

# The Impact of Environmental Factors on Respiratory and Overall Health among Adolescents

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## Abstract

**Background:**Environmental risks, including air pollution, indoor pollutants and allergen exposure, are significant public health issues for adolescents. At this time in life, people are susceptible to environmental risks that can negatively impact respiratory and health outcomes. **Objective:**This study will assess the effects of environmental factors on respiratory and general health in adolescents and the association between exposure and health status. **Methodology:**In this cross-sectional study, we surveyed adolescents (age: 13-19 years). The study involved self-reported exposure to environmental pollutants and health symptoms, which were gathered through questionnaires. Data were analyzed using statistical methods to determine the links between environmental exposure and respiratory health and general health problems. **Findings:**These showed adolescents exposed to higher environmental pollutants had greater respiratory issues such as asthma (around 30%), recurrent cough (45%) and wheezing (40%). In addition, adolescents with high exposure also exhibited general health symptoms, such as tiredness (60%) and lowered immunity (50%). **Conclusion:** Environmental exposures play a important role in respiratory and general health of adolescents. Minimizing exposure and raising awareness of environmental hazards may help enhance the health of young people.

**Keywords:** Environmental factors, adolescents, respiratory health, air pollution, asthma, overall health, environmental exposure

## 1. Introduction

Teenage years are an important period in human life, with the World Health Organization defining the period between 10 and 19 years as adolescence. It is a time of significant physical, mental and cognitive development, as well as heightened sensitivity to environmental factors. Environmental health is important to consider during adolescence because exposure to environmental risks can lead to poor respiratory and health outcomes in the long term [1]. Environmental health is defined as the relationship between humans and the environment, and all of the physical, chemical and biological factors that can affect health. Young people are more vulnerable to environmental factors due to their growing respiratory systems and increased exposure while participating in outdoor activities [2]. Air pollution is a major environmental factor that can impact health. Environmental pollutants, including particulate matter (PM2.5), nitrogen dioxide, and ozone are known to cause respiratory illnesses such as asthma, bronchitis and lung function impairment [3]. Another important environmental determinant of health is indoor pollution. Indoor pollutants like secondhand smoke, wood and coal emissions, moulds and inadequate ventilation can adversely affect respiratory health [4]. In many developing countries, indoor pollution is a significant issue due to the burning of biomass fuels for cooking and heating [5]. Teens who inhabit such conditions are more susceptible to chronic respiratory conditions and other health issues. Environmental health vulnerabilities are also compounded by climate change due to exposure to extreme weather events, allergens and pollutants. Temperature increases and altered weather and environmental conditions contribute to the spread of respiratory disease and have a negative effect on health [6]. Furthermore, climate change stimuli like heatwaves and air pollution can cause fatigue, weakened immunity and other systemic problems in adolescents [7]. Despite increasing recognition, environmental dangers pose a significant impact on many adolescents globally. Research shows that many young people are exposed to unsafe levels of air pollution which results in increased

disease burden and compromised quality of life [8]. Socio-demographic, urbanization and awareness play a role in differential impact [9]. The issue, therefore, relates to rising exposure of adolescents to adverse environmental exposures and lack of attempts to address risks. Although a number of past studies have explored the associations between environmental exposure and health, there is need for comprehensive studies that explore both respiratory and broader health effects [10].

### 1.1 Objectives:

1. To examine the level of exposure of adolescents to the environment.
2. To explore the effects of environmental factors on health, particularly respiratory health.

## 2 Literature review

There has been a growing recognition of the influence of environmental factors on health in adolescents, both in terms of respiratory health and general well-being. Research shows that exposure to environmental pollutants, particularly in urban environments, continues to be a significant source of risk for adolescents' health [11]. Urbanization, industrialization and motor vehicle pollution have led to a greater exposure to environmental pollutants such as particulate matter (PM<sub>2.5</sub>) and nitrogen dioxide. There is significant association between environmental exposure and respiratory diseases. New research findings show a greater prevalence of asthma, bronchitis and chronic respiratory symptoms in teens exposed to increased levels of air pollution [12]. Chronic exposure has also been associated with impaired lung function and increased risk of infections [13]. Poorer households in low-income countries are also affected by indoor air pollution from smoking, mould and inadequate ventilation [14]. Environmental factors impact on general health too. Young people exposed to pollution commonly report fatigue, headaches and decreased immunity [15]. Recent research has also found that environmental factors can indirectly impact mental health and well-being via sleep and physiological stress responses [16]. Fencing climate change has also contributed to increased health risks for youth via heatwaves and contact with allergens [17]. Although this has been well studied, there is a lack of evidence about the effects of interacting environmental exposures on adolescent health. Studies often examine single pollutants or select health outcomes, which hampers a holistic approach to understanding multiple exposures and effects. Further research is needed to provide localized data and longitudinal research into long-term impacts [18,19]. These knowledge gaps need to be addressed to design tailored interventions and policies to safeguard young people's health.

