

EaveTubes combined with house screening successfully reduces malaria transmission but is there a route to market?

Jackie Cook

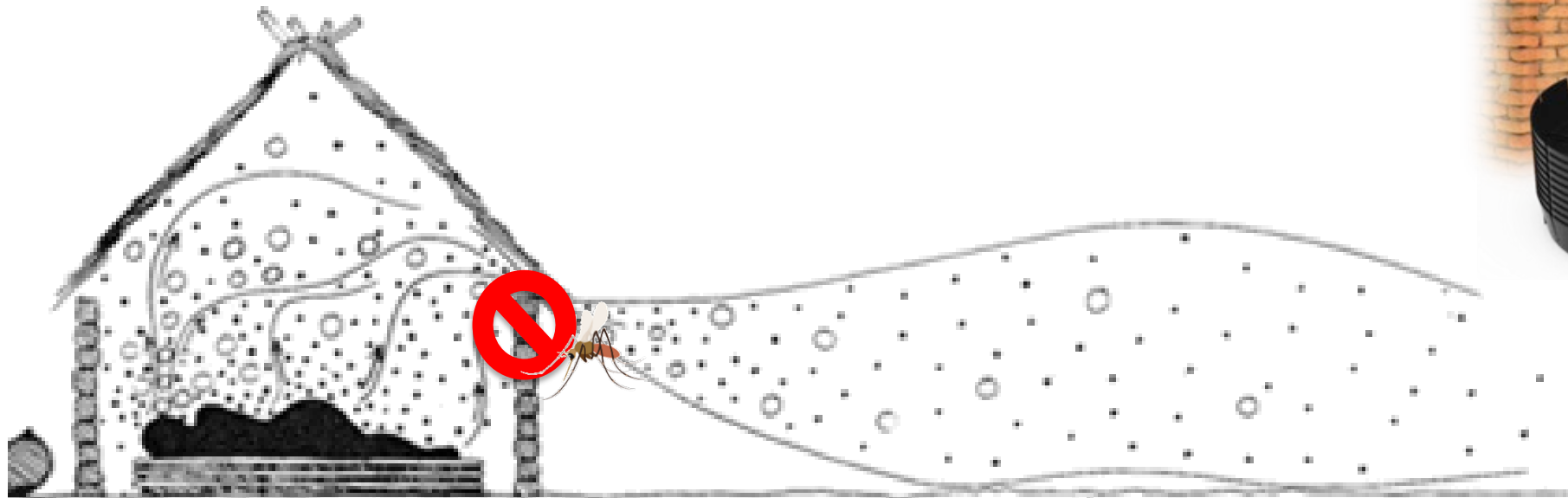
MRC International Statistics and Epidemiology group (ISEG)

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All about Eaves...

The eaves are a favoured entry point for Anopheline mosquitoes
Closing eaves reduces exposure to malaria mosquitoes
(Lindsay et al (2003), Kirby et al (2008), Wanzirah et al (2015))



Some advantages of EaveTubes

- **As an intervention**
 - Passive technology
 - Minimal logistics once installed
 - Ventilation in the house: “Lure and Kill”
- **As a vector control tool**
 - Small amount of insecticide required
 - Electrostatic netting provides enhanced bioavailability of insecticides (Andriessen et al (2015))
 - Concentrated dose of pyrethroid kills pyrethroid-resistant mosquitoes (insecticide tested in trial was 10% beta-cyfluthrin)
 - Can test insecticides that are not currently recommended for IRS or LLINs



Intervention installation



Cote d'Ivoire trial: EaveTubes and house screening



- Combined intervention (SET) installed in approx 3000 houses across 20 villages in Bouake, central Cote d'Ivoire
- Range of coverage (by village) achieved (35% to 100%)
- Inserts of tubes needed to be retreated every 4 months
- Screening required maintenance
- Evaluated epidemiological and entomological impact
- Cost-effectiveness
- Community acceptance

Impact and cost-effectiveness of a lethal house lure against malaria transmission in central Côte d'Ivoire: a two-arm, cluster-randomised controlled trial



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Summary

Background New vector control tools are required to sustain the fight against malaria. Lethal house lures, which target mosquitoes as they attempt to enter houses to blood feed, are one approach. Here we evaluated lethal house lures consisting of In2Care (Wageningen, Netherlands) Eave Tubes, which provide point-source insecticide treatments against host-seeking mosquitoes, in combination with house screening, which aims to reduce mosquito entry.

