Entomological Monitoring for Larval Source Management for Control of *Anopheles stephensi* in Ethiopia

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Background

- About 69% of the total population in Ethiopia is at risk of malaria infection and transmission is highly seasonal.
- Historically, the primary vector of malaria in Ethiopia has been *An. arabiensis*.
- The invasive malaria vector *Anopheles stephensi* was reported for the first time in Ethiopia in 2016.
  - To date, it has been found in 52 urban and peri-urban sites.
To help curb the spread of *An. stephensi*, PMI VectorLink/Evolve collaborated with the Ministry of Health to implement LSM in 8 urban towns starting in August 2022.

Entomological monitoring was conducted to understand the impact of LSM on larval density, larval habitat indices and adult resting density.
Entomology Monitoring Overview and Timeline

Entomology Data Collection

- Baseline conducted for 2-4 weeks from Jul 25-Aug 20, 2022 prior to start of LSM
- Weekly larval/pupal sampling from tracked permanent & random larval habitats
- Adult sampling in houses near tracked larval habitats and animal shelters using Prokopack
- Transport larvae/pupae to insectary for rearing to adult and identification to species
• Methods: Direct application and spraying of VectoBac WG, source reduction (protocol was developed with the manufacturers and LSM experts)
• Larval habitats visited and appropriate LSM method administered biweekly
• mHealth tool guided larvicide dosage
# Results

Properties and larval habitats accessed per cycle across the eight towns

<table>
<thead>
<tr>
<th>Dates and frequency of LSM implementation</th>
<th>Every two weeks from Aug. 2022-Dec. 2023</th>
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<tbody>
<tr>
<td># of towns covered by PMI-supported LSM</td>
<td>8 towns</td>
</tr>
<tr>
<td>Average # of properties visited per cycle</td>
<td>87,996</td>
</tr>
<tr>
<td>Average # of larval habitats treated by direct application</td>
<td>30,046 (44%)</td>
</tr>
<tr>
<td>Average # of larval habitats treated by spraying</td>
<td>1,741 (3%)</td>
</tr>
<tr>
<td>Average # of larval habitats source reduced</td>
<td>36,191 (53%)</td>
</tr>
<tr>
<td>Population protected</td>
<td>611,360</td>
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<tr>
<td>Larvicide (VectoBac in Kg)</td>
<td>2,015</td>
</tr>
</tbody>
</table>
Results: Mean Larval Density of *Anopheles* from Tracked Habitats in Awash, Dire Dawa, and Kebridehar

LSM resulted in decline of the mean larval density of *Anopheles*
Results: Mean Larval Density of *Anopheles* from Tracked Habitats in Batu, Degehabour, Godey, Meki, and Semera-Logia.
Results: Mean Larval Habitat Indices (Larval Habitat Positivity) of *Anopheles* Mosquitoes from Tracked Habitats in Awash, Dire Dawa, and Kebridehar.
**Results:** Mean Larval Habitat Positivity of *Anopheles* from Tracked Habitats in Batu, Degehabour, Godey, Meki, and Semera-Logia
Key Findings and Lessons Learned (1)

1. Enumeration of households (properties) and larval habitats prior to LSM enabled good coverage and high-quality implementation
   - Facilitated estimation of HR, larvicide, and equipment needs
   - Each property received an ID number which was used to assign LSM personnel.
     *It is worth noting that enumeration is dynamic; at no point in time will it be the same.*

2. Most larval habitats were artificial water containers, which were limited in number and accessible and easily identified by CVCTs.
   - Implementing LSM in these habitats may help control the spread of *An. stephensi*. 

![Images of cistern, water tanks, and barrels]
3. Larval surveillance on the edge of slow-flowing rivers indicated that these water bodies could be breeding habitats for both *An. stephensi* and *An. arabiensis*.
   • Residual life of VectoBac®WG in such habitats was very short and thus would require more frequent application (weekly instead of every two weeks).

4. Implementation of high quality LSM resulted in a decline in larval density, pupal density, and habitat indices compared to baseline.
   • Further investigation of epidemiological data is needed, however, to understand if this has translated into a decline in malaria incidence.
Thank You!
EXTRA SLIDES
Pupal Density of Tracked Habitats in Awash, Dire Dawa, and Kebridehar
Pupal Density of Tracked Habitats in Batu, Degehabour, Godey, Meki, and Semera-Logia
Pupal Index of Tracked Habitats in Awash, Dire Dawa, and Kebridehar
Pupal Index of Tracked Habitats in Batu, Degehabour, Godey, Meki, and Semera-Logia