Modelling spatio-temporal dynamics of malaria and mortality to develop optimised interventions and surveillance tools in Africa

Overarching goal
Reduce malaria burden in Africa by developing and validating tools (methods, knowledge, software) to strengthen malaria surveillance for disease control and elimination.

Specific objectives
1. Assess spatio-temporal dynamics of malaria risk and measure effectiveness of related interventions at local scale in Africa.
2. Estimate the malaria-related mortality across all age groups in Africa.
3. Assess spatio-temporal dynamics and obtain up-to-date high resolution estimates of infant and child mortality across Africa.
5. Propose strategies to optimise health systems performance and interventions to reduce malaria and mortality burden.
6. Develop and disseminate software for malaria surveillance (i.e. Bayesian geostatistical malaria mapping and early detection of malaria outbreaks).

Expected scientific contributions
Results of the project will be:
- Rigorous data-driven spatial statistical models tailored to the analysis of Malaria Indicator Survey (MIS), Demographic Health Survey (DHS) and other health survey data.
- Up-to-date spatially explicit estimates of malaria burden (risk and number of children infected) for countries with Malaria Indicator Surveys (MIS) in 2006-2015.
- Continent-wide maps and spatially explicit estimates for infant and under five years old mortality.
- Estimates of the spatio-temporal dynamics of malaria and mortality.
- A quantification of the relation between malaria exposure and mortality across different age groups and levels of endemicity.
- Geo-referenced estimates of the number of malaria attributed deaths at the countries with MIS during 2006-2015.
- Malaria and mortality-specific indices of health system performance.
- Estimates of the effects of interventions in reducing malaria and mortality burden.
- Predictions of cost-effectiveness of interventions at a given location based on the malaria risk.
- Identified gaps in effective delivery of interventions and health services in relation to mortality and malaria burden in Uganda and Burkina Faso.
- Novel statistical methods for early detection of outbreaks.
- Software for malaria surveillance which performs Bayesian geostatistical analyses of MIS data and early detection of outbreaks.

Development relevance
- Results will be translated to tools (e.g. maps, burden estimates, cost-effectiveness of interventions, strategies to improve health system performance, surveillance software) that can assist efforts of the control programmes towards malaria elimination and reduction of mortality.
- These products can be used to influence policy makers to choose appropriate interventions and improve local health systems in Uganda and Burkina Faso in a targeted way.
- The project builds capacity in advance statistical modelling by giving the opportunity to (i) 2 PhD students from Uganda and 2 PhD students from Burkina Faso (ii) 2 MSc students from Ghana and Cameroon and (iii) 1 Post-doctoral scientist from the CRSN in Burkina Faso to be trained in advanced methods on disease mapping, Bayesian spatio-temporal modelling and computation.

Project organisation and team
The project consists of (i) the Swiss TPH group (ii) the group from the School of Public Health at Makerere University (MAK) in Uganda and (iii) the group from the Centre de Recherche en Santé de Nouna (CRSN) in Burkina Faso.

Applicants

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- Eleni Santé de Nouna
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- MSc, Swiss TPH
- Dr. Salomon Gottlieb
- MSc, Swiss TPH
- Tonye Nambuusi
- PhD, CRSN
- Samuel Kick-off workshop in Ouagadougou jointly organised with the Malaria Programmes