

# Burden, Timing, and frequency of Malaria Infection in Pregnancy and Association with Low Birthweight: Evidence from the PRISMA Maternal and Newborn Health Prospective Cohort in Western Kenya

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## BACKGROUND

- Malaria in pregnancy remains a major public health concern in sub-Saharan Africa.
- According to the 2023 WHO World Malaria Report, an estimated 12.7 million (36%) of the 35.4 million pregnancies in 2022 were exposed to malaria infection.
- The prevalence in Western Kenya exceeds 20%.
- While the association between malaria in pregnancy and low-birth weight (LBW) is well-established.
- Critical gaps persist in understanding how the timing and frequency of infection modify this risk.

**OBJECTIVE:** This study aimed to assess the burden, timing, and frequency of malaria infection in pregnancy and their association with LBW in Western Kenya.

## METHODOLOGY:

- We conducted a Kenya-specific sub-analysis from Pregnancy Risk, Infant Surveillance, and Measurement Alliance (PRISMA) Maternal and Newborn Health.

**STUDY AREA:** Western Kenya (Siaya and Kisumu HDSS catchment area)

**STUDY DESIGN AND SAMPLING:** a multi-country, prospective open-cohort.

- Inclusion criteria include: aged  $\geq 18$  years or meeting criteria for emancipated minors, residence within the study catchment area with no plans to relocate during the study period, intrauterine pregnancy  $< 20$  weeks gestational age (GA) verified by ultrasound, and provide informed consent to participate.

**STATISTICAL ANALYSIS:** Multivariable mixed-effects logistic regression estimated associations between malaria exposure, timing and frequency — and LBW, adjusting for HIV, anemia, gravidity, age, and nutritional status.

- Malaria was assessed at five scheduled antenatal care (ANC) visits using WHO-recommended rapid diagnostic tests (RDTs) and microscopy as confirmatory.
- LBW was defined as birthweight  $< 2,500$ g.

## RESULTS:

Among 2,312 participants, 22.1% experienced at least one malaria infection during pregnancy, while 95% received intermittent preventive treatment in pregnancy (IPTp). The median age was 26.1 years (IQR: 7.7), with approximately 83% of participants aged 20–35 years. The median gestational age at baseline was 14.1 (IQR: 6.1) weeks. Most participants (61.7%,  $n = 1,916$ ) resided in peri-urban areas. The prevalence of HIV at baseline was 12%.

