Vector Control Working Group
1st New Challenges, New Tools Workstream Meeting

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Key messages:

• **Universal coverage of LLINs (or IRS)** remain an absolute priority, all other methods are **supplementary** to reducing malaria and achieving elimination

• Need to generate local evidence on the **magnitude of the outdoor/residual transmission**
  – BOTH human and vector behaviour

• Industry and their partners are encouraged to develop **new vector control tools** to address residual transmission
  – Role of IVCC & VCAG

• Recommendation **NOT** to evaluate individual products, but a **class of products** that has an effect.

• Recommendation to **partner with local economically-vested stakeholders** (i.e. extractive industries) as these companies are financially autonomous and often willing to provide support towards public health product evaluations as this also contributes to labor workforce benefit.
Activities:

• Establish Regional Networks, Mekong, Africa and Amazonia
• Develop guidelines /estimate the importance of residual transmission
• Develop guidelines /estimate malaria risk in specific populations exposed to outdoor transmission (soldiers, forest workers, migrants, mobile populations)
• Outline strategic plan for R&D of new tools
• Establish network of communications and mutual technical support amongst stakeholders including an effective 'feedback system' to inform on operational impact of any new tools being developed/evaluated specific for RT

Approach:

• Establish and/or strengthen regional hubs
• Multidisciplinary approach: entomology, epidemiology, social science, surveillance, R&D
• Partnership: NMCP, academia, private industry, donor institutions
• Strategic Plan Development
• Mobilize stakeholders
R&D: A real need for new tools

- BMGF Grand Challenges Explorations Round 14: New Approaches for Addressing Outdoor/Residual Malaria Transmission:
  - 2 calls (Q3 2014 & Q1 2015)
  - 9 funded Phase I awards made ($100K/18mo)
- IVCC call for expression: Responding to the challenge of Outdoor Transmission of Malaria (Sept 2014)
- WHO Vector Control Advisory Group (VCAG) on new tools: To review and assess the public health value of new paradigms, tools

Promising Technologies:
- Spatial repellents
- Attractive toxic sugar baits (ATSBs)
- Genetic manipulated vectors (Gene Drive)
- Housing improvements (e.g. Eave Tubes)
Previous WS definition of residual malaria transmission:

- Residual is generally a quantity left over at the end of a process
- Residual Transmission = transmission that persists AFTER having achieved universal coverage with effective LLIN and/or IRS interventions

Residual Transmission due to:
- Outdoor biting/resting vectors
- Early evening/morning biting vectors
  - (indoors & outdoors)
- Human behavior and activity outside the protection of indoor-based interventions
Correlation between outdoor activities and biting times of vectors

Mean number of host seeking mosquitoes

Cooking
Eating
Watching television
Selling and Buying
Telling stories
Anopheles arabiensis
Anopheles funestus

Moshi et al. unpublished data
Nearly 1 million lives saved in Africa since 2000, due to enhanced malaria vector control, but there remains residual malaria transmission mediated by resilient and resistant sub-populations of vectors.
A proposed definition of residual transmission:

“In line with goals of malaria elimination, I define residual malaria transmission as the complete set of transmission events that continue to occur in communities where primary interventions such as LLINS, IRS, case management and larviciding have already been widely implemented at high coverage, but where new *Plasmodium* infections still occur locally. Residual transmission therefore also refers to all new local malaria transmission events in non-naïve communities.”
Very high transmission scenarios cannot yet be addressed

Vectorial capacity is determined by:
- A preference for human-biting (anthropophagic)
- Close association with human habitations (domestic, peridomestic)
- Competence to become infected and transmit malaria parasites

In Africa, this is the case with the *An. gambiae* and *funestus* species complexes

Sub-Saharan Africa represents the malaria “heartland” where it is often not possible:
- to access populations in the rainy season, and
- where resources are not available or
- interventions are too costly for local populations to access
Measuring malaria transmission

Based on parasitological estimates: relevant as indicators of disease burden

Based on entomological estimates: relevant as indicators of force of transmission

Mosquito densities  Parasite Infection rates (Sporozoite rates)  Human biting rates

Estimation of No. infectious bites /person/period, i.e. Entomological Inoculation Rate (EIR) = Biting Rate x Sporozoite Rate
Simple rules for monitoring transmission:

There are a number of correlates of biting risk that could be used to predict areas/households where biting risk is highest:

• House designs
• Household occupancy
• Topography
• Ground water flow
• Vegetation cover
Gaps associated with disenfranchised minorities: potential last frontiers
No Front Line Implementers: Malaria vector entomologists are now an endangered minority

Malaria vector control at crossroads: public health entomology and the drive to elimination

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Field entomological techniques will be critical in the fight against residual vectors.

Raymond Shannon 1931
Gaps associated with test methodologies and study sites:

- Few guidelines for new paradigms
- Standards still lacking
- Stringent evaluation programs
- Overreliance on RCTs
- Fixation on indoor insecticidal interventions at the expense of other potentially beneficial techniques
- GLP site accreditation as part of I2I
Insecticide Resistance

Wide-spread insecticide resistance in malaria vector populations will cause purely-insecticidal interventions to lose efficacy
LSM for Malaria Elimination: “It was a seemingly impossible idea, but Soper did it in 22 months”
-Malcolm Gladwell
The world has three potential future trajectories for malaria...

Global annual malaria parasite incidence

Goals
1. Accelerate to Zero Now (new strategies using current tools)
2. Prepare for the Future (new strategies using new tools)
3. Sustain Progress (current strategies using current tools)

Bend the Curve