## 3 Types of Environmental factors

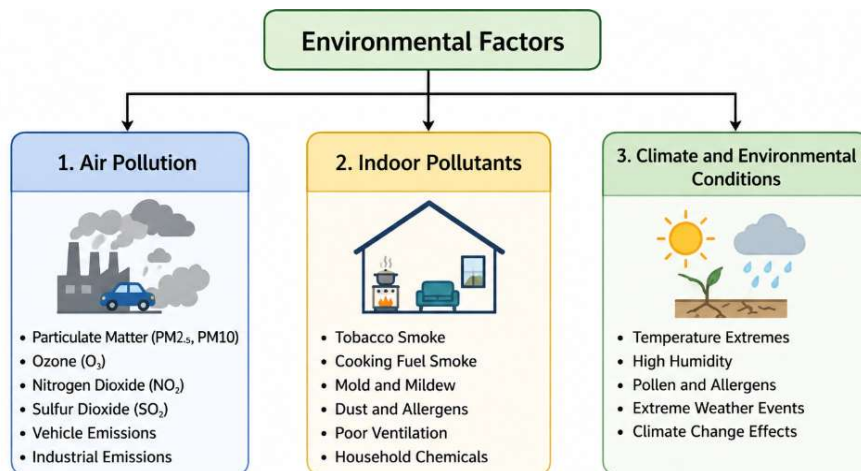


Figure 1: Types of Environmental Factors

Figure 1 shows the types of environmental factors which impact on children's respiratory and general health. These can be further divided into air pollution, indoor air pollutants and climate and weather factors. Air pollution factors such as particulate matter, nitrogen dioxide, and motor and industrial emissions have direct impacts on respiratory health and respiratory disease risk. Indoor pollutants, including cigarette smoke, chemicals, mold, and inadequate ventilation, also

play a significant role in health issues, particularly in indoor environments. Environmental factors such as extreme temperatures, humidity, allergens, and impacts of climate change also pose additional health risks, by enhancing exposure to pollutants. This figure shows the way all of these contribute to our health, particularly of adolescents, and the importance of better managing and raising awareness of issues to minimize exposure and make our environments healthier.

**3.1 Conceptual Frameworks** The study is built upon the conceptual frameworks of Environmental Health Model and Exposure–Outcome Relationship. These concepts are illustrated in figure 2, where they describe how exposures impact on the biological mechanisms of humans and go on to impact on adolescent health.

### 3.1 Conceptual Frameworks

The conceptual framework for this study is grounded in the Environmental Health Model and the Exposure–Outcome Relationship. As shown in figure 2 these frameworks explain how environmental exposures influence biological systems and ultimately affect health outcomes among adolescents.

