

Pollution its impact on Respiratory Health



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This article explores the impact of the environment on the health of people with asthma and COPD and focuses on two key areas, indoor (home) and outdoor pollutants and severe weather extremes such as heat waves or very cold weather.

Indoor Air Pollution

Most people spend about 90% of their time inside. This might be within their own homes, in the office where they work, in schools, or shops and restaurant environments. Poor indoor air quality has been linked for some time to lung diseases, particularly asthma and allergies, chronic obstructive pulmonary disease (COPD) and even lung cancer.¹ People who already have a lung disease are more likely to be affected by indoor air pollution and those with severe disease, are also more likely to spend additional time indoors due to poor health and reduced mobility, increasing their exposure.

Indoor air pollution can come from many places, including open fires and heaters, certain building materials and furniture, as well as the use of cleaning products – all of which release chemicals into the air – and cooling systems. Mechanical ventilation, the ventilation that is provided by an outdoor vented fan or an air conditioning system will allow external pollution to infiltrate. Further outside air contamination will infiltrate through cracks in the building walls, floors, or ceilings, and windows and doors.

The effects of pollution on people's health can be clearly observed. Irritant effects such as a dry or tickly throat, sore eyes, nasal discharge, or an increased cough, can be felt quite quickly after exposure to indoor air pollution and these effects can last for days or even weeks. The effects of longer-term exposure to indoor pollutants, however, may not be apparent for many years when lung cancer or other conditions can develop. Pollutants can impact an individual in different ways depending on the demographic. Children tend to be more sensitive to other people's tobacco smoke, for example. The lungs are still developing so they are more vulnerable and more reactive, cigarette and cannabis smoke in the home can remain at harmful levels for up to five hours. The vapour from e-cigarettes, though thought to be less harmful than tobacco smoke, can still trigger asthma in some patients who are sensitive to it. Women in general are more likely to suffer from dry throat and dry eyes, and people who are atopic and live with allergies, particularly to dust mites and or pet dander will suffer more when they're exposed to them indoors.

When exposure is very high, almost every person will suffer. Levels of outdoor pollution are measured and recorded in almost every country in Europe, and there are maximum levels that countries have to aim to adhere to.² However, setting maximum levels of indoor air pollution is very difficult. There is a certain amount of individual choice in, and control over, what is used in personal homes and how people choose to ventilate them. Laws introduced to improve indoor air quality outside of the home have had positive effects on some population groups, an obvious example being the ban on smoking in public areas, which has reduced the risk to non-smokers, bar workers and others exposed in such work environments.

Two key exploratory questions can help determine if indoor pollution may be a factor or risk to someone's health:-

- **Are there any signs of a problem in the indoor environment, such as mould or smells?**
- **Do you feel that you have symptoms that improve when you're away from a certain indoor environment?**

Primary Care Respiratory Update

The answers to these questions do not prove that there is an issue with air quality indoors, but they do allow for a discussion about the risks and how to reduce exposure and reduce harm. People often have little or no awareness of indoor pollutants, or underestimate the impact exposure and duration of exposure can have. The more common modifiable risks are highlighted below:



The most important thing to address indoor pollution is to keep each room aired and well-ventilated either by using an extraction fan or by opening windows, ideally both.

Indoor Cooking and Heating

Gas and electric cookers release particulate matter. This particulate matter can make some symptoms of lung conditions, in particular asthma, much worse. Electricity is seen as the cleanest energy to use for heating and cooking, as it releases fewer particles than gas, individuals who find they're having flare-ups of symptoms from using gas cooking, if possible, should consider switching to an electric cooker.

Those with lung conditions are advised to avoid wood-burning stoves as these appliances release more particulate matter air pollution than road traffic. If this is not possible, however, individuals should be advised to make sure that chimneys are regularly cleaned and maintained professionally, and alarms to detect smoke and carbon monoxide installed. It is also recommended that only dry and untreated wood is burned and that users avoid burning refuse, rubbish or packaging as this can lead to the formation of toxic substances within the home.

Burning Incense or Scented Candles

The use of scented materials within closed or poorly ventilated environments such as incense, candles and aerosol-based commodities has increased in popularity.



