

ANALYSIS OF THE RELATIONSHIP BETWEEN ASTHMA AND CLIMATIC ELEMENTS IN ORLU ZONE, IMO STATE, NIGERIA

¹David Miracle Okorochukwu*; ¹Nwabueze, I. Igu and ²Ngozi and V. Okolo

¹Department of Geography and Meteorology, Nnamdi Azikiwe University, Awka

²Department of Environmental Management, Nnamdi Azikiwe University, Awka

*Corresponding author: abrammiracle@yahoo.com

Abstract

This study examined the relationship between asthma disease and climatic element in Orlu zone. Reported asthma cases for the period of fifteen years were acquired from Imo State University teaching hospital Orlu, while the weather data of the area were acquired from NIMET for the same period of fifteen years. Data were analyzed using frequency distribution tables and trend analysis in Statistical Package for Social Science (SPSS) and Microsoft Excel, while the distribution of asthma disease across the area was mapped with ArcGIS 10.3 software. It was observed that the total number of asthma cases was higher (215 cases) in the raining season than the dry season which recorded 168 cases. This showed that asthma cases in Orlu zone (from 2005 to 2019) to be more prevalent in the raining season although still very significant in the dry season; with the highest reported asthma cases recorded in the month of May. Average temperature for the period of study indicated a significant increase of approximately 9.3°C at the rate of 0.63°C per year, rainfall indicated a significant increase of approximately 118.5mm at the rate of 7.9mm per year, while Average Relative Humidity indicated an insignificant decrease of approximately 169.5% at the rate of 11.3 % per year. Furthermore, the regression analysis further revealed enough evidence to accept the Alternate hypothesis affirming that there is significant relationship between asthma disease and climatic elements in Orlu Zone. (Sig. F Change 0.000 at 0.05 significant Level). The study recommended among others that every asthmatic patient should be prepared for asthma attack at all time, but much cautious during cold weather when the incidence is at its peak.

Keywords: Asthma, climate, disease, seasons, tropical, weather.

INTRODUCTION

The environmental conditions produced by different weather parameters are known to impact the quality of the surrounding ecosystem. Asthma is one of those health conditions which is induced and aggravated by changes in weather and climate. Luber, (2014) revealed that asthma is exacerbated by changes in pollen season and allergenicity and in exposures to air pollutants affected by changes in temperature, and humidity. Cecchi, (2010) further suggested that increase in the intensity and frequency of heavy rainfall and storminess over decades is likely to be associated with spikes in aeroallergen concentration and the potential for related increases in the number and servility of allergic illness. According to Cookson (1999), Asthma is an inflammatory disease of the small airways of the lungs. It is characterized by the intermittent airway narrowing and airflow obstruction that leads to symptoms of wheeze and shortness of breath.

Chabra, Gupta (2021) stated that asthma is both a generic and environmentally induced condition which is one of the fastest killers. Asthma attack can be triggered by environmental factors as Amato, Liccardi, Amato (2000) pointed out that some environmental factors previously proposed to explain the increased global prevalence of asthma include increased air pollution. Furthermore, Amato et al., (2014) further revealed that climate change increases water and air pollution which can cause and aggravate chronic respiratory disease, such as asthma. Hence, this environmental induced asthma attack causes the airway tubes of the lungs to swell, making breathing difficult because the wall of the airway becomes narrow, hence, allowing less air get in and out of the lungs, thereby inducing coughing, wheezing and shortness of breath. According to Koskela (2007), physiologically, air temperature and humidity affect lung function, because cold air can trigger symptoms of asthma by

