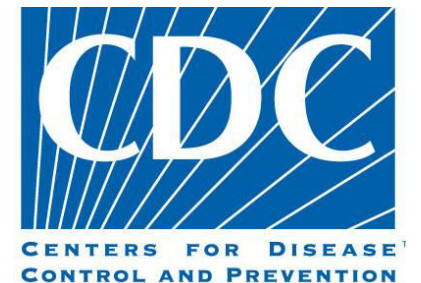


Late morning biting behaviour of *Anopheles funestus* is a risk factor for transmission in schools in Siaya, western Kenya

Seline Omondi, Jackline Kosgei, George Musula, Margaret Muchoki, Bernard Abong'o, Silas Agumba, Caroline Ogwang, Daniel P. McDermott, Martin J. Donnelly, Sarah G. Staedke, Jonathan Schultz, Julie R. Gutman, John E. Gimnig & Eric Ochomo



Background



- Malaria case burden extends to the 5–15-year-old age group
- Malaria infection prevalence is often highest in this group
- Asymptomatic infections (reservoir)

Effects of malaria

- fatigue, reduced concentration and lower school attendance
- poorer academic performance
- poverty

Background

- Limited malaria vector interventions that target school-aged children
- Vector surveillance in Siaya County has observed a peak in biting by *An. funestus* at 06:00 h with continued biting into the later hours of the morning
- Observations have shown that many children in this area consistently arrive at school between 06:00 and 07:00 h



Objective

To characterise mosquito abundance and biting in primary schools at night and in the morning hours when children would normally be in school.

Methodology

Study was conducted in four non-boarding primary schools within Alego-Usonga Sub-County, Siaya County, western Kenya: Bukhoba, Gangu, Kanyaboli, and Gendro



Methodology

Human landing catches (HLC) were done in five classrooms per school for 2 days in August 2023



