Entomological surveillance following a long-lasting insecticidal net universal coverage campaign in mid-western Uganda

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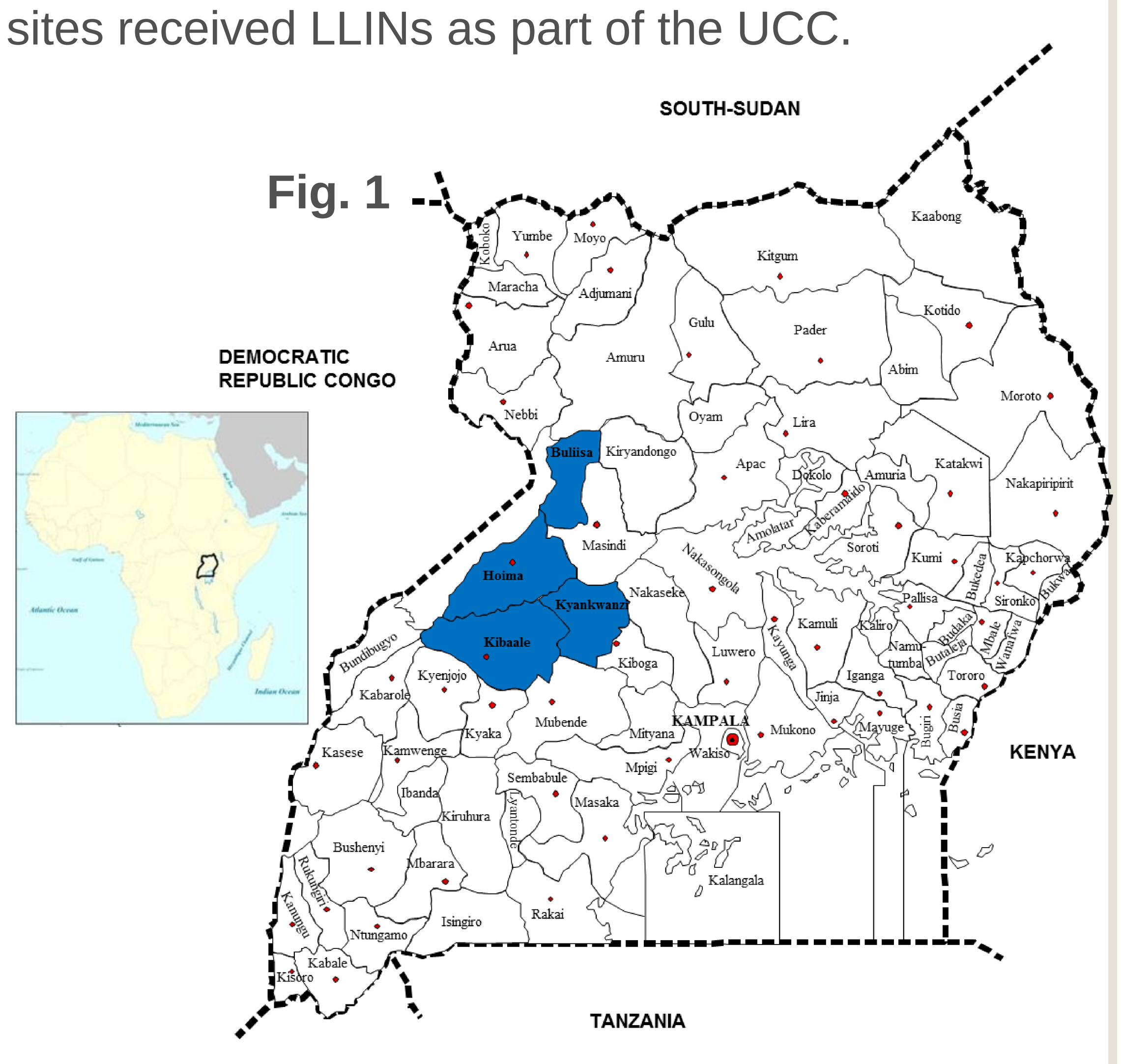
Introduction

A universal coverage campaign (UCC) was implemented in the mid-western region of Uganda to distribute long-lasting insecticidal nets (LLINs) in 2009-2010. In addition, malaria case management at facility level was improved with the introduction of rapid diagnostic tests (RDTs) and training of health workers. Extensive behaviour change communication (BCC) to promote uptake of services by the community took place. Entomological surveys were carried out to monitor vector density, behaviour, and malaria transmission at baseline before the campaign and over a period of four years following the campaign.

