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Malaria Morbidity in Akure, Southwest, Nigeria: A Temporal Observation in a Climate Change Scenario

A.O. Ayeni

Department of Geography, University of Lagos, Akoka, Lagos, Nigeria

ABSTRACT

Nigeria is located primarily within the lowland humid tropics and generally characterized by a high temperature throughout the year. Record shows that malaria accounted for over 45% of all out-patients and about 50% of the Nigerians suffer from at least one episode of malaria each year. Over the years, the increase in population, rainfall fluctuation and urban heat cum high thermal discomfort that has been experiencing recently and the problem of unhygienic environment are noted to have contributed to the increase in malaria morbidity in Akure. This study based on an evaluation of the existing framework on malaria incidence using meteorology data between 1986 and 2008 and hospital records between 2000 and 2008 as well as relevant field studies. Malaria cases increased from 24,092 (of which male and female accounted for 12,477 and 11,615 respectively) in year 2000 to 62,121 (of which male and female accounted for 30,413 and 31,708, respectively) in year 2008. It was noted over the area that, the rainfall trend has reduced by -0.008 cm annually (the highest and lowest rainfall was received in 1997 and 2003 respectively within the 23 years studied). Temperature shows little deviation but on the average decreases by -0.002°C (the year 1994 and 1995 experienced highest temperature while 2007 recorded the lowest). Also, malaria morbidity index shows an increase of 0.005 annually between 2000 and 2008. The study also discusses various future climate change scenario associated risks in Akure if the issue is not well addressed at appropriate time.

Key words: Climatic variables, malaria, trend, morbidity, Akure, Nigeria

INTRODUCTION

Extreme weather events are becoming more intense, more frequent and having impact on infectious disease as the world climate changes (Colwell *et al.*, 1998; Adeyemi, 2000; Epstein, 2002). Global climate change may be a major contributor of infectious diseases, although their spreads are multi-causal. Weather and climate can influence host defenses, vectors, pathogens and habitat (Epstein, 2002). Temperature and rainfall are climatic causal factor of diseases and a small change in temperature and rainfall are unlikely to have a significant impact on the spread of disease (Epstein *et al.*, 1998; Bate, 2004). Small *et al.* (2003) found that rainfall, rather than temperature, was the primary forcing factor in malaria transmission trends in Africa during most of the twentieth century.

Research finding estimates that between 150,000 and 160,000 excess deaths are caused every year by human-enhanced climate change (WHO, 2003; Doyle, 2003; Bate, 2004). Bate (2004) stated that some of these deaths occur in the developed world but the majority was attributed to the developing world. Diseases such as malaria, yellow and dengue fever have increased in frequency and distribution in the last decade and due to climate change, the number of excess deaths is projected to have doubled by 2020 (Attaran *et al.*, 2000; Reiter, 2008; Bate, 2004).

Malaria is known to be endemic in the tropic (Evangard and Sauerborn, 2009). At least, most of today's human malaria population *P. falciparum* and *P. vivax* may have had their origin in West Africa and Central Africa respectively (Joy *et al.*, 2003). Its common symptoms are headaches, weakness, fever, aches, pains, high body temperature, bitterness of the mouth, loss of appetite, nausea and vomiting. It is a serious disease affecting children and adults but its consequences are graver among children and pregnant women (UNICEF, 2000; Van-Geertruyden *et al.*, 2004). Nigeria is known for a high prevalence of malaria (Federal Ministry of Health, 2001; Onwujekwe *et al.*, 2000) and it is a leading cause of morbidity and mortality in the country (Federal Ministry of Health, 2001). Available records show that at least 50% of the population of Nigeria suffers from at least one episode of malaria each year and malaria accounts for over 45% of all out-patients visits (Federal Ministry of Health, 2001; Ejezie *et al.*, 1991). It was reported that malaria prevalence (notified cases) in 2000 was about 2.4 million (Federal Ministry of Health, 2001) and responsible for an estimated average annual reduction of 1.3% in economic growth for the countries with the highest burden, Nigeria inclusive (Onwujekwe *et al.*, 2000). Therefore, it imposes a great burden on the country in terms of pains and trauma suffered by its victims as well as loss in outputs and cost of treatments (Onwujekwe *et al.*, 2004).