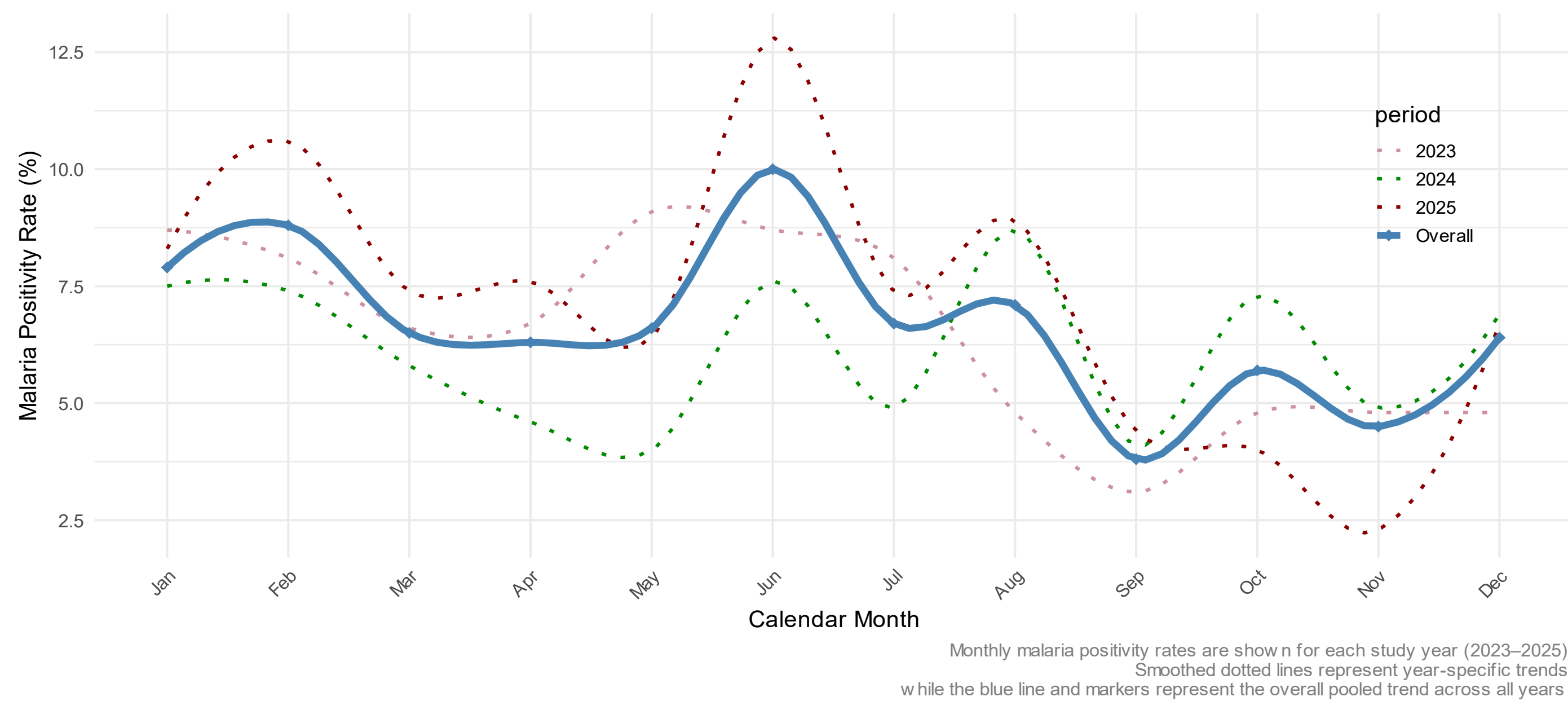


Figure 1. Temporal trend and seasonal pattern of Malaria positivity among pregnant women attending Antenatal care, 2023-2025

- Malaria positivity demonstrated temporal and seasonal variation, with fluctuating rates across the study period and higher positivity during peak transmission months, particularly June, February, and August.