helping to evaporate surface fluid in the airway. According to Bedirhan Ustun, Chatterji, Mechbal, Murray (2003) World Health Survey (WHS) on asthma championed by the World Health Organization (WHO) estimated the global burden of asthma in adults to be 4.3%, while Skrepnek and Skrepnek, (2004) observed that asthma affects nearly 300 million people globally and 11% of the United States (US) population. This indicates that asthma prevalent is very significant globally. Meanwhile in Nigeria according to Musa, and Aliyu (2014), revealed that out of the 300 million cases of asthma worldwide, Nigeria accounts for about 15 million. This should create more worry in the society because, asthma is of a public health concern as it causes infirmity, depletes scarce health resources, and reduces the quality of life of affected individuals (Musa and Aliyu, 2014). The major issue in our society today is not only the high rate of increase in asthma disease but also the fact that in terms of asthma management, our society focuses more on medicals without putting much concentration on other environmental issues that triggers asthma. As a result, climatic elements that also contribute to the disease are being neglected. Many asthma patients does not have asthma disease in their gene but developed it as a result of environmental issues (Jenna Fletcher 2019). Worst of it is that Asthma cannot be cured though can be managed (WHO 2020), which implies that it is not less serious than HIVAIDS. This therefore elucidates the need to carry out more research on asthma especially on the area of its causation of which this study has focused. Hence, this research examined the relationship between asthma and selected climatic elements (Temperature, Rainfall and Relative Humidity), by analyzing the reported asthma cases and weather condition of the same time from 2005 to 2019 in Orlu zone, Imo State. In order to achieve the above aim, the following objectives were considered and carried out (i) Analyse the bio-data of the reported asthma patient (ii) Analyse the variation of temperature, rainfall and relative humidity data within the period of fifteen years in the area, (iii) Examine hospital reported Asthma cases in the area within the period of fifteen years (iv) Examine the relationship between the occurrence of asthma attack and variation of temperature, rainfall, and relative humidity in the area

Materials and Methods

Study Area

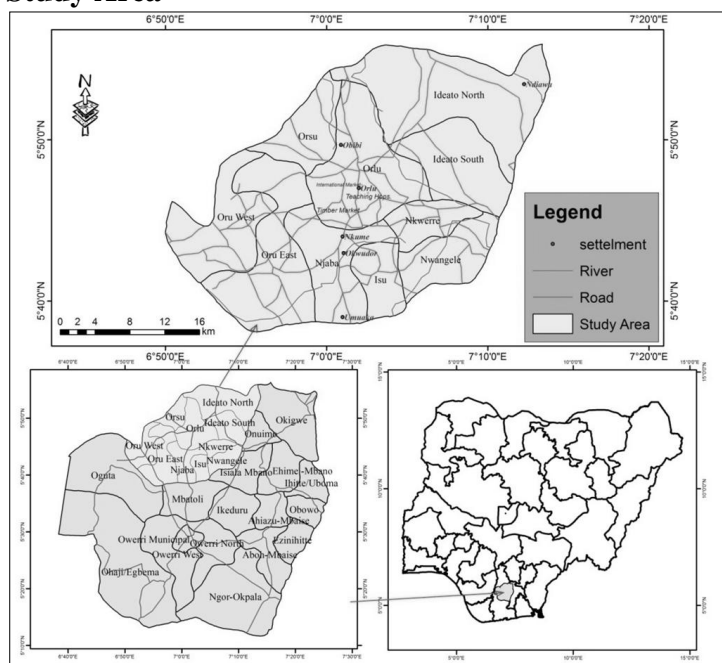


Figure 1: The Map Of Orlu zone (Study Area) and inset map of Nigeria and Imo State.
Source: GIS Lab, Imo state University, Owerri

The study area for this research is Orlu zone in Imo State in Nigeria. Orlu is the First largest city in terms of spatial extent in Imo State followed by Owerri then Okigwe as third. Orlu zone consist of twelve local government areas Orlu, Orsu, Isu, Oru West, Oru East, Njaba, Ideato North, Ideato South, Oguta, Nkwere, Ohaji/Egbema, and Nwangele, thus, in considering proximity to the

Hospital, the study was narrowed to the LGAs that are much closer to the Hospital which include: Orlu, Orsu, Isu, Oru West, Oru East, Njaba, Ideato North, Ideato South, Nkwere, and Nwangele. The area is geographically located at Longitude 6.662E -7.121E and Latitude 5.274N -5.949N (fig 1). It is bordered by Okigwe and Owerri on the East, River Niger and Delta State to the West, Anambra on the North and Rivers State to the South. Orlu Zone is in the rain forest belt of Africa. The area has a wet tropical climate according to the Koppen-geiger system of classification hence; it rains in most months of the year. However, it is pertinent to note that the density of rain forest vegetation has drastically reduced due mainly to anthropogenic activities such as urbanization, deforestation and agricultural activities. The residents of Orlu Zone also experience a brief dry season that is accompanied by harmattan though less pronounced when compared to many other Nigerian cities. The average temperature is 26.4 °C and average precipitation of 363mm (Climate-Data.org., 2016). The people of Orlu are mainly civil and public servants. However, a large number still engage in primary activities such as agriculture which is common in places such as Njaba, Ideato, Orsu which are popularly known for basket making etc.