MATERIALS AND METHODS

The study area: Akure town is the capital of Ondo State, Nigeria and the major dominating town of Akure South Local Government. It lies between longitude 5°06'E to 5°38'E (i.e., 727500 to 755000 Easting) and between latitude 7°07'N to 7°37'N (i.e., 790000 and 815000 Northing) in the Southwestern Nigeria (Fig. 1). It is bounded by Owo Local Government Area in the east, Akure North and Ifedore Local Government Areas in the north, Ile-Oluji/Oke-Igbo Local Government

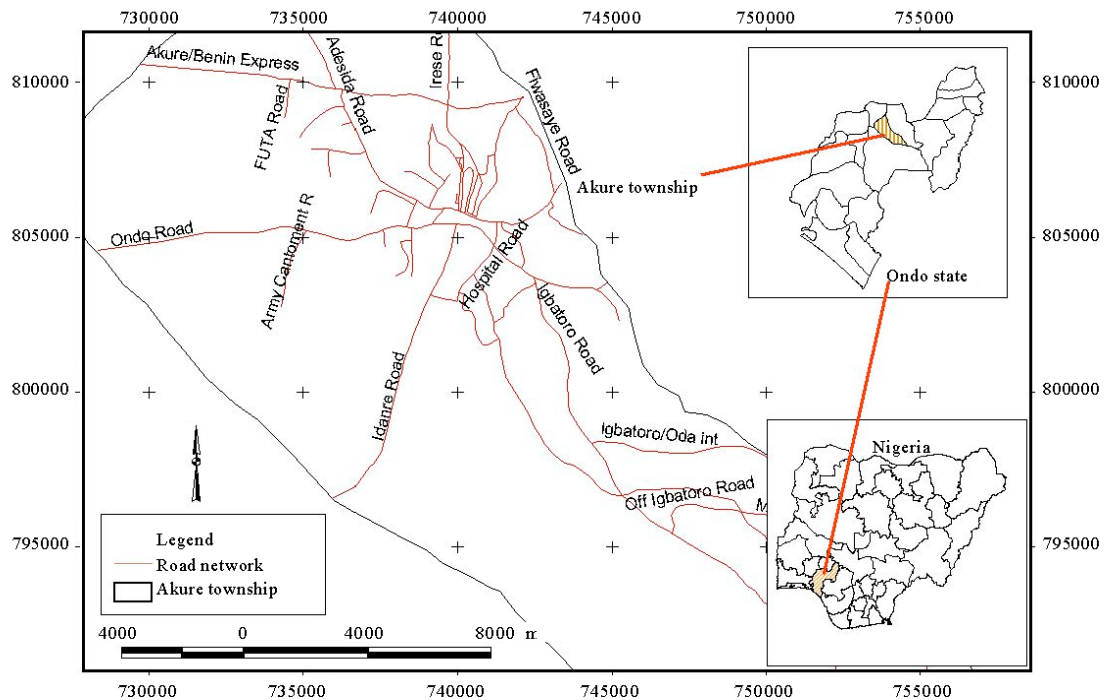


Fig. 1: Akure township

Area in the west and Idanre Local Government Area in the south. The people of Akure are of the Yoruba ethnic group and have population of about 353,211 as at 2006 (Federal Bureau of Statistics, 2007). Akure and its environs experience a frequent annual rainfall of over 1500 mm with a short August break. The average temperature is about 22°C during harmattan (December-February) and 32°C in March. The vegetation is tropical rainforest and drained by River Ala and its tributaries (Barbour *et al.*, 1982; Iloeje, 1977; Uluocha and Ekop, 2002).

Methods: Existing climatic elements data (monthly rainfall and temperature) generated over Akure between 1986 and 2008 was use to determine temporal climatic index. On the other hand, malaria morbidity data between 2000 and 2008 were use to determine the trend of malaria morbidity. Socio-economic surveys instrument was used to evaluate the relationship between human, environment and malaria causal factors in Akure, Southwestern, Nigeria. Rainfall data were collected from Nigerian Meteorological Agency (NIMET), Akure Airport unit in which the data are kept on daily reading from their meteorological station while hospital records on both malaria In-patients and Out-patients (includes male and female) were collected from Ondo State Specialist Hospital, Akure. Interview were conducted with 10 Health Care Officers (Medical Doctor and Health Inspection Officers) from ten selected hospital (Public and private) in Akure to understand their views on major factor responsible to have been promoting the breeding and the spread of malaria vector (mosquitoes). In order to generate information on residents view about the causes of increase in malaria morbidity in Akure, 75 questionnaires were spatially administered of which 71 were completed and retrieved. Also, relevant text and journals were consulted for the study.

