Malaria in Pregnancy: Prevalence and Associated Factors at First Antenatal Care Visit in Nakivale Refugee Settlement, Uganda

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Abstract

Background

Malaria remains a leading cause of illness and death in Uganda, disproportionately affecting children under five and pregnant women. In the aftermath of COVID-19, malaria incidence has risen globally, and Uganda ranks among the countries with the heaviest burden, recording the third-highest number of cases and deaths worldwide and the highest prevalence in East and Southern Africa. Pregnant women in refugee settlements face heightened vulnerability due to limited resources, poor living conditions, and reduced access to healthcare. However, little was previously known about malaria prevalence and risk factors in refugee settings such as Nakivale refugee settlement in southwestern Uganda.

Methods

This study aimed to determine the prevalence of malaria infection and associated factors among pregnant women attending their first antenatal care (ANC) visit in Nakivale and Rubondo Health Centre IIIs. A cross-sectional survey was conducted among 374 pregnant women. Data were collected through interviewer-administered questionnaires, key informant interviews, and laboratory testing of capillary blood for *Plasmodium* infection by microscopy. Quantitative data were analyzed using STATA 15.0 with modified Poisson regression to identify associated factors, while qualitative data underwent thematic analysis in Atlas.ti.

Results

The study found that malaria prevalence among the pregnant women was 19.3% (72/374), more than double the 8.9% reported for Western Uganda overall. Nearly half of the participants (46.8%) demonstrated low knowledge of malaria prevention. Risk factors significantly associated with malaria infection included low knowledge of malaria prevention (APR = 1.89, 95% CI: 1.15–3.09), living ≥ 5 km from the nearest health facility (APR = 1.78, 95% CI: 1.18–2.62), and non-use of insecticide-treated nets (ITNs) (APR = 1.76, 95% CI: 1.23–2.52). Protective factors were secondary or higher education (APR = 0.53, 95% CI: 0.33–0.83), perception of high malaria risk (APR = 0.53, 95% CI: 0.36–0.78), being in the second trimester (APR = 0.64, 95% CI: 0.46–0.89), and receipt of indoor residual spraying (IRS) within the last year (APR = 0.16, 95% CI: 0.08–0.33).

Conclusion

In conclusion, malaria prevalence in Nakivale refugee settlement is alarmingly high among pregnant women. Low knowledge and limited access to preventive measures contribute to increased risk, while education, awareness, and preventive interventions such as ITN use and IRS reduce vulnerability.

Strengthening health education, improving access to malaria prevention tools, and targeting interventions to high-risk groups are critical to lowering the malaria burden in refugee populations.

Background

Malaria remains a major public health problem globally, with over 247 million cases reported in 2021, of which 95% occurred in the World Health Organization (WHO) African Region. This region also accounted for 96% of global malaria-related deaths, underscoring the disproportionate burden in sub-Saharan Africa (WHO, 2023). Despite global progress, including a 37% decline in malaria incidence and a 60% reduction in mortality between 2000 and 2015, recent trends show stagnation and even resurgence in some high-burden settings (Roca-Feltrer et al., 2023).

Uganda is among the countries with the heaviest malaria burden. In 2020, the country had the fifth-highest malaria mortality rate globally (3.5%) and the third-highest burden of malaria cases and deaths (5.4%), with a prevalence of 23.2% in East and Southern Africa (WHO, 2022). The majority of infections are due to *Plasmodium falciparum* (94%), with *P. malariae* accounting for a smaller proportion (Namawejje et al., 2022).

Pregnant women and young children are the groups most vulnerable to malaria. Malaria in pregnancy can result in maternal anemia, preterm delivery, spontaneous abortion, stillbirth, and increased neonatal mortality (Malebranche et al., 2017). In sub-Saharan Africa, an estimated 32% of pregnancies are affected by malaria (WHO, 2023). Infection risk is highest in the first trimester and among women attending their first antenatal care (ANC) visit (Okoyo et al., 2021). Malaria in pregnancy also serves as a useful indicator for community-level malaria surveillance (Emerson et al., 2023).

