



The Prevalence Of Pollution-Based Asthma In A Population

¹Maurya sakshi s., ² DR. Murtaza Hajoori

Surat, Gujarat

Abstract: Air pollution is the presence of human-harming substances in the atmosphere. It is linked to a significant risk of cardiovascular diseases (such as strokes and ischemic heart disease), chronic obstructive pulmonary disease, asthma, lower respiratory infections, and lung cancer that cause premature death. The primary gaseous pollutants are volatile organic compounds (VOCs), such as polycyclic aromatic hydrocarbons (PAHs), as well as inorganic substances like lead or chromium (Pb or Cr), ozone (O₃), carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and carbon dioxide (CO₂). The respiratory symptoms of asthma, which include coughing, wheezing, dyspnoea, and chest tightness linked to fluctuating expiratory airflow limitation, are indicative of a chronic inflammatory airway disease. tiny particles in the air that are present in smoke, haze. As a result of breathing in tiny particles from contaminated air, soot and airborne dust can cause major issues with air quality and irritate your lungs. Inhaled tiny particles and irritating gases can pose a larger risk to individuals suffering from asthma. They may aggravate asthma by irritating the respiratory tract. Although anybody can be affected by air pollution, those who have asthma are more vulnerable. Pollution both indoors and outside can aggravate asthma symptoms.

Keywords:- asthma conditions, air pollution, outdoor air pollutants, indoor air pollutants, asthma symptoms, exacerbations, management

I. INTRODUCTION

The term "air pollution" refers to the presence of harmful substances for human health in the atmosphere. It is linked to a higher risk of dying young from cardiovascular diseases (such as strokes and ischemic heart disease), chronic obstructive pulmonary disease, asthma, lower respiratory infections, and lung cancer [1,2]. The burden of outdoor (ambient) air pollution falls disproportionately on people living in developing and overpopulated countries; 91% of the 4.2 million premature deaths in 2016 occurred in low- and middle-income countries in South-East Asia, Central Africa, and the Western Pacific, where exposure to pollution is higher [3]. While air quality has been becoming better in wealthy nations, air pollution is continuously increasing in emerging nations [4] The World Health Organisation (WHO) established air quality guidelines for several pollutants in order to quantify air pollution. Nine out of ten individuals, according to WHO data, breathe air that is highly polluted. In urban areas where air pollution is tracked, over 80% of residents are subjected to levels of air pollution that are higher than those recommended by the World Health Organisation. Furthermore, the use of biomass, kerosene fuels, and coal for cooking and home heating exposes almost 3 billion people to high levels of indoor (household) air pollution, resulting in a high prevalence of respiratory conditions [5] The primary gaseous pollutants are volatile organic compounds (VOCs), such as polycyclic aromatic hydrocarbons (PAHs), as well as inorganic substances like lead or chromium (Pb or Cr), ozone (O₃), carbon monoxide (CO), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), and carbon dioxide (CO₂). While some of them, like NO₂ and SO₂, are directly produced by various sources of pollution, others, like O₃, are created when sunlight interacts with nitric oxides and volatile organic compounds. Particulate matter (PM), which is often employed as a gauge of air quality, is the pollutant that has the biggest influence on human health [6,7].

The respiratory system is especially negatively impacted by "afflict-related air pollution" (TRAP), a complex mixture high in PM. Some of them, like O₃, are produced when sunlight interacts with nitric oxides and volatile organic molecules; others, like NO₂ and SO₂, are directly produced by different sources of pollution. The pollutant that has the greatest impact on human health is particulate matter (PM), which is frequently used as a proxy for air quality [6,7]. PM is especially harmful to the functioning of the respiratory system [5].

Chronic inflammatory airway disease is indicated by the respiratory symptoms of asthma, which include coughing, wheezing, dyspnea, and chest tightness along with fluctuating expiratory airflow limitation. It is believed that between 1 and 18% of people worldwide suffer from asthma. Statistics showed that air pollution has a negative impact on asthma outcomes in both adult and paediatric populations, and research suggests that TRAP may account for 13% of the world's paediatric asthma cases [8].

The most recent studies on the impact of various indoor and outdoor pollutants on asthma symptoms, severity, exacerbations/hospitalizations, lung function, and medication use are summarised in this review. It also draws attention to possible countermeasures against the detrimental effects of these contaminants on asthmatic outcomes. Specific interrogation questions regarding possible recent exposures that exacerbate respiratory symptoms could improve the daily practices of physicians (e.g., general practitioners, pulmonologists, allergologists, paediatricians, gynaecologists, and emergency department doctors). Patients would also benefit from learning how to minimise exposure and use action plans to control their asthma. It would be beneficial to have a deeper comprehension of how air pollution negatively impacts asthma outcomes. Meanwhile, governments should be encouraged by the global recognition of how air pollution affects asthma and public health organisations to put more potent regulations in place that lessen exposure to air pollution. [8]

Air Pollution and Risk of Asthma:-

What is air pollution:-

Serious issues with air quality can result from tiny airborne particles, which are present in haze, smoke, soot, and airborne dust.