Index analysis which shows both positive and negative dispersion/disparsity that exists between the variables (Rainfall, temperature and malaria morbidity records) from the mean was employed for inferential statistics analysis. The results of questionnaires were analyzed descriptively.

RESULTS

In Akure town, the highest rainfall was received in 1997 while 2003 had the lowest rainfall within the 23 year studied. Rainfall index show a decrease of -0.008 cm yearly from the intercept depicting more dryness with a consistent low rainfall trends (Fig. 2). On the other hand, the year

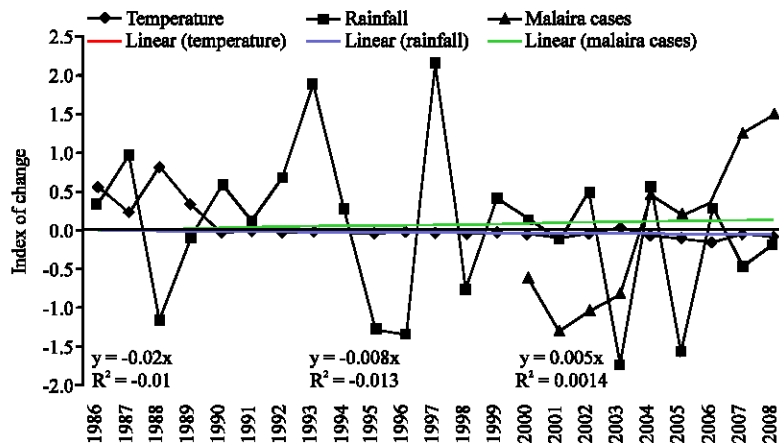


Fig. 2: Index of temperature, rainfall and malaria cases in Akure, Southwest Nigeria. Source: NIMET, Akure unit and State Specialist Hospital, Akure (2009)

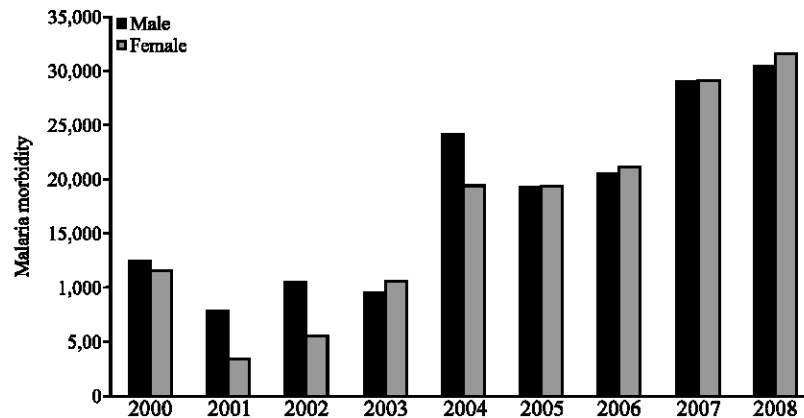


Fig. 3: Temporal Disparity of Malaria Morbidity among Gender in Akure, Southwest Nigeria.
Source: State Specialist Hospital, Akure (2009)

1994 and 1995 experience highest temperature while 2007 recorded the lowest temperature of 21.42°C. The temperature index also shows a decrease of 0.002°C annually (2). It was observed that the years that received low rainfall (1988, 1995, 2003 and 2007) recorded high temperature of over 26°C except 1996. The available data shows that malaria morbidity was generally low before 2004. The reported cases increase from 43,533 in 2004 to about 62,121 cases in 2008. The malaria morbidity index revealed an increase of 0.005 annually between 2000 and 2008.

Figure 3 compares the temporal trend of malaria morbidity among genders between 2000 and 2008. It was discovered that male were mostly affected by malaria in year 2000, 2001, 2002, 2004 and 2007. Female were mostly affected in the year 2003, 2005, 2006 and 2008. The margin was quite lower in 2005, 2006 and 2007 compared to wide margin in 2001, 2002 and 2004.

The Health Care Officers argued that, dirty environment, climatic inconsistency, non-availability of treated mosquito nets, infrequent uses of insecticides in the individual house were the factors promoting malaria morbidity. About 43.66% (31) of the respondents agreed that climatic factors determine the magnitude and/or causes of malaria morbidity. For instance, the respondents believed that malaria morbidity increases yearly between February and April. They observed that March usually marked the hottest period of the year while April marked the onset of raining season. About 29.57% (21) attributed the causes and increase of malaria morbidity to dirty and unsanitary environment while the remaining 26.76% (19) attributed the increase in malaria morbidity to non-availability of treated mosquito nets and infrequent uses of insecticides by many households in the area.

