Proposed Evidence Review Group on assessment of malariogenic potential to inform elimination strategies and plans to prevent re-establishment

Malaria Policy Advisory Committee Meeting
Geneva, Switzerland
11 – 13 April 2018

Global **Malaria** Programme

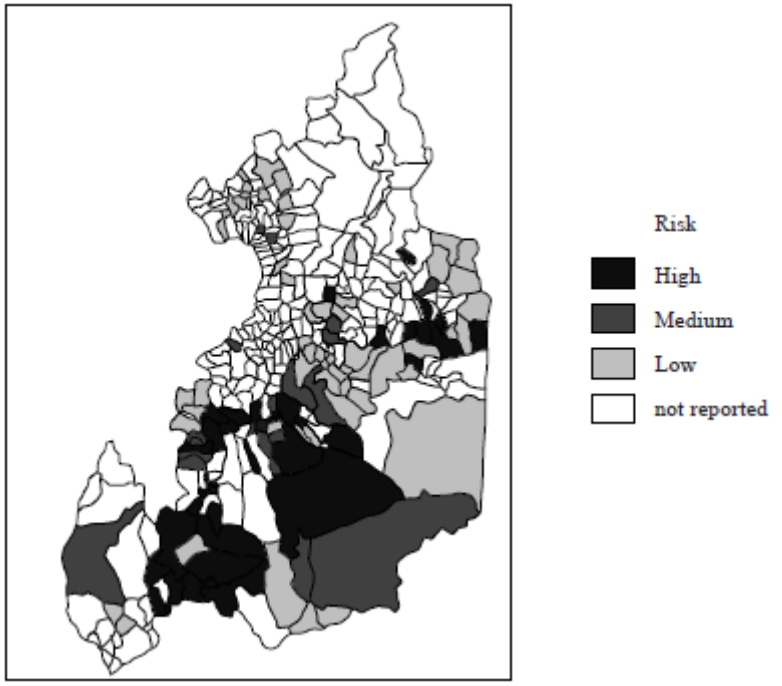
World Health Organization

Background

- Understanding malaria transmission risk in a given geographical area provides the foundation for the design of (cost-)effective intervention programmes to decrease malaria burden, eliminate transmission and prevent re-establishment of malaria

Malaria transmission risk =

malariogenic potential



Note: Figure depicting malaria risk in Moneragala district, Sri Lanka, based on median annual parasite incidence. From Wickremasinghe et al. 2002

Background - terminology

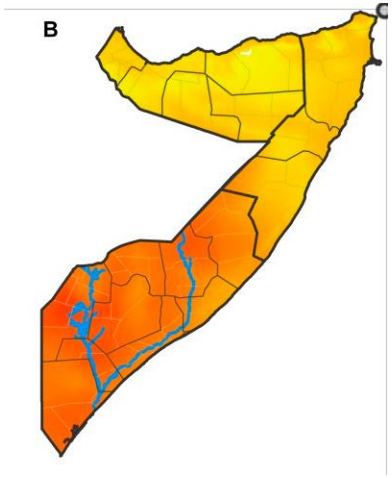
MALARIOGENIC POTENTIAL = RECEPTIVITY + VULNERABILITY + 'INFECTIVITY'

- RECEPTIVITY
  - COMPETENT VECTORS
  - SUITABLE CLIMATE
  - SUSCEPTIBLE POPULATION
- VULNERABILITY
  - RATE OF IMPORTATION OF PARASITES
- 'INFECTIVITY'
  - COMPATIBILITY OF VECOR & INFECTING *Plasmodium* STRAIN

Receptivity measurements

- Historic parasite prevalence measures

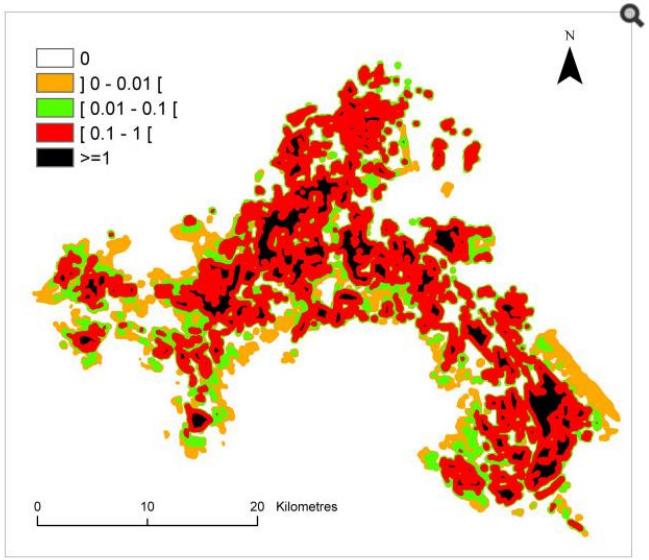
Map of the maximum mean *Pf*$PR_{2–10}$ prediction (receptive) at 1×1 km grid location as computed from the posterior annual mean *Pf*$PR_{2–10}$ prediction for each year from 2007 to 2010