Some of these products are designed to release scent into the air at regular intervals and all of these emit particles and other pollutants when they burn or are in use. Incense sticks can give out over a hundred times more fine particles than scented candles. Candles are less of a health risk, but some fragranced candles may contain

volatile organic compounds (VOCs). Individuals who use these products should be warned of the risk of increased indoor air pollution and to only burn these products in a larger space with open windows as opposed to smaller spaces such as a bathroom.

Mould Formation

Individuals can be advised to reduce moisture levels and reduce the risk of damp and the development of mould by:

- **Controlling moisture:** Use dehumidifiers, fix leaks, and ensure proper ventilation.
- **Cleaning regularly:** Especially in areas prone to dampness like bathrooms and kitchens.
- **Using air purifiers:** With EPA filters to reduce airborne spores.

Moulds are fungi that grow in the form of multicellular filaments called hyphae. They reproduce via spores, which can be airborne, and they thrive in moist and warm environments. When mould spores are inhaled, they can cause various respiratory issues, particularly in individuals with pre-existing health conditions or compromised immune systems.³ Exposure can trigger allergic reactions, infections, exacerbations of conditions such as asthma and COPD, and in rare cases toxicity. Where the level of risk cannot be modified, optimisation of treatment for known conditions is essential and individuals may require support to instigate improvements when in social housing or private rental.

PCRS has template letters for healthcare professionals to adapt to support patients to seek support from landlords to address pollutants at home - as shown via these QR codes



Radon Exposure

Radon is a naturally occurring radioactive gas that results from the decay of uranium in soil, rock, and water. It is colorless, odorless, and tasteless, and can accumulate to dangerous levels indoors, particularly in lower areas such as basements and crawl spaces. It enters buildings through cracks in foundations, walls, and floors, or gaps around pipes and cables. Exposure to high levels of radon gas can significantly increase the risk of lung cancer. Individuals who live in a high radon area, which is usually the west of the UK, where many houses are built on granite can have an increased risk of radon exposure. More information on Radon including a Radon Address search option is available at <https://www.ukradon.org/information/risks>. Individuals living in high radon areas should seek advice on getting tested.

Outdoor air pollution

There are many pollutants in the air and the level of exposure varies from one area to another. Some pollutants are more closely monitored in the environment than others because they are known to cause significant damage.⁴ The primary known pollutants include ozone, nitrogen dioxide, particulate matter and sulphur dioxide.



Nitrogen dioxide is a toxic gas in the air. Levels are higher on busy roads - particularly on roads with heavy vehicles like lorries or where traffic is moving slowly - around industrial sites like factories, building sites, and again where fossil fuels like coal and oil are burned. Although there has been a drive towards electric vehicles in recent years which are better for the environment, they still produce particulate matter from brake and tyre wear, and road dust.

Ozone is produced when sunlight combines with nitrogen dioxide, particulate matter and other gases. Particulate matter is made up of tiny pieces of varying sizes of solids or liquids in the air, for example, dust, dirt or smoke. Particulate matter levels increase at different times of the year, one example of this is in early November around bonfire night. People should be made aware of this and advised to avoid spending a long time outside during these days. The smoke from fireworks and bonfires can create what's known as winter smog, which can be worse on cold still days. Particulate matter can also be produced naturally from volcanoes, sea spray, pollen and soil.

You'll also see higher levels of ozone in the spring and the summer and in the afternoons. Ozone levels are also often higher in the countryside rather than in towns. This is sometimes called the 'ozone paradox'. Ozone can be degraded by the compounds (NOx) by which it is also formed. Lower ozone levels tend to occur in the winter and the mornings so people should be advised that if they need to go out during the day go in the morning when these levels are lower, particularly if they are sensitive to high pollution levels.

Sulphur dioxide is mainly produced by burning fuels like coal and oil. This includes domestic heating, factories, petrol refineries and building sites, sulphur dioxide can also be a primary cause of smog.

The effects of these pollutants on health depend on the type and the mix of pollutants, their concentration in the air, the amount of time of exposure and how much of the pollutant can

penetrate the lungs. Lung health symptoms such as wheezing, cough, chest tightness, and shortness of breath in people with asthma can be seen straight after exposure to high pollution levels, increasing the risk of somebody having an exacerbation of their asthma. Being exposed to air pollutants for long periods has also been shown to increase the occurrence of lung diseases including cancer and so advising individuals who are exposed to both indoor and outdoor pollutants of the additional more avoidable risk of smoking is important.

