One Health and Vector-Borne Diseases Webinar Series (Webinar #1)

One Health Research Consortium

Project Title: **Enhancing One-health Surveillance and Control of Vector-borne Diseases related to Climate Change in the West Africa region**

Presenter: Prof Rosemary Audu, Director of Research, NIMR

Background

- Climate change remains a major unrecognised threat in Africa.
- It has led to extinction of certain organisms, expansion of others, brought some animals closer to humans & increased risk of zoonotic diseases.
- Diseases transmitted to humans by vectors account for 17% of all infectious diseases.
- Studies demonstrate impact of climate change on the incidence of VBDs.
- Generating meteorological and biological data in hotspot areas are important.
- IPD & NIMR have an MOU and have significant experience in leading research on VBDs (arboviruses).

Study Goal

To jointly undertake a mixed retrospective-prospective research to determine the effect of climate change on VBD emergence, outbreaks and spread in our countries which can be extended to other parts of West Africa.

Objectives

- (a) To collate 10 years retrospective meteorological, climatic, disease prevalence and transmission data on mosquito-borne diseases in Nigeria and Senegal and overlay one with another.
  (b) To conduct prospective research investigating the spatial distribution and habitat characterization of mosquito vectors in relation to climate change in Nigeria and Senegal.

- To develop a joint training platform of human, animal and environmental health workers capable of rapidly detecting and responding to VBD outbreaks in West Africa.

- To strengthen the effective collaboration among our consortium, regional and national organizations to optimize VBD surveillance, prevention and response.

Methodology

- **Deliverable 1:** To conduct one joint applied research investigating the spatial distribution and habitat characterization of vectors in relation to climate change in Nigeria and Senegal applying a mix retrospective-prospective design.

- **Deliverable 2:** To develop a joint training platform of human, animal and environmental health workers capable of rapidly detecting and responding to VBD outbreaks in West Africa

- **Deliverable 3:** To strengthen effective collaboration among our consortium, regional and national organizations to optimize VBD surveillance, prevention and response.

Methodology (retrospective analysis)

- Collect 10-years (2012-2022) national retrospective data on disease prevalence, vector species and transmission dynamics and meteorological information.
- Data will be obtained from Teranga in Senegal and DHIS-2 and SORMAS in Nigeria
- Retrospective epidemiological, transmission and meteorological data collected from each country will be analyzed
- Meteorological data: Weekly climate data (temperature, relative humidity, and rainfall)
- Access from available meteorological stations

Datasets	Full product name	Types Products	Period	Temporal resolution	Temporal resolution	References
ENACS (ANACIM)	Enhancing National Climate Services	Stations+Satellite	1970-2022	0.5° x 0.5°	Daily	Temporal resolution
WFDEI-CRU	WATCH Forcing Data ERAInterim (WFDEI) corrected using Climatic Research Unit (CRU)	Reanalysis	1979-2018	0.5° x 0.5°	3hours/day	Weedon et al. (2014)
ERA5	European Re-Analysis, 5th Generation	Reanalysis	1979-P	0.25° x 0.25°	4h/day	Hersbach et al. (2020)
CHIRPS v2.0	Climate Hazard group InfraRed Precipitation with Stations v2.0	Satellite	1981-P	0.05° x 0.05°	Daily	Funk et al. (2015)

Table 1: Characteristics of some climatic products.

Methodology (prospective analysis)

- **Study population**: Febrile (≥ 38.0°C) patients attending healthcare facilities who consent to participate.
- **Sample size**: 1200 individuals/ country.
- **Sample collection**: Blood samples will be collected and stored at +4°C and transported within 72 hours to IPD in Senegal and NIMR in Nigeria
- **Sample analysis**:
  - Serological testing will be by ELISA/RDT/PRNT (targeted virus DENV, YFV, CHIKV, or RVFV)
  - Virological by RT-qPCR
  - Positive samples will be sequenced using the MinION platform

Study sites

- Two sentinel sites Matam region (Bokidiawé and Agam-Siwal) will be used.