PM stands for particulate matter, which is a term for tiny airborne particles. The most hazardous particles are the smallest ones, known as PM_{2.5}. They may enter your bloodstream or go deep into your lungs. [9]

Small particles in contaminated air can irritate your lungs when you breathe them in. Inhaled tiny particles and irritating gases can pose a larger risk to individuals suffering from asthma. They may aggravate asthma by irritating the respiratory tract. Although anybody can be affected by air pollution, those who have asthma are more vulnerable. [9] The development of asthma has also been linked, according to reports, to secondhand smoke (SHS).

How Does Air Pollution Affect Asthma and Health?

Airborne particles and gases can enter your mouth or nose and enter your bloodstream and lungs. Exposure to air pollution, whether short-term or long-term, can result in numerous health issues. [10]

Breathing in air pollution can cause:

Breathing problems

Asthma attacks

Difficulty breathing deeply

Worsened asthma symptoms

Decreased lung growth in kids

Reduced lung function

Needing more doses of asthma drugs

Needing emergency treatment for asthma

Hospital visits

Adverse birth outcomes (such as preterm birth, low birth weight, stillbirth)

Early death [11]

Who Is Most at Risk From Air Pollution?

Everyone may be harmed by air pollution at high concentrations. However, health effects from air pollution can occur at even lower levels. The following are the most vulnerable to the negative consequences of air pollution:

- People with lung disease like asthma
- People with heart disease
- Babies and children
- Senior adults
- People who work outside

The most recent information regarding how different indoor and outdoor pollutants affect asthma development, symptoms, hospitalisations and exacerbations, severity, lung function, and medication use. [12]

Outdoor and indoor pollution:-

1. Outdoor Pollutants:

Particulate Matter (PM_{2.5} and PM₁₀): Research has indicated a strong correlation between increased asthma symptoms, hospitalisations, exacerbations, and reduced lung function, and particulate matter exposure.[13]

Ozone (O₃): Increased medication use among asthmatics and asthma exacerbations have been related to elevated ozone levels. [14]

Nitrogen Dioxide (NO₂): Exposure to NO₂ has been linked to decreased lung function, heightened asthma severity, and worsening asthma symptoms.

Sulphur Dioxide (SO₂): Exposure to SO₂ has been linked to an increase in asthma exacerbations and symptoms, particularly in people who already have asthma.

Air pollution caused by traffic: Living close to busy roads has been associated with increased hospital admissions, asthma exacerbations, and prevalence of the condition.[15]

Indoor Pollutants:

Pollutant exposure can lead to more frequent and severe asthma exacerbations, requiring higher doses of medication and increased healthcare utilization. Long-term exposure to pollutants may contribute to the development of asthma in susceptible individuals, as well as worsen existing asthma symptoms over a time.[18]

Tobacco Smoke: There is a clear correlation between exposure to firsthand and secondhand smoke and the development of asthma, as well as an increase in symptoms, exacerbations, and a loss in lung function. [16]

Indoor Allergens (e.g., Dust Mites, Pet Dander, Mould): In vulnerable people, sensitization to indoor allergens can result in asthma attacks and symptoms.[17]

Organic Volatile Compounds (VOCs): Exposure to volatile organic compounds (VOCs) from air fresheners, paints, and household cleaners can exacerbate asthma symptoms and lead to exacerbations.

Cooking and heating sources that are not properly vented can release pollutants like particulate matter and nitrogen dioxide into the air, which can worsen asthma symptoms.

Household Pests: For those who are sensitive, indoor allergens such as cockroaches and rodents can worsen symptoms of asthma.[18].

2.Impact on Asthma Development, Severity, and Medication Use:

Exposure to outdoor and indoor pollutants has been associated with increased asthma prevalence, severity, and medication use.

Pollutant exposure can lead to more frequent and severe asthma exacerbations, requiring higher doses of medication and increased healthcare utilization.

Long-term exposure to pollutants may contribute to the development of asthma in susceptible individuals, as well as worsen existing asthma symptoms over a time.[18]

How to control asthma :-

Asthma cannot be cured, yet there are various ways to manage it. The most popular course of treatment involves inhaling medication into the lungs directly. People with asthma can live normal, active lives and manage their symptoms with inhaled medicine. With the use of inhalers, asthmatics can better manage their condition and lead regular, active lives. [19]

There are two main types of inhaler:

bronchodilators, like salbutamol, which ease symptoms by opening airways, and

steroids, like beclometasone, which lessen inflammation in airways, improve asthma symptoms and lower the chance of fatal asthma episodes. Reducing asthma triggers can also aid in lessening the symptoms of asthma. [19]

Self-care

To learn more about their asthma, those who have it and their families need education. This covers their available treatments, things to avoid as triggers, and how to take care of their symptoms at home.