Refugee and migrant populations face unique risks. In Ugandan migrants, malaria prevalence has been reported at 28.3%, with children disproportionately affected (Wångdahl et al., 2023). Frequent exposure before, during, and after migration amplifies risks to maternal and fetal health. However, little is known about malaria prevalence and associated factors among pregnant women in refugee settings, where barriers such as poor access to healthcare, long distances to health facilities, and inadequate preventive interventions may increase vulnerability.

To address this knowledge gap, this study investigated the prevalence of malaria and associated factors among pregnant women attending their first ANC visit in Nakivale refugee settlement, southwestern Uganda. Findings from this study will provide evidence to guide targeted interventions and improve malaria control strategies in refugee populations.

Methods

Study Design and Setting

A cross-sectional study using both quantitative and qualitative methods was conducted at Nakivale and Rubondo Health Centre IIIs, located within Nakivale Refugee Settlement, Isingiro District, southwestern Uganda. These government-run facilities provide a range of medical and surgical services, including antenatal care (ANC), malaria screening, and treatment. The facilities were purposively selected from four health centers in the settlement because they record the highest ANC attendance and provide comprehensive maternal health services.

Study Population and Eligibility

The study population comprised pregnant women attending their first ANC visit at the two health facilities. Women were eligible if they had lived in the refugee settlement for at least six months and were not on intermittent preventive treatment for malaria in pregnancy (IPTp) at the time of recruitment. Pregnant women who were severely ill were excluded. For the qualitative component, health workers directly involved in ANC and malaria prevention were purposively selected as key informants.

Sample Size and Sampling

A total of 374 pregnant women were recruited. Probability proportionate to size sampling was applied to determine the number of participants per facility, based on the average monthly first ANC attendance. Accordingly, 196 participants were enrolled from Rubondo HCIII and 178 from Nakivale HCIII. Eligible participants at each facility were consecutively recruited until the required sample size was reached. For the qualitative arm, seven key informant interviews (KIIs) were conducted with staff, four at Rubondo and three ith staff at Nakivale until data saturation was achieved.

Data Collection

Quantitative data were collected through interviewer-administered questionnaires capturing socio-demographic, obstetric, household, and institutional factors, as well as knowledge, perceptions, and practices regarding malaria prevention. Capillary blood samples were obtained via finger-prick and examined by microscopy to determine Plasmodium infection status. Qualitative data were collected using a semi-structured KII guide. Interviews were audio-recorded, transcribed verbatim, and managed in Atlas.ti for thematic analysis.

Variables

The primary outcome variable was malaria infection status (positive/negative by microscopy). Independent variables included

- **Individual factors**: socio-demographic and obstetric characteristics, knowledge, perceptions, and preventive practices.
- **Household factors**: housing type, sleeping arrangements, household environment, distance to health facility, and malaria prevention interventions.

- **Institutional factors**: access to healthcare, health education, and provision of malaria prevention interventions.

Data Management and Analysis

Quantitative data were entered into EPI Info version 7.0, cleaned in MS Excel 2016, and analyzed in STATA 15.0. Descriptive statistics (frequencies, proportions, means, and standard deviations) summarized participants' characteristics and malaria prevention practices. Associations between independent variables and malaria infection were assessed using generalized modified Poisson regression, suitable for binary outcomes with prevalence > 10%. Crude prevalence ratios (CPR) were calculated at the bivariate level. Variables with $p < 0.20$ were included in the multivariable model, and backward elimination was applied to retain only significant predictors. Adjusted prevalence ratios (APR) with 95% confidence intervals were reported. Statistical significance was set at $p < 0.05$. Results were presented in tables and figures.

For the qualitative data, transcripts were reviewed for completeness and consistency. An inductive thematic analysis approach was used. Codes were generated and grouped into categories, from which themes and subthemes were developed based on study objectives. Representative quotations were selected to illustrate key findings.

Results

This was a cross sectional survey aimed at determining the prevalence of malaria among pregnant women attending their first ANC in Nakivale refugee settlement. A total of 374 randomly selected pregnant women attending their first ANC were enrolled in the study between from July to August 2023 at Nakivale and Rubondo health center.