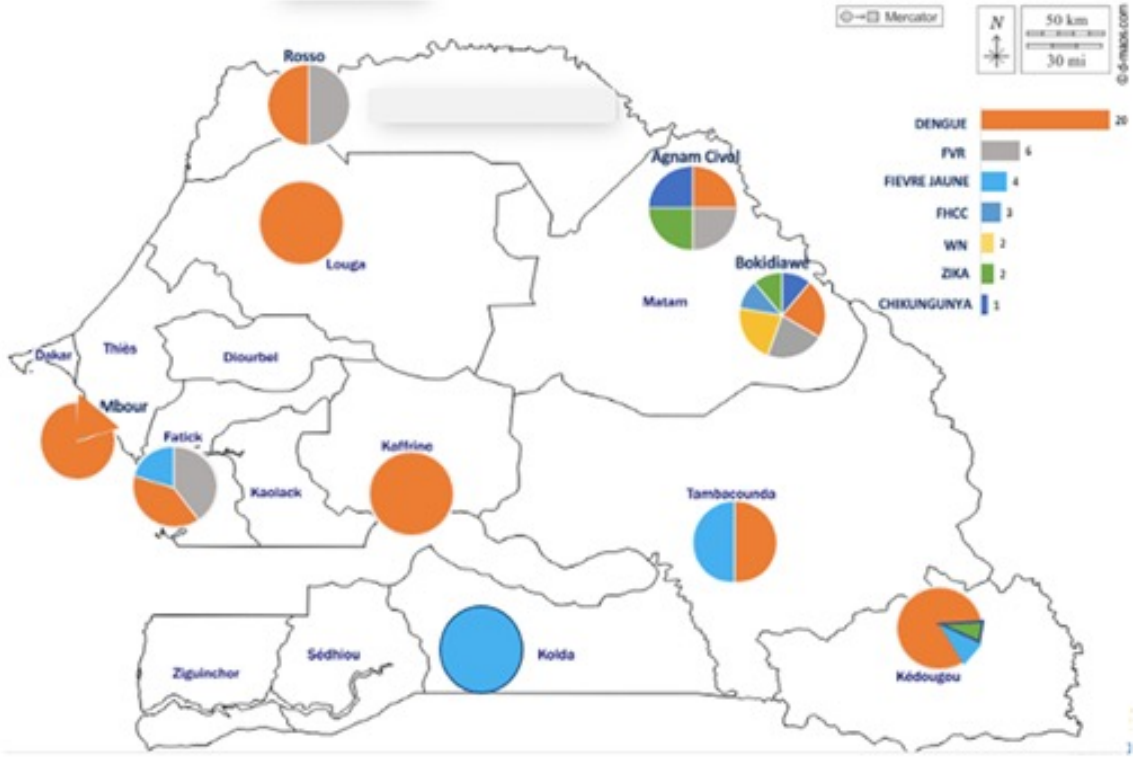

Figure 1: Senegal map with arboviruses detected

- In Nigeria, three health facilities in Ika North-East LGA, Delta State will serve as study sites.

Figure 2: Map of Ika North-East Local Government Area, Delta State, Nigeria

Entomological study

Sample Site Selection

- Dengue, Yellow fever, Zika and Chikungunya viruses' vector
  - Immature and adult stages of mosquitoes will be collected in domestic and peri-domestic environments.
- Rift valley fever vectors collection by specific approach
  - CDC light traps with/without CO2 and/or animal-baited traps.
- **Sample treatment**: collected mosquitoes will be cold-killed and processed according to standard procedures.
- **Mapping of vector breeding habitats**: using Google Maps, GPS and GIS tools
- **Species identification**: All mosquitoes (adult/larvae) will be identified to the genus and/or species level.

Statistical analysis

- **Regression model** - to determine whether the relationship exists or not.
- **Using MaxEnt with maps** - for the distribution of species
- **Generalized linear mixed model** - to describe the relation between the variables and to decide whether the relationship is statistically significant
- **Shannon-Wiener diversity index** (H1) - important information on the rarity and commonness of species in a community
- **Shannon evenness index** (E) - to establish the role of climatic factors in VBD incidence

Potential value of results

1. Creation of high-quality new knowledge in terms of VBDs and climatic parameters
2. Support open science through data and tools
3. Contribute to regional and international pandemic preparedness and response networks
4. Provide a platform and data sources for projects for Masters, Doctoral and postdoctoral researchers (2 MSc and 1 PhD to be generated using data from our project).
5. Promoting the uptake of research and innovation by the scientific community, health systems and industry.

Study Team

Senegal				
Dr Cheikh Talla	M	Institut Pasteur de Dakar	Statistics and data science	Principal Investigator (IPD)
Dr Cheikh Loucoubar	M	Institut Pasteur de Dakar	Statistics and data science	Co-Investigator
Dr Oumar Faye	M	Institut Pasteur de Dakar	Virology and diagnostics	Co-Investigator
Dr Mawlouth Diallo	M	Institut Pasteur de Dakar	Entomology	Co-Investigator
Dr Alioune Gaye	M	Institut Pasteur de Dakar	Entomology	Co-Investigator
Dr Ousmane Faye	M	Institut Pasteur de Dakar	Virology and diagnostics	Co-Investigator
Dr Martin Faye	M	Institut Pasteur de Dakar	Virology and diagnostics	Co-Investigator
Dr Ibrahima Diouf	M	Laboratory of Physics of Atmosphere and Ocean - Siméon Fongang (LPAO-SF) at the polytechnic Higher School	Climate Health	Co-Investigator

Nigeria				
Prof Rosemary Audu	W	Nigerian Institute of Medical Research	Medical Virology	Principal Investigator (NIMR)
Prof Ehimario Igumbor	M	Nigerian Institute of Medical Research	Epidemiology/Public Health	Co-Investigator
Ms Fehintola Ige	W	Nigerian Institute of Medical Research	Cell Biology and Genetics	Co-Investigator
Dr Adedapo Adeogun	M	Nigerian Institute of Medical Research	Entomology	Co-Investigator
Dr Olaide Kareem	W	Nigerian Institute of Medical Research	Veterinary Medicine	Co-Investigator
Dr Olufemi Amoo	M	Nigerian Institute of Medical Research	Cell Biology/Biochemistry	Co-Investigator
Shaibu Joseph	M	Nigerian Institute of Medical Research	Molecular Virology	Co-Investigator
Dr Azuka Okwuraiwe	M	Nigerian Institute of Medical Research	Biochemistry	Co-Investigator
Dr Babalola Ayodele	M	Nigerian Institute of Medical Research	Parasitology/Modelling	Co-Investigator
Qazeem Akinlotan	M	University of Lagos	Parasitology & Bioinformatics	PhD Student
Dr Henry Oshilonyah	M	University of Delta	Public Health Microbiology	Co-Investigator
Dr Gloria Patrick-Ferife	W	Delta State Ministry of Health	Public Health	Co-Investigator

Thank You for Listening