

# Breathe In, Breathe Out: Asthmatics and Environmental Challenges in Grand-Lome, Togo

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**Abstract:-** Over recent decades, interest in the impact of climate change and air pollution on respiratory conditions has significantly increased. Despite this attention, patients, as a vulnerable group, remain relatively uninformed about the potential links between climate, pollution, and their health. This study aimed to assess the perception of asthmatics in Togo regarding the relationship between climatic variables, air pollution, and the severity of their asthma attacks. Conducted in healthcare centers in the Grand-Lome regions, the survey revealed a predominance of young adults, mainly males aged 18 to 30 years. Most participants have attained an education level ranging from high school diploma to bachelor's degree, but a significant portion has an education level below high school diploma. Regarding knowledge about climate change and air pollution, a quarter of participants have no knowledge on the subject, while a minority possess an advanced level of knowledge. Nearly half of the participants attribute their asthma attacks to climate and pollution, with critical periods being the dry season, rainy season, and harmattan, with major triggers including heat, exhaust fumes, and dust. The majority of participants use charcoal and firewood as cooking energy sources, exacerbating asthma symptoms. Although 60% of participants regularly visit healthcare centers for asthma control, nearly 40% do not, citing social beliefs that asthma is a spiritual disease and should be treated in convents or prayer places. Financial constraints also contribute to non-attendance. Among those who experienced at least 10 attacks in the last 12 months, over half have no knowledge of climate change and air pollution, mainly within the under 30 age group, highlighting the need for targeted awareness and intervention programs for this demographic.

**Keywords :-** Perception, Climate Variability, Air pollution, Asthmatic, Togo.

## I. INTRODUCTION

By the end of the 21st century, a global temperature increase of 1.5°C to 4.8°C is likely to have a negative impact on climate, human health, and the economy [1]. Consequently, the human health sector is one of the most vulnerable sectors to climate change, given that weather events (heatwaves, storms, droughts, floods, and wildfires) strain the already fragile healthcare system in less developed countries [2]. Additionally, individuals with respiratory diseases will be affected by extreme weather conditions [3]. According to the same authors, these climate variabilities and changes coupled with deteriorating air quality will exacerbate morbidity and mortality associated with respiratory diseases, including asthma. In 2019, 4.1 million deaths were attributed solely to ambient air pollution, while indoor air pollution from cooking with polluting fuels caused approximately 2.3 million deaths during the same period [4].

The World Health Organization (WHO) defines asthma as a chronic lung condition that affects people of all ages. It is caused by inflammation and constriction of the muscles around the airways, making breathing more difficult. Approximately 300 million people worldwide suffer from asthma, and according to the WHO, 495,000 people die from asthma each year, with prevalence in Africa ranging from 4% to 22% depending on the country [5].

Asthmatics, being among the most vulnerable, find themselves somewhat helpless in the face of this public health emergency, which often hinders their well-being. Understanding and addressing these issues are therefore crucial, and asthmatics must actively engage with them. Accordingly, investigating the effects of climate variability and change on the environment and their impact on respiratory diseases could provide additional insights to improve the daily lives and public habits of asthmatics. This study aims to address the current misunderstandings of asthmatics regarding the potential impacts of climate on their health by thoroughly exploring the specific aspects of the link between climate change, air pollution, and respiratory diseases. The goal is to inform concrete measures to mitigate

these impacts and promote a more fulfilling daily life despite their environment.

## II. METHODOLOGY

### A. Study Area

The Grand-Lomé region provided the geographical setting for this study. It is in the extreme southwest of the country, along the coastline of the Gulf of Guinea, and is home to the capital of the country (Figure 1). With an estimated population of 2,188,376 inhabitants in 2022 [6], Grand-Lomé enjoys a Guinean climate and experiences two rainy seasons. The main one starts in April and ends in July, followed by a lesser season beginning in September and ending in late November. The average maximum temperature under shelter is 30°C in the afternoon, and the average minimum temperature is 23°C in the morning. From December to February or March, the Harmattan, a dry wind from the Sahara, sometimes blows, bringing the morning temperature down to 19°C. The region's rainfall amounts to approximately 900 mm per year. Maintaining the Integrity of the Specifications