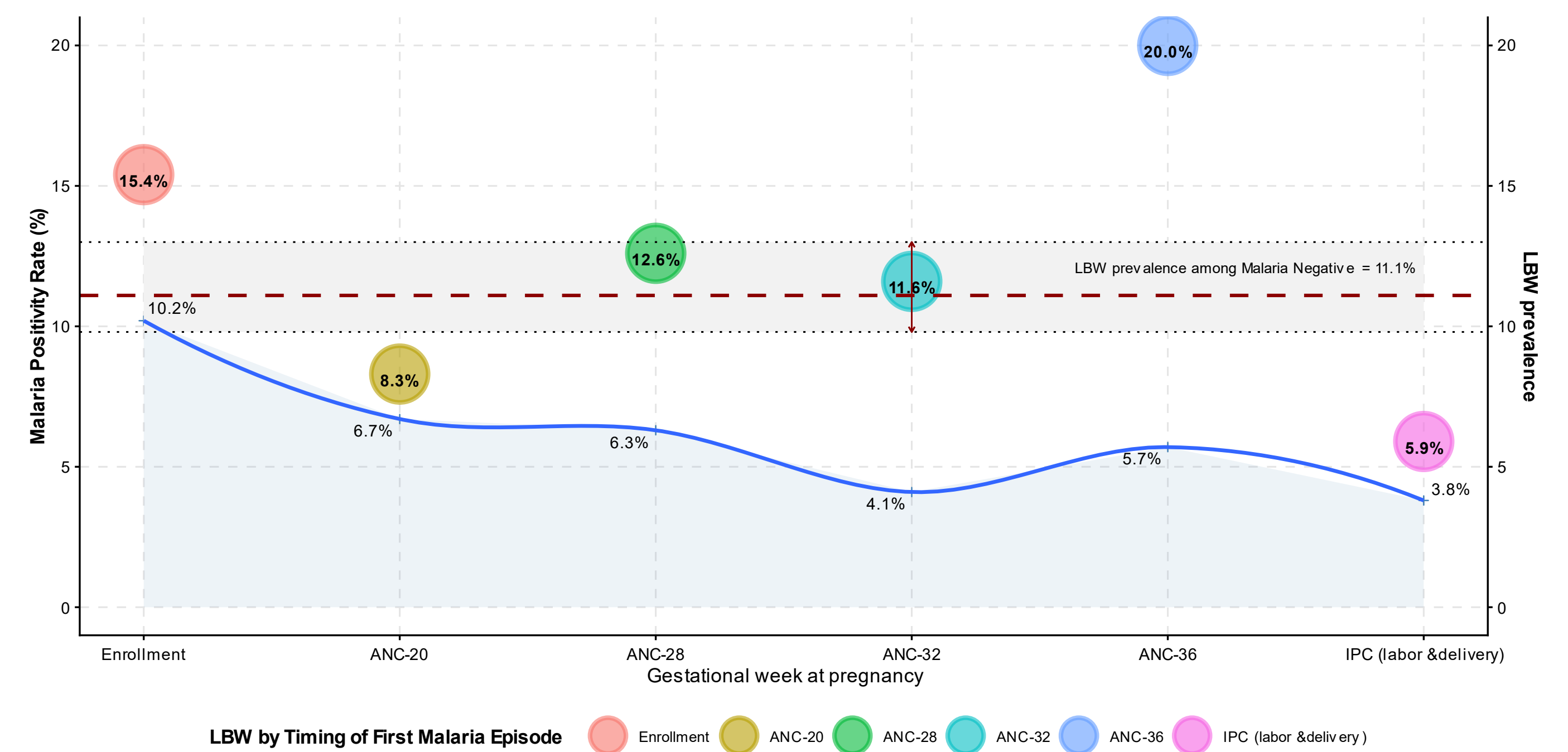


Figure 2. Prevalence of Low Birth Weight by Gestational Timing of First Malaria Infection and Malaria Positivity Trends During Pregnancy

- Malaria positivity declines over pregnancy: The malaria positivity rate decreases from about 10.2% at baseline to 3.8% at delivery (IPC), with a slight uptick around ANC-36 (5.7%).
- The prevalence of low birth weight was highest (20.0%) among women whose first malaria episode occurred at ANC-36, followed by 15.4% among women whose first malaria episode occurred at baseline.
- The prevalence of LBW was 11.1% among those with zero episode during pregnancy.