Social demographic characteristics of participants.

Out of the 374 participants in this study, almost three-fifths 59.6% (223/374) were aged between 21 and 30 years, with the mean age of 22 ± 8.6 years. The majority of the participants 64.7% (242/374) were married, 57.5% (215/374) multi-parous, and over two-thirds 69.8% (261/374) had given birth three times or less. Regarding education level, about three-fifths of the participants 59.89% (224/374) had not attained any formal education, and only 22.2% (83/374) had attained primary education. In addition, most of the participants 58.0% (217/374) had small household sizes ranging from 1 to 4 family members. About half 54.3% (203/374) of the participants were farmers (Table 2).

Table 2
Social demographic characteristics of the participants

Variable	Frequency (n = 374)	Percentage (%)
Age (years)		
15 to 20	54	14.4
21 to 30	223	59.6
Above 30	97	25.9
Nationality		
Burundian	51	13.6
Congolese	202	54.0
Ethiopian	1	0.3
Rwandese	56	15.0
Somali	6	1.6
Ugandan	58	15.5
Marital status		
Single	10	2.7
Married	242	64.7
Cohabiting	109	29.1
Divorced	13	3.5
Level of education		
No formal education attained	224	59.9
Primary	83	22.2
Secondary	60	16.0
Tertiary	7	1.9
Religion		
Anglican	100	26.7
Catholic	52	13.9
Muslim	33	8.8
Pagans	2	0.5

Variable	Frequency (n = 374)	Percentage (%)
Age (years)		
Pentecostal	115	30.8
SDA	69	18.5
Traditional	3	0.8
Main source of income		
Business	7	1.9
Casual labor	96	25.7
Formal employment	23	6.2
Farming	203	54.3
UNHCR	45	12.0
Number of family members in household		
1–4 (Small)	217	58.0
5–7 (Medium)	114	30.5
> 8 (Many)	43	11.5
Gravidity		
Primigravidae	87	23.3
Secondigravidae	72	19.3
Multigravidae	215	57.5
Parity		
≤ 3	261	69.8
> 3	113	30.2
Gestational age		
First trimester (1–12 weeks)	122	32.62
Second trimester (13–28 weeks)	188	50.27
Third trimester (29–40 weeks)	64	17.11

Household characteristics and health care seeking behavior.

Most of the participants 53.2% (199/374) lived in semi-permanent house structures and a significant proportion 82.1% (307/374) used tap water as their main source of water. Concerning accessibility to health facility, almost half of the participants 49.2% (184/374) stayed at least 5Kms away from the nearest health facility and the largest proportion 63.4% (237/374) walked to these facilities. The majority of participants 83.4% (312/374) attended Antenatal care (ANC) at government health facility, and 58.0% (218/374) perceived care during ANC visits as good. Notably, a significant proportion of participants reported being health educated regarding malaria prevention during ANC (Table 3)

Table 3
Household characteristics and health care seeking

Variable	Frequency(n = 374)	Percentage (%)
Household type		
Permanent	21	5.6
Semi-permanent	199	53.2
Temporary	154	41.2
Main source of water		
Bore hole	54	14.4
Dug well	9	2.4
Surface water	4	1.1
Tap	307	82.1
Type of facility where ANC was attended		
Government Health Centre	312	83.4
PNFP	50	13.4
Private hospital/clinic	12	3.2
Distance to nearest Health facility		
< 5Kms	190	50.8
≥ 5Kms	184	49.2
Most common transportation means to health facility		
Bicycle	10	2.7
Motorcycle	127	34.0
Walking	237	63.4
Average waiting time on ANC visit (n = 245)		
≤ 4 hours	224	91.4
> 4 hours	21	8.6
Provision of malaria health education during ANC visit		
No	15	4.0
Yes	359	96.0

Prevalence of malaria among the study participants

The prevalence of malaria among participants by microscopy was 19.3% (72/374) (Fig. 2).