Method of Data analysis

The data used for this study includes the following: **Weather data** (Temperature, Rainfall and Relative Humidity) from 2005-2019. This data were acquired from NIMET

Records of asthma disease: This includes the number of recorded asthma cases in the hospital within the period of fifteen years included also are the bio data of all asthma patients from 2005 to 2019 and their location addresses. This data was acquired from Imo University Teaching Hospital Umuna Orlu, Imo State.

Results and Discussions

Analysis of Hospital Reported Asthma Cases in Owerri Urban Within Fifteen Years

Fifteen years cases of asthma disease were collected from Imo State University teaching Hospital in the study area alongside the age, gender of the patients and the date of hospital admission.

The Bio-data of the Patient

The Bio-date of the patient such as sex, age, was examined as shown in Tables 1 and 2.

Table 1: Bio-data of the reported asthma patients

Gender	Frequency	Percentage (%)
Male	190	49.6
Female	193	50.4
Total	383	100.0

Source: Researchers field work

It is shown in Table 4.1 that more than half (50.4%) of the reported asthma patients were female while the male amount to 49.6% of the total reported asthma cases in Orlu zone. This reveals that female suffer asthma disease more than the male in the area. However, the gender difference in this study is not very significant yet it agreed with Akinbami et al,(2011) who also revealed that among the U.S. population, females have a higher prevalence of asthma than male.

The Age of the Asthma Patients

The age distribution of the reported asthma patient were summarized and presented in Table 2 below.

Table 2: Age of the reported asthma patients

Age Bracket	Frequency	Percentage (%)
0-14	90	23.5
15-24	69	18.0
25-34	89	23.2
35-44	79	20.6
above 44	56	14.6
Total	383	100.0

Source: Researchers field work

From Table 4.2, it was observed the majority (23.5%) of the patients were children, followed by youths which amount 23.2% and lastly the older people 14.6%. Therefore, this suggests that asthma disease is mostly prevalent among the children in Orlu zone. This agreed with the findings of Skrepnek and Skrepnek (2004) and Akinbami et al., (2011) in US that children have a greater prevalence of asthma than adults. The population that is most vulnerable to having an urgent visit related to asthma were children.

Monthly Distribution of Asthma Disease in the Study Area

Daily asthma cases for fifteen years were captured from the hospital’s medical record. The data were further summarized by months.