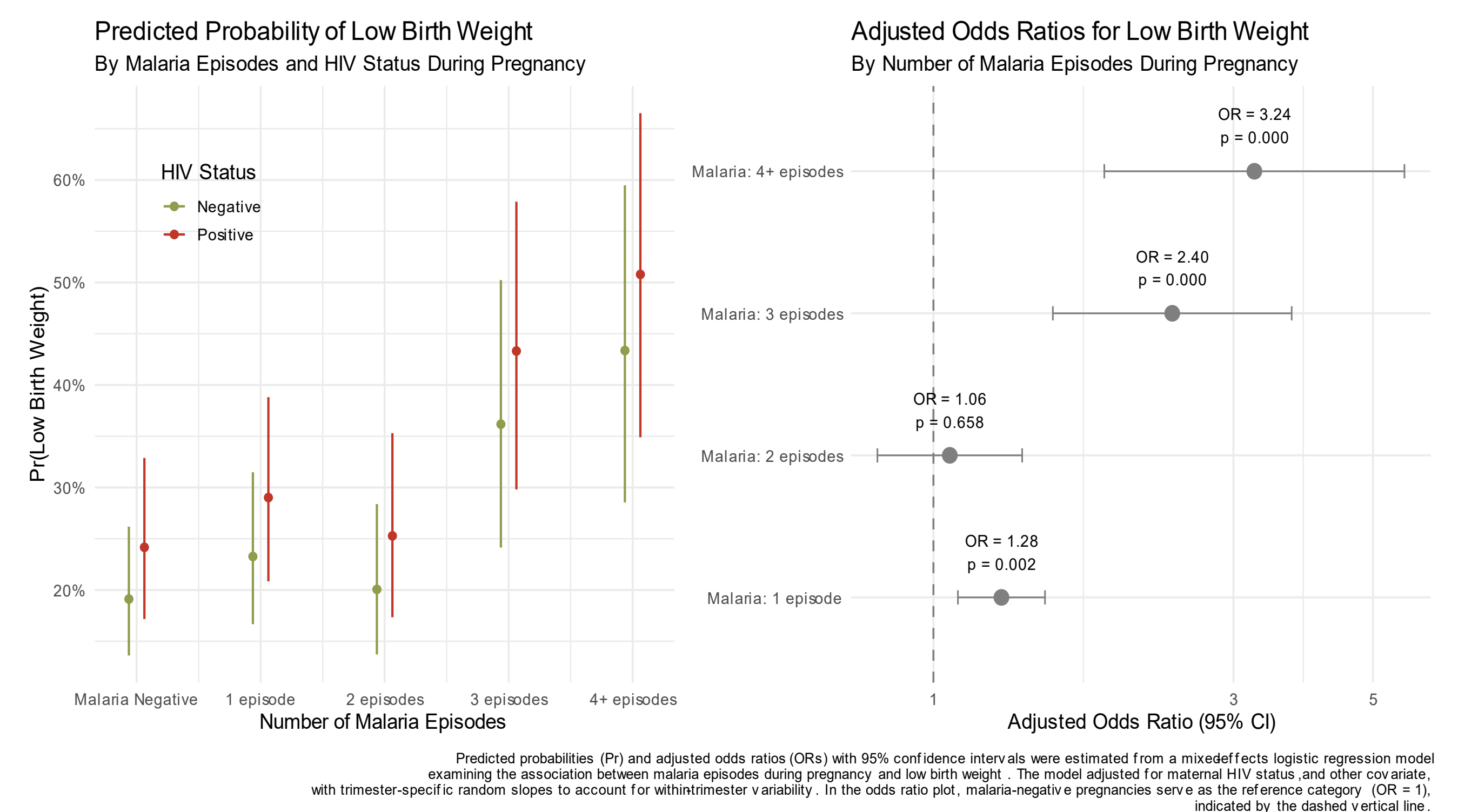


Figure 3. Adjusted Odds and predicted probability of Low Birth Weight by number of malaria episodes

- A dose-response relationship: participants with one, three, and  $\geq 4$  malaria episodes had adjusted odds ratios for LBW of 1.28 ( $p=0.002$ ), 2.40 ( $p<0.001$ ), and 3.24 ( $p<0.001$ ), respectively.
- LBW risk increases with malaria episodes: The predicted probability of low birth weight (LBW) rises steadily with increasing number of malaria episodes during pregnancy.
- Highest risk with  $\geq 4$  episodes: Women with 4 or more malaria episodes have the highest predicted probability of LBW ( $\approx 43\%$  in HIV-negative and  $\approx 51\%$  in HIV-positive).
- Consistent HIV effect: At every level of malaria exposure, HIV-positive women have a higher predicted probability of LBW compared to HIV-negative women.

## CONCLUSIONS

- Recurrent malaria, particularly from early gestation, increases LBW risk.
- Optimizing IPTp timing, sustaining ITN coverage, and strengthening early antenatal malaria screening — especially among HIV-positive — are critical to reducing malaria-associated adverse birth outcomes.

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