HLC indoors



HLC outdoors



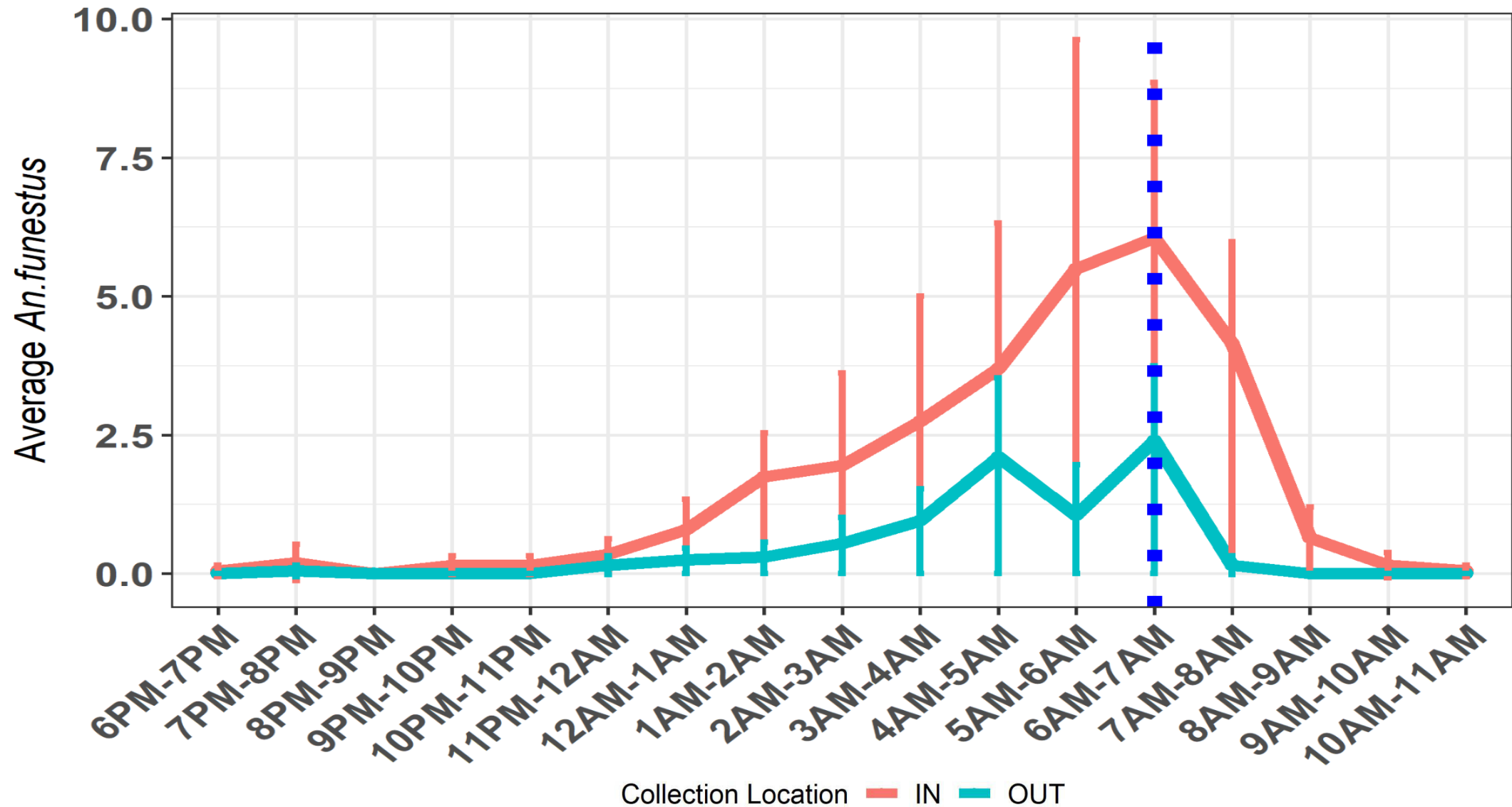
Collected mosquitoes

Results

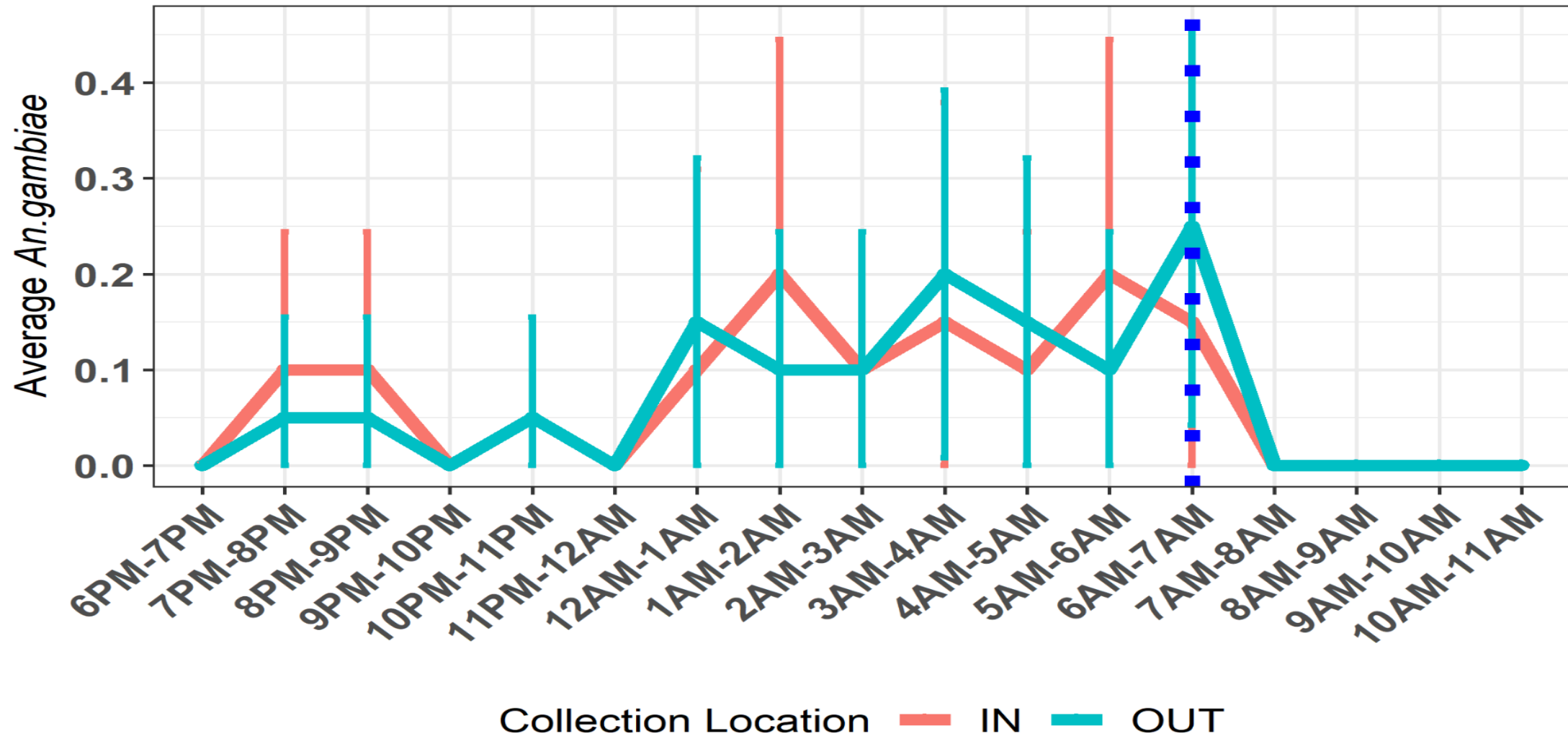
The number (%) of *Anopheles* collected (Over just two nights!!) detailing the school categorized by location and species.

