Could Soper’s success with larviciding be recreated in Africa with a mobile app?

A small-scale controlled trial in Obuasi, Ghana

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Background

- 1938-1940: campaign to eliminate *Anopheles gambiae* from eastern Brazil led by Fred Soper \(^1\)
  - Primary method: larviciding
  - Success within 2 years
  - Key challenges: worker management & high coverage
- 2019: use of larviciding for vector control is marginal
- Control programs and policy makers focus on adulticiding

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Operational challenges in large-scale larviciding

❖ Low coverage of water sources (Only 66.2% in Chaki et al. [2])
❖ Difficulty in returning to treated water sources for respraying
❖ Requires a strong surveillance system (WHO Operational Manual, 2013)
❖ Low cost-effectiveness in remote/rural areas (WHO position statement, 2012)

Zzapp System: tackles larviciding operational challenges

- Mobile app - allocates tasks, guides field workers, collects and transmits data

- Executive web portal - displays data to campaign managers and alerts to undertreated areas
Executive Web Portal: Planning and Costing

**Obuasi**

<table>
<thead>
<tr>
<th>Community Area</th>
<th>Travel Cost</th>
<th>Scanning Cost</th>
<th>Scanning Personnel</th>
<th>Treatment Personnel</th>
<th>Scanning Schedule</th>
<th>Precipitation Over Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Km</td>
<td>$200</td>
<td>$150</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Km</td>
<td>$1500</td>
<td></td>
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</tbody>
</table>

Larviciding frequency: once in 10 days
Executive Web Portal: Surveillance and Progress
Zoom in: water source details, including larva presence if sampled
Mobile app: scanning

- Allocates small chunks of land for field workers to scan.
- Tracks workers using GPS to ensure the entire chunk is covered.
- Route is highlighted in yellow, making it clear where to scan next.
- Team leader approves or rejects the chunk based on the worker’s route.
Mobile app: Reporting and Spraying

- Potential larval sites are geotagged and presented on the map
- Sprayers revisit the sites at the required spraying frequency
A randomized controlled trial in Obuasi, Ghana

- Mining town located in the Ashanti region
  - 175,000 residents

- AGAMal - a malaria control company, subsidiary of the AngloGold Ashanti gold mine
  (see: www.agamal.org)
  - Successful IRS program
  - Recently initiated larviciding
Objective

Does the mobile app increase larviciding coverage in a semi-urban setting?

❖ Experimental groups:
  ➢ Scanning with the mobile app - experimental
  ➢ Routine scanning method (managed by a team leader) - control

❖ Outcome variable: number of water sources reported
Method

- Participants: 10 spraying workers from AGAMal
  - Randomly divided into two groups
- Scanning area: 1,200m x 600m
- Procedure:
  - Day 1: group 1 area A, group 2 area B
  - Day 2: group 1 area B, group 2 area A
## Results

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Mobile app group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total reports</td>
<td>147</td>
<td>87</td>
</tr>
<tr>
<td>Duplicate reports</td>
<td>75</td>
<td>5</td>
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<tr>
<td>Erroneous reports</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Outside bounds</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total valid sites</strong></td>
<td><strong>64</strong></td>
<td><strong>82</strong></td>
</tr>
</tbody>
</table>

Guided by the mobile app, workers detected 28% more water sources.
Future studies

❖ Implementation in a large-scale larviciding operation
❖ Assess impact on Anopheles and malaria reduction
❖ Larviciding following case detection
❖ Spatial Intelligence System (SIS)
  ➢ Integration with drones and satellites
  ➢ To be tested soon in Zanzibar
  ➢ Funded by IVCC