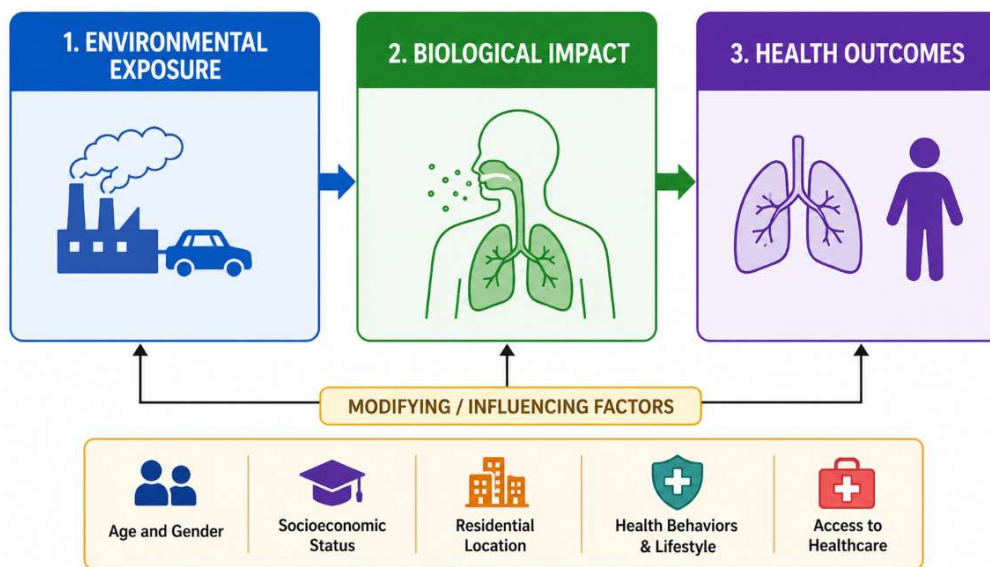


Fig.2. Conceptual model

The Environmental Health Model highlights the relationship between the environment and health. This model proposes that exposure to environmental agents (such as air and indoor pollutants, temperature, and climate change) can disrupt the body's normal processes. This can have a greater impact on teenagers because of their immature lungs. The Exposure–Outcome Relationship also highlights the relationship between the duration of exposure and health outcomes. Increasing exposure to pollutants can lead to a greater risk of damage to biological systems, including airway inflammation, reduced lung capacity and impaired immune system.

## 4 Methods

### 4.1 Study Design

A cross-sectional design was used to study the relationship between environmental exposure and respiratory or general health of adolescents. This study design is suitable for measuring exposure and health outcomes concurrently in a population at a particular point in time. It provides a useful method for identifying links between environmental and health factors [20].

### 4.2 Population and Sample

We included adolescents (13-19 years old) from schools and neighborhoods. Using convenience sampling, a total of 200 (n=200) participants were recruited (as shown in table 1). To ensure gender representation, both boys and girls were represented. Adolescents from different socio-economic classes were targeted to account for different exposure levels.

**Table 1: Demographic Characteristics**

Variable	Category	Percentage
Age	13–15	45%
	16–19	55%
Gender	Male	50%
	Female	50%

#### 4.3 Data Collection

This chapter details the results on environmental factors' effects on respiratory health and general health issues among adolescents. Results for 200 subjects were used to examine the impact of exposure. The outcomes reveal strong associations between environmental risks and respiratory symptoms and health issues. These connections are depicted using tables and figures, offering a detailed picture of the impacts of environmental hazards on young people.

#### 4.4 Data Analysis

Data were analyzed using software like SPSS. Data on demographic variables and levels of exposure were described using descriptive statistics (frequencies, percentages, means). Inferential statistical methods like the chi-square test and correlation analysis were used to assess the associations between environmental exposure and health effects. Data were presented in tables and graphs for interpretation. This data analysis approach increases the reliability and validity of the results [21].

## 5 Results & Discussion

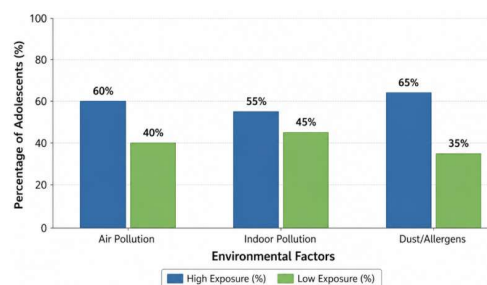
This section presents the findings on the impact of environmental factors on respiratory and overall health among adolescents. Data from 200 participants were analyzed to assess exposure levels and associated health outcomes. The results highlight clear patterns between environmental exposure and the prevalence of respiratory conditions as well as general health issues. Tables and figures are used to illustrate these relationships, providing a comprehensive understanding of how environmental risks affect adolescent health.

#### 5.1 Environmental Exposure Levels

**Table.2. Exposure to Environmental Factors**

Environmental Factor	High Exposure (%)	Low Exposure (%)
Air Pollution	60%	40%
Indoor Pollution	55%	45%
Dust/Allergens	65%	35%

The majority of adolescents reported the risk factors were in high levels especially dust/allergens (65%) and air pollution (60%) in table 2. This suggests exposure to environmental hazards is common among the population, which could have negative health effects.



