JA RED

Joint Action on REspiratory Diseases

Reducing environmental risk factors for COPD in elderly homes: practical guidance

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Key message

Creating a healthy indoor environment in elderly homes is essential for protecting residents with respiratory conditions. Ensuring adequate ventilation, maintaining appropriate indoor temperature, and reducing exposure to indoor pollutants can significantly reduce exacerbations and improve quality of life.

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1. Introduction

The air we breathe plays a crucial role in health and well-being. Air pollution is a major environmental health risk, affecting both outdoor and indoor environments and contributing to respiratory, cardiovascular, and neurological diseases.

Residents of elderly homes are particularly vulnerable, as older adults and people with chronic respiratory conditions such as COPD are more sensitive to environmental exposures. Indoor environments are especially important, as residents spend most of their time indoors.

This document provides practical, evidence-based recommendations to help care providers reduce environmental risk factors and improve indoor air quality, thermal comfort, and overall living conditions in elderly homes.

2. Understanding air pollution

2.1 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.

The major air pollutants include:

- 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.

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 cause serious health problems like 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

2.2 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 quality, indoor pollution sources, and the effectiveness of ventilation.

Major indoor air pollutants include:

- 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

3. Evidence supporting environmental risk factors in COPD and respiratory disease prevention

Respiratory diseases represent a major public health burden in Europe, accounting for approximately 350,000–400,000 deaths annually, depending on the population and methodology considered. Chronic respiratory diseases such as COPD and asthma are strongly influenced by environmental factors, including air pollution, occupational exposures, temperature extremes, and second-hand smoke.

Many of these deaths could be prevented or delayed through reductions in environmental risks - particularly air pollution, which remains one of the most significant contributors. Air pollutants such as $PM_{2.5}$, NO_2, and O_3 irritate the respiratory system, triggering inflammation and oxidative stress, and exacerbating chronic conditions such as COPD and asthma. According to estimates from the European Environment Agency, hundreds of thousands of deaths in Europe each year are attributable to these pollutants (approximately 182,000 premature deaths attributable to $PM_{2.5}$, 34,000 to NO_2, and 63,000 to O_3 in the EU-27 (2023 data)), although these figures are not directly additive and reflect overlapping exposures (EEA, 2025).

Climate change is expected to further increase the burden of respiratory diseases. It is driving more frequent and intense heatwaves, wildfires, and dust events, while also extending pollen seasons and increasing exposure to allergens and indoor mould. These changes contribute to worsening air quality and increase respiratory morbidity. At the same time, cold weather episodes can also exacerbate respiratory conditions by increasing susceptibility to viral infections, inducing bronchoconstriction, and impairing immune responses.

Environmental risks are, to a large extent, preventable, and addressing them is essential for reducing respiratory disease burden. This is particularly important in sensitive settings such as elderly homes. Ensuring completely smoke-free environments remains a fundamental public health priority.

4. Practical recommendations

4.1 Weather and temperature awareness

Both cold and hot weather can worsen respiratory symptoms. Care providers should monitor weather forecasts, prepare for extreme conditions, and ensure residents have access to necessary medication.

4.1.1 Cold weather

Impact of cold weather

- Cold air can irritate airways, trigger bronchoconstriction, and increase risk of respiratory infections such as influenza.
- Heating systems can dry indoor air, which may irritate the skin, eyes, and respiratory tract.
- People tend to keep windows closed, allowing indoor pollutants and moisture to accumulate; poor air quality can worsen respiratory symptoms.
- Poor ventilation, combined with high indoor humidity and temperature differences, can lead to condensation and mould growth.

How to prevent cold-related indoor risks

- Maintain a stable indoor temperature. Aim for 21–23°C in living spaces for elderly residents during the heating season. Avoid large temperature fluctuations.
- Ensure proper ventilation even in winter. Air rooms briefly but regularly (5–15 minutes depending on temperature difference). Use mechanical ventilation where available.
- Control humidity. Maintain indoor relative humidity between 35–55%. Use humidifiers if air becomes too dry, but ensure they are properly maintained and cleaned.
- Reduce heat loss. Seal windows and doors properly and use curtains or insulation to maintain warmth.
- Pay special attention to residents. Older adults, especially those with chronic illnesses, are more sensitive to cold and poor air quality.

4.1.2 Non-heating season

- During non-heating seasons, the recommended indoor temperature range is 20–26°C.

- Above 27°C, apply cooling techniques such as shading during the daytime, night-time ventilation, and the use of air conditioning (preferably energy-efficient systems).

4.1.3. Heatwaves

Keeping indoor spaces cool during heatwaves is essential, especially for older adults and people with respiratory or cardiovascular conditions. High indoor temperatures can quickly become dangerous if not properly managed.

Target indoor temperature

- Aim to keep indoor temperatures below 27°C, where possible.
- Night-time temperatures should ideally be below 24°C to support adequate rest.