Methods We did a two-arm, cluster-randomised controlled trial with 40 village-level clusters in central Côte d'Ivoire between Sept 26, 2016, and April 10, 2019. All households received new insecticide-treated nets at universal coverage (one bednet per two people). Suitable households within the clusters assigned to the treatment group were offered

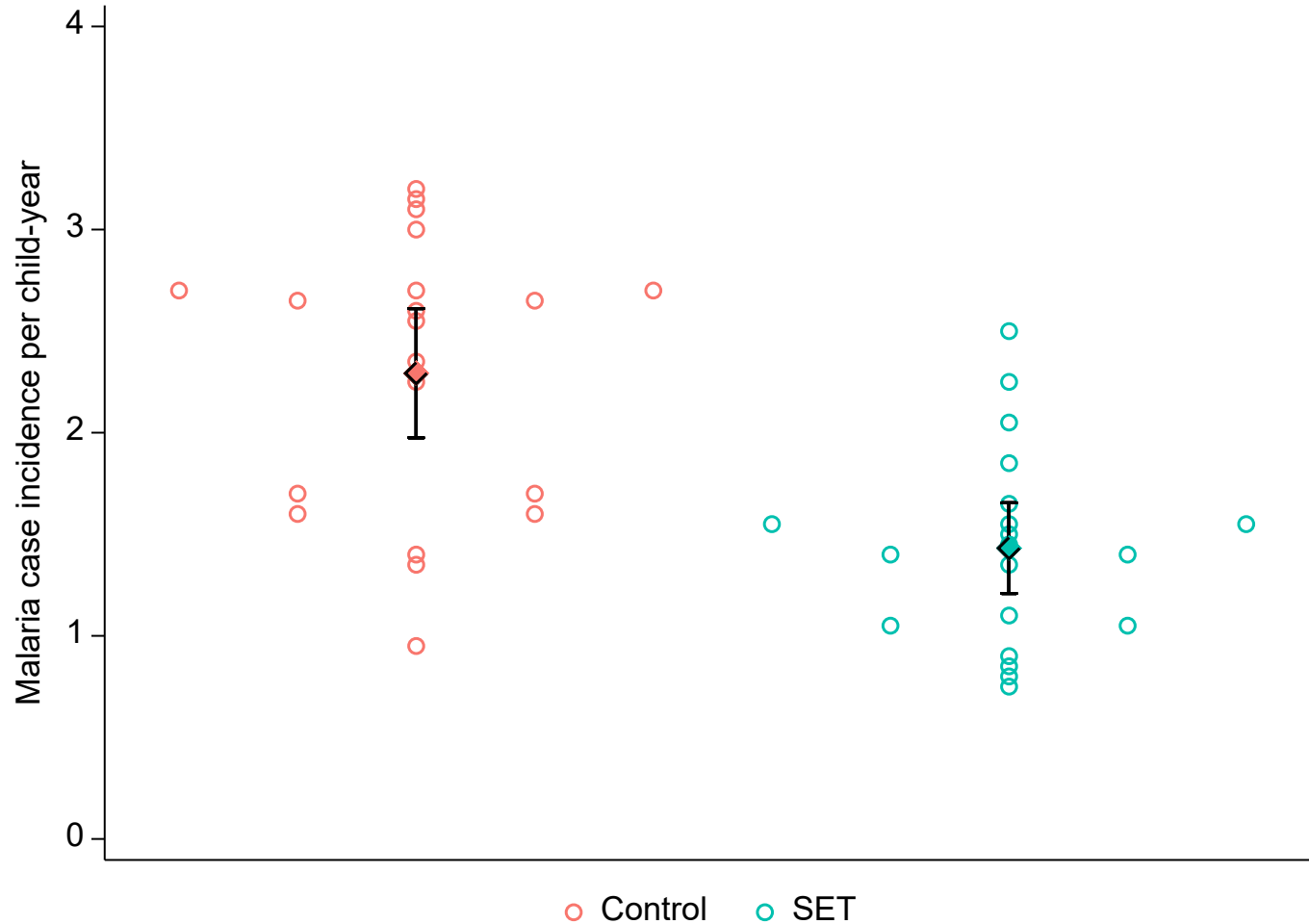
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EaveTubes and house screening reduced malaria case incidence by 38%



**Cluster mean incidence
(cases per child-year)**

Control: 2.29 (95%CI 1.97-2.61)

