Republic of Kenya   **Republic of Kenya**

KENYA METEOROLOGICAL DEPARTMENT   **MINISTRY OF HEALTH**

MALARIA EPIDEMIC EARLY WARNING PREDICTION SYSTEM FOR WESTERN   KENYA HIGHLAND FOR NOVEMBER 2023

Ref No: KMD/MM/11-2023   *Issue Date: 01/11/2023*

1.   Summary

The model outputs for the malaria epidemic early prediction system for the western highlands of Kenya indicate **high** risk of Malaria in Kakamega and Nandi areas and low risk in Kisii in the months of November and December 2023

The weather observations indicate generally a slight increase in maximum temperature and a decrease in total monthly rainfall amounts in all the three areas.

2.   Model Outputs

2.1   Malaria epidemic early prediction system for Kakamega

Table 1 below shows the malaria epidemic early prediction system for Kakamega for November 2023.

Table 1: MALARIA EPIDEMIC EARLY PREDICTION SYSTEM: KAKAMEGA

Yr.	Month	Tmax	Mean Tmax	Tmax Deviation /anomaly	R/fall (mm)	R/fall Code	Tmax Deviation /anomaly Code	Additive % Risk
2022	12	27.6	27.5	0.1	166.0	1	1	9.1
2023	01	29.8	28.3	1.5	14.3	0	4	4.5
2023	02	28.6	29.2	-0.3	43.8	0	0	18.2
2023	03	29.0	29.1	-0.1	310.3	6	3	27.3
2023	04	28.4	27.3	1.1	247.1	4	1	18.2
2023	05	28.7	27.3	1.4	114.8	0	4	4.5
2023	06	28.3	25.8	2.5	195.7	2	9	27.3
2023	07	28.4	25.6	2.8	119.6	0	9	40.9
2023	08	29.3	26.1	3.2	118.1	0	16	40.9
2023	09	28.3	26.9	1.4	343.5	4	4	100
2023	10	28.7	27.0	1.7	306.8	6	4	45.5

The observed climate data for October 2023 indicates a slight increase in maximum temperature from 28.3°C in September 2023 to 28.7°C in October 2023. This observation in October 2023 was positive (1.7 above the mean of the month). Rainfall decreased from 343.5mm in September to 306.8mm in October 2023. The additive model percentage risk in October 2023 was **45.5%.**

Consequently, there is high risk of the Malaria Epidemic in Kakamega in the month of November and December 2023(See Figure 1)

Table 2 below shows the malaria epidemic early prediction system for Kisii for November 2023.

Table 2: MALARIA EPIDEMIC EARLY PREDICTION SYSTEM: KISII

Yr	Mon	Tmax (^{0}C)	Mean Tmax (^{0}C)	Tmin (^{0}C)	Mean Tmin (^{0}C)	Tmax Dev./anom	Tmin Dev./anom	Total Temp Dev./Anom	Temp Dev./anom Code	R/fall (mm)	R/fall Code	Model Output
2022	12	25.0	25.4	15.4	15.4	-0.4	0.0	-0.4	0	152.8	0	0
2023	01	27.1	26.1	15.4	15.7	1.0	-0.3	0.7	0	23.0	0	0
2023	02	30.0	27.0	16.9	16.1	3.0	0.8	3.8	4	22.7	0	0
2023	03	26.1	27.0	15.8	15.9	-0.9	-0.1	-1.0	0	408.6	4	0
2023	04	25.2	25.5	15.7	15.8	-0.3	-0.1	-0.4	0	278.0	5	50
2023	05	26.5	25.1	15.9	15.6	1.4	0.3	1.7	2	292.8	2	0
2023	06	25.8	24.6	16.0	15.0	1.2	1.0	2.3	3	177.7	0	0
2023	07	25.8	24.5	15.5	14.5	1.3	1.0	2.3	3	96.4	0	0
2023	08	26.4	24.9	15.8	14.7	1.5	1.1	2.6	3	137.8	0	0
2023	09	26.4	26.0	15.7	15.1	0.4	0.6	0.9	0	330.1	3	56.3
2023	10	27.0	25.8	16.2	15.2	1.2	1.0	2.2	3	149.7	0	0

The observed climate data for Kisii for October 2023 indicates a slight increase in maximum temperature from 26.4°C in September 2023 to 27.0°C in October 2023. This observation in October 2023 was positive (1.2°C above the mean of the month). Rainfall decreased from 330.1mm in September 2023 to 149.7 mm in October 2023. The Model output risk is NIL**.**

Hence, there is low risk of malaria epidemic in Kisii in the month of November and December 2023. (See Figure 2).

2.2   Malaria epidemic early prediction system for Nandi

Table 3 below shows the malaria epidemic early prediction system for Nandi for October 2023.