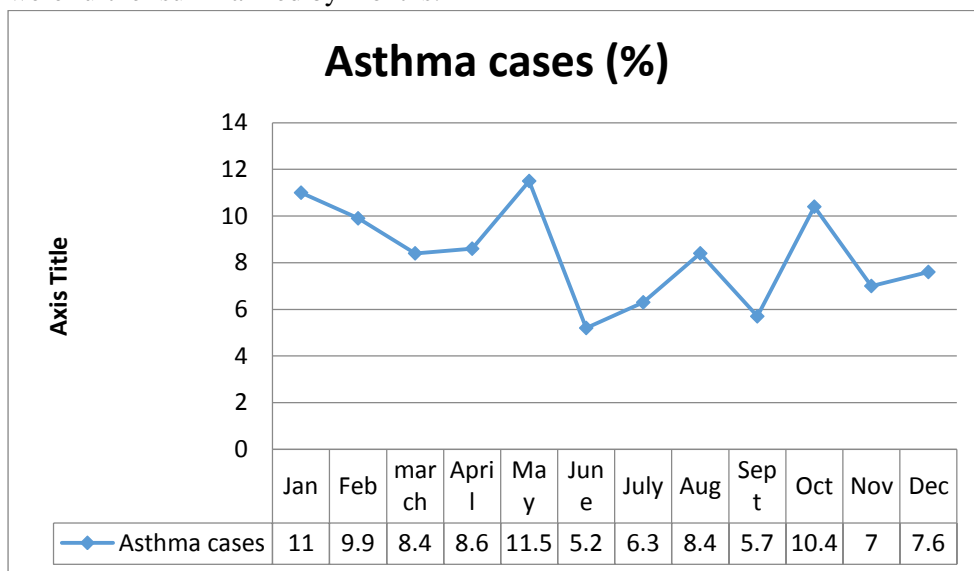


Fig 1: Monthly Distribution of asthma diseases from 2005 to 2019

Source: Researchers field work

As shown in Table 1, the highest (11.5%) cases of asthma disease were recorded in May followed by Jan (11%) while the least (5.2%) asthma cases were reported in June. The finding reveals that asthma disease is very significant in both raining and dry season.

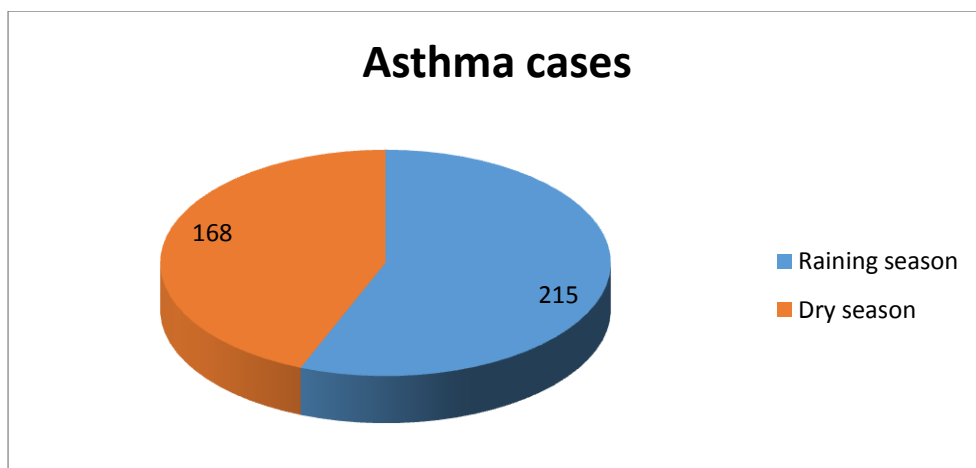


Fig 2: Seasonal reported asthma cases in the study area
 Source: Researchers field work

From fig. 2 it was observed that the total number of asthma cases was higher (215 cases) in the raining season than the dry season which recorded 168 cases. This therefore shows that asthma cases in Orlu zone from 2005 to 2019, is more prevalent in the raining season although still very significant in the dry season. Hence, this agrees with the findings of Edelu, Eze, Ayuk, Oguonu (2016) who found that more children with exacerbation were admitted during the rainy season months of May and June, while the dry season month of December and January recorded lower number of asthma. Olufemi (2011) also revealed that bronchial asthma was more common in the wet season than the dry season; similar result was reported in a retrospective review of asthma cases in Ibadan, Nigeria (Behera, Dash, Malik 1988).

Asthma and Weather.

Table 3: Monthly distribution of asthma cases and weather parameters

Month	Rainfall (mm)		Mean Temperature (C)		Mean Humidity	Relative	Number of Asthma cases	
	mm	%	(C)	%	Freq (%)	%	No.	%
Jan	233.40	0.7	404.50	8.3	739.50	6.1	42	11.0
Feb	536.70	1.7	424.00	8.7	777.80	6.4	38	9.9
Mar	1399.80	4.4	423.85	8.7	817.00	6.7	32	8.4
Apr	1931.10	6.1	419.15	8.6	963.50	8.0	33	8.6
May	3498.30	11.0	411.95	8.5	1074.50	8.9	44	11.5
Jun	3821.70	12.0	396.15	8.1	1120.00	9.2	20	5.2
Jul	4675.80	14.7	388.10	8.0	1248.00	10.3	24	6.3
Aug	4952.20	15.6	386.05	7.9	1240.50	10.2	32	8.4
Sep	5534.30	17.4	393.30	8.1	1233.00	10.2	22	5.7
Oct	3801.30	12.0	398.00	8.2	1143.00	9.4	40	10.4
Nov	1032.20	3.2	421.95	8.7	925.00	7.6	27	7.0
Dec	371.80	1.2	402.95	8.3	833.50	6.9	29	7.6
Total	31788.60	100.	4869.9	100.0	12115.30	100.0	383	100.0