People with existing lung disease and other vulnerable groups such as children and the elderly should be advised to check the air pollution alert for the day in their area using the Department for Environment, Food and Rural Affairs UK Air Information also known as DEFRA in order that they can make informed choices about travel and outdoor activity plans.

How polluted is your street?

The BBC has a webpage in which you can enter your postcode to find out how polluted your street is on a scale of 1-6 – see <https://www.bbc.co.uk/news/science-environment-42566393>

Climate Change

Climate change disproportionately affects the most vulnerable in societies including older people, children, disadvantaged socioeconomic groups and those living in the most fragile of countries.

Climate change has a direct impact on extreme weather, forest fires, flooding and heat waves. Extreme heat can trigger asthma symptoms for some people. The exact causes are not completely clear, but breathing in hot air can cause the airways to narrow, leading to coughing and shortness of breath. Secondly, when temperatures are higher in the summer, there are also often higher levels of pollutants and pollens in the air. During pollen season windy conditions caused by thunderstorms can blow pollen high up into the air. The moisture higher up breaks the pollen down into much smaller pieces, which are then settled back down in the atmosphere where they can be breathed in, irritating the smaller airways of the lungs and causing inflammation.

According to the Lancet Countdown Report,⁵ heat-related deaths in the elderly have increased by more than 50 % in the past two years.

In extreme cold, breathing in dry cold air irritates the airways and this causes them to be constricted, causing difficulty in breathing. Cold air also increases mucus production and, the risk of infections such as influenza, and it forces people to stay

indoors more often, increasing their exposure to indoor air pollution.

In February 2019, NICE issued its Quality Standard on outdoor air quality and health for England and Wales (QS181).⁶ The statement recommends that clinicians provide patients with chronic respiratory conditions with advice on what to do when outdoor air quality is poor. This advice should be offered at routine appointments and enable patients and their families or carers to protect themselves and prevent their respiratory condition from worsening.

The emphasis of treatment for patients with respiratory disease is to minimise and modify where possible exposure to both indoor and outdoor pollutants. Ensure that they are adhering to the inhaler regime they are prescribed, keep their inhalers in a cool place and out of direct sunlight to ensure they continue to work well, and that they know they can request a review, even if not due their annual overview if they remain symptomatic. Warnings of the impact of weather conditions should be included in the personalised action plans so your patients know what to do if hot or cold weather triggers any symptoms. Advise them to monitor pollution and pollen forecasts so they can anticipate any worsening or deterioration in their symptoms and ensure that your patients with pollen-related atopy utilize antihistamines in advance of symptoms worsening.

Advice for patients on mitigating the effects of climate change include:

- Avoiding or reducing strenuous activity outside, especially in highly polluted locations such as busy streets, and particularly if experiencing symptoms such as sore eyes, a cough or sore throat
- Using an asthma/COPD reliever inhaler more often, as needed
- Closing external doors and windows facing a busy street at times when traffic is heavy or congested to minimise the amount of polluted air coming into the home
- Being aware of expected outdoor air quality in the days ahead so that time outside the home can be planned or minimised as appropriate.

Sources of information on national and local air pollution levels

- **Government monitoring services:**
 - UK-wide: Department for Environment, Food and Rural Affairs Daily Air Quality Index (<https://uk-air.defra.gov.uk/>)
 - Scotland: <http://www.scottishairquality.scot/>
 - Wales: <https://airquality.gov.wales/>
 - Northern Ireland: <https://www.airqualityni.co.uk/>
- **Text messaging services:**
 - London: <https://www.airtext.info/>
 - Hertfordshire and Bedfordshire <https://www.airqualityengland.co.uk/local-authority/knr-subscription>
 - Manchester <https://cleanairm.com/data-hub/forecast-and-alerts/text-sign-up/>
 - Sussex: <https://airalert.info/Splash.aspx>
 - Scotland: <http://www.scottishairquality.scot/know-and-respond/>

Pollution, both indoor and outdoor, can have a negative effect on respiratory health particularly those with pre-existing respiratory conditions, the frail and vulnerable. People need support and guidance as to how best to reduce risk and exposure.

References

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