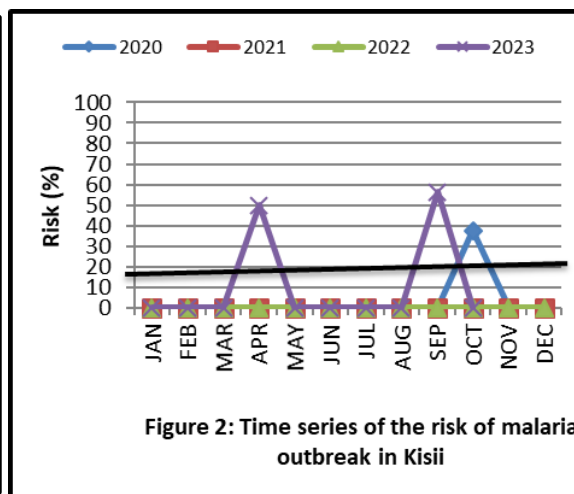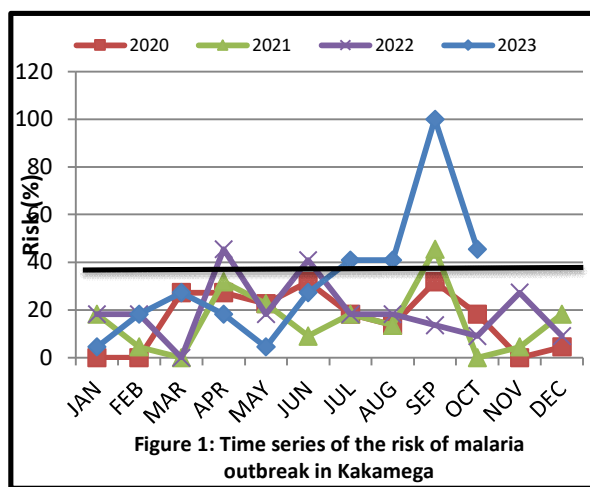**Table 3: NANDI MALARIA EPIDEMIC EARLY PREDICTION SYSTEM**

Yr	Mon	Tmax	Mean Tmax	Tmax Dev.	Tmin	Mean Tmin	Tmin Dev.	Total Temp	R/fall (mm)	Temp Dev.	R/fall Filter	Multiplicativ

		(°C)	(°C)				/anom	Dev. /Anom.		Filters	s	e Model
2022	12	24.3	24.7	0.6	11.8	10.8	1.0	1.6	167.1	2	0	0
2023	01	26.4	23.3	0.1	8.9	10.9	-2.0	2.1	17.8	5	0	0
2023	02	29.6	23.2	6.4	10.3	11.7	-1.4	5.0	13.2	5	0	0
2023	03	25.0	23.0	2.0	12.4	11.5	0.9	2.9	316.3	3	3	75.0
2023	04	24.7	22.8	1.9	11.9	11.2	0.7	2.6	182.4	3	0	0.0
2023	05	25.1	22.7	2.4	11.7	10.7	1.0	3.4	236.0	4	1	15.0
2023	06	24.0	22.7	1.3	12.4	10.9	1.5	2.8	137.6	3	0	0.0
2023	07	24.2	22.8	1.4	12.0	10.6	1.4	2.8	103.3	3	0	0.0
2023	08	25.0	23.1	1.9	12.4	10.8	1.6	3.6	103.5	4	0	0.0
2023	09	24.8	23.3	1.5	12.6	11.1	1.5	3.0	291.3	4	2	30.0
2023	10	25.4	23.3	2.1	11.2	10.7	0.5	2.5	222.8	3	1	20.0

The maximum temperature in Nandi indicates a slight increase from 24.8°C in September 2023 to 25.4°C in October 2023. This observation in October 2023 for Nandi was positive (0.5°C above the mean of the month). Rainfall decreased from 291.3mm in September 2023 to 222.8mm in October 2023. The additive model percentage risk in October 2023 was **20%.**

Box 3:
For Nandi, epidemic threshold level is 20%.

Hence, there is high risk of malaria epidemic in Nandi in the month of November and December 2023. (See Figure 3)

Figure 1: Time series of the risk of malaria outbreak in Kakamega

Figure 2: Time series of the risk of malaria outbreak in Kisii

Figure 3: Time series of the risk of malaria outbreak in Nandi
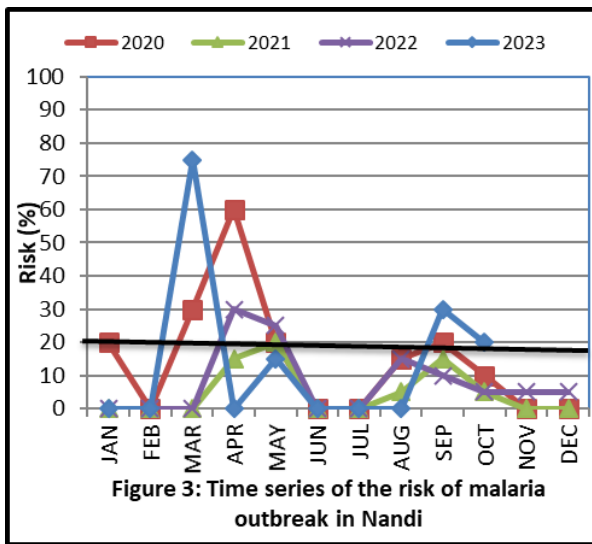
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