Don't Hold Your Breath:
Adapt and Become More Resilient Against Air Pollution

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The Clean Breathing Institute

There is broad consensus amongst experts on the impact of air pollution and climate change on health.[1,2] **Even healthy individuals are impacted.**[1-3]

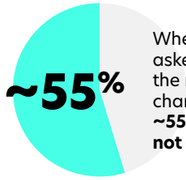
Respiratory health effects of air pollution[1,4]

- Increased risk of COPD, bronchitis, and asthma exacerbation
- Airway remodelling, oxidative stress, and inflammation
- Increased susceptibility to respiratory infections
- Reduced lung function
- Increased rates of pulmonary mortality
- Lung cancer

Climate change impacts levels of air pollutants such as CO_2 levels and pollen counts[5]

≤10%↑

cardiorespiratory mortality on days with peak pollen concentrations.[6]



~55%

When symposium attendees were asked if they advise patients on the role of air pollution and climate change on respiratory ailments, **~55% either did not or found it not applicable to their role.**

Healthcare professionals should provide clear, evidence-based guidance to support adaptation at the individual level to ensure resiliency against increasing air pollution.

1 Strategy #1: Encourage behaviours in day-to-day life that promote resilience to air pollution

To mitigate negative effects of air pollution, it is important to promote health-modifying behaviours and manage pre-existing cardiorespiratory conditions[3,7,8]

Adaptations at home

Avoiding indoor tobacco smoking prevents multiple pollutants at home.[7]

Indoor plants can reduce air pollutants, ozone, and indoor air VOC pollution.[8,9]

Air purifiers cause a dramatic reduction in indoor particulate matter numbers.[10]

Using **gaseous fuels at home instead of biomass** reduces the risk of respiratory issues and pregnancy complications.[11]

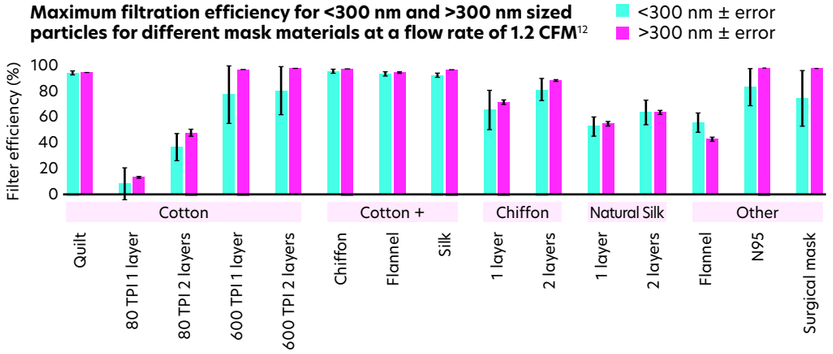
What if electricity, which is considered a clean fuel, and gaseous fuels are not available?[4,11]

- Cross-ventilation (opening windows and doors) in cooking areas can be beneficial, although **this must be balanced with consideration of outdoor dust levels as noted by symposium attendees**.
- Switching to more efficient cookstoves can be beneficial if possible.

What about when outdoors?

Beyond avoiding highly polluted areas, **a well-fitting face mask can be protective, but choice of mask is important:**[12]

Maximum filtration efficiency for <300 nm and >300 nm sized particles for different mask materials at a flow rate of 1.2 CFM[12]



Experts attending the symposium highlighted that:

- If one has access to an electric car with a particulate matter meter, it allows monitoring of when to close the windows.
- Patients appear receptive to information on reducing costs of methods to support resilience, such as prescription air filters.

2 Strategy #2: Adapt diet and exercise to promote protective effects against the harmful impact of air pollution on both the heart and lungs

Higher banana, apple, and tomato intake can slow age-related lung function decline.[13]

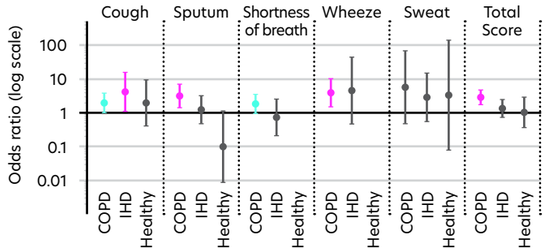
Pro-, pre-, and synbiotics may be capable of reversing the effects of air pollution via the gut-lung axis.[14]

The Mediterranean diet can lower the risk of impaired lung function in adult smokers.[15]

Omega-3 may lower airway inflammation, but **omega-6** may raise it.[16,17]

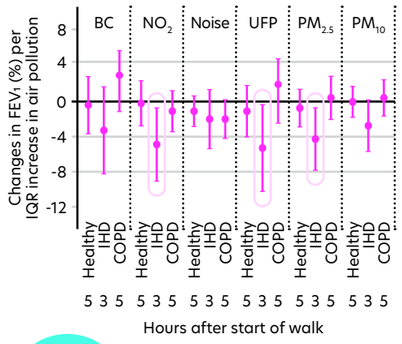
While the benefits of exercise are well-known, adaptations can be made to mitigate the negative effects of air pollution. Benefits of exercise can be curtailed when performed in areas with high air pollution.[3]

