Update on Modelling work package

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Aim and objectives

Aim

Develop mathematical models and software tools that can support the elimination of VL as a public health problem, and the maintenance of that elimination

Objectives

1. Develop age-time-space based transmission dynamic models, using data from other SPEAK research programmes
2. Use the models to consider the 'minimum surveillance set' of data required to understand VL transmission dynamics and predict epidemics
3. Use the models to evaluate potential changes to interventions, e.g. focal IRS and active case finding.
4. Develop the 'RiskMap' software programme for the short-term prediction of VL outbreaks and long terms changes in risk of lymphatic filariasis
5. Support the development of quantitative capacity within NVBDCP to use these tools

Project activities / deliverables

Objective 1: Age-time-space based transmission dynamic models

- Review and provide a summary of data available for modelling sand fly population dynamics and ecological modelling, and the assumptions and structure of the models (VCRC)
- Model the transmission dynamics in human-parasite-vector (LSHTM/VCRC)
- Extend, parameterize, and validate existing VL transmission dynamic models (LSHTM/VCRC)
- Develop a model of sand fly population dynamics that can be used to predict the impact of sand fly controls (LSHTM/VCRC)

Project activities / deliverables

Obj 4: Develop the 'RiskMap' software programme for the short-term prediction of VL outbreaks and long terms changes in risk of LF

1. Extraction of block level covariates data (environmental, bioclimatic and socio-economic)

2. Explore the association of VL cases with covariates, and predict block level incidence using Integrated Nested Laplace Approximation (INLA)

3. Develop modelling framework to predict the risk of resurgence at block level associated with covariates

Project activities completed

Objective 1: Age-time-space based transmission dynamic models

- Review and provide a summary of data available for modelling sand fly population dynamics and ecological modelling, and the assumptions and structure of the models (VCRC)

  - Reviewed five papers on population dynamics, 28 on ecological modelling and one review paper on transmission model - Nine papers on VL.

  - Draft manuscript prepared and shared with LSHTM for review

Project activities completed

Objective 4: Develop 'RiskMap' software for short-term prediction of VL outbreaks and long terms changes in the risk of LF

1. Extraction of block level covariates data

- Extracted monthly data on climatic and environmental covariates for all the 534 blocks (endemic / non-endemic) in Bihar for the period from Jan 2013 to Dec 2019.

  Environmental data - Land surface temperature **(LST),** Normalized difference vegetation index **(NDVI),** Enhanced vegetation index **(EVI)** and Soil moisture (TerraClim database, MODISTools in R, spatial resolution 4 km)

- **19 Bioclimatic variables** (BIO1 to BIO19, dismo package in R, WorldClim database**)**

Project activities in progress

Objective 4: Develop ‘RiskMap’ software for short-term prediction of VL outbreaks and long terms changes in the risk of LF

- Extraction of covariates data for blocks in Jharkhand, UP and West Bengal - (One month)
- Modelling association of VL cases with covariates, and predict block level incidence using INLA (Integrated Nested Laplace Approximation) – 3 months including write-up)

Project activities to be done

Objective 1: Age-time-space based transmission dynamic models

- Model the transmission dynamics in human-parasite-vector
- Extend, parameterize, and validate existing VL transmission models
- Apply model to identify the 'minimum surveillance set' data and evaluate potential changes to interventions

Objective 4: Develop the 'RiskMap' software programme for the short-term prediction of VL outbreaks and long terms changes in risk of LF

- Modelling framework to predict the risk of resurgence at block level associated with covariates

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Thank you