Participants awareness and knowledge regarding malaria.

All the participants 100.0% (374/374) had ever heard of malaria disease, more than four-fifths 99.2% (371/374) knew that it is transmitted through mosquito bites while 27.5% (103/374) thought it was transmitted through getting soaked in the rain. Regarding preventive measures, majority of the participants 98.7% (369/374) reported sleeping under ITN, keeping the surrounding environment clean 57.5% (215/374), taking preventive medicine 36% (133/374), indoor residual spraying 19.0% (71/374), use of mosquito repellants 8.8% (33/374), use of mosquito coils 14.4% (54/374), use of window screens 26.7% (100/374). Notably, Majority of the participants 92.8% (347/374) reported pregnant women as one of the vulnerable populations at risk of malaria, and majority 93.9% (351/374) reported fever as a symptom of malaria (Table 4).

Table 4
Participants' response on malaria knowledge questions

Variable	Frequency (n = 374)	Percentage (%)
Ever heard of malaria illness		
Yes	374	100.0
No	0	0.0
Transmission routes of malaria*		
Mosquito bite	371	99.2
Drinking dirty water	93	24.9
Dirty/contaminated food	19	5.1
Changing cold weather	56	15.0
Witchcraft	9	2.4
Getting soaked in rain	103	27.5
Symptoms of malaria*		
Fever	351	93.9
Seizure/convulsions	33	8.8
Feeling cold/shivering	125	33.4
Headache	282	75.4
Not being active	32	8.6
Restlessness	43	11.5
Vomiting	199	53.2
Diarrhea	104	27.8
Sweating	67	17.9
Dizziness	73	19.5
Fainting	42	11.2
Loss appetite	117	31.3
Joint pain	113	30.2
Body weakness	58	15.5
***Multiple response questions		

Variable	Frequency (n = 374)	Percentage (%)
Ever heard of malaria illness		
Blurred vision	10	2.7
Preventive measures of malaria *		
Sleeping under ITN	369	98.7
Mosquito repellants	33	8.8
Long sleeved shirts and trousers in evenings to avoid bites	24	6.4
Taking preventive medicine	133	35.6
Indoor residual spraying	71	19.0
Use of mosquito coils	54	14.4
Filling paddles with stagnant water	127	34.0
Keeping house surrounding clean	215	57.5
Use of window screens	100	26.7
Vulnerable groups for malaria*		
Pregnant mothers	347	92.8
Children below 5 years	183	48.9
Adolescents	10	2.7
Very old men and women	60	16.0
Children between 5 & 12 years	22	5.9
Don’t know	16	4.3
***Multiple response questions		

Overall, nearly half of the participants 46.8% (175/374) had a low level of knowledge regarding malaria prevention.

Perception/attitude of participants towards malaria.

About 28.6% (107/374) of the participants agreed that pregnant women are more at risk of malaria, almost half 46.3% (173/374) agreed that they were at risk of malaria during their past pregnancy, and over two-fifths 42.0% (157/374) were in-agreement that malaria causes complications during pregnancy. Furthermore, a significant proportion of participants 51.9% (194/374) strongly agreed that malaria causes complications during pregnancy, and 50.3% (188/374) agreed that Fansidar is important in reducing malaria complications during pregnancy (Table 5).

Table 5
Perception/attitude of participants towards malaria

Variable	Frequency (n = 374)	Percentage (%)
Pregnant women are more at risk of malaria		
Agree	107	28.6
Disagree	3	0.8
Neither	5	1.3
Strongly agree	256	68.5
Strongly disagree	3	0.8
I was at risk of malaria during my last pregnancy		
Agree	173	46.3
Disagree	14	3.7
Neither	12	3.2
Strongly agree	172	46.0
Strongly disagree	3	0.8
Malaria causes complications during pregnancy		
Agree	157	42.0
Disagree	5	1.3
Neither	16	4.3
Strongly agree	194	51.9
Strongly disagree	2	0.5
Fansidar is important in reducing malaria risk during pregnancy		
Agree	188	50.3
Disagree	7	1.9
Neither	39	10.4
Strongly agree	137	36.6
Strongly disagree	3	0.8
Women are individually responsible for preventing malaria during pregnancy		

