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Guest Editorial

Impact of Air Pollution on Lungs and Other Organs of the Body

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Introduction

Asthma is due to chronic inflammation within the bronchi and bronchioles in the lungs, causing symptoms such as, wheezing and coughing [1]. The aetiology of asthma is multifactorial, as there are intrinsic genetic elements and external triggers, most important of which is air pollution [2].

Air pollution is defined by the World Health Organisation (WHO) as 'Contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. WHO also state that 'ninety nine percent of the global population breathes air that exceeds WHO guideline limits, containing high levels of pollutants, with low-and middle-income countries suffering from the highest exposures' [3].

Asthma affects around 344 million people worldwide, and it is amongst the top 20 chronic conditions according to the global ranking of disability-adjusted life years in children. In children aged around 5 - 14 years old, asthma is amongst the top 10 causes of disease [4].

Children are significantly more vulnerable to air pollution than adults. One reason for this is that they will have a longer exposure from 'in the womb', till birth and beyond compared to adults. They also have a higher metabolic and heart rate than adults do, so they will intake more air, which subsequently means more of the polluting gases are being inhaled into their bodies [5].

Air pollution consists of many different chemicals. The main ones are sulfur dioxide, nitrous dioxide, carbon monoxide and ozone. Ozone has been shown to exacerbate the intensity for children who suffer with asthma. It can lead to many hospital visits for medical intervention and even can lead to fatal outcomes over a long-term exposure [6].

Polluting air also contains particulate matter. This can be in many different states and can be inhaled into the child's body [7]. Particulate matter comes in three main sizes, PM: 0.1, PM: 2.5 and PM: 10. The numbers indicate the size of particles in microns. (PM: 0.1 are 0.1 microns or less, called ultra fine particles (UFP), PM: 2.5 are 2.5 microns or less and PM: 10 is particles 10 microns or less in diameter).

PM: 2.5 or less can stay in the atmosphere for many days or even weeks and has a dispersion distance of 100 to thousands of kilometres, whereas PM: 10 microns or less only stays in the atmosphere for minutes, at most hours, which is a significantly reduced time compared to the PM: 2.5 microns or less. PM: 10 or less only has a dispersion distance of 1 - 10 km [8].

The size of these particulate matter particles is very significant, as the smaller the particles are, the more damage they will have on the child's body, especially the respiratory tract. This is because PM: 0.1 and PM: 2.5 are so small, they can penetrate the respiratory system, which not only affect the respiratory system, but can affect other parts of the child's body, such as the immune system as these penetrate the alveolar capillaries travelling to the brain, heart, pancreas etc. [9].

These findings indicate, for example on how UFPs could induce specific organ toxic effects, such as on the cardiovascular system. The first is by directly reaching the heart through the blood stream and the other two pathways being indirect - mediated by pulmonary oxidative stress and inflammatory response and interaction on the autonomic nervous system via specific lung receptors (Dockery and Stone, 2007; Simkhovich., *et al*. 2008].

Increasing greenhouse gases through burning of fossil fuels, have impacted on air pollution levels, especially Ozone and particulates. We are therefore witnessing health effects on pregnant mothers and their unborn babies.

Some of these impacts are increased rates of pre-eclampsia, low birth weights and premature labour, but ultimately, we are seeing a higher incidence for infant mortality rates too [10]. Even after the child is born, studies have shown that air pollutant exposure to the newborn and young children can increase the complications through increased oxidative stress and endothelial disfunction, which could lead to longer term health impacts for the child (Shkirkova., *et al*. 2020). A case in point is a coroner certifying death, due directly to air pollution of a 9-year-old girl called Ella Kissa Debra who lived around the South Circular in London (BMJ 2020;371:m4902, Dyer, 2020).

Air pollution has become a problem, soon after the industrial revolution over 150 years ago. This is because we have continued to exponentially burn fossil fuels which are leading to devastating effects on our health (Figure 1).

