Testing a method of sampling for entomological determination of transmission of Wuchereria bancrofti (Wb) in urban settings

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Introduction

There is ongoing debate about the scale-up of mass drug administration for lymphatic filiariasis to urban areas, where determining Wb transmission – and therefore the need to treat – is more complex.

Entomological methodologies are a potential solution, yet there is a lack of clear guidance on how to undertake transmission assessment this way.

Here a sampling and trapping methodology is evaluated by:

- Effectiveness: Have sufficient Culex and Anopheles mosquitoes been collected?
- Cost-effectiveness: Is the trap optimal for collection?
- Suitability: Do the traps function to full capacity?
- Applicability: Could results be used to inform treatment decisions?

Methods

Our strategy was evaluated in Minna and Kaduna in Nigeria. Each city constituted one evaluation unit. In each, three communities had a combination of gravid traps, exit traps and pyrethrum spray catches (PSC) undertaken between May and September 2018.

- The no. of mosquitoes collected per trap was recorded daily, according to species and abdominal state, along with trap conditions and household actions.
- The cost of each trap type was tracked and calculated, with cost-effectiveness determined via cost per mosquito collected.
- The target sample size for each evaluation unit was 10,000 female mosquitoes with at least 1,500 Anopheles.

Breakdown of trapping events during study

	Sites per community	Days per month	Total trapping events
Exit	15	10	4,420
Gravid	5	7	393
PSC	21	1	614

Results

Effectiveness and cost-effectiveness

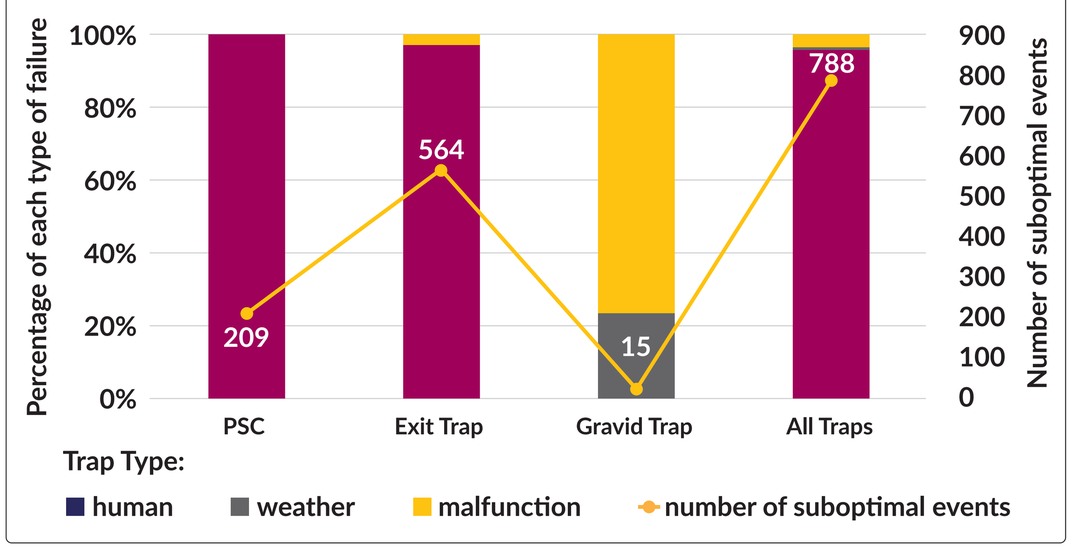
Breakdown and cost of mosquitoes catch per trap type