Variable	Frequency (n = 374)	Percentage (%)
Pregnant women are more at risk of malaria		
Agree	175	46.8
Disagree	66	17.7
Neither	50	13.4
Strongly agree	81	21.7
Strongly disagree	2	0.5
Only the government is responsible for preventing malaria in pregnancy		
Agree	163	43.6
Disagree	63	16.8
Neither	65	17.4
Strongly agree	66	17.7
Strongly disagree	17	4.6
Both government and women are responsible for preventing malaria in pregnancy		
Agree	163	43.6
Disagree	63	16.8
Neither	65	17.4
Strongly agree	66	17.7
Strongly disagree	17	4.6
Government, NGO's and women are responsible for preventing malaria in pregnancy		
Agree	214	57.2
Disagree	19	5.1
Neither	33	8.8
Strongly agree	106	28.3
Strongly disagree	2	0.5

Overall, 35.6% (133/374) of the participants had negative perceptions/attitude towards malaria prevention.

Use of malaria preventive interventions by the participants

Majority of the participants 86.1% (322/374) slept under a mosquito net. Reasons for not sleeping under the mosquito net included the net being too hot 38.5% (20/52), bad smell 7.69% (4/52), presence of holes 19.2% (10/52), net not being hanged 28.9% (15/52), and absence of mosquitoes 5.8% (3/52). The majority of the participants 96.3% (360/374) reported that their beds had mosquito nets, however, about two thirds 65.5% (245/374) slept under a mosquito net consistently during their last pregnancy. In addition, the majority 93.9% (351/374) reported that no residual spraying was conducted in their households in the previous 12 months. Regarding malaria treatment, most of the participants had taken malaria medication in their previous pregnancy. Overall, more than half 61.8% (231/374) exhibited good practices towards malaria prevention.

(Table 6).

Table 6
Use of malaria preventive interventions among the participants

Variable	Frequency (n = 374)	Percentage (%)
Slept under a mosquito net in the previous night		
Yes	322	86.1
No	52	13.9
Reasons for not sleeping under a mosquito net (n = 52) *		
Don't like the smell	4	7.7
Net is old (has holes)	10	19.2
Net not hanged	15	28.9
No mosquitoes	3	5.8
Too hot	20	38.5
Participants bed had a mosquito net		
Yes	360	96.3
No	14	3.7
Slept under mosquito net consistently during last pregnancy	245	65.5
No	129	34.5
Yes	245	65.5
Prophylaxis against malaria received during the last pregnancy* (n = 310)	310	82.9
Coatem	1	0.3
SP/Fansidar	309	99.7
HH that had IRS in the last 12 months		
No	351	93.9
Yes	23	6.2
Sources of ITN used in the HH*		
Government facility	257	68.7
Private health facility	17	4.6

***Multiple response question

Variable	Frequency (n = 374)	Percentage (%)
Slept under a mosquito net in the previous night		
Pharmacy	4	1.1
Shop	65	17.4
Open market	74	19.8
Hawker	2	0.5
Church	6	1.6
NGO project	96	25.7
Campaign	25	6.7
Practices	143	38.2
Poor practices	231	61.8
Good practices		
***Multiple response question		

Factors associated with malaria infection among participants.

Quantitative Results.

Bivariate analysis showed that low knowledge of malaria prevention, non-use of insecticide-treated nets (ITNs), long distance to health facilities, and lower education levels were significantly associated with malaria infection.

In multivariable analysis, independent predictors of malaria infection were:

- **Low knowledge of malaria prevention** (APR = 1.89, 95% CI: 1.15–3.09)
- **Living ≥ 5 km from a health facility** (APR = 1.78, 95% CI: 1.18–2.62)
- **Non-use of ITNs** (APR = 1.76, 95% CI: 1.23–2.52)

Protective factors included:

- **Secondary or higher education** (APR = 0.53, 95% CI: 0.33–0.83)
- **High perceived risk of malaria infection** (APR = 0.53, 95% CI: 0.36–0.78)
- **Being in the second trimester** (APR = 0.64, 95% CI: 0.46–0.89)
- **Having received indoor residual spraying (IRS) in the past 12 months** (APR = 0.16, 95% CI: 0.08–0.33)

Table 7
Factors associated with prevalence of malaria among participants.

