

SUPPLEMENTARY MATERIAL

The influence of climatic factors on age-group-specific malaria burden in Western Kenya

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I. Assessment of Goodness-of-Fit

For this assessment, we considered a Poisson model, Negative Binomial model, and their zero-inflated counterparts. The formulae used for this assessment includes the outcome (number of positive cases), and age groups and health facility (sites) as the predictor and random effect, respectively. The table below shows all results from this assessment, showing the degrees of freedom (DF), and Akaike Information Criterion (AIC), and Negative Log-Likelihood (LogLik).

Table S1. Assessment of Goodness-of-Fit

Model	DF	AIC	LogLik
Poisson	3	2521.360	-1257.68
Zero Inflated Poisson	4	2322.320	-1157.16
Zero Inflated Negative Binomial	5	1422.326	-706.16
Negative Binomial	4	1420.326	-706.16

II. Analysis of Deviance for Negative Binomial Model

In this section, we present a table with the results from the analysis of deviance for the Negative Binomial model, where terms are added sequentially (first to last). The terms considered are the age group, site, and season, and results from this assessment were used along with the interaction plots to determine whether the age-site and age-season interactions will be included in the model fits.

Table S2. Analysis of Deviance for Negative Binomial

Model	Comparison	DF	Deviance	Residual DF	Residual Deviance	P-Value
Count ~ Age Group * Site	≤5 vs >5	-	-	143	313.59	-
		1	96.829	142	216.76	< 2.2 x10 ⁻¹⁶
		2	64.095	140	152.67	1.21 x10 ⁻¹⁴
		2	5.334	138	147.33	0.0695
	≤5 vs 6-15	-	-	143	257.85	-
		1	5.487	142	252.36	0.0192
		2	63.105	14	189.25	1.98 x10 ⁻¹⁴
		2	39.842	138	149.41	2.23 x10 ⁻⁹
Count ~ Age Group * Season	≤5 vs >5	-	-	143	237.80	-
		1	73.177	142	164.62	2.2 x10 ⁻¹⁶
		4	14.866	138	149.75	0.0050
		4	0.600	134	149.15	0.9631
	≤5 vs 6-15	-	-	143	174.91	-
		1	3.6442	142	169.27	0.0563
		4	16.4809	138	152.78	0.0024
		4	2.1642	134	150.62	0.7056

III. Interaction Plots

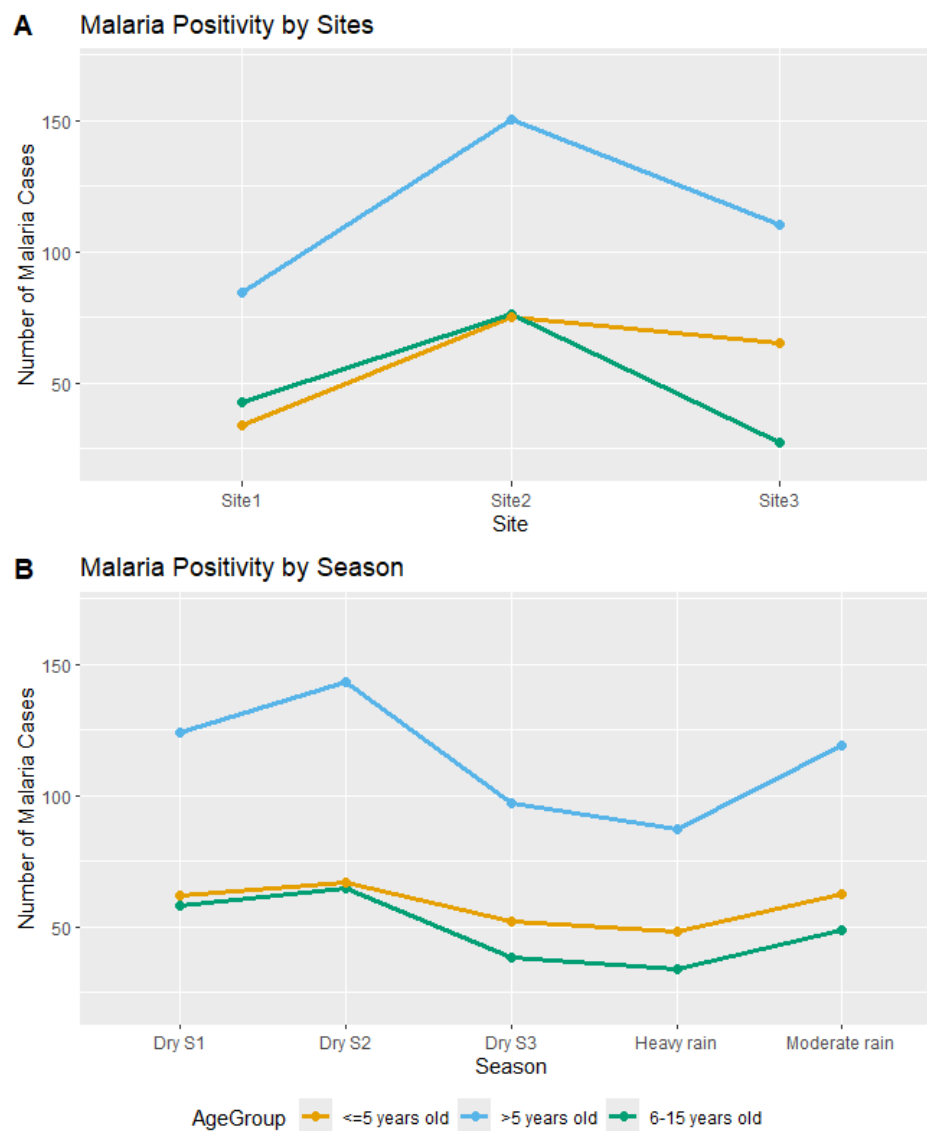


Figure S1. Interaction plots between (A) malaria positivity and study sites, and (B) malaria positivity and season. Malaria positivity data is defined as confirmed malaria cases by microscopy or RDT testing.

IV. Model Validation

This table shows some validation metrics of the model. While the models used in this study demonstrate reasonable predictive performance, with R^2 values ranging from 0.343 to 0.703 and ICC between 0.319 and 0.512, the RMSE values exceeding 20 indicate limitations in capturing the full variability in malaria transmission. This is likely because non-spatial variation was not explicitly accounted for, and key factors such as vector density, human mobility, and land use changes were not included in these models. These additional variables will be considered in future studies as we increase our collaborative network with the Kenyan government and local communities.

Table S3. Model Validation

Comparative Analyses: Negative Binomial					
Comparison	Model	R2 (Conditional)	R2 (Marginal)	ICC	RMSE
≤5 vs >5 years old	M1	0.604	0.334	0.405	36.470
	M3	0.703	0.393	0.512	32.875
≤5 vs 6-15 years old	M2	0.343	0.035	0.319	25.023
	M4	0.480	0.183	0.363	23.959
Age-Specific Subgroup Analyses					
>5 years old	M5	0.518	0.187	0.407	40.896
6-15 years old	M6	0.605	0.269	0.459	21.314
Change Model Analyses					
≤5 vs >5 years old	M7	0.673	0.389	0.464	33.653
≤5 vs 6-15 years old	M8	0.474	0.149	0.381	24.361