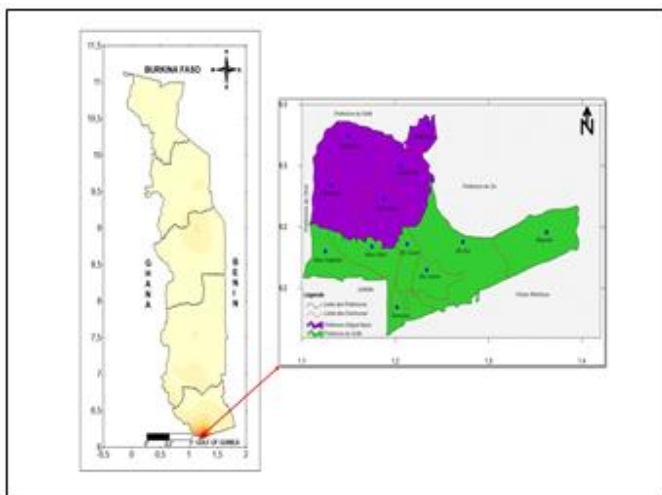


Fig 1 : Study Area

### B. Target Population

The target population of this study mainly comprises asthmatics from the Grand Lomé region. The population size to be surveyed was based on a mixed approach involving retrospective and prospective searches. The retrospective search involved examining the registry of asthmatics for whom contact details were available. The prospective search involved surveying asthmatics who presented directly for consultation at the pulmonology, pediatrics, and internal medicine departments. For this study, questionnaires were distributed to a sample of asthmatic patients from the Grand-Lomé region.

### C. Estimation of Sample Size

To determine the number of individuals to survey, we used the following SCHWARTZ formula (Equation 1):

$$n = \frac{z^2 * p(1-p) * N}{z^2 * p(1-p) + (N-1)e^2} \quad (1)$$

Where :

- n is the minimum sample size to survey for obtaining significant results;
- z is the confidence level, i.e., the 95th percentile of the normal distribution (z=1.96);
- N: size of the target population (N=575)
- p = Initial level of proportion for a population characteristic (p =0.5);
- e = the margin of error, typically set at 5%.

Thus, by substituting the values into the formula, we find n=230, which rounds up to 288 individuals to survey. Due to non-responses, we increase this number to a total of 275 and got 250 responses.

### D. Ethical Considerations

The Increasingly, surveys raise a number of ethical issues. These issues relate to individuals' right to privacy, the necessity of obtaining informed consent, and the responsibilities involved in disclosing potential health problems during a survey. It was therefore important to consider these principles from the outset of the survey.

Thus, confidentiality was maintained throughout the survey. Recordings were securely stored and did not contain any names. Respondents were informed of the interview contents and the measures taken. They understood the procedures and gave their full approval. Informed consent was sought from each respondent, and interviews were conducted in private. To obtain respondents' consent, a consent form was read and explained to them before we started.

### E. Statistical Analysis

In this study, the online tool Google Forms via tablets was used for data collection. Data collected in the field were exported to Excel software for cleaning and processing. Data cleaning is the first fundamental step in the data preparation process. It involved identifying errors, missing values, outliers, syntax errors, irregularities, etc., in a dataset and correcting them to ensure that only high-quality and clean data are used for analysis.

## III. RESULTS

### A. Profile of Participants and Their Level of Knowledge on Climate Change and Air Pollution

This section summarises the socio-professional characteristics of the respondents as well as their level of knowledge on climate change and air pollution (Table 1).

The distribution by gender of the surveyed patients shows a predominance of males, representing 57.1% of the sample, while females represent 42.9%. 84.5% of the respondents have an education level ranging from high school diploma to master's degree. This indicates a certain degree of formal education within the sample. However, it is concerning to note that 13.5% of patients have an education level below high school diploma, which may limit their access to information on environmental factors related to asthma and their understanding of associated risks. The most represented

age group is 18-30 years old, constituting 78.6% of the sample. This suggests that young adults are particularly affected by asthma in this region.

Regarding their level of knowledge on climate change and air pollution, the results reveal that nearly a quarter 24.5% of patients have no knowledge of climate change and air

pollution. Furthermore, 49% of patients are at a beginner level of knowledge, indicating an urgent need for education and awareness on these issues. Only 6.9% of patients have an advanced level of knowledge, highlighting a lack of deep understanding of the relationship between climate variability and respiratory diseases among asthmatic patients in the region.