Variables	Malaria				CPR at 95%CI	P-values < 0.05	APR at 95%CI	P-values < 0.05
	Positive (n = 72)		Negative (n = 302)					
	F	%	F	%				
Marital status								
Not married	5	6.9	18	6.0	1.0			
Married	67	93.1	284	94.0	0.88 (0.39–1.97)	0.752		
Age								
< 20 years	46	63.9	240	79.5	1.0		1.0	
Above 20 years	26	36.1	62	20.5	0.54 (0.36–0.83)	**0.004***	0.79 (0.49–1.28)	0.347
Ever attended school								
Yes	44	61.1	180	59.6	1.0			
No	28	38.9	122	40.4	1.05 (0.69–1.61)	0.815		
Level of education								
No formal education attained	40	55.6	184	60.9	1.0		1.0	
Primary	15	20.8	68	22.5	1.01 (0.59–1.73)	0.965	0.50 (0.30–0.83)	0.118
Secondary and above	17	23.6	50	16.6	1.42 (0.86–2.34)	0.167	0.53 (0.33–0.83)	**0.006***
Source of income								
Business/Daily wage	17	23.6	86	28.5	1.0		1.0	
Employed	5	6.9	18	6.0	1.32 (0.54–3.21)	0.544	0.89 (0.45–1.73)	0.720
Farming	38	52.8	165	54.6	1.13 (0.67–1.91)	0.636	1.13 (0.74–1.75)	0.571

Variables	Malaria				CPR at 95%CI	P-values < 0.05	APR at 95%CI	P-values < 0.05
	Positive (n = 72)		Negative (n = 302)					
	F	%	F	%				
UNHCR	12	16.7	33	10.9	1.62 (0.84–3.10)	0.149	0.96 (0.58–1.59)	0.868
Housing type								
Permanent	4	5.6	17	5.6	1.0			
Semi-permanent	35	48.6	164	54.3	0.92 (0.36–2.35)	0.867		
Temporary	33	45.8	121	40.1	1.13 (0.44–2.86)	0.805		
Distance to nearest Health facility								
< 5 Kms	18	25.0	198	65.6	1.0		1.0	
≥ 5 Kms	54	75.0	104	34.4	4.10 (2.50–6.72)	**0.000***	1.78 (1.18–2.62)	**0.006***
Household size								
Small (1–4)	36	50.0	181	59.9	1.0		1.0	
Medium (5–7)	26	36.1	88	29.1	1.37 (088-2.16)	0.167	1.57 (0.88–2.85)	0.122
Large (≥ 8)	10	13.9	33	10.9	1.40 (0.75–2.61)	0.286	2.23 (1.13–4.42)	**0.021***
Surface as main water source								
No	69	95.8	299	99.0	1.0		1.0	
Yes	3	4.2	3	1.0	2.67 (1.16–6.10)	**0.020***	1.39 (0.78–2.48)	0.264
Perception as at risk of malaria								
No	41	56.9	10	3.3	1.0		1.0	