Methods

The entomological study took place in four sentinel sites located in four districts (Hoima, Kyankwanzi, Buliisa, Kibaale) in mid-western Uganda (Fig. 1). All sites received LLINs as part of the UCC.

Fig. 1



Six sentinel houses were selected in each site. *Anopheles* mosquitoes were collected using CDC light traps quarterly in three houses and human landing catch (HLC) twice a year in the three remaining houses (Fig. 2).

Fig. 2

Plasmodium falciparum sporozoite enzyme-linked immunosorbent assays (ELISAs) were performed on mosquitoes collected from human landing catches to determine infection rates.

Results

Fig. 3: The UCC resulted in an increase in net use for children under five from 14% at baseline to 45% three years post-distribution (2013 Endline survey). Household ownership of at least one ITN was 64% by 2013.

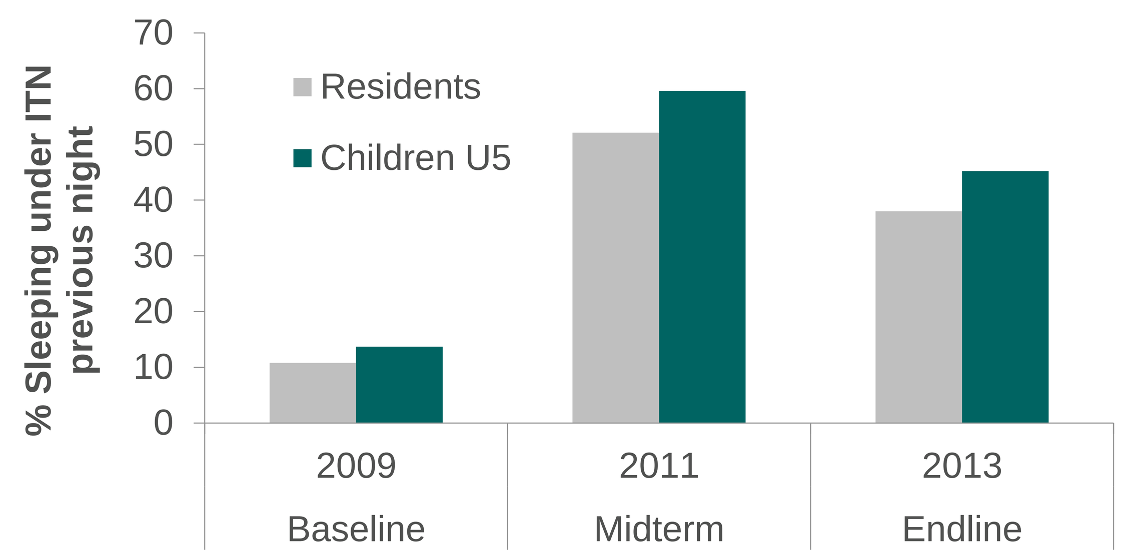


Fig. 4: The dominant malaria vector in all sites was *Anopheles gambiae* s.l. (representing 91% of all anopheline caught) followed by *A. funestus* s.l.

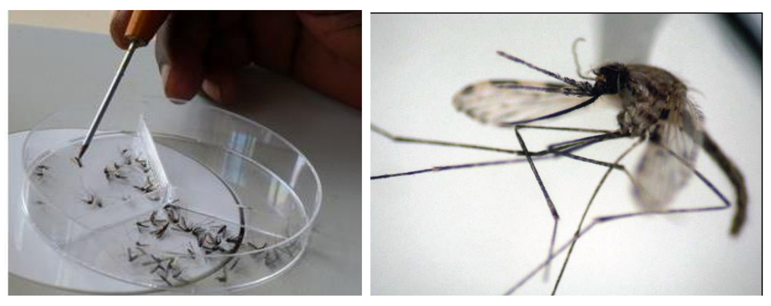


Fig. 6: The reduction in the EIR was primarily the result of a strong reduction in vector density following the UCC, expressed here as the human biting rate (No. of bites per person per night).

