

# Evaluating the impact of eave tubes plus house screening on malaria transmission

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<b>Registration date</b> 01/02/2017	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
<b>Last Edited</b> 09/05/2023	<b>Condition category</b> Infections and Infestations	<input type="checkbox"/> Individual participant data

## Plain English summary of protocol

Background and study aims:

Malaria is a deadly disease caused by infection with malaria parasites. Every year, millions of people become infected with malaria parasites and hundreds of thousands of people die from the infection. The biggest burden of disease is in children, and particularly children who live in Africa. Malaria parasites are transmitted through the bite of a female malaria mosquito. Many of these infectious bites happen at night, when people are sleeping inside their homes. To protect themselves from malaria mosquitoes, people can sleep under an insecticide treated bed net or have their walls sprayed with insecticides. Although these tools have contributed substantially to the recent reductions in malaria cases, they face various challenges, such as the resistance of mosquitoes to the insecticides used for malaria control and the practical difficulties associated with spraying houses. Eave tubes are a new control tool that addresses these challenges. The basic principle of the eave tube technology is to limit mosquito access into the house by screening or blocking as many openings as possible, and adding tubes containing insecticide-treated netting into the eaves of the house. Heat and odors rise out of the house and through the tubes, and these cues attract mosquitoes in search of a blood meal. The insecticide-treated netting inside the tubes provide a focal point to kill mosquitoes as they try to enter or exit through the openings. The advantages of this approach include the fact that eave tubes and window screening protect an entire household without any additional effort by the occupants, and that the eave tubes require only a small amount of insecticide, and the insecticide is placed in a location that is inaccessible to children. The aim of this study is to investigate the effectiveness of the eave tube approach in reducing malaria.

Who can participate?

Children between 6 months and 10 years old living in houses that are suitable to the eave tube modification.

What does the study involve?

Eligible villages (a minimum of 100 houses and 50 children in the village) are randomly assigned to one of two groups: treatment or control. All householders in the treatment group, are offered the opportunity to have their houses screened and modified with eave tubes. Villages in both groups receive insecticide-treated bed nets.

What are the possible benefits and risks of participating?

The study participants will benefit from close monitoring and treatment of any illness, including malaria. In the treatment arm, participants will benefit from improvements to their house including screening of their windows and sealing any cracks or holes in their walls. All participants will benefit from new, insecticide-treated nets. There is a small risk that improving the condition of the houses will decrease airflow and increase the risk of respiratory diseases, but this will be monitored throughout the study and any children with respiratory disease will be referred to a local health facility (a practice already followed by the resident community health workers).

Where is the study run from?

The study is run from Institut Pierre Richet and takes place in villages within an approximately 50km radius of Bouake (Cote d'Ivoire)

When is study starting and how long is it expected to run for?

November 2015 to March 2019

Who is funding the study?

Bill and Melinda Gates Foundation (USA)

Who is the main contact?

Professor Matthew Thomas  
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## Contact information

**Type(s)**

Scientific

**Contact name**

Prof Matthew Thomas

**Contact details**

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## Additional identifiers

**EudraCT/CTIS number**

**IRAS number**

**ClinicalTrials.gov number**

**Secondary identifying numbers**

## Study information

### Scientific Title

Evaluating the impact of eave tubes plus house screening on malaria transmission: A randomized controlled trial in central Cote d'Ivoire

### Study objectives

Installing eave tubes plus associated house screening will prevent mosquito entry into the house and kill mosquitoes attempting to enter houses at eaves level. This will reduce the incidence of malaria infection in children living in villages where houses have been modified with eave tubes and associated screening.

### Ethics approval required

Old ethics approval format

### Ethics approval(s)

1. Cote d'Ivoire Ministry of Health, National Committee for Ethics and Research (Comite National d'Ethique et de la Recherche), 04/08/2015, ref: 039/MSLS/CNER-dkn
2. Penn State University Institutional Review Board (IRB), 27/10/2016, ref: STUDY00004815
3. London School of Hygiene and Tropical Medicine (Pending)

### Study design

Two-arm cluster randomized controlled trial (RCT)

### Primary study design

Interventional

### Secondary study design

Cluster randomised trial

### Study setting(s)

Community

### Study type(s)

Prevention

### Participant information sheet

No participant information sheet available

### Health condition(s) or problem(s) studied

Malaria

### Interventions

Villages (clusters) will be allocated to one of two treatments through restricted randomization based on village size and malaria prevalence in children between the ages of 6 months in 10 years. There will be 20 villages in each trial arm with 100-200 houses per village.

Control arm treatment: at the start of the trial, each household will receive the number of long lasting insecticidal nets (LLINs) necessary to achieve universal bed net coverage (1 bed net for ever 2 people in the household. Houses will not be modified in the control arm.

Treatment (eave tube) arm treatment: at the start of the trial, each eligible household will be offered the option of having their house modified with eave tubes. This consists of installing eave tubes, screening windows, and sealing any large cracks in the walls. A house is eligible for the intervention if it has a metal roof (as opposed to thatch) and the walls are in sufficiently good condition to support drilling to install the eave tubes. The eave tubes will then be fitted with screened inserts treated with a 10% formulation of beta cyflutherin. After the installation of the eave tubes, each household will also receive LLINs as in the control arm.