Variables	Malaria				CPR at 95%CI	P-values < 0.05	APR at 95%CI	P-values < 0.05
	Positive (n = 72)		Negative (n = 302)					
	F	%	F	%				
Yes	31	43.1	292	96.7	0.12 (0.83 – 0.17)	**0.000***	0.53 (0.36–0.78)	**0.001***
Use ITN								
Yes	44	61.1	268	88.7	1.0		1.0	
No	28	38.9	34	11.3	3.20 (2.17–4.72)	**0.000***	1.76 (1.23–2.52)	**0.002***
IRS done in past 12 months								
No	63	87.5	43	14.2	1.0		1.0	
Yes	9	12.5	259	85.8	0.06 (0.03–0.11)	**0.000***	0.16 (0.08–0.33)	**0.000***
Gravidity								
Multi-gravidae	18	25.0	197	65.2	1.0		1.0	
Primigravidae	40	55.6	47	15.6	5.49 (3.34–9.04)	**0.000***	2.17 (1.39–3.40)	**0.001***
Secondi-gravidae	14	19.4	58	19.2	2.32 (1.22–4.43)	**0.011***	1.67 (1.04–2.69)	**0.034***
Parity								
≤ 3	42	58.3	219	72.5	1.0		1.0	
> 3	30	41.7	83	27.5	1.65 (1.09–2.50)	**0.018***	1.69 (1.12–2.56)	**0.013***
Gestational age								
First trimester (1–12 weeks)	42	58.3	80	26.5	1.0		1.0	
Second trimester (13–28 weeks)	21	29.2	167	55.3	0.32 (0.20–0.52)	**0.000***	0.64 (0.46–0.89)	**0.008***

Variables	Malaria				CPR at 95%CI	P-values < 0.05	APR at 95%CI	P-values < 0.05
	Positive (n = 72)		Negative (n = 302)					
	F	%	F	%				
Third trimester (29–40 weeks)	9	12.5	55	18.2	0.41 (0.21–0.79)	**0.007***	1.20 (0.64–2.24)	0.566
Health education on malaria prevention during ANC visit								
Yes	33	45.8	292	96.7	1.0		1.0	
No	39	54.2	10	3.3	7.83(5.50-11.16)	**0.000***	1.50 (1.01–2.23)	**0.043***
Perception towards malaria prevention								
Good perception	38	52.8	203	67.2	1.0		1.0	
Poor perception	34	47.2	99	32.8	1.62 (1.07–2.45)	**0.022***	0.91 (0.61–1.37)	0.653
Knowledge towards malaria prevention								
High	14	19.4	185	61.3	1.0		1.0	
Low	58	80.6	117	38.7	4.71 (2.72–8.14)	**0.000***	1.89 (1.15–3.09)	**0.013***

* C.I - Confidence Interval, CPR -Crude Prevalence Ratio, APR – Adjusted Prevalence Ratio, considering a 95% C.I, a p-value < 0.05 was considered statistically significant.

6.5.2. Qualitative results

Key informant interviews with seven health workers highlighted gaps in community knowledge, inconsistent ITN use, and challenges in accessing ANC services due to distance and mobility within the settlement. Respondents emphasized the need for strengthened health education, regular IRS, and improved distribution of ITNs to reduce malaria burden among pregnant women.

Discussion

This study found that the prevalence of malaria among pregnant women attending their first ANC visit in Nakivale refugee settlement was 19.3%, indicating that nearly one in five women were infected. This prevalence is higher than the average in low transmission settings of Western Uganda (8.9%) but lower than estimates from high transmission areas (up to 50%) (Braun et al., 2015a; Okiring et al., 2019). It is also comparable to findings from Northwest Ethiopia (20%) (Almaw et al., 2022), higher than those reported in Western Ethiopia (10.2%) (Gontie et al., 2020a) and Ghana (8.9%) (Fondjo et al., 2020), but lower than estimates from Ghana (47%) (Dosoo et al., 2020). These differences may reflect variations in transmission intensity, environmental conditions, and coverage of preventive interventions across settings.

Consistent with earlier studies (Semakula et al., 2023; Mangusho et al., 2023), knowledge and attitudes towards malaria prevention emerged as significant predictors. Women with low knowledge were more likely to be infected, highlighting the role of health education in prevention. Similarly, formal education was protective, aligning with findings from Ethiopia (Gontie et al., 2020), Nigeria (Fana et al., 2015), and Ghana (Tagbor et al., 2008), where maternal education improved awareness and adoption of preventive practices.

The study also found that women who perceived themselves at risk of malaria were less likely to be infected. This supports the Health Belief Model (Maiman and Becker, 1974) and echoes findings from McCombie (2002), underscoring the importance of perception in driving preventive behaviours.