Rainfall (B=-0.005, pValue = .011), Temperature (B=0.684, pValue = 0.000)

Asthma Relative Humidity (B= 0.079, pValue = 0.00),

Model Total R and Rsquare=.383^a and 0.147, Df1 = 3, Df2= 176, P-Valu= 0.00

Source: Researcher’s field work

Table 3 revealed that the highest (44) number of asthma cases were recorded in the months of May. This month is known to be the middle of raining season. This finding reveals that more asthma patients reports to hospital during raining season. Furthermore, the second highest (42) number of asthma cases within the fifteen years of study was captured in January. Thus, this can be attributed to the harmattan cold and atmospheric dust which characterizes the period. The regression analysis shows that the p-value for rainfall = 0.011 at 0.05 significant level shows that there is enough evidence to prove that there is relationship between rainfall and Asthma disease in Orlu zone. Also, the p-value for Temperature = 0.000 at 0.05 significant level shows that there is enough evidence to prove that there is relationship between temperature and Asthma disease in Orlu zone. Lastly, the p-value for Relative Humidity = 0.000 at 0.05 significant level shows that there is enough evidence to prove that there is relationship between Relative Humidity and Asthma disease in Orlu zone. Therefore, regression analysis showed enough evidence to accept the Alternate hypothesis affirming that there is significant relationship between asthma disease and climatic elements in Orlu Zone. Also, it was revealed that the coefficient of determination (R square) is 0.147 therefore; about 14.7% of the variation in asthma disease can be explained by weather parameter Thus, this supports the findings of Luber, (2014) that asthma is exacerbated by changes in pollen season and allergenicity and in exposures to air pollutants affected by changes in temperature and humidity. Another study in Italy which found positive correlations between asthma and pollens, molds, wind speed, rainfall, air pollution with peaks in the fall and spring (Ruffoni , Passalacqua , Ricciardolo , Furgani , Negrini , De Amici, 2013). This further explained that weather has both direct and indirect relationship to asthma. In some cases like heavy rainfall, apart from the associated cold which is not good for asthmatic, it can also promote pollens, thunder storm; etc which triggers asthma faster.

Furthermore, the effects of seasonal shifts on incidence of asthma and other respiratory diseases, often depend on the degree of ambient temperatures rise, heat waves and excessive rainfall, as well as the impact of these changes on other health-relevant factors, such as air pollution, allergens and moulds (Olufemi 2011). In Orlu zone, subsistence agriculture is practiced, the rainy (wet) season is mostly used for planting of crops, and some other cultural activities are very strategic in this same raining season. As a result, agricultural and social activities provides the opportunity for some people to get in exposed to some climatic element associated with raining season which can induced or trigger asthma. In high income countries in the Northern hemisphere as well as in Australia and New Zealand, asthma exacerbation in children is said to peak during the early autumn (September),(Pauwels, Pedersen, Busse 2003) which is associated with lots of wind and heavy rainfall driving pollen and respiratory viruses. In our study, the peak presentation occurred in May which is also associated with heavy rainfall and wind with the high prevalence of viral respiratory infections. Tan (2004) revealed that Heavy rainfall associated with thunder has also been associated with increased prevalence of asthma exacerbation.

Conclusion and Recommendation

Asthma disease is both genetic and environmentally induced. This study analyzed the relationship between asthma and climatic element in Orlu zone which revealed that there was a significant increase of mean temperature and Rainfall and average Relative humidity. Furthermore, asthma cases which were more prevalence among children and female in the area was also revealed to be higher in the raining season within the fifteen years of the study. Thus the findings revealed that there is a significant relationship between asthma and the climatic elements studied. Hence, weather is a good element to predict asthma disease in Orlu zone. As a result, the following recommendations were made:

- i) People should avoid exposing bodies during raining season and harmattan period so as to avoid developing asthma and its trigger
- ii) Parents should take note and adhere to the preventive medical precaution on their children to avoid them from asthma disease.
- iii) Every asthmatic patient should be prepared for asthma attack at all time with their inhaler especially during cold weather.
- iv) For further study, the relationship between asthma and other climatic elements like Thunder storm, wind speed and direction etc can be studied.

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