Keep heat out during the day

- Close windows, curtains, and blinds when it is hotter outside than inside.
- Use external shading (e.g. shutters, awnings), which is more effective than internal shading.
- Avoid direct sunlight entering rooms, especially during peak hours (11:00–17:00).

Ventilate at the right time

- Open windows early in the morning and late at night when outdoor air is cooler.
- Use night-time ventilation (e.g. partially opened or tilted windows) to cool indoor spaces.
- Create cross-ventilation to remove accumulated heat.
- Use fans to improve air circulation; note that they cool people rather than the air itself.

Reduce internal heat sources

- Limit the use of ovens, stoves, and other heat-generating appliances during the day.
- Switch off unnecessary lights and electronic devices.
- Use energy-efficient appliances where possible.

Use cooling devices wisely

- Air conditioners can be effective; set them to 24–26°C to avoid excessive cooling.
- Avoid large temperature differences between indoor and outdoor environments.
- Use air conditioning together with proper insulation but ensure adequate fresh air intake is maintained.

Stay cool and hydrated

- Encourage regular fluid intake, even if residents do not feel thirsty.
- Use cooling methods such as cool showers, damp cloths, or misting.
- Promote light, breathable clothing.

Protection of vulnerable residents

Older adults, individuals with chronic illnesses, and elderly home residents require special attention:

- Monitor indoor temperatures regularly.
- Ensure continuous airflow and cooling.
- Watch for signs of heat stress (e.g. fatigue, dizziness, confusion).

Outdoor environment considerations

- Vegetation and external shading (e.g. trees, plants, awnings) can significantly reduce heat gain by shading windows and façade surfaces without restricting airflow.
- In contrast, extensive use of paving stones can increase the local heat island effect around buildings.

4.1.4 Maintenance of air conditioners

Proper maintenance of air conditioners improves performance and indoor air quality, reduces energy consumption, and extends the lifespan of the unit. However, it requires regular attention. Poorly maintained systems can circulate dust, allergens, and microorganisms, increasing the risk of respiratory irritation and infections. Regular cleaning and servicing help maintain a healthy and comfortable indoor environment.

Important note: Room air conditioners can help improve air quality, but do not replace proper ventilation or the need for adequate outdoor air intake.

Routine maintenance

- Clean or replace filters regularly.
  This is the most important maintenance task. Dirty filters restrict airflow, reduce efficiency, and worsen indoor air quality. Clean or replace filters every 2–4 weeks during periods of heavy use. More frequent cleaning may be necessary in dusty environments or where pets or allergies are present.
- Keep airflow unobstructed.

Ensure that vents and indoor units are not blocked by furniture or curtains. For outdoor units, remove leaves, dust, and debris. Maintain at least 30–50 cm of clear space around the unit.

Moisture and drainage management

Air conditioners remove humidity, so proper drainage is essential:

- Check that the drain pipe is not clogged.
- Clean the drip tray regularly to prevent mould and bacterial growth.
- Watch for water leaks or unusual odours, which may indicate problems.

Cleaning of key components

- Evaporator and condenser coils should be cleaned at least once per year.
- Dust accumulation reduces cooling efficiency and increases energy consumption.
- Light surface cleaning can be done by staff, but deep cleaning should be carried out by a professional.

Professional servicing

At least once a year (ideally before the cooling season), a qualified technician should:

- Check refrigerant levels,
- Inspect electrical components,
- Clean internal parts thoroughly,
- Test overall system performance.

Efficient use

- Set a moderate temperature (24–26°C) to reduce system strain.
- Avoid frequent switching on and off.
- Use “eco” or “sleep” modes where available.

Warning signs requiring attention

Contact a professional if any of the following are observed:

- Weak airflow,
- Unusual noises,
- Unpleasant odours (may indicate mould or bacterial growth),
- Increased energy consumption without changes in usage.

4.2 Improving indoor air quality in elderly homes

4.2.1 Reducing indoor air pollution

Indoor air pollutants can originate from heating and cooking, cleaning products and sprays, furniture and building materials, as well as damp, dust mites, and pets. These exposures can adversely affect respiratory health, particularly among individuals with chronic respiratory diseases. Indoor air quality can be improved through informed daily practices:

- Control chemical emissions. Furniture and building materials may emit chemicals such as formaldehyde, which can irritate the respiratory system. Paints, solvents, varnishes, and glues can release volatile organic compounds (VOCs). Use low-emission products and ensure adequate ventilation during and after use.
- Use low-emission cleaning products. Avoid sprays and strongly scented products; prefer unscented or low-emission alternatives.
- Adopt appropriate cleaning practices. Use damp dusting instead of dry dusting, and vacuum with HEPA filters where possible to reduce airborne particles.
- Avoid indoor combustion sources. Burning candles, incense, or solid fuels indoors should be minimized, as they emit harmful pollutants.
- Use safer cooking methods. Gas cookers emit PM and NO_2. Switching to electric appliances and ensuring adequate ventilation during cooking can reduce exposure.
- Ensure adequate ventilation. Regular airing (e.g. short, intensive window opening) or properly maintained mechanical ventilation systems help dilute indoor pollutants.
- Ensure smoke-free environments. Exposure to tobacco smoke and e-cigarette vapour should be strictly avoided indoors.
- Ensure proper maintenance of heating systems. Regular inspection of boilers, stoves, and ventilation systems helps prevent pollutant emissions and ensures safe operation.
- Install carbon monoxide detectors. Carbon monoxide is a colourless, odourless gas produced by faulty gas appliances or the burning of solid fuels (e.g. wood or coal). Installing detectors is essential for safety.
- Prevent damp and mould. Damp and mould pose significant risks, especially for individuals with lung conditions. Mould exposure can lead to infections, coughing, and worsening respiratory symptoms. Prompt removal of mould and prevention of condensation are essential.
- Reduce dust mite exposure. Dust mites are common allergens that can aggravate asthma and other respiratory conditions. Maintaining indoor humidity below 55–60%, washing bedding regularly at ≥60 °C, cleaning surfaces and carpets, and using dust mite-proof covers can help reduce exposure.

- Reduce exposure to aeroallergens. Pet dander can trigger respiratory symptoms, and pests such as cockroaches and rodents can contribute to allergic reactions. Appropriate cleaning and pest control measures are important.
- Maintain clean indoor textiles. Regular cleaning of bedding, curtains, and upholstery helps reduce dust and allergens.

4.2.2 Proper ventilation in elderly homes

Good ventilation is essential for maintaining healthy indoor air. It can be achieved naturally (by opening windows), mechanically (using HVAC systems), or by combining both approaches. In everyday situations, airing rooms for about 10–15 minutes several times a day is usually sufficient, particularly when cross-ventilation or a strong draft is created to enhance air exchange. However, when outdoor air pollution levels are high, natural ventilation should be minimized, and mechanical systems should be adjusted accordingly - by operating them for longer periods or at reduced capacity, rather than switching them off completely.

Proper ventilation improves comfort, health, and well-being by replacing stale indoor air, diluting pollutants from indoor sources, and preventing moisture accumulation that can lead to mould growth and dust mite proliferation. It also reduces the risk of airborne transmission of respiratory infections such as influenza. Ventilation is especially critical in elderly homes, where residents are more vulnerable to respiratory infections.

4.2.2.1 Natural ventilation

To effectively dilute indoor pollutants and airborne pathogens, a continuous supply of fresh air is required. The recommended ventilation rates are 25–30 m^3/hour/person under normal conditions (EN-16798), increasing to at least 36 m^3/hour/person during epidemic periods.

As a rule of thumb, if each person has around 30 m^3 of indoor space (e.g. 10 m^2 floor area with a 3 m ceiling), the air should be fully exchanged about once per hour. In more crowded conditions, continuous ventilation (e.g. slightly open windows or air inlets) may be necessary.

The required duration of window opening depends on the temperature difference between indoor and outdoor air:

- >20°C difference: about 5 minutes,
- 10–20°C difference: 5–15 minutes,
- <10°C difference: 15–20 minutes.

When temperature differences are small, airflow can be enhanced through cross-ventilation, wind effects, or stack (chimney) ventilation, where building

design allows. Fans may help improve air movement and thermal comfort but do not replace ventilation. If prolonged airing is not feasible due to thermal discomfort or building constraints, supplementary mechanical ventilation should be used where available.

Carbon dioxide (CO_2) sensors can help manage air quality. Ventilation is generally recommended when indoor CO_2 levels reach 1000–1200 ppm, or 800–1000 ppm during periods of increased infection risk.

However, elderly people may have specific thermal comfort needs and can be more sensitive to rapid temperature changes or cold drafts. Therefore, ventilation practices should be adapted to ensure both adequate air exchange and thermal comfort.

4.2.2.2 Mechanical ventilation

Mechanical ventilation systems - ideally energy-efficient HVAC units - can ensure a consistent supply of filtered fresh air while maintaining indoor temperature. They are particularly important in urban or polluted environments where natural ventilation may be limited.

Key recommendations:

- Provide outdoor air supply of 25–30 m^3/hour/person (at least 36 m^3/hour/person during epidemic periods).
- Ensure that fresh air supply and exhaust air streams do not mix (e.g. use properly designed heat recovery systems)
- Locate air intake points in clean areas (e.g. rooftops, away from traffic or pollution sources).
- Regularly maintain systems, including inspection, cleaning, and timely filter replacement.

Important note: Portable air cleaners can reduce concentrations of certain indoor pollutants and particles; however, they do not replace adequate ventilation or the need for outdoor air supply.

Maintaining healthy indoor and outdoor environments is an essential component of respiratory disease prevention in elderly homes. Combining adequate ventilation, pollution reduction, thermal comfort, and preventive maintenance can substantially reduce health risks and improve quality of life for both residents and staff.

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