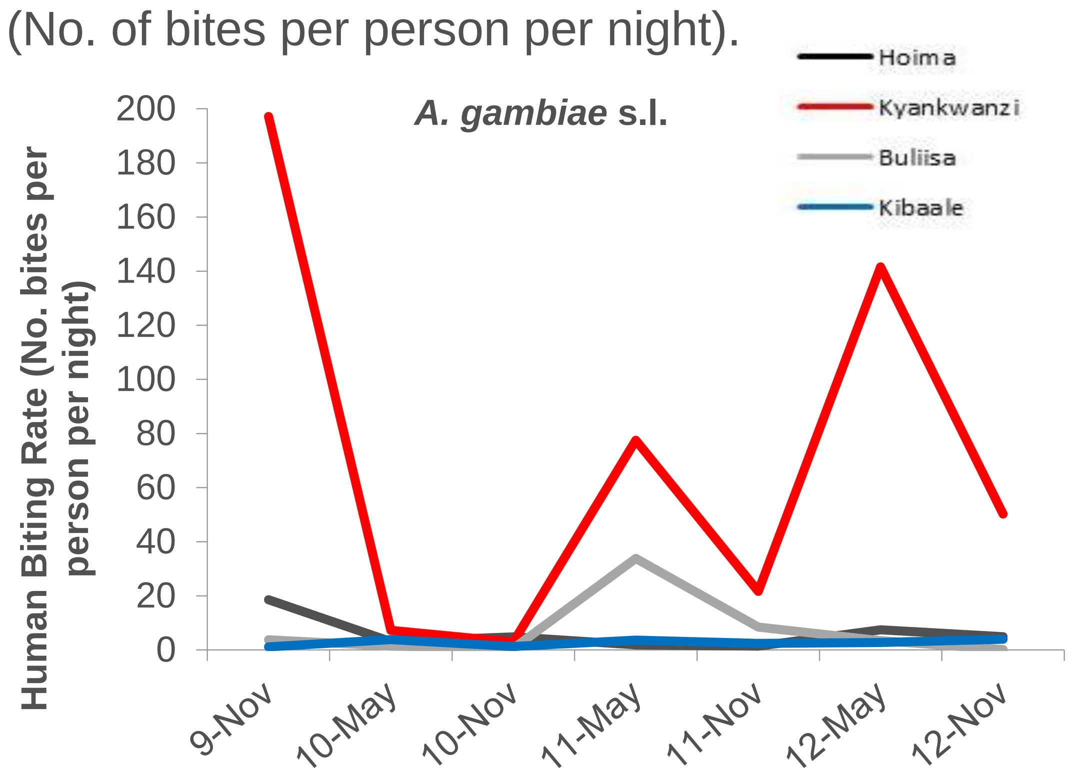


Table. 2: There was no indication of a change in indoor or outdoor feeding behaviour as a result of the use of LLINs, and both *A. gambiae* s.l. and *A. funestus* s.l. continued to seek hosts primarily after 10 pm following the UCC. On average 88% of all bites occurred indoors after 10 pm across sites and years.

Fig. 5: The Entomological Inoculation Rate (EIR), i.e., the number of infective bites per person per night, was used to measure changes in intensity of malaria transmission in the four sites. A decrease in the EIR was observed after LLIN distribution compared to baseline (Nov 09). The reduction was most pronounced in the year following the UCC (2010). In subsequent years, the EIR increased again although values did not reach baseline figures.