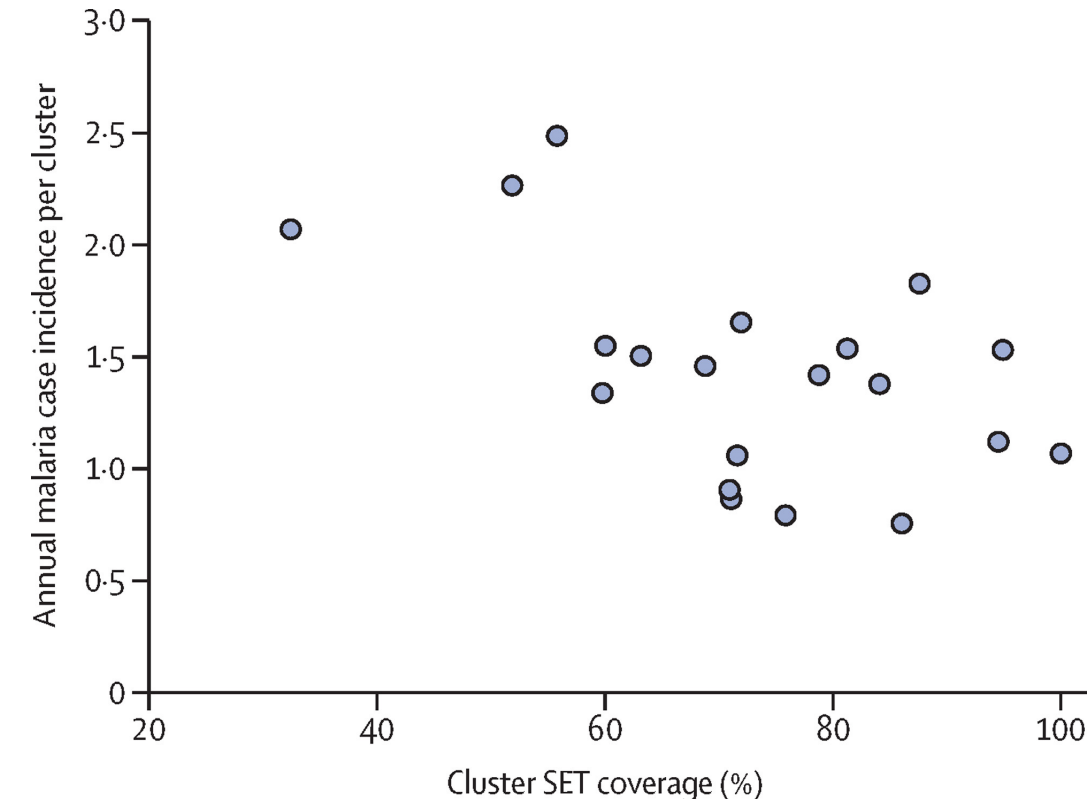
SET*: 1.43 (95%CI 1.21-1.65)

Incidence Rate Ratio: 0.62 (95%CI 0.49-0.79)

No. of cases: 3635 2355

* SET= Screening and EaveTubes

Coverage of intervention matters



- In clusters where coverage >70% (13 clusters), risk of a malaria case was 47% lower compared to control clusters (HR=0.53 (0.43-0.65), $p<0.001$)
- In clusters where coverage $\leq 70\%$, still evidence of a reduction (HR=0.79 (0.63-1.00, $p=0.05$)
- Some indication of a community effect
 - Children living in intervention village but without intervention, compared to control villages= HR 0.73 (0.54-0.99), $p=0.042$
 - This effect was not present if just looking in clusters where SET coverage was less than 70% (HR 0.96 (0.78-1.19), $p=0.733$) * very underpowered

Cost-effectiveness data

	USD
Total annualised societal economic costs of SET (provider and community)	\$723,421.06 40% screening 39% EaveTubes 21% maintenance
Simulated costs per house per year	\$51.76 (36.77-73.43)
Simulated costs per person protected per year	\$19.62 (5.59-45.38)
Cost per case averted	\$26.44(6.25-67.50)

- SET was in a similar cost-effectiveness range as other interventions- if EaveTubes alone could achieve similar impact, cost-effectiveness would be greater

Do EaveTubes work alone?

Currently no epidemiological data for this

BUT

Some entomological evidence (Barreaux et al (2018))

- Reduced mosquito entry in huts with EaveTubes only
- Increased mosquito mortality

Trials assessing impact of house screening have not consistently shown impact on epidemiological outcomes

- But may be the combination of the two that results in high impact...

Can EaveTubes be scaled up?

- Suitability of house construction
- Retro-fit vs pre-fit
 - Behind air ventilation bricks
 - Private estates i.e. sugar plantations, army barracks
- Specialised drill bits for installing in houses
- Retreatment of inserts took place in Cote d'Ivoire using a specialised machine



Public sector funding

- Ideally obtain a WHO recommendation (requires two trials in different settings)
 - Currently only have evidence for combined intervention
 - Potential factorial trial planned to tease apart contribution of screening and EaveTubes- gain WHO recommendation for SET
- Limited funds

Private sector funding

- Tap into the new housing market: “healthy homes”
- Already have evidence the combined technology works in Cote d’Ivoire
 - Register product in-country

- Factorial cluster randomised trial to generate evidence for:
 - SET (to enable WHO policy recommendation)
 - EaveTubes alone
 - Screening alone
- In a different setting (Tanzania)
 - Different vectors
 - Different house types
- Focus on potential future scale up alongside the trial
 - For EaveTubes (with/without screening)
 - For other house modification tools for public health
 - Intersectoral collaboration will be key

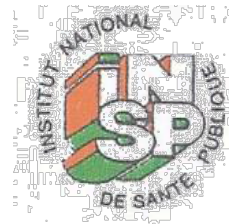


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