing, and shortness of breath,
- headaches, fatigue, and dizziness,
- allergic reactions such as hay fever or asthma attacks,
- long-term exposure to certain indoor air pollutants can increase the risk of chronic respiratory diseases, cardiovascular problems, and in severe cases, lung cancer.

These health effects can be reduced or prevented by improving indoor air quality. The following section provides practical steps.

4.4 Reduce sources of indoor air pollution

- Indoor air quality is influenced by daily habits, the food we cook, the fuels we use, pets, and environmental factors. To maintain a healthier indoor environment, avoid smoking and using electronic cigarettes or vaping devices indoors. Both secondhand and thirdhand smoke are harmful. Tobacco smoke contains more than 7,000 chemicals, many of which are toxic or carcinogenic.
- Use safer cooking practices. Use kitchen hoods or exhaust fans to reduce pollution and consider using electric or induction stoves instead of gas stoves whenever possible. If these are not available, ventilate well during and after cooking (e.g. by opening windows).
- Limit the use of products that release harmful chemicals into the air. Avoid aerosol sprays, nail polish, air fresheners, and harsh chemical cleaners. For better long-term indoor air quality, choose paints, carpets, and furniture with low levels of VOCs or formaldehyde.
- Avoid or limit the use of candles and incense, as they emit soot and VOCs. To remove odours, prioritize cleanliness and proper ventilation rather than masking them with fragrances. If you do use candles, choose those made from natural materials and ensure the room is well ventilated.
- Plants can remove some VOCs, but very slowly in real indoor environments, while proper air exchange (e.g. opening windows or using ventilation systems) is far more effective. Indoor plants can still offer indirect benefits, such as slightly increasing humidity, trapping some dust, improving well-being, and encouraging people to ventilate and care for their indoor environment.

4.5 Ensure proper ventilation of living spaces

During the winter, people spend over 85–90% of their time indoors, making it essential to maintain a healthy indoor environment. A comfortable indoor environment depends on the right combination of temperature, humidity, and air movement, while keeping pollutant levels low. One of the most effective ways to achieve this is proper ventilation. Maintaining optimal indoor conditions helps prevent health and well-being.

During the cold season, indoor temperatures in living and public spaces should range between 18–22°C. Young children and elderly residents require slightly higher temperatures. In sleeping areas, it is recommended to keep the temperature 2–3°C lower to improve sleep quality. Relative humidity should be maintained between 30–55%, and the recommended air movement speed is <0.2 m/s in cool conditions.

It is important to maintain thermal comfort without reducing the supply of fresh air.

Proper ventilation of indoor spaces

- Ventilation can be achieved naturally, mechanically, or by combining both methods. For natural ventilation, it is recommended to open windows for at least 10–15 minutes several times a day. The most effective methods include creating short, intensive drafts to promote faster air exchange and cross-ventilation, where air flows through the space.
- Limit natural ventilation when outdoor air pollution levels are high (e.g. during traffic peaks or smog episodes), and ventilate when air quality improves.
- Proper ventilation not only improves comfort and productivity but also helps reduce the risk of respiratory infections such as influenza, COVID-19, and other infectious diseases. It also prevents the growth of mould and the accumulation of house dust mites, both of which can trigger allergic reactions and affect the immune system.

4.6 Reduce and control biological pollutants indoors

Controlling biological pollutants - such as mould, house dust mites, bacteria, viruses, pet dander, pollen, and other organic contaminants - is essential for maintaining healthy indoor air and preventing allergies, asthma, and infections.

Key recommendations:

- **Control humidity:** High humidity promotes the growth of mould, dust mites, and bacteria. Use dehumidifiers in damp areas (e.g. basements), and ventilate bathrooms, kitchens, and laundry rooms with exhaust fans. Fix leaks promptly, and avoid drying clothes indoors without proper ventilation.
- **Regular cleaning:** Clean surfaces with a damp cloth to remove dust mites, pet dander, pollen, bacteria, and mould spores. Use microfiber cloths to prevent particles from becoming airborne. Disinfect high-touch surfaces (e.g. door-

knobs, light switches) regularly using appropriate disinfectants. (Note: common household products like vinegar or baking soda can help with cleaning but are not reliable disinfectants.)

- **Control dust mites:** Wash bedding weekly in hot water (at least 60 °C). Use dust-mite-proof mattress and pillow covers. If possible, replace carpets with hard flooring, and vacuum regularly (2–3 times per week) using a HEPA-filter vacuum.

5. Educate children and communities about reducing air pollution

Change begins with each of us - we can all help reduce pollution through our daily choices. Encouraging a healthy lifestyle should start in childhood, helping children develop the ability to make informed, health-conscious decisions and understand their well-being. It is important to teach them to recognize harmful environmental conditions and allergens that can affect their health.

As a community, raising awareness about the risks of air pollution is essential. While individuals can take steps to reduce pollution and limit their exposure, policymakers at all levels also play a key role in ensuring clean air. Getting involved in local initiatives or community actions can help amplify your voice - by sharing experiences and supporting efforts that promote cleaner air. Together, education, personal action, and community engagement can contribute to a healthier environment for all.

6. Special considerations for early life (pregnancy and children)

Early life - including the prenatal period, infancy, and early childhood - is a critical window for lung development and immune system maturation. During these stages, exposure to air pollution and environmental irritants can have lasting effects on respiratory health and may increase the risk of developing asthma and allergies. Reducing exposure during this period is therefore particularly important.

Key recommendations:

- Reduce exposure during pregnancy: Pregnant individuals should avoid areas with high air pollution, such as heavy traffic or industrial zones, especially during peak pollution periods. Following air quality forecasts and adjusting daily activities accordingly can help minimise exposure.
- Maintain clean indoor air in homes with infants and young children: Ensure smoke-free environments at all times. Avoid the use of candles, incense, and fragranced products. Ventilate regularly, while considering outdoor air quality, and prioritise source control (e.g. safe cooking and heating practices).
- Reduce exposure to allergens and biological pollutants: Control indoor humidity, prevent mould growth, and reduce dust accumulation through regular cleaning. Pay special attention to sleeping environments, where children spend a significant amount of time.
- Balance protection with physical activity: Regular physical activity is essential for healthy development. Children should be encouraged to play and exercise outdoors when air quality is good, while avoiding intense activity during periods of high pollution or high pollen level.

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