

Village-based analysis of environmental malaria risk in South East Asia within a malaria elimination program – EASIMES project

This **Master 2 internship project** will take place at UMR SESSTIM in Marseille, in partnership with the Shoklo Malaria Research Unit (SMRU), a branch of the Mahidol Oxford Tropical Medicine Research Unit and with a team from UMR ESPACE-DEV hosted at Pasteur Institute in Cambodia.

Over the last 15 years, the burden of malaria decreased considerably in Thailand, including in the regions bordering Myanmar, due to the deployment of artemisinin-based combination therapies (ACT) and intense effort to increase access to diagnosis and treatment. Pockets of malaria transmission remain in some hard to reach areas, and on the Myanmar side where conflict between Karen ethnic military groups and the Myanmar army have been ongoing for over 40 years.

This decrease of *P. falciparum* malaria incidence, observed throughout South East Asia, is now threatened by the emergence of artemisinin- and multidrug resistant parasites in Cambodia. In order to stop the spread of resistance and to limit its damages, an unprecedented effort has been launched aiming at malaria elimination in the eastern region of Myanmar: the Malaria Elimination Task Force (METF).

METF is the result of a partnership between 8 community-based organizations providing healthcare in the 4 regions of Myanmar targeted by the program with the technical and scientific support of SMRU. The elimination strategy relies on the deployment of early diagnosis and treatment of malaria in all villages (Malaria Posts, MP), and on targeted mass drug administration (MDA) interventions in hotspots of malaria asymptomatic carriage.

The METF network counts over 1200 Malaria Posts which are supplied, monitored, provide access to diagnosis and treatment to 365,000 persons at all times, and report activity data on a weekly basis. In 70 villages, MDA campaigns were deployed and reduced the number of infected carriers drastically. Five years into this program, *P. falciparum* malaria has been eliminated from 3 regions and incidence collapsed in the 4th region. *Plasmodium vivax* malaria incidence remains high, since interventions did not target this parasite specifically.

The heterogeneity of malaria distribution across the different localities of the program remains strong, and differential decreases were observed while deploying similar interventions in different localities. In order to document the main drivers of falciparum decrease and to improve the targeting of upcoming interventions against vivax malaria, an additional research project is developing environmental data acquisition and analysis in order to characterize the relationships between environment, malaria incidence and malaria transmission at community level, improve surveillance and develop an early warning system. In South East Asia, malaria is persistently linked to forest environments at regional level and to forest-going activities in individual surveys. However little is known about forest transmission, where vectors are poorly described, where places of human exposure are usually inferred from travel surveys, and quantitative data is scarce at community scale, a crucial link where people tend to share most of their living and working environments.

The objectives are to identify what elements in the environment contribute to explaining a higher risk for a given community, whether related to its surroundings, to seasonally changing patterns, or both. Specifically:

- **to understand which type of environments are associated with higher risks of malaria at the village level, and link them with human activities conducted in them.**
- **to understand which seasonal changes in the environment are associated with changing risks of malaria**

- **to quantify the contribution of these factors in the distribution of malaria incidence and its evolution**

In this project, the intern will rely on environmental data obtained from a landuse-landcover developed specifically for the region, to characterize environmental features at risk of malaria, and combine them to time series of environmental indices (NDVI and other), in order to link them to specific patterns of malaria : baseline incidence, persisting incidence, outbreaks, and to quantify their contribution.

Challenges:

small size of population (100 to 300 inhabitants),

low incidence rate (average in target region : 4 cases/1000 person.months at the start of the program), decreasing trend over time

MP deployed gradually over 2 years in an operational research context

Strengths:

>500 villages with PF cases, 1 region with higher incidence and higher prevalence (>400 villages, 75% with PF).

Weekly data

All villages included in a GIS

Data available (incidence >3 years for all villages; environmental data currently under production)

Comparison with PV dynamics (Impact of MP on transmission is different from PF due to PV life cycle).

Malaria prevalence data for a subsample of villages (>250 villages surveyed over 3 years)

Candidate profile

- **Master 2 student (Epidemiology, Statistics, Data Science with interest for health issues)**
- **Proficient in statistics using R or STATA software:**
 - **Basic stats skills required : Data management, standard tests and logistic regression**
 - **GLM and/or descriptive multivariate analysis (MCA, PCA) is a plus**
 - **Interest in advanced methods (time-series, functional regression, classification...)**
- French or English speaker (command of English language is required for mission to South East Asia)

Practical details

- **Marseille, France** (a mission to Shoklo Malaria Research Unit, Mae Sot, Thailand and/or at Pasteur Institute Cambodia, Phnom Penh, might be necessary according to progress).
- **5-6 months between January and September 2020**

Contact

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Links

SESSTIM: <https://sesstim.univ-amu.fr/>

METF: <http://www.shoklo-unit.com/humanitarian-activities/malaria-elimination-task-force>

References

J Landier, DM Parker, AM Thu, KM Lwin, G Delmas, FH Nosten (2018) *Effect of generalised access to early diagnosis and treatment and targeted mass drug administration on Plasmodium falciparum malaria in Eastern Myanmar: an observational study of a regional elimination programme*. **The Lancet**

DM Parker, J Landier, AM Thu, KM Lwin, G Delmas, FH Nosten (2017) *Scale up of a elimination program and surveillance system in Kayin State, Myanmar*. **Wellcome Open Research**