Table 1: Profile of Surveyed Patients

Gender Distribution of Surveyed Patients					Total
Distribution by sex					
Male		Female			
57.1%		42.9%			100%
Age Group Distribution of Surveyed Patients					
Age (year)	[0-17]	[18-30]	[31-40]	[41-50]	>50
Proportion	1%	78.6%	13.4%	4.7%	2.3%
Education level of surveyed patients					
< Bachelor's degree					13.5%
[Bachelor-master's degree]					84.5%
> Master's degree					2.2%
Knowledge level of asthmatic regarding climate change and air pollution					
Beneficiaries					39,2%
Non-beneficiaries					60,8%
level of knowledge about climate change and health					
None					24.5%
Beginner					49%
Intermediate					19.7%
Advanced					6.9%

*B. Perception of the Link Between Asthma Attacks and Climate Change and Air Pollution*

Nearly half of the participants (49.5%) believe that their discomfort or asthma attacks are attributable to climate and pollution. However, it is noteworthy that a significant

proportion (13.8%) of participants reject this idea and believe that their discomfort or asthma attacks are not related to climate and pollution. Finally, approximately 38.7% of participants responded with "Don't know" to the question.

Table 2: Influence of Climate Change and Air Quality on Asthma Attacks

Do you think your discomfort/asthma attacks are also attributable to climate and pollution?		
Yes	No	Don't know
49.5%	13.8%	38.7%

*C. Perception of Asthma Exacerbation Periods and Trigger Factors*

The survey results among asthmatic patients in Togo reveal a significant trend regarding the time of year when discomfort or asthma attacks are most pronounced (Table 3). The dry season appears to be the most critical period, with 45.8% of participants reporting an increase in asthma symptoms during this time. Conversely, the rainy season and the harmattan (a dry, dusty wind) are also sensitive periods,

with 16.9% and 37.7% of participants respectively experiencing heightened respiratory issues. Regarding the triggering factors for asthma attacks, heat is identified as the primary trigger, with 54.7% of participants citing this factor. Other triggers include exhaust fumes (49.7%), smoke (36%), and dust (80.2%), suggesting an increased sensitivity to environmental conditions among asthmatic patients in Togo.

Table 3: Asthma-Favorable Periods and Trigger Actors

Period within the year with most asthma hospitalisations						
Rainy season	Dry season	Harmattan	Heat period	Cold Period	High humidity	
16.9%	45.8%	37.77%	61.9%	32.6%	11.9%	
Asthma triggering factors						
Heat	Cold	Bush fire	Fume	Exhaust Wind	Gas	Dust
54.7%	36%	32,3%	42.6%	49.7%	30%	80.2%

**D. Cooking Energy Sources and Building Cooling Systems**

The survey conducted among asthmatic patients in Togo reveals important information about cooking energy sources and building cooling systems, which are potential environmental factors that can influence asthma symptoms (Table 4).

Natural gas is the most used cooking energy source, accounting for 74.4% of responses. Charcoal is also widely used, with 59.3% of participants indicating it as their cooking energy source. These results suggest that the combustion of

these fuels may contribute to indoor air pollution, which can worsen asthma symptoms in patients.

In terms of Building Cooling Systems, fans are the most widely used cooling system, with 65.3% of participants reporting their use. However, only 22.1% use air conditioners, and an even smaller proportion use room humidifier 4.2%.

These results suggest that indoor temperature and humidity conditions can vary significantly, which may also impact asthma symptoms.

Table 4: Cooking and Ventilation Sources

Cooking energy source					
Gas	Charcoal	Wood	Petroleum	Other	
74.4%	59.3%	13.4%	18.8%	0.7%	
Building cooling system					
Fan	Air conditioner	Bedroom humidifier	None	Other	
65.3%	22.1%	4.2%	18.8%	1.9%	

**E. Attendance at Healthcare Centers for the Control and Management of Asthma**

The results of this survey among asthmatics in Togo reveal an interesting pattern regarding attendance at healthcare centers for asthma control.

Approximately 60% of participants stated that they attend healthcare centers for the control of their asthma. This suggests good medical care and a willingness to undergo regular treatment to control the disease.

However, nearly 40% of participants reported that they do not attend healthcare centers for the control of their asthma. This could be concerning as regular medical follow-up is essential for effective asthma management.

attendance at health centers for asthma monitoring and control, their cooking energy source, as well as their age group for a better understanding of factors associated with their asthmatic experience.

The results of this survey, specifically focusing on asthmatics who have experienced at least 10 crises in the past 12 months, provide crucial information on several aspects related to asthma management and associated environmental factors.

Regarding the level of knowledge about climate change and air pollution, it is concerning to note that a significant proportion of participants (53.8%) report having no knowledge on these subjects. This underscores an urgent need for education and awareness, especially among populations most affected by asthma, to better understand the links between these environmental factors and respiratory health.