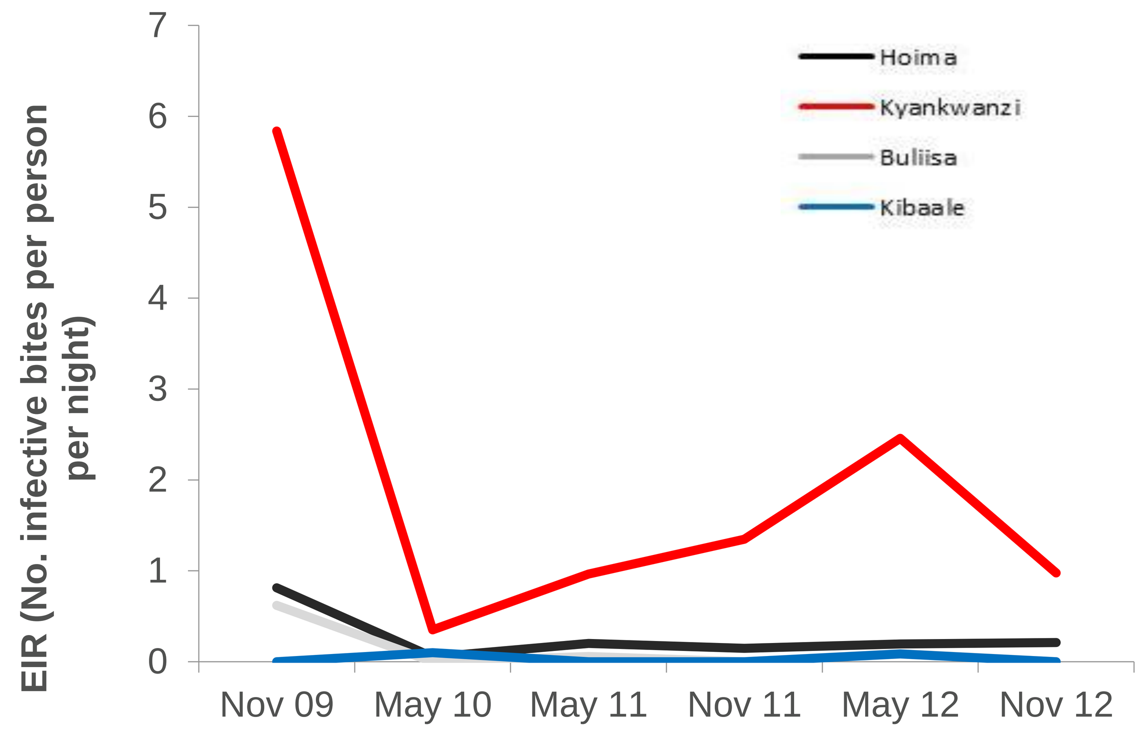


Table 1: The proportion of mosquitoes infected with *P. falciparum* sporozoites was determined. A significant reduction in the sporozoite rate was observed during the duration of the study (χ^2= 17.4, P=0.001; data were combined by species and study site).

% Sporozoite infected *A. gambiae* s.l. and *A. funestus* s.l. The number of mosquitoes tested is indicated between brackets			
2009	**2010**	**2011**	**2012**
3.12 (4327)	2.95 (343)	1.93 (2227)	1.80 (3552)

Table 2

District	Species	Biting location and time	% Host-seeking anopheline collected by HLC			
			2009	2010	2011	2012
Kyankwanzi	*A. gambiae* s.l.	Outside <10 pm	2.1	6.4	2.7	3.2
		Inside <10 pm	8.3	11.8	6.0	5.4
		Inside > 10 pm	89.6	81.9	91.3	91.4
Hoima	*A. gambiae* s.l.	Outside <10 pm	6.2	3.4	3.1	4.7
		Inside <10 pm	18.4	5.4	9.4	7.2
		Inside > 10 pm	75.3	91.3	87.5	88.1
Kibaale	*A. gambiae* s.l.	Outside <10 pm	16.0	3.1	7.6	6.9
		Inside <10 pm	16.0	5.2	6.8	4.6
		Inside > 10 pm	68.0	91.8	85.6	88.5
Buliisa	*A. gambiae* s.l.	Outside <10 pm	18.5	5.0	7.0	11.0
		Inside <10 pm	6.2	17.5	10.8	9.6
		Inside > 10 pm	75.3	77.5	82.2	79.5
	A. funestus s.l.	Outside <10 pm	1.6	4.3	0.0	1.5
		Inside <10 pm	5.7	4.3	3.3	3.9
		Inside > 10 pm	92.7	91.3	96.7	94.6

Conclusions

- ❖ The entomological surveys indicate that there was a reduction in transmission intensity coinciding with a large scale increase in coverage and use of LLINs and other antimalarial interventions in mid-western Uganda.
- ❖ There was no indication of a change in vector feeding habits following the UCC.
- ❖ The gradual increase in mosquito numbers in years following the UCC could be due to many factors including the decline in LLIN ownership and use rates, changes in climatic conditions, insecticide resistance, or a combination of these and other factors.

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