From Outdoor Transmission to Residual Malaria Transmission WS

Context, challenge and framework for solution

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Residual Malaria Transmission

Transmission control beyond the reach of Long Lasting Insecticidal Nets, and Indoor Residual Spraying

*Residual transmission* results from either a behavioural insecticide avoidance, or the behaviour-related ability of malaria vectors to be unaffected by interventions using insecticides indoors (IRS & ITNs) and which is independent of insecticide susceptibility (insecticide resistance).
The ‘GAP’ of vector control!

**Two ecological contexts:**

- Where **early and/or outdoor biting** vectors transmit within a community before the time people are under a net that has been treated or where **outdoor resting** vectors are unaffected by IRS.
- Where, for **occupational reasons**, people are away from the house, where indoor residual spraying, insecticidal nets is not feasible, e.g. rubber tappers, forest workers, miners, displaced persons (mainly outdoor transmission).

Durnez & Coosemans 2013
http://dx.doi.org/10.5772/55925
Natural behavioural avoidance occurs when, regardless of the presence of ITNs or IRS, mosquitoes exhibit behaviour that does not bring them in contact with the insecticides, namely biting outside or early in the evening, or morning, or mostly biting animals, and resting outside.

Indeed, both IRS and ITNs will mainly affect anthropophilic mosquitoes biting indoors, leaving ample opportunity for more exophilic, exophagic, early-biting and/or zoophilic vectors to avoid contact with insecticide treated surfaces and to maintain a certain level of transmission.

Protective behavioural avoidance: occurs in response to the presence of (indoor) use of insecticides. Insecticide induced exophily, exophagy, zoophily or early biting may then occurred. E.g. Excito-repellent of insecticides. Behavioural resistance? (evidence?)
Shifts observed in the presence of indoor insecticidal pressure

A shift means an observed change, including relative changes, with reasonable link to indoor use of insecticides (ITNs or IRS).

- Species shift
- Shifts to early-evening or early-morning
- Shifts to exophagy
- Shifts to zoophily
- Shifts to exophily

Shifts can result from:
- Inherent species behavioral traits (can evolve)
- A phenotypic plasticity within the species (not evolving),
- Selected behavioral genetic traits (behavioral resistance): genetic markers have been shown to be associated with behavioral traits but so far no evidence that indoor use of insecticides lead to selection of behavioral genetic traits. (evolving).

=> So far no evidence for an evolving phenomenon

Durnez & Coosemans 2013
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Residual Transmission: is this important?

**YES.**

- In the Mekong Region, where artemisinin resistance is present, transmission among populations temporarily outside the home, in the forest or rubber plantation for occupational reasons, **threatens drug resistance containment** and the future of global malaria control.

- In areas where artemisinin resistance is not yet an immediate threat, in South Asia, Amazon Region, Africa and the Western Pacific, control of residual transmission is **critical for malaria elimination.**

To contain a potential catastrophic spread of artemisinin resistance and to enable countries to changing transmission ecologies in the drive to elimination we need to address residual transmission – or we fail.
Residual transmission needs: Human ecology
Residual Transmission needs: vector ecology

Species shifts in Kenya

Start upscaling bednets

Bayoh et al, 2010 MJ 9,62
Former Outdoor work stream

Initial focus on personal protection for mobile populations in the Mekong, where emerging artemisinin resistance poses the other great threat to global malaria control efforts.

Aim was to bring together commercial sector, academia, and national programs to inventory resources, and create common protocols for examining efficacy and community acceptability for repellents and other treated materials that could supplement current vector control tools.
Extension from *Outdoor to Residual* Transmission work stream

**Aims:**

1. Establish Regional Networks, Mekong, Africa and Amazonia;
2. Develop guidelines / estimate importance of residual transmission;
3. Develop guidelines / estimate malaria risk in specific populations exposed to outdoor transmission (soldiers, forest workers, migrants, mobile populations);
4. Outline strategic plan for R&D of new tools;
5. 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:

1. Establish Regional Hubs

Formally establish regional ‘hubs’ and identify at least one local scientist to serve as Secretariat.

The Secretariat should have the capacity to implement and/or facilitate work stream aims to include a working relationship with National Control Programmes in the region.

Hubs and Secretariats under consideration:

- Latin America
- Tropical Africa
- Southeast Asia
Approach:

2. Define role of regional hub secretariats

- Define the role of regional work stream Secretariats (e.g. exchange of information, updating the list of partners by category, technical support)

- Include anticipated FTE and budgetary and/or capacity needs to support regional hub activities related to work stream objectives
Approach:

3. Strategic Plan Development

  • Engage WHO/HQ and WHO Regional Offices to determine roles and processes for work stream strategic plan development

  • Develop plan with National Control Programmes & other stakeholders
Approach:

4. Mobilize stakeholders

Identify and mobilise partners on work stream objectives from

• Private Sector,
• Donors (BMGF, DFID, EC),
• Product Development Partners (IVCC, VCAG, Army Forces, others)
• Scientific Institutions (including social scientists) engaged in the development and/or evaluation of new tools (paradigms) that address residual transmission.
• National Control Programmes and other stakeholders
Meeting of stakeholders at the 2014 ASTMH annual conference in New Orleans, LA USA. November 2-6, 2014

The decision to change the Work Streams name from “outdoor” to “residual ” Transmission is both apt and timely, as it syncs with current intentions to have a VCGW-wide consultations to realign the WS. To formalize the change, we need a motion for a name change during the upcoming meeting of the Work Stream at New Orleans.

Goals of the meeting will be to inform on work stream objectives, provide an overview of strategic plan development and approach for group discussion as well as outline action items moving forward. Support to NMCP and/or Secretariat partners will be explored through RBM VCWG, BMGF and DFID, ADB/APLMA Regional Trust Fund).