**Figure.3. Environmental Exposure Levels**

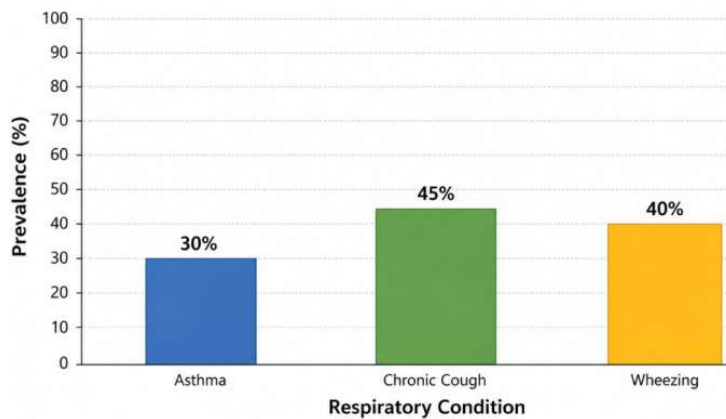
The figure.3 clearly illustrates the high exposure to environmental pollution among adolescents, with air pollution and dust being the major environmental pollutants.

### 5.2 Respiratory Health Outcomes

**Table.3. Respiratory Health Conditions**

Condition	Prevalence (%)
Asthma	30%
Chronic Cough	45%
Wheezing	40%

There was a prevalence of respiratory conditions among adolescents with chronic cough (45%) and wheezing (40%) being the most common. As indicated in table 3 Asthma prevalence (30%) also shows an association between the environment and respiratory health problems.



**Figure.4. Respiratory Health Outcomes**

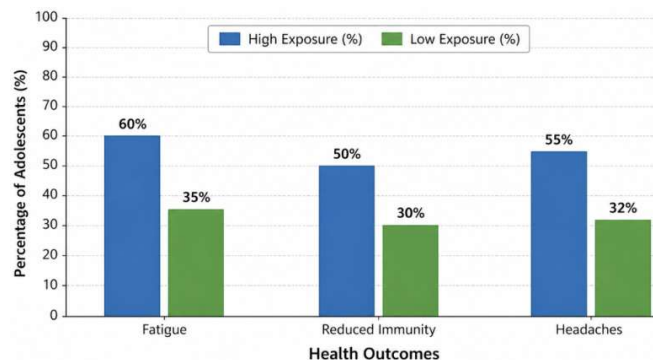
The figure 4 shows the prevalence of respiratory conditions among adolescents. Chronic cough is the most common at 45%, followed by wheezing at 40%, while asthma is reported by 30%. This suggests that cough-related symptoms are more widespread than asthma, with wheezing also affecting a significant proportion of adolescents in this dataset.

### 5.3 Overall Health Outcomes

**Table.4. General Health Effects**

Health Outcome	High Exposure (%)	Low Exposure (%)
Fatigue	60%	35%
Reduced Immunity	50%	30%
Headaches	55%	32%

Teens exposed to high environmental exposure felt more fatigued, suffered from headaches, and had a lowered immunity seen in table 4. This shows that environmental factors do not only have an impact on respiratory health but also general well being.



**Figure.5. Overall Health Impact**

The figure 5 shows that adolescents with high exposure report worse health outcomes than those with low exposure. Fatigue affects 60% versus 35%, reduced immunity 50% versus 30%, and headaches 55% versus 32%. This indicates a clear association between higher exposure levels and increased physical health problems among adolescents overall.

#### 5.4 Discussion

This study shows a link between the environment and respiratory, as well as general health in adolescents. Increased exposure to environmental pollutants (air pollution, indoor pollutants, and allergens) was associated with greater incidence of respiratory symptoms such as asthma, persistent cough and wheezing. Exposure to increased environmental risks was also associated with increased symptoms of fatigue, headaches and decreased immunity. These findings are supported by current evidence showing the impact environmental factors have on adolescents due to the physiological changes that occur during development. The research also highlights the potential risk from exposure to multiple environmental factors. In summary, the study highlights the need to enhance environmental quality and adopt preventive measures for optimal health.

## 6 Conclusion and future scope

This research shows that the environment plays an important role in respiratory health and other health-related aspects of adolescents. The study demonstrates that elevated levels of environmental factors like air pollution, indoor pollutants, and exposure to environmental allergens increase the risk of respiratory conditions (including asthma, wheezing and chronic cough). Furthermore, exposure to these environmental hazards also leads to more general health problems, such as fatigue, headache and impaired immunity, which affect adolescents' overall health and well-being. The findings also show the susceptibility of adolescents to environmental risks because of their immature systems. The findings highlight the importance of measures to mitigate environmental risk, such as improving air quality, indoor ventilation and raising awareness. A safer environment for adolescents should be prioritised by schools and families. In terms of future work, more longitudinal studies are needed to study the long-term effects of environmental exposure. Studies are also needed to explore regional variability and interactive effects of the pollutants. Also, sophisticated monitoring tools and policy interventions can be used to better control adolescent health risks.

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