Table 5: Attendance Rates at Healthcare Centers by Asthmatics

Do you attend care centers for managing your asthma?	
Yes	No
50.1%	40.9%

Results concerning regular attendance at health centers reveal a positive trend, with over half of the participants (54.8%) reporting regular consultations at these establishments for asthma monitoring and control. This indicates an awareness of the importance of medical monitoring in disease management and may contribute to improving symptom management.

**F. Zooming in on asthmatics who have experienced at least 10 crises in the past 12 months**

In this section, we focus our attention on a specific subgroup of asthmatics who have experienced at least 10 crises in the past 12 months. We assess their level of knowledge regarding climate change and air pollution, environmental variables that could potentially influence their respiratory condition. Additionally, we explore their regular

Regarding the cooking energy source, a large majority of participants (85%) use charcoal and firewood. This cooking method is associated with incomplete combustion,



which can lead to increased indoor air pollution and worsen asthma symptoms.

Regarding age distribution, it is noteworthy that most participants (75%) fall within the age group of 0 to 30 years.

This information can guide awareness programs and interventions aimed at improving asthma management and reducing associated environmental risks in this specific population.

Table 6: Profile of Asthmatics Who have Experienced at Least 10 Crises in the Past 12 Months

Level of knowledge of asthmatics about climate change and air pollution			
None	Beginner	Intermediate	Advanced
53.8%	26.8%	14.4%	5.6%
Do you regularly attend health centers for the monitoring and control of your asthma?			
Yes		No	
54.8%		45.2%	
Cooking energy source			
Gas		Charcoal and firewood	
15%		85%	
Age group			
[0-30]	[31-40]	[41 and above]	
75%	15%	10%	
Level of knowledge about climate change and health			
None		24.5%	
Beginner		49%	
Intermediate		19.7%	
Advanced		6.9%	

#### IV. DISUSSION

The results obtained from this study have led to significant findings that deserve thorough discussion. Indeed, the analysis of these results has shed light on several crucial aspects related to asthma crises and environmental factors.

The results of this study have revealed that asthma is a condition that affects all age groups. According to the Global Initiative for Asthma [7], the disease is prevalent across all age groups and affects approximately 300 million people worldwide, causing 250,000 deaths annually.

The predominance of men, particularly in the age group of 18-30 years, in the studied sample can be partly attributed to socio-cultural factors and beliefs. Men, being more involved in professional activities, are often exposed to polluted urban and industrial environmental conditions as well as intense physical activities, which can affect their health. Additionally, their higher utilization of healthcare facilities could also be explained by their greater financial means and workplace health insurance coverage, facilitating easier access to healthcare facilities. In contrast, women, sometimes due to lack of financial means or spiritual beliefs, may prefer traditional or spiritual practices for asthma treatment.

Although several studies, including those by [8], reveal that asthma can be exacerbated by environmental factors such as air pollution or climate change, a significant proportion of the surveyed asthmatics either reject or remain uncertain about this potential link. This could be attributable to a lack of awareness and education regarding the severity of the effects of climate change and air pollution on respiratory health. This underscores a lack of access to information, gaps in

educational programs, or linguistic and cultural barriers. Moreover, the very low proportion of participants with advanced knowledge levels highlights a general lack of comprehensive understanding of the links between climate change, air pollution, and respiratory diseases, which may require increased efforts to promote environmental education and understanding of associated health risks.

However, when asked to identify the periods favorable for exacerbating their asthma crises and triggering factors, the results indicated increased sensitivity to environmental conditions, especially heat and dust, which are identified as the primary triggers of asthma attacks. The dry season is also highlighted as a critical period, which may be linked to increased air pollution and weather conditions conducive to the spread of allergens. Extreme heat and high humidity have been shown to trigger asthma symptoms, and prolonged exposure to sunlight increases the formation of tropospheric ozone, a potent lung irritant that can trigger asthma and respiratory disease mortality. Furthermore, changes in meteorological parameters significantly increase respiratory morbidity and mortality among adults with common chronic lung diseases such as asthma and other serious lung diseases. Moreover, cyclones have also been linked to asthma exacerbations.

An overview of the cooking energy source and building cooling system used by asthmatics reveals a predominance of the use of charcoal and firewood. The widespread use of charcoal and firewood as cooking energy sources can contribute to indoor air pollution, thus aggravating asthma symptoms. Similarly, the low usage of air conditioners and room humidifiers can lead to temperature and humidity variations indoors, which can affect respiratory health.