It was observed in Akure that, about 40.48% (29) of the respondents had bushes in their close vicinity, 59.15% (42) respondents had no bushes in their close vicinity. About 60.56% (43) of the respondents have stagnant water within their close vicinity while 39.43% (28) claimed no stagnant water within their close vicinity. Only about 11.08% (10) of the respondents claimed to have access to public dumping sites of about 500 m to their residents while 85.91% (61) dispose their households waste indiscriminately in an open space, drainage channel among others.

DISCUSSION

The finding of this study shows that although climatic parameters had influence on malaria transmission (i.e., there is a relationship) but, human immediate environment is the major factors

influencing the high rate of malaria morbidity in Akure. This is in contrary with Njuguna *et al.* (2009) where they observed in their study on the trends in malaria morbidity in the low risk Kenyan district that temperature is a major climatic factor influencing the transmission of malaria. Bate (2004) argued that the recent increase in mosquito-borne disease (malaria) may have resulted from poor advice from the WHO and national health policies failure in the tropical countries. Indiscriminate disposal of waste (e.g., perishable and non perishable items) and improper drainage system (which includes abandoned reservoirs, covered and uncovered gutters as well as stagnant water) are also known to be the contributory factors to the proliferation of mosquitoes that cause malaria morbidity (Afolabi *et al.*, 2006). For instance, result reveals that about 87.32% of the sampled populations in Akure Township have experienced malaria diseases. This is quite high compared to the findings of Aribodor *et al.* (2003) who had reported and Umeanaeto and Ekejindu (2006), who reported 76% prevalence in Azia, Anambra State-Nigeria and 46% prevalence in Nwewi, Anambra State-Nigeria respectively. The spread of infectious diseases such as malaria is multi-causal but could be influenced by global climate change or climatic variability directly or indirectly (Patz, 2000; Woodruff *et al.*, 2002; Evengard and Sauerborn, 2009).

However, based on the above fact, the finding of this study is consistent with the findings of Pietro and Ceccato *et al.* (2007) study in part of Eritrea and Guofa *et al.* (2004) study in East Africa Highland where they observed a relationship between malaria incidence and climatic anomalies (temperature and rainfall). Weather and climate can influence host defenses, vectors, pathogens and habitat, nevertheless, disease such as malaria could be spread even without excessive rainfall and temperature but extreme rainfall and temperature increases the likelihood of its high morbidity (Reiter, 2001; Epstein, 2002; Bate, 2004).

Expected risk in a climate change scenario: Increase in human population and continuous emissions of greenhouse gases into the atmosphere from cars, power plants, land use and other sources will determine the rate at which our climate will change and the kind of safe future environment our next generation will live. Unexpected and precarious infectious diseases may be the earliest biological expressions of underestimated of rate of climate change and insensitive to biological systems if this scenario is not address properly in Sub-Sahara Africa especially Nigeria (Walther *et al.* (2002). Nevertheless, examining climatic variables associated with infectious diseases will go a long way in anticipating associated future risks and direct our attentions at observations (Epstein, 2002).

CONCLUSION

Malaria has been a major disease in the tropics especially Sub-Sahara Africa. From the finding about 87.32% (62) of the respondents argued that at least a family member experienced malaria illness within six months in a year. Although, researchers opinions reveals that rainfall and temperature are the major causal factor that determine the spread of malaria but little changes in climate as in the case of Akure will likely have no discernible influence on the spread of diseases mortality like malaria. Comparatively, little climate changes is not imperative as compared with other factors, such as improvements in housing and medical technology and public health awareness. The increase in population of Akure, Southwestern Nigeria over the years and the problem of unhygienic environment (Indiscriminate disposal of waste and poor drainage system) has contributed to the increase in malaria cases in Akure.

In conclusion, Climate change will worsen the situation in Akure if the trend depicted in figure 2 and 3 continued while the spread of many climate change related diseases remains the foreseen implication in the area. Although, it was recorded that during the 20th century the average temperature in Africa rose by around 0.7°C while annual rainfall declined in some regions, nevertheless it is difficult to make predictions about future climate change in the area since vast climatic data is not available.

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