To prevent a catastrophic asthma attack, it is crucial for individuals to know when to increase their therapy when their symptoms get worse. A plan of action for asthma may be provided by medical professionals to enable patients to better manage their asthma. [19]

In the adult random sample, the prevalence of severe asthma was 1.1%, but in the asthma sample, it was 9.5%. Compared to people with other types of asthma, individuals with severe asthma were older, had more symptoms, restrictions on their activities, heart disease, and blood neutrophils. Their lung function was also reduced, and in spite of these impairments, 32% did not visit a healthcare professional on a yearly basis. [19]

Conclusion :-

The latest results, in summary, demonstrate the substantial influence that indoor and outdoor pollutants have on asthma development, symptoms, exacerbations, severity, lung function, and medication use. In order to lessen the impact of asthma on those who are impacted by it as well as the healthcare system, it is imperative that efforts be made to limit exposure to these pollutants through environmental legislation, public health initiatives, and individual lifestyle modifications. In comparison to earlier research, the prevalence of severe asthma was higher, and many of those who had the condition did not regularly interact with medical professionals. Because people with severe asthma have a high burden of symptoms and impairments, it is critical that the healthcare system put procedures in place to enhance follow-up and evaluate these patients in accordance with current guidelines.

References:-

[1] De Matteis, S., Forastiere, F., Baldacci, S., Maio, S., Tagliaferro, S., Fasola, S., ... & Viegi, G. (2022). Issue 1-“Update on adverse respiratory effects of outdoor air pollution”. Part 1): Outdoor air pollution and respiratory diseases: A general update and an Italian perspective. *Pulmonology*, 28(4), 284-296.

[2] Liu, Y., Pan, J., Zhang, H., Shi, C., Li, G., Peng, Z., ... & Zhang, L. (2019). Short-term exposure to ambient air pollution and asthma mortality. *American journal of respiratory and critical care medicine*, 200(1), 24-32.

[3] World Health Organization. (2021). WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health Organization.

[4] Fann, N. L., Nolte, C. G., Sarofim, M. C., Martinich, J., & Nassikas, N. J. (2021). Associations between simulated future changes in climate, air quality, and human health. *JAMA Network Open*, 4(1), e2032064-e2032064.

- [5] World Health Organization. (2019). Ambient air pollution: training for health care providers (No. WHO/CED/PHE/EPE/19.12. 14). World Health Organization.
- [6] Sompornrattanaphan, M., Thongngarm, T., Ratanawatkul, P., Wongsa, C., & Swigris, J. J. (2020). The contribution of particulate matter to respiratory allergy. *Asian Pacific journal of allergy and immunology*, 38(1), 19-28.
- [7] Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: a review. *Frontiers in public health*, 8, 505570.
- [8] https://www.cdc.gov/climateandhealth/effects/air_pollution.html
- [9] <https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/health-impacts>.
- [10] <https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/health-impacts>.
- [11] <https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/health-impacts>.
- [12] Anenberg, S. C., Henze, D. K., Tinney, V., Kinney, P. L., Raich, W., Fann, N., ... & Kuylenstierna, J. C. (2018). Estimates of the global burden of ambient PM 2.5, ozone, and NO 2 on asthma incidence and emergency room visits. *Environmental health perspectives*, 126(10), 107004.
- [13] Nuvolone, D., Petri, D., & Voller, F. (2018). The effects of ozone on human health. *Environmental Science and Pollution Research*, 25, 8074-8088.
- [14] Huff, R. D., Carlsten, C., & Hirota, J. A. (2019). An update on immunologic mechanisms in the respiratory mucosa in response to air pollutants. *Journal of allergy and clinical immunology*, 143(6), 1989-2001.
- [15] St Claire, S., Fayokun, R., Commar, A., Schotte, K., & Prasad, V. M. (2020). The World Health Organization's world no tobacco day 2020 campaign exposes tobacco and related industry tactics to manipulate children and young people and hook a new generation of users. *Journal of Adolescent Health*, 67(3), 334-337.
- [16] Szeffler, S. J., Gergen, P. J., Mitchell, H., & Morgan, W. (2010). Achieving asthma control in the inner city: do the National Institutes of Health Asthma Guidelines really work?. *Journal of allergy and clinical immunology*, 125(3), 521-526.
- [17] Sharpe, R. A., Thornton, C. R., Tyrrell, J., Nikolaou, V., & Osborne, N. J. (2015). Variable risk of atopic disease due to indoor fungal exposure in NHANES 2005–2006. *Clinical & Experimental Allergy*, 45(10), 1566-1578.
- [18] Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., ... & Bhutta, Z. A. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The lancet*, 396(10258), 1204-1222.