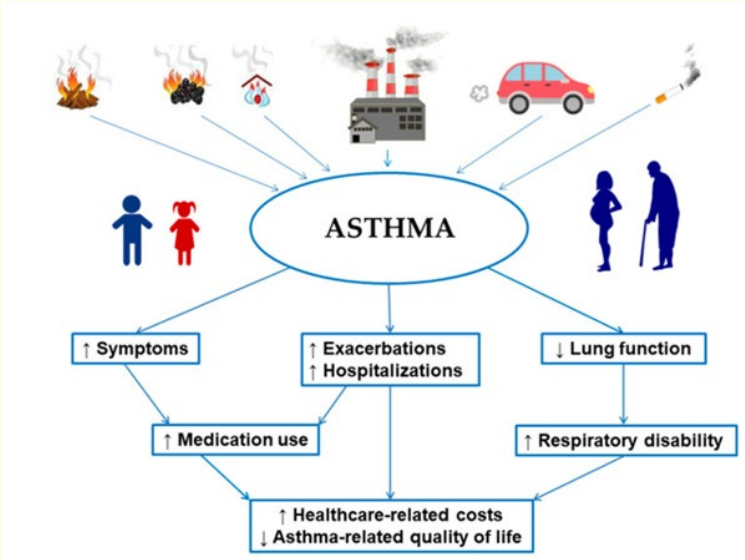

Figure 1: *Shows the impacts of air pollution on asthma outcomes and how it has significant Socio-economic impacts (Tiotiu., et al. 2020).*

In an effort to fight air pollution, governments and local authorities in some cities have brought in low emission zones, to try and decrease the rates of air pollution from the transport sector, which will certainly help in decreasing pollution levels in those local areas

[11]. To this end, Air quality index monitoring helps. This measures the amount of air pollution of different gasses and particulate matter present in the atmosphere. The places where high detection is usually recorded are urban areas and in proximity of busy roads, especially at rush hour time [12,13].

Another preventative measure that individuals are undertaking is to wear FFP2 masks which are effective particularly against particulate matter [14]. In polluted cities such as Beijing, they have become a norm for many [15].

For protection of children, in 2018, some state schools in London started introducing air purifiers into the classrooms. This intervention showed a significant improvement in asthma symptoms, and coughing fits from children who previously suffered, before the purifiers were implemented [16].

Finally, simple lifestyle changes such as walking, cycling and limiting flying will help decrease the production and need for fossil fuels significantly, with a considerably co-benefit to health [17].

Bibliography

1. James W Mims. "Asthma: definitions and pathophysiology". *International Forum of Allergy and Rhinology* 5.1 (2015): S2-S6.
2. K Adams., *et al*. "Particulate matter components, sources and health: Systematic approaches to testing effects". *Journal of Air Waste and Management Association* 65.5 (2015): 544-558.
3. World Health Organisation. "Air pollution" (2022).
4. I Asher and N Pearce. "Global burden of asthma among children". *The International Journal of Tuberculosis and Lung Disease* 18.11 (2014): 1269-1278.
5. Thomas F Bateson and Joel Schwartz. "Children's response to air pollutants". *Journal of Toxicology and Environmental Health, Part A* 71.3 (2008): 238-243.
6. JJ Zhang., *et al*. "Ozone pollution: A major health hazard worldwide". *Frontliners in Immunology* 10 (2019): 2518.
7. Gritt O. "What is air pollution and what are its main components?" Cp Medical Centre (2021).
8. SM Godoy., *et al*. "Assessment of impact distances for particulate matter dispersion: A stochastic approach". *Reliability Engineering and System Safety* 94.10 (2009): 1658-1665.
9. I Manisalidis., *et al*. "Environmental and health impacts of air pollution: A review". *Frontiers in Public Health* 8 (2020): 14.
10. P Poursafa and R Kelishadi. "What health professionals should know about the health effects of air pollution and climate change on children and pregnant mothers". *Iranian Journal of Nursing and Midwifery Research* 16.3 (2011): 257-264.
11. D Dias., *et al*. "Integrated modelling approach for the evaluation of low emission zones". *Journal of Environmental Management* 177 (2016): 253-263.
12. LTN Ngoc., *et al*. "Particulate matter exposure of passengers at bus stations: A review". *International Journal of Environmental Research and Public Health* 15.12 (2018): 2886.
13. United states environmental protection agency. Patient exposure and the air quality index. Available online: Patient Exposure and the Air Quality Index | US EPA (2022).

14. CM Sterr., *et al*. "Medical face masks offer self- protection against aerosols: An evaluation using a practical *in vitro* approach on a dummy head". *PLOS ONE* 16.3 (2021): e0248099.

15. JW Cherrie, *et al*. "Effectiveness of face masks used to protect Beijing residents against particulate air pollution". *Occupational and Environmental Medicine* 75.6 (2018): 446-452.

16. Smart Air UK. Air purifiers for schools and universities. Schools and Universities – Smart Air UK (smartairfilters.com) (2022).

17. United states Environmental Protection Agency. Health effects of ozone pollution. Health Effects of Ozone Pollution | US EPA (2022).

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