INTEGRATED VECTOR MANAGEMENT FOR MALARIA AND OTHER VECTOR- BORNE DISEASES CONTROL IN ETHIOPIA

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RBM Vector Control Working Group
7-9 February 2018
Geneva, Switzerland
Vector-Borne Diseases in Ethiopia

- Malaria
- Leishmaniasis
- Onchocerciasis
- Lymphatic Filariasis
- Schistosomiasis
- Dengue (emerging)
- Yellow Fever
- Chikungunya

However, historically malaria accounts for most of the cases and deaths in Ethiopia.
Clinical Malaria cases in Ethiopia

- **Malaria Cases (X Millions)**
  - Values range from 0 to 6.
  - Highest value in 2004.

- **No. tested (X Millions)**
  - Values range from 0 to 10.
  - Significant increase in 2012 and 2013.

Years covered: 2001 to 2016.
Co-endemicity of P. falciparum and P. vivax in Ethiopia
Vectors of malaria in Ethiopia

Malaria Vectors:

- *Anopheles arabiensis*: Primary vector, wide distribution all over the country


- *An. coustani*: suspected vector??
Malaria control intervention policies and strategies

- Early diagnosis and appropriate treatment (RDTs and ACTs)

- Vector control (ITNs/LLINs, IRS, Environmental Management etc.,)

- Prevention, early detection and control of epidemics
The current national malaria context

- Achieved significant progress in reducing the burden of malaria (Reduced malaria cases and deaths since 2006)

- Low parasite malaria prevalence (0.5% MIS 2015)

- Reduced epidemics
Goal of NMCP in Ethiopia

• Vision: ‘To see malaria free Ethiopia’

• Goals:

  By **2020:**
  
  o Maintain near zero malaria deaths  
    (<1 confirmed malaria death per 100,000 pop. at risk);
  
  o Reduce malaria cases by 40% from 2016;
  
  o Eliminate malaria in selected low transmission areas.

  By **2030:**
  
  o Eliminate malaria from Ethiopia.
Strategic framework for malaria elimination in Ethiopia

Vision
To see a malaria-free Ethiopia.

Goal
By 2030, to eliminate malaria nationwide.

Objectives
To reduce malaria case incidence to zero by 2030.
To reduce malaria mortality rate to zero by 2030.
To prevent re-establishment of malaria in all malaria-free districts
Challenges of Malaria and other VBDs Control in Ethiopia

- Naturally occurring climate change
- Ecological changes resulted mainly from water resources development projects
- Changes in vector behavior
- Insecticide resistance by malaria vectors
Historical Use of Insecticides in Ethiopia

IRS
✓ DDT/malathion (1955–2008)
✓ Delta (2009-2011)
✓ Bendiocarb/propoxur/pirimiphos methyl (2012 – present)

ITNs/LLINs
✓ (Since 1997/1998- present)

✓ Crop protection (Prolonged time??-present)

Household insecticides (??)
Insecticide use for IRS in Oromia Regional State (2012-2016)
IR Monitoring
Mapping IR in Ethiopia (2012-2016)

Messenger et al 2017
## Kdr Allele Frequency in An. arabiensis (2015)

<table>
<thead>
<tr>
<th>Village/Site</th>
<th>Insecticide</th>
<th>Survival status after exposure</th>
<th># Mosquitoes tested</th>
<th>Homozygote mutation (RR)</th>
<th>Heterozygote (RS)</th>
<th>Homozygote Wild type (SS)</th>
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<td>1</td>
<td>0.5   0.5</td>
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</table>
Mosquito mortality with \textit{kdr} frequency (2016)

![Graph showing the relationship between kdr-R Allele Frequency and % Mosquito Mortality across different study sites.](image)
Multiple IR \((Kdr + GST)\) (2015)

Alemayehu et al 2017
## Proxy of P450 in Pyrethroid Resistance (2016)

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<tr>
<th>Insecticide</th>
<th>Asendabo</th>
<th>Serbo</th>
<th>Jimma</th>
<th>Goro</th>
<th>Angergutin</th>
<th>Pawi</th>
<th>Abobo</th>
<th>Harbu</th>
<th>Lokha</th>
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<th>Wondo</th>
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</tbody>
</table>

Yewhalaw et al (Unpublished)
Summary of IR Mechanisms in Vector Populations, Ethiopia

- High frequency of kdr-west
- Presence of Monooxygenases (Cytochrome P450s)
- Elevated Esterases
- Elevated level of GSTs
- No Acetylcholinesterase

Therefore, there is a need to develop & implement IVM for effective vector control
Opportunities for IVM Development & Implementation

- Ethiopia developed Insecticide Resistance Monitoring and Management strategy
Opportunities for IVM Development & Implementation in Ethiopia

- IRMM sentinel sites established
Opportunities for IVM Development & Implementation in Ethiopia

- Health care system (HEWs)
- Malaria strata and endemicity of other vector-borne diseases mapped
- Co-endemicity of vector-borne diseases identified

Map of malaria strata in Ethiopia (2017)
IVM Experience from Tolay Malaria Control Project, Ethiopia

IVM:

- is a rational decision-making process to maximize the use of resources for vector control (WHO 2008)
- Is ecologically sound, cost-effective and sustainable VBDs control strategy
IVM Experience from Tolay Malaria Control Project, Ethiopia

IVM Project Outcomes:

- IVM (use of long-lasting insecticide treated nets [LLINs] + intensive community education and mobilization [CEM] + larviciding with Bti) reduced Anopheles mosquito densities in Tolay by 60% when compared to the control situation (LLINs only).

- A significant reduction of 40-70% malaria prevalence observed in Tolay for the comprehensive IVM intervention when compared to Control.

Source: ICIPE Annual Report 2015
IVM Experience from Tolay Malaria Control Project, Ethiopia

Integrated Vector Management (IVM)
Malaria Control Project Workshop
Addis Ababa, Ethiopia, November 28, 2011
Meeting of ICIPE and Jimma University team on Areas of Collaboration for the Development and Implementation Plan of IVM in Ethiopia

Jimma University
May 9, 2013 Ethiopia
Conclusions

- To date only combination use of vector control tools (IRS, LLINS, Larval Source Management/chemical larviciding)

- No other core principles of IVM considered
Recommendations

- Development of national policy and strategic plan for IVM
- Development of national IVM implementation plan
- Development of national guidelines for IVM
Thank You