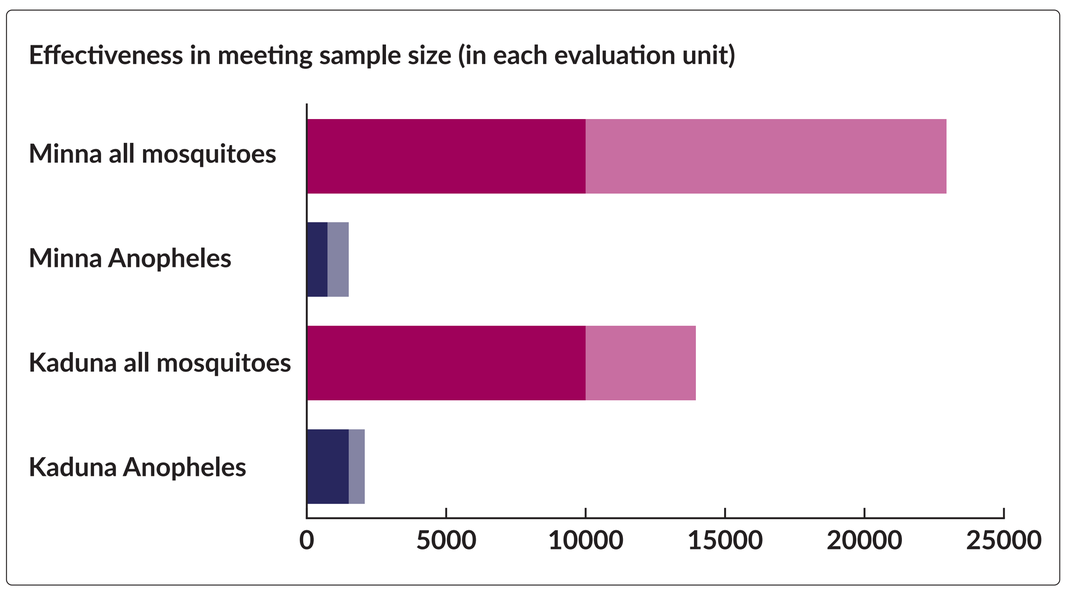
	PSC	Exit Trap	Gravid Trap	All Traps
Number of trapping events (percentage catching any mosquito)	614 (59%)	4,420 (49%)	393 (94%)	5,427 (53%)
Number of mosquitoes	2,126	9,235	25,519	36,880
Number of Anopheles (percentage of all mosquitoes caught)	626 (29%)	2,156 (23%)	36 (0.1%)	2,818 (8%)
Mean mosquitoes collected in trapping event	3.5	2.1	64.9	6.8
Mean Anopheles collected in trapping event	1	0.5	0.1	0.52
Cost of trapping event	20.2	6.4	13.3	
Cost per mosquito (USD)	5.8	12.8	0.2	
Cost per Anopheles (USD)	20.2	12.7	133.1	

- PSC traps had the highest mean catch of Anopheles mosquitoes per trapping. Given the frequency of trapping, the majority of Anopheles were caught in exit traps (making them the most cost-effective method for Anopheles).
- Gravid traps were the most cost-effective for mosquitoes in general and Culex specifically.

Suitability

- Community researchers were critical in improving acceptability and gaining access to households. Besides guiding, they also emptied traps successfully.
- Of our trapping events, 86% were thought to have run smoothly.
- 96% of compromising factors were caused by human actions, such as using mosquito nets/insecticide, or leaving doors and windows open. However, as this only impacted 14% of trapping events, the traps were deemed mainly acceptable.
- The traps were quite robust, with only 30 malfunctions among all events (5,427) and five instances where they were affected by adverse weather.





Applicability

Each city encompassed several Local Government Areas (LGA) at which a treat/don't treat decision would be made.

It is unclear if the presence or absence of transmission determined by this catch could be applied to all of them.

When considered at the level of treatment decision, only one LGA had sufficient mosquitoes.

Mosquitoes catch per treatment decision-making unit

Implementation unit	Anopheles	All mosquitoes
Kaduna South	1,578	9,963
Kaduna North	505	3,981
Bosso	531	17,345
Chanchaga	204	5,591

Conclusion

- Planning needs to focus around catching events targeted towards Anopheles through careful site selection and phasing trap placement, so that areas favourable to their collection can be better identified. Weighting trapping toward the later rains may also be useful.
- We propose planning 250 gravid trap and 3,724 exit trap events in similar Culex led urban settings, leaving out pyrethrum spray catches.
- Given the critical role of community researchers and their comparative lower cost, their involvement should be significantly increased.
- Most importantly, evaluation units should correspond to implementation units to facilitate applicability of findings to treatment decisions.

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