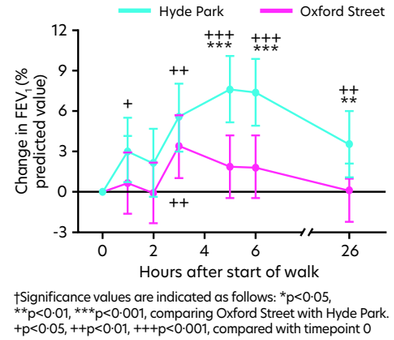
Those with cardiovascular or respiratory disease can experience more respiratory events in polluted areas compared to when in areas with lower air pollution*[3]



*All study participants were at least 60 years old. In data from the United Kingdom shown, where applicable, Oxford street is indicated as a polluted area and Hyde Park is indicated as an area with clean air.[3]

Lung capacity when exercising is impacted by air pollution.*†[3] To maximise the benefits of walking exercise, highly polluted areas should be avoided.[3]





†Significance values are indicated as follows: *p<0·05, **p<0·01, ***p<0·001, comparing Oxford Street with Hyde Park. +p<0·05, ++p<0·01, +++p<0·001, compared with timepoint 0

Symposium attendees **recommended exercising in local parks and cycling to work, instead of using high-exposure public transport routes**, to help balance the benefits of exercise with the negative effects of air pollution.

3 Strategy #3: Build resilience through use of antioxidants and anti-inflammatory treatments

Dietary antioxidants could alleviate oxidative stress and inflammation caused by reactive oxygen species seen in pollution-induced airway inflammation.[18]

Key antioxidant sources:[18-20]

- Vitamin C and E
- Carotenoids
- Soluble fibres
- N-acetylcysteine

Nasal saline irrigation can reduce pollutant contact time on the respiratory mucosa in both adults and children and can have anti-inflammatory effects.[21]

Nasal anti-inflammatory steroid sprays may increase resistance of nasal mucosa against the negative effects of air pollution.[22]

People with rhinitis living in highly polluted areas may benefit particularly.[22,23]

When symposium attendees were asked if they advise their patients with allergic rhinitis to use nasal steroids to minimise effects of air pollution, **86% did not or found it not applicable to their role**.

Choice of answers:

A) Yes, for all my patients
B) Yes, for some of my patients
C) I don't offer this advice to any of my patients
D) Not applicable to my professional role

Inhaled corticosteroids:[24]

- May decrease susceptibility to particulate matter in people with asthma.
- May increase vulnerability to nitrogen oxide and carbon monoxide.

Recommending combination regimens may be beneficial but require further study to confirm impact.[25]

Abbreviations:

BC: black carbon; CFM: cubic feet per minute; COPD: chronic obstructive pulmonary disease; FEV: forced expiratory volume; IHD: ischemic heart disease; IQR: interquartile range; NO_2: nitrous dioxide; PM: particulate matter; $PM_{2.5}$: particles < 2.5 µm in diameter (per 14.94 µg/m³); PM_{10}: particles < 10 µm in diameter (per 14.47 µg/m³); TPI: threads per inch; UFP: ultrafine particles; VOC: volatile organic compound.

Key takeaways and considerations when communicating mitigation strategies

Many healthcare professionals see advising on health-related impacts of air pollution and climate change as outside their role, but they should embrace the challenge.

Recommendations should be personalised based on their unique health status.

Key strategies that can be recommended:

- Behaviour, both indoors and outdoors, can be adapted to reduce risk of health concerns.
- Adapting exercise pattern and diet can ameliorate negative effects and reduce risk air pollution.
- Using anti-inflammatories and increasing intake of antioxidants can promote resilience.

Continued research will help refine guidelines and ensure recommendations are based on solid evidence.

References:

1. Grigorieva E et al. Atmosphere. 2021;12:790. 2. Seastedt H et al. Ann Allergy Asthma Immunol. 2023;131(6):694-702. 3. Sinharay R et al. Lancet. 2018;391(10118):339-49. 4. Carlsten C et al. Eur Respir J. 2020;55(6):1902056. 5. Zhang Y et al. Nat Commun. 2022;13:1234. 6. Brunekreef B et al. Lancet. 2000;355(9214):1517-18(2). 7. Ni Y et al. Environ Res. 2020;181:108910. 8. Papinchak HL et al. HortTechnology. 2009;19(2);286-90. 9. Wood RA et al. Water, Air and Soil Pollution. 2006;175:163-80. 10. Vyas S et al. PLoS One. 2016;11(12):e0167999. 11. Puzzolo E et al. Lancet Resp Med. 2024;12(4):281-93. 12. Konda A et al. ACS Nano. 2020;14(5):6339-47. 13. Garcia-Larsen V et al. Eur Respir J. 2017;50(6):1602286 14. Keulers L et al. Environ Pollut. 2022;302:119066. 15. Catalin RE et al. Nutrients. 2023;15(5):1272. 16. Rutting S et al. Am J Physiol Lung Cell Mol Physiol. 2018;314(6):L922-35. 17. Kumar A et al. Nutr Res Rev. 2016;29:1-16. 18. Péter S et al. Nutrients. 2015;7(12):10398-416. 19. Hosseini B et al. Am J Clin Nutr. 2018;108:136-55. 20. Ezerina D et al. Cell Chem Biol. 2018;25(4):447-59.e4. 21. Head K et al. Cochrane Database Syst Rev. 2018 (6);6:CD012597. 22. Zhang Y et al. Allergy Asthma Clin Immunol. 2022;18:56. 23. Greiner AN et al. Lancet. 2011;378(9809):2112-22. 24. Staggers K et al. Am J Respir Crit Care Med. 2024;Online ahead of print. 25. Shikani AH et al. Ear Nose Throat J. 2014;93(4-5):E48-54.