A subset of study participants in both arms (50 children per village, 2,000 children total) will be enrolled in the epidemiological monitoring, which will involve monthly (November - April) or fortnightly visits (May - October). Every 3 months there will be a "walk through" of all study villages to check the condition of the houses. Participants in the treatment arm will also be informed that they can contact the study team at any point for repairs relating to the eave tube intervention. A sample of insecticide treated inserts will be taken from the treatment villages each month to test for persistence of the insecticide. Inserts will be replaced once post-exposure mortality in mosquitoes falls below 50% (expected to be every 3-4 months).

## **Intervention Type**

Other

## **Primary outcome measure**

Malaria incidence will be monitored in cohorts of children (6 months through 10 years old) through active case detection (ACD) with monthly visits during the dry season (November – April) and fortnightly visits during the rainy season (May – October). Clinical malaria will be defined as a positive malaria rapid diagnostic test (RDT) and an axillary body temperature of  $\geq 37.5$ °C. Malaria infections will be confirmed by PCR of blood samples for malaria parasite DNA.

## **Secondary outcome measures**

1. Clinical malaria incidence in all children will be measured by clinic visits throughout the course of two year monitoring period. Malaria diagnosis will be defined as any child presenting with an axillary body temperature of  $\geq 37.5$ °C and a positive Rapid Diagnostic Test (RDT).
2. Prevalence of anemia and respiratory infections in the study cohort, measured twice yearly (April and November) for two years. Anemia will be testing using blood samples and the Hemocue Hb system and defined as moderate (7 – 9.9 g/dL hemoglobin) to severe ( $< 7$  g/dL hemoglobin) anemia. Respiratory infections will be diagnosed based on clinical symptoms including coughing, and either a raised age-specific respiratory rate or chest indrawing.
3. Malaria vector densities will be measured by CDC light traps for two nights every month, and by human landing catches for 2 nights every two months. Mosquito species identification will be done based on morphology and confirmed by PCR. Parity rates will be measured through a visual inspection of ovaries and sporozoite prevalence will be measured by ELISA in a subset of the mosquito catches. Prevalence of kdr and ace1 resistance alleles will also be measured through PCR in a subset of the catches.
4. Data loggers will be used to record hourly temperature and relative humidity in a subset of study houses in each village to determine whether house modifications affect indoor microclimate. A commercial air sampler will be used to assess whether house modifications

affect indoor air quality every month from baseline to two years

5. Public attitudes about malaria, its prevention, and whether eave tube technology is acceptable to the residents will be measured through surveys from baseline to two years

**Overall study start date**

20/11/2015

**Completion date**

01/03/2019

## **Eligibility**

**Key inclusion criteria**

1. Aged 6 months – 10 years old
2. Resident in houses enrolled in the study
3. Whose parents/guardians give written, informed consent for their child to be included in the study
4. In the case of school-aged children, only those who live in their villages throughout the school term will be eligible for enrollment
5. For the results to be as generalizable as possible, no distinctions will be made in terms of medical condition, physical health, gender or ethnic group

**Participant type(s)**

Healthy volunteer

**Age group**

Child

**Lower age limit**

6 Months

**Upper age limit**

10 Years

**Sex**

Both

**Target number of participants**

2,000 children, 1,000 in each arm.

**Total final enrolment**

2560

**Key exclusion criteria**

1. For whom informed consent is not or cannot be provided by a parent or guardian
2. Who are under 6 months or over 10 years at any point in the study
3. Expected to be non-resident during a significant part of the transmission season

**Date of first enrolment**

15/02/2017

**Date of final enrolment**

15/02/2019

**Locations****Countries of recruitment**

Côte d'Ivoire

**Study participating centre****Institut Pierre Richet**

01 B.P. 1500

Bouake

Côte d'Ivoire

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**Sponsor information****Organisation**

The Pennsylvania State University

**Sponsor details**

Office of Sponsored Programs

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**Sponsor type**

University/education

**ROR**

<https://ror.org/04p491231>

**Funder(s)****Funder type**

Charity

**Funder Name**

Bill and Melinda Gates Foundation

**Alternative Name(s)**

Bill & Melinda Gates Foundation, Gates Foundation, BMGF, B&MGF, GF

**Funding Body Type**

Government organisation

**Funding Body Subtype**

Trusts, charities, foundations (both public and private)

**Location**

United States of America

## Results and Publications

**Publication and dissemination plan**

Planned publication in a high-impact peer reviewed journal within a year of the end of the trial period.

**Intention to publish date**

01/03/2020

**Individual participant data (IPD) sharing plan**

The current data sharing plans for the current study are unknown and will be made available at a later date.

**IPD sharing plan summary**

Data sharing statement to be made available at a later date

**Study outputs**

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Protocol article</a>	protocol	18/07/2018	09/09/2019	Yes	No
<a href="#">Results article</a>	results	27/02/2021	01/03/2021	Yes	No
<a href="#">Results article</a>	results	04/05/2023	09/05/2023	Yes	No