Changing weather factors implication on the prevalence of malaria in Ado-Ekiti, South west, Nigeria

By
A Akinbobola., J Bayo Omotosho and E.C Okogbue

Presented by A. AKINBOBOLA

Department of Meteorology and Climate Science,
School of Earth and Mineral Sciences,
Federal University of Technology, Akure.

E-mail: aakinbobola@futa.edu.ng, desmondbobola@gmail.com
• Introduction
• Facts and figures about Malaria
• Research questions, aim and objectives
• Methodology
• Results
• Further work
• Conclusion
• Recommendation
Introduction


- Whoever wishes to investigate medicine properly, should proceed thus:
  -- Consider the seasons of the year;
    -- what effects each of them produces.
    -- Then the winds, the hot and the cold.
Many of the major killers diseases are climate sensitive. Each year:

-- Undernutrition kills 3.7 million
-- Diarrhoea kills 1.8 million
-- Malaria kills 1.1 million

Each of the above is highly sensitive to temperature and precipitation (WHO 2007)
The health effects of changing weather and climate include:

--Temperature-related illness and death
--Extreme weather-related health effects
--Air pollution-related health effects
--Water and food-borne diseases
--Vector-borne and rodent-borne diseases
Facts about malaria

- 40% of world’s population at risk
- World Health Organization (WHO 2007) estimates
  1. 300-500 million/year diagnosed
  2. 2,000,000 deaths/year
  3. 90% of deaths in sub-saharan Africa
  4. Nearly \( \frac{3}{4} \) of deaths are children under 5
  5. Roughly 1 African child dies every 30 seconds!
Scientific questions

- What is the state of the art of the disease early warning system?

- How is variation in occurrence of the disease linked with weather/climatic factors?

- How should the disease prevention and control be linked to changing weather and climate?

- How helpful are time series methods in forecasting the disease?
Aim and objectives

- **AIM.**
  - To describe malaria occurrence in response to changing weather/climate and develop forecasting models for this disease.
Objectives

- To assess the effects of selected weather parameters on malaria disease in Ado and establish if any correlation exists between them.

- To study the variations in the occurrences of this disease linked with weather/climatic factors.

- To develop early warning systems for this disease and discuss the implications for prevention and control towards effective and enhanced healthcare delivery system.
Possible gains

- Improved understanding of the changing effects of climatic factors on malaria prevalence

- High community awareness of individual actions will be in place to reduce climatic change related mortality

- Development of disease-climate models leading to:
  -- Improved Prevention and control capability for better health care delivery
Possible gains CONTD

- More effective collaboration and coordination at the national and local levels between health and meteorological services
Methodology
Fig 3: Map of Nigeria showing the station used for the study
Climate of the study area

- The climate over the area of study is tropical wet and dry climate.
- It experiences a bimodal rainfall of May, June, July (MJJ) rainy season which peaks in July and September –November (SON) rains which peak in September.
- A brief dry spell is experienced in August.
- The long dry spell setting in mid/late December to late February/early March.
Methodology

- Two types of data were used, namely medical records and weather/climate records.
  -- Medical records.
    * Monthly numbers of malaria cases
* for years (2005-2012) were obtained from standard government hospitals located in the city.
Methodology Contd

- Meteorological records;
  * Monthly values of;
    - maximum and minimum temperature (°C)
    - relative humidity (%),
    - rainfall (mm)
  for the same period and stations from the Nigerian Meteorological Agency (NIMET) Oshodi, Lagos.
Data Quality Control

- The cumulative mass curve technique was used to test the homogeneity of the data
Methodology

- Mean monthly, seasonal trends of the variables were computed.

- Correlation were found between the Medical and Meteorological variables to identify any relationship before further analysis.
Methodology

Temperature and relative humidity threshold

- There were various numbers of this disease occurrence under different temperature and relative humidity.
- Based on this behaviour, a temperature range of 2°C was assumed against relative humidity range of 20%.
- The number of disease occurrences was classified into the temperature and relative humidity threshold they assume.
Results

$T_{\text{max}}$ and RH threshold for malaria in pregnancy
Results

- These figures indicate that between this temperature range of (30.1-32) and relative humidity range of (60.1-80) there were 6700 number of malaria cases recorded for pregnant women.
- While about 87 number of malaria cases were recorded at temperature between 34.1-36 and relative humidity of between (80.1-100) % which shows that at (30.1-32)°c of temperature and (60.1-80) of relative humidity favours the prevalence of this disease.
Results

Tmax and RH threshold for malaria in children more than 5 years
Results

- The figures show that of people 5yrs and above in the station, it shows that at (36.1-38) of temperature and (60.1-80) of relative humidity about 80 cases of malaria were recorded.
- At (28-30) of temperature and (60.1-80) of relative humidity about 53500 cases of malaria incidence were recorded.
Results

*Tmax and RH threshold for malaria in children less than 5 years*
Results

- At (30.1-32) of temperature and (60.1-80) of relative humidity, malaria cases recorded for children below 5 yrs was about 72000. While at (34.1-36) of temperature and (60.1-80) of relative humidity, we have very reduced number of malaria cases recorded within this threshold.
Further work

- Climate drivers of malaria
- Rainfall: provides breeding sites for larvae.
- Temperature: larvae growth, vector survival, egg development in vector, parasite development in vector.
- Relative Humidity: dessication of vector.
- Wind: Advection of vector, strong winds reduce CO2 tracking.
- >2 bites are required to pass on the disease:
Further work

- VECTRI: VECtor-borne disease community model of ICTP, TRIeste
Further work

- A model for the impact of weather on malaria, with:
  - daily timestep
  - surface hydrology
  - regional to global scales with resolution down to 5km
  - incorporating population interactions (migration, immunity) and interventions (spraying, drugs, bednets).
Further work

Uses:
- Community model
- Research and operational tool
- Seasonal forecasting
- Climate projections
- Further info:
  http://www.ictp.it/~tompkins/vectri
  Tompkins
- A.M. and Ermert V, 2013: A regional-scale, high resolution
dynamical malaria model that accounts for population density,
climate and surface hydrology, Mal. J., DOI:10.1186/1475-2875-12-65
The incidence of malaria is more prevalent especially among the age less than 5 years.
Recommendations

- Daily comprehensive records of reported cases of the diseases should be kept in all the hospitals.

- More meteorological stations should be established.

- Extensive collaborations between climate scientists and medical sciences should be enhanced.
Recommendations
Contd.

- Increasing interest in climate-health links particularly with operational predictions

- Need to raise awareness at all levels
  - students and practitioners to researchers to decision and policy makers