Noor *et al. BMJ Open* 2012

- Calculation of vectorial capacity (or a proxy)

Spatial variations of *P. falciparum* transmission risk estimate (ranging from 0 to more than 1) in August in the Camargue, France



Ponçon *et al. Malar J* 2008

Vulnerability

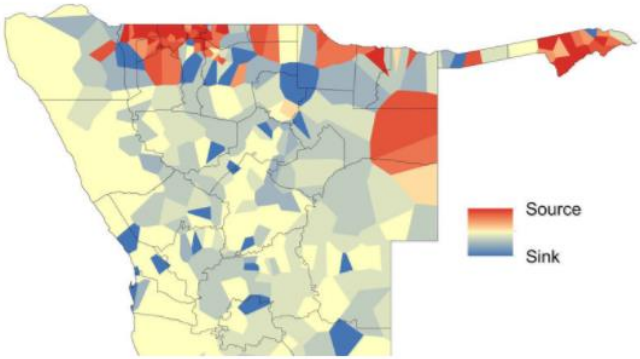
- Importation of infections derived from census-based movement patterns

Expected immigration of infected people into each province in Costa Rica

Ruktanonchai, *Malar J* 2016

- Net rates of importation derived from mobile phone data

Mapped 'sources' (net exporters) and 'sinks' (net importers) of malaria importation risk



Tatem, *Malar J* 2014

Infectivity

- Regional receptivity of endemic anophelines to exotic strains of human malarias
- Data suggest that not all anophelines can be infected equally by all Plasmodium spp.

Table 1. Results of comparative infection experiments with *A. atroparvus, A. labranchiae,* and *A. gambiae* fed on gametocyte carriers of *P. falciparum* at Kisumu, Kenya

Anopheles strain	Mid-gut dissections		Salivary gland dissections	
	number examined	number showing oocysts	number examined	number showing sporo-zoites
A. atroparvus (Orcia)	48	0	15	0
A. atroparvus (Upper Volturno)	69	3[a]	41	0
A. labranchiae (Tarquinia)	17	0	14	0
A. gambiae species B (Kisumu)	170	131	72[b]	23

[a] Two dissected on the 9th and 11th days, respectively, showed a single oocyst. One dissected on the 19th day showed 3 incompletely developed oocysts containing no sporozoites.

[b] Includes 50 oocyst-positive and 22 oocyst-negative specimens.

de Zulueta, *Bull WHO* 1975

Background – WHO guidance

- WHO *Framework for malaria elimination* recommends:
  - subnational stratification to inform the selection of interventions
  - measurement of receptivity and vulnerability to prevent re-establishment of transmission after elimination
  - vector control coverage should be maintained after elimination in areas with high malariogenic potential

Identified needs & opportunities

- Increasing demand for guidance around the assessment of receptivity and vulnerability, especially for countries that are working to prevent re-establishment of transmission
- Existing guidance in this area is limited, resulting in substantial investments, for example into entomological surveillance, sometimes without a clear link between the data generated and programmatic decision-making
- Vector susceptibility to imported parasites contributes to malariogenic potential that is not frequently considered
- Opportunities for improved guidance:
  - Availability of more sophisticated methods and data sources, such model-based geostatistical frameworks, cell phone information and other remotely sensed data for population mobility
  - Increasing amounts of practical experience with the challenges of transitioning programmes from control activities to more targeted designs aimed at eliminating malaria or preventing its re-establishment.

Proposed ERG objectives

1. To review current **definitions** of receptivity, vulnerability and malariogenic potential contained in the WHO glossary and, if required, recommend improvements to ensure that the definitions are valid and appropriate;

2. To review available **methodologies** for assessing receptivity and recommend appropriate and valid methodological approaches, including data requirements, for national malaria programmes to use to measure receptivity in their respective countries;

3. To advise WHO on **options for classifying receptivity** according to programmatically relevant categories aimed at guiding interventions to prevent re-establishment of transmission;

Proposed ERG objectives

4. To review the validity and practicality of available methods for assessing vulnerability and recommend appropriate and valid **methodological approaches**, including data requirements, for national malaria programmes to use to **assess vulnerability** in their respective countries;

5. To review data on the regional receptivity ('**infectivity**') of endemic anophelines to exotic strains of human malaria;

6. To advise WHO on **approaches to combining measures** of receptivity, vulnerability and infectivity to guide national malaria programmes in designing strategies to prevent re-establishment of transmission.

Questions to MPAC

- Does MPAC support the convening of the proposed ERG meeting in principle?

- Do the objectives of the ERG accurately reflect the identified needs for improved guidance or are modifications to the TORs needed?