According to [9], air pollution (both indoor and outdoor) is the most significant environmental risk factor, responsible for 6.7 million deaths worldwide in 2019, including 373,000 in Europe. Greenhouse gases and air pollutants share the same major sources, such as the combustion of fossil fuels and biomass (notably wood and coal for energy production, heating, cooking, etc.). Additionally, a systematic review by [10] found that the link between indoor air chemical pollutants and respiratory manifestations appears strengthened.

In summary, these results highlight the importance of awareness, education, and access to healthcare for effective asthma management, especially in the context of environmental challenges such as climate change and air pollution.

## V. ADAPTATION STRATEGIES FOR ASTHMATICS

Adaptation strategies used by asthmatics vary depending on various factors such as their environments and available resources. Here are some commonly used strategies:

The adaptation strategies employed by asthmatics vary depending on factors such as their environments and available resources. Here are some commonly utilized strategies: avoiding densely populated areas and smoke, regularly wearing face masks in polluted or dusty environments, donning warm clothing during cooler weather, seeking consultation with specialists to identify and mitigate risk factors, staying hydrated during hot temperatures, carrying asthma medications regularly, dampening floors before sweeping to reduce dust, using fans judiciously, covering the head and ears before bedtime to prevent morning chill-induced asthma attacks, maintaining and improving living spaces, limiting outdoor activities during periods of high heat, dust, and dry weather, and ensuring regular visits to healthcare centers for monitoring and management.

## VI. RECOMMENDATIONS

As recommendations from the study, it is advised to implement several measures for the effective management of asthma. Firstly, asthmatics should be encouraged to monitor weather forecasts, enabling them to anticipate days with poor air quality or weather conditions that may worsen their symptoms. This proactive approach allows them to take necessary precautions or adjust their routines accordingly. Secondly, there is a pressing need to raise awareness among the general population about the importance of early asthma screening and consistent follow-up care in healthcare centers. It's crucial to dispel misconceptions surrounding asthma, emphasizing that it is not predetermined fate or a "mystical" illness. Thirdly, healthcare professionals should receive training to incorporate climatic factors into their treatment approaches, leading to more comprehensive patient care and follow-up. Lastly, it is recommended to establish a screening mechanism and provide free or subsidized care to support asthmatics in managing their condition effectively. These

recommendations aim to enhance asthma management strategies and improve overall patient outcomes.

## VII. CONCLUSION

The findings of this study shed light on significant aspects related to asthma crises and environmental factors. The prevalence of asthma affects individuals across all age groups, with a notable predominance of young adults aged 18 to 30 in the studied sample. This demographic trend could be attributed to various socio-cultural factors and beliefs, where men, primarily engaged in outdoor activities and exposed to urban and industrial pollution, are more susceptible to asthma symptoms. Additionally, their better access to healthcare facilities due to financial means and workplace healthcare coverage might facilitate their regular medical visits compared to women, who sometimes resort to spiritual or traditional practices for asthma treatment due to financial constraints or cultural beliefs.

While studies have highlighted the exacerbation of asthma by environmental factors such as air pollution and climate change, a significant proportion of surveyed asthmatics reject or remain uncertain about this potential link. This underscores the urgent need for environmental education and awareness, particularly among the most affected populations, to better understand the connections between these environmental factors and respiratory health.

Regarding periods favorable to asthma exacerbation and triggering factors, participants exhibited heightened sensitivity to environmental conditions, particularly heat and dust, identified as the primary triggers. The dry season emerged as the most critical period, potentially due to increased air pollution and favorable conditions for allergen propagation. Extreme temperatures and prolonged sunlight exposure were also associated with increased asthma symptoms, corroborating findings from previous studies.

Analysis of cooking energy sources and building cooling systems among asthmatics revealed a prevalence of charcoal and firewood usage, contributing to indoor air pollution and exacerbating asthma symptoms. Moreover, limited usage of air conditioners and humidifiers may result in temperature and humidity variations indoors, impacting respiratory health.

In summary, these results underscore the importance of awareness, education, and access to healthcare for effective asthma management, especially in the context of environmental challenges like climate change and air pollution. Adaptation strategies for asthmatics must prioritize environmental education, access to healthcare services, and interventions targeting specific demographic groups to mitigate the adverse effects of environmental factors on respiratory health.

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