Gravidity and trimester were also associated with malaria risk. Primigravidae and women in the first trimester were more vulnerable, consistent with studies in Ethiopia (Tilahun et al., 2020) and Kenya (Nyamu et al., 2020), though contrasting with findings from Mali (Dicko et al., 2003). These differences may reflect immunological changes across pregnancy as well as differential health-seeking behaviour with repeated pregnancies.

Environmental and structural factors further influenced malaria risk. Larger household sizes increased the likelihood of infection, as also reported in Ethiopia (Peterson et al., 2009) and Congo. Distance to health facilities was another predictor; women living ≥ 5 km away had higher risk, consistent with studies from Ethiopia (Almaw et al., 2022) and elsewhere (Yadav et al., 2014; Coetzer and Adeola, 2020). In refugee settings, such barriers may be amplified by mobility, housing conditions, and limited access to services.

Preventive measures, particularly ITN use and IRS, were strongly protective, confirming their importance in malaria control. These findings align with studies in Nigeria (Agomo and Oyibo, 2013) and Ethiopia (Gontie et al., 2020b). However, challenges with ITN use including misuse and reduced effectiveness due to insecticide resistance remain well documented in Uganda (Ekusai-Sebatta et al., 2021; Perkins et al., 2019). Scaling up newer dual-active ingredient nets recommended by WHO (2023c) and expanding IRS in refugee settlements could further reduce transmission.

The qualitative findings reinforced these results, with health workers citing poor housing, irregular ITN use, and inadequate environmental management as key drivers of malaria transmission. These structural barriers highlight the need for multi-sectoral interventions that extend beyond health services to address housing, sanitation, and community engagement.

Strengths and limitations

This study combined quantitative and qualitative methods, providing both statistical evidence and contextual insights. The use of microscopy improved diagnostic accuracy. However, the cross-sectional design limits causal inference, and the study population was restricted to women attending their first ANC visit, which may not reflect all pregnant women in the settlement.

Implications

These findings underscore the need for targeted malaria interventions in refugee settings, including health education, promotion of early ANC attendance, expansion of IRS, improved ITN distribution and use, and support for large households. Collaboration between the Ministry of Health, UNHCR, and implementing partners is essential to strengthen malaria prevention and control in Nakivale and similar settlements.

Conclusion

This study revealed the prevalence of malaria among pregnant mothers in the refugee settlement to be at 19.3% more than 2 times the prevalence in Western Uganda (8.9%), which is one of the low transmission areas in Uganda. The level of education, gravidity, trimester, parity, gestational age, perceived risk of malaria infection, ITNs usage, IRS status, number of dependents, distance from the health facility and knowledge towards malaria prevention were important risk factors associated with malaria infection among pregnant mothers in the refugee settlement. Additionally, knowledge, perceptions and practices towards malaria prevention measures were low, positive and good respectively. The factors elucidated in this study should be articulated to effectively scale up malaria prevention strategies among pregnant women. Further, health education, early attendance and utilization of focused antenatal care services by all pregnant women will reduce the risk of malaria in pregnancy in refugee settlements like Nakivale.

Abbreviations

ACT
Artemisinin-Combination Therapy
ANC
Antenatal care
ASAQ

Artésunate–amodiaquine

IPTp

Intermittent preventive treatment in pregnancy

IPTp-SP

Intermittent preventive treatment in pregnancy with sulfadoxine pyrimethamine

IRB

Institutional review board

IRS

Indoor residual spraying

ITN

Insecticide treated nets

LLIN

Long lasting insecticidal nets

NMCP

National malaria control programme

OPD

Outpatient Department

SOP

Standard operating procedure

UBOS

Uganda Bureau of Statistics

UNHCR

United nations high commission for refugees

WHO

World Health Organization

Declarations

The Consent form.

STUDY TITLE: **Malaria in Pregnancy: Prevalence and Associated Factors at First Antenatal Care Visit in Nakivale Refugee Settlement, Uganda**

My name is **Mr. Jowali