National Institute of Environmental Health Sciences

Development of a new version of the Liverpool Malaria Model. II. Calibration and validation for West Africa

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Abstract:

BACKGROUND: In the first part of this study, an extensive literature survey led to the construction of a new version of the Liverpool Malaria Model (LMM). A new set of parameter settings was provided and a new development of the mathematical formulation of important processes related to the vector population was performed within the LMM. In this part of the study, so far undetermined model parameters are calibrated through the use of data from field studies. The latter are also used to validate the new LMM version, which is furthermore compared against the original LMM version. METHODS: For the calibration and validation of the LMM, numerous entomological and parasitological field observations were gathered for West Africa. Continuous and quality-controlled temperature and precipitation time series were constructed using intermittent raw data from 34 weather stations across West Africa. The meteorological time series served as the LMM data input. The skill of LMM simulations was tested for 830 different sets of parameter settings of the undetermined LMM parameters. The model version with the highest skill score in terms of entomological malaria variables was taken as the final setting of the new LMM version. RESULTS: Validation of the new LMM version in West Africa revealed that the simulations compare well with entomological field observations. The new version reproduces realistic transmission rates and simulated malaria seasons are comparable to field observations. Overall the new model version performs much better than the original model. The new model version enables the detection of the epidemic malaria potential at fringes of endemic areas and, more importantly, it is now applicable to the vast area of malaria endemicity in the humid African tropics. CONCLUSIONS: A review of entomological and parasitological data from West Africa enabled the construction of a new LMM version. This model version represents a significant step forward in the modelling of a weather-driven malaria transmission cycle. The LMM is now more suitable for the use in malaria early warning systems as well as for malaria projections based on climate change scenarios, both in epidemic and endemic malaria areas.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3070689

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: Liverpool Malaria Model

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Meteorological Factors, Precipitation, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Africa

African Region/Country: African Region

Other African Region: West Africa

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: Malaria

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Outcome Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Short-Term (

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content