Decentralized Entomological Surveillance : Community-based Approach

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Background

- Monitoring mosquito population dynamics to guide selection and evaluation of malaria vector control interventions
- Typically implemented by highly qualified, centrally-based experts
- *Piloted district based surveillance in 18 sentinel sites*
- Limitations in costs, timely visitations and frequency of implementation
- Community-based (CB) mosquito trapping schemes could complement efforts
Approach /Methodology

• **A longitudinal Community – Based (CB) surveillance scheme**
  • Monthly sampling and reporting cycle
  • Centers for Disease Control and Prevention light traps (LT) and Ifakara Tent Traps (ITT),
  • Trained Community health workers (CHW) within health facilities

• **CHWs were trained**
  • Basic operation of traps,
  • Basic sampling procedures
  • Morphological identification of mosquitoes
  • Storage, labelling and data entry in simplified form

• **Quality assurance (QA) by central team to evaluate accuracy**
  • Used Human Landing Catches (HLC), LTs and ITT

• **Cost implication of the CB surveillance scheme**

• **Epidemiological relevance of CB through active surveillance of malaria parasite**
Nyimba/Luangwa: 14 clusters, 1000/cluster

3 CHWs/cluster

CHW #1

CHW #2

CHW #3

60 HH ea

45 HH

15 HH

Epidemiological Survey (CHWs)

Entomological Survey (CHWs)

Active: Monthly finger stick blood samples

Passive

RDT +ve → treated (~20% were positive)

Entomological training

- use of trap (CDC-LT, ITT)
- Sort mosquitoes by eye (Genus)
- Storage (silica) / Dessication
- Simple recording (Anopheles/Culex)

Collections

- 1 night/month (299 HH) (1900-0700)
- Collection night was set per house
  - Indoor LT (at foot of sleeping space)
  - Outdoor ITT (5m)

Monthly collection by NMCP team

- Morphological / molecular identification
- ELISA

Luangwa: January 2011 – April 2013
Nyimba: April 2011 – April 2013
Table 2: Crude estimates of the costs per sampling scheme per trap-night and per *Anopheles funestus* caught for the three months when community-based sampling was validated with quality assured sampling schemes

| Estimated parameter | Units | Quality assured | | Community-based | |
|---------------------|-------|-----------------|-----------------|-----------------|
| Number of samples   | Person-night | QA-HLC | QA-LT | QA-ITT | CB-LT | CB-ITT |
| Numbers Caught      | Number of *Anopheles funestus* | 526 | 41 | 32 | 637 | 156 |
| Mean Caught         | Number of *Anopheles funestus* per person-night | 13.2 | 2.1 | 1.6 | 2.6 | 0.6 |
| Personal costs a    | $(ZMW)$ | 2,180(11,401.4) | 1,520(7,949.6) | 1,076(5,627.5) | 2509.4(13,124.2) | 2,939.4(15,373.1) |
| Per diem costs b    | $(ZMW)$ | 414(2,165.2) | 1,243(6,500.9) | 1,243(6,500.9) | 621(3,247.8) | 621(3,247.8) |
| Trap depreciation costs | $(ZMW)$ | 0(0) | 87.5(457.6) | 125(653.8) | 87.5(457.6) | 125(653.8) |
| Transport costs c   | $(ZMW)$ | 225(1,176.8) | 225(1,176.8) | 225(1,176.8) | 0(0) | 0(0) |
| Vehicle maintenance costs d | $(ZMW)$ | 212(1,108.8) | 211(1,108.8) | 212(1,108.8) | 71(371.3) | 71(371.3) |
| Vehicle depreciation cost e | $(ZMW)$ | 2,500(13,075) | 2,500(13,075) | 2,500(13,075) | 0(0) | 0(0) |
| Bicycle repair costs c | $(ZMW)$ | 0(0) | 0(0) | 0(0) | 94(491.6) | 611(3,195.5) |
| Bicycle depreciation costs d | $(ZMW)$ | 0(0) | 0(0) | 0(0) | 0(0) | 5(26.2) |
| Total expenditure   | $(ZMW)$ | 5,531(28,927.1) | 5,788(30,268.6) | 5,381(28,142.6) | 3,388(17,718.7) | 4,372(22,867.7) |
| Cost per person-night of sampling | $(ZMW)$ | 138.3(723.2) | 289.4(1,513.4) | 269.1(1,407.1) | 13.6(71.2) | 18.0(94.1) |
| Cost per specimen of *An. funestus* caught | $(ZMW)$ | 10.5(55) | 141.2(738.3) | 168.2(879.5) | 5.3(27.8) | 28.0(146.6) |

a Cost estimates were based on the approximated time and efforts spent on each trapping method  
b Assumptions made on the salaries paid and per diem to the central level teams during their visits  
c Estimated cost incurred for maintaining the equipment for transporting or visiting the trapping schemes per location  
d Monthly depreciation costs calculated when both trapping schemes were operational for three months  

$ - US dollar  
ZWK - Zambian Kwacha  
Note: 1$ ≈ ZMK 5.23 which was the average exchange during the midpoint year of 2012

Quality Assurance

- ITT / CDC-LT / HLC (in /out)
- Experienced CHWs (Chisobe, Luangwa)
- Same HH visited 2 days earlier
  - Day 1: House 1: in/out HLC ; House 2: ITT/CDC-LT
  - Day 2: House 2: in/out HLC ; House 1: ITT/CDC-LT
- All clusters (but 1)
- Feb-April 2013 (last 3 months of study)
Challenges

• Training of CHWs required
  – CHWs conducted less catches when there were fewer mosquitoes (value of 0)
  – Re-training may be needed
• Communication (illness / reliability / resignation)
• Lower CB efficacy in trapping mosquitoes
  – QA needed to validate accuracy and identify limitations (quantify) – prerequisite to interpretations
Concluding Points

- Community engagement & ownership
- Practical and cost effective for routine entomological surveillance
- Higher frequency, captures temporal trends with far greater resolution
- Epidemiologically relevant
- The QA validation exercise was short (three months)
- None continuous, none randomized
- Evaluation and Constant refresher trainings

Temporal variations of *Anopheles funestus* mean catches by light traps and the malaria diagnostic positivity among human residents from January to September 2011 in 2 districts

Different models with different assumptions

- Different approaches adopted in sentinel sites
  - Communities engaged differently
  - Partnership and resource consideration

- Central level - Oversight, Insecticide resistance, molecular analysis and quality assurance strengthening

- Optimization to national level scales for sustainability

Model 1: CHWs limited to trap placement, health facility (district) level overseer & enter all data
Model 2: CHWs trap placement, initial data entry health facility (district) level verify
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Thank you!