Results from the dengue integrated vector management (IVM) project

John Hustedt
Dengue

- 3.6 billion at risk with 390 million infections each year, of which 96 million are symptomatic (70% in Asia).
- Cambodia reported approximately 15,000 dengue cases in 2015 through its surveillance system. 13% of these were registered in Kampong Cham province.
- Not confined to urban areas or children, with outbreaks in rural areas and non-endemic areas in north-east provinces (12% of symptomatic cases in Cambodia are over 18 years of age).
- No vaccine or therapeutic treatment available at scale in Cambodia, so prevention relies on vector control.
Background
What should be targeted?
Container surveys in Kampong Cham, Cambodia

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Baseline (297)</th>
<th>Baseline (251)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Pupae</td>
</tr>
<tr>
<td>Drum</td>
<td>120</td>
<td>148</td>
</tr>
<tr>
<td>Concrete water jar</td>
<td>896</td>
<td>9,804</td>
</tr>
<tr>
<td>Concrete tank</td>
<td>162</td>
<td>692</td>
</tr>
<tr>
<td>Small pot</td>
<td>165</td>
<td>284</td>
</tr>
<tr>
<td>Flower vase</td>
<td>51</td>
<td>29</td>
</tr>
<tr>
<td>Tires</td>
<td>79</td>
<td>251</td>
</tr>
<tr>
<td>Tin can</td>
<td>189</td>
<td>129</td>
</tr>
<tr>
<td>Broken pot</td>
<td>283</td>
<td>72</td>
</tr>
<tr>
<td>Other</td>
<td>293</td>
<td>290</td>
</tr>
<tr>
<td>Total</td>
<td>2,238</td>
<td>11,699</td>
</tr>
</tbody>
</table>

Source: Chang et al. 2008

Pupal biomass:
- Water jars, drums, and concrete tanks (>50L): ≈90%
- Small containers (<50L): ≈10%

8293
What should be targeted?

Interventions

- Larvivorous fish (guppies) (>50L)
- Communication for behavioral impact (COMBI)
- Slow-release juvenile hormone analogue (Pyriproxyfen) (<50L)

Pupal biomass:

- Water jars, drums, and concrete tanks (>50L): ≈90%
- Small containers (<50L): ≈10%
Challenges in vector control
Pyriproxyfen – Sumilarv© 2MR

Source: Sumitomo
Communication for behavioural impact (COMBI) activities
COMBI activities
Methods
Methods

Study design

The cluster randomised trial aimed to evaluate the efficacy of three interventions over 12 months (October 2015-September 2016) and will have three arms:

1. Guppies + PPF resin matrix + COMBI
2. Guppies + COMBI
3. Control

Each arm had 10 clusters of approximately 200 HHs
Methods

Hypothesis:

• Use of guppies, pyriproxyfen (PPF) and communication for behavioural impact (COMBI) activities will reduce numbers of *Aedes aegypti* by reducing its breeding through larval control and source reduction

• COMBI activities will improve the community’s knowledge, attitudes, and behaviour around water use and vector borne disease prevention

• Guppies and Pyriproxyfen are acceptable among the target villages
Methods

Study location

Arm 1: G + PPF + COMBI
Arm 2: G + COMBI
Arm 3: Control
Methods

Study location
Methods

Distribution and coverage

Intervention village

Health Centre guppy bank
Methods

Distribution and coverage

Intervention village

Health Centre guppy bank
Methods

Outcome measures

*Primary outcome measure:*
Density of resting adult female *Aedes aegypti* in the household as measured by entomology surveys at BL, 4, 8, 12 months after start of intervention.

*Secondary outcome measures:*
- House index
- Container index
- Breteau index
- Pupae per house
- Pupae per person
- Percentage of indoor resting mosquitos positive for dengue virus
Methods

Data collection

- Entomology Survey (every three months)
  - Adult mosquito collection
  - Larvae and pupae collection
  - Container survey
  - Premise condition Index
- Knowledge, Attitudes, and Practice Survey (baseline and endline)
- Acceptability Survey (endline)
- Adult Emergence Inhibition Assays
- CHW monthly monitoring (coverage)
Results
Figure 1: Mean number of adult *Aedes* females per household by arm and survey.

- Arm 1 - Guppy+PPF
- Arm 2 - Guppy
- Arm 3 - Control
Figure 2: Mean number of *Aedes* pupae per person by arm and survey
Figure 3: Percentage of water containers ≥50L in intervention villages with two or more guppies or containers <50L with at least one Sumilarv© 2MR by arm and month, November 2015-September 2016.
Discussion
Limitations

• Lack of epidemiological outcome. Reduction in vector biomass correlates with reduction in dengue infections?
• Important to assess how the intervention is sustained after project ends.
• Intervention focused on households only. May be important to target public spaces (e.g. schools, religious centers, and open public places).
Discussion

• Both intervention arms significantly reduced the number of pupae and adults when compared to a control arm.

• Keeping high coverage of interventions through community engagement is essential. Adding additional interventions that require behaviour change in the community may not add value.

• Interventions did not reach all breeding sites. A small number of mosquitoes may cause outbreaks. How to target these (is it possible, feasible and/or worth it?).
Acknowledgements
Thank you