| School | Gendro | Kanyaboli | Gangu | Bukhoba |
|----------------------------|----------|-----------|-----------|-----------|
| Number Collected | 66 | 109 | 138 | 467 |
| Indoor | 52 (79%) | 93 (85%) | 96 (70%) | 353 (76%) |
| Outdoor | 14 (21%) | 16 (15%) | 42 (30%) | 114 (24%) |
| Species | | | | |
| <i>An. funestus</i> | 52 (79%) | 104 (95%) | 130 (94%) | 441 (94%) |
| <i>An. gambiae</i> | 14 (21%) | 5 (4.6%) | 8 (5.8%) | 22 (4.7%) |
| <i>An. coustani</i> | 0 | 0 | 0 | 2 (0.4%) |
| <i>An. ziemanni</i> | 0 | 0 | 0 | 2 (0.4%) |

An. funestus hourly biting rates from 6pm to 11am



An. gambiae hourly biting rates from 6pm to 11am



Abdominal status for female *An. funestus*

| School | Gendro | Kanyaboli | Gangu | Bukhoba |
|------------------------|-------------------|----------------|------------------|-------------------|
| Fed | 28 (42%) | 69 (63%) | 49 (36%) | 224 (48%) |
| Gravid | 6 (9.1%) | 11 (10%) | 13 (9.4%) | 15 (3.2%) |
| Half gravid | 1 (1.5%) | | 2 (1.4%) | 6 (1.3%) |
| Unfed | 31 (47%) | 29 (27%) | 74 (54%) | 222 (48%) |
| Parity (No. dissected) | 17 | 10 | 33 | 97 |
| Nulliparous | 2 (11.8%) | 1 (10%) | 0 | 14 (14.4%) |
| Parous | 15 (88.2%) | 9 (90%) | 33 (100%) | 83 (85.6%) |



An. funestus - sporozoite rate of 2.05%

'SMARTER'

Mosquitoes arriving in schools at 6am to bite pupils, says Kemri study

The insects are running away from treated bed nets at home

JOHN MUCHANGI
@Jomunji

Mosquitoes have become smarter.

Some are avoiding homes and instead hanging around primary schools waiting for children who arrive for early morning preps, a new study says.

They begin feasting on the pupils at 6am.

Researchers who established this pattern said they believe the mosquitoes are going to schools to avoid the treated bed nets distributed in homes in Western Kenya by the Ministry of Health and its partners.

"The early morning biting observed here points to a change in behaviour to avoid bed nets," they said in results presented at the ongoing Kenya Medical Research Institute Annual Scientific and Health Conference in Nairobi.

The 14 researchers, led by Kemri's Eric Ochomo, conducted the study in four day primary schools in Ale-

go-Usonga, Siaya county. They are Bukhoba, Gangu, Kanyaboli and Gendro. Children in these schools wear shorts.

Siaya has the second-highest malaria prevalence nationally and residents regularly receive long-lasting insecticidal nets.

The researchers camped at the schools between August 4 and 6, 2023. They observed that many children consistently arrived at school between 6am and 7am.

They would find mosquitoes waiting for them. "Interestingly, the peak in biting was at 6am, just as the children would normally be arriving at school," they said.

The researchers also collected most mosquitoes that landed on people, every hour, until 11am.

Most of those collected were the anopheles funestus, which transmits malaria with a notoriously high efficiency. At least half of them were full of human blood or were carrying eggs.

"Surprisingly, more than half of

all the mosquitoes collected landing on the collectors were either already fed or gravid, suggesting that the vector has a repeat feeding behaviour," they said.

"This means that children sitting in these structures are potentially being bitten during their morning classes as they sit still and pay attention during their lessons."

Studies have reported changes in mosquitoes biting behaviour, with changing preference towards early evening and late morning when people are often not under the protection of bed nets.

However, this is the first investigation of anopheles vectors as a contributor to malaria transmission within these school settings.

The study notes many children in high transmission settings have developed immunity by this age.

Such children are less likely to seek treatment than younger children and therefore less likely to have the parasitaemia cleared with antimalaria drugs.

Take home message

There is an urgent need to consider vector control approaches targeting schools and other peridomestic spaces in the morning hours when *An. funestus* is active.

