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

Malaria Policy Advisory Committee Meeting
Geneva, Switzerland
11 – 13 April 2018
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
MALARIOGENIC POTENTIAL = RECEPTIVITY + VULNERABILITY + ‘INFECTIVITY’

↑ COMPETENT VECTORS
↑ SUITABLE CLIMATE
↑ SUSCEPTIBLE POPULATION

↑ RATE OF IMPORTATION OF PARASITES

↑ COMPATIBILITY OF VECOR & INFECTING Plasmodium STRAIN
Receptivity measurements

- Historic parasite prevalence measures

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

- 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

Noor et al. BMJ Open 2012

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

- 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
• 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.

<table>
<thead>
<tr>
<th>Anopheles strain</th>
<th>Mid-gut dissections</th>
<th>Salivary gland dissections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number examined</td>
<td>number showing oocysts</td>
</tr>
<tr>
<td><em>A. atroparvus</em> (Orcia)</td>
<td>48</td>
<td>0</td>
</tr>
<tr>
<td><em>A. atroparvus</em> (Upper Volturmo)</td>
<td>69</td>
<td>3 (^a)</td>
</tr>
<tr>
<td><em>A. labranchiae</em> (Tarquini)</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td><em>A. gambiae</em> species B (Kisumu)</td>
<td>170</td>
<td>131</td>
</tr>
</tbody>
</table>

\(^a\) 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
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 malarialogenic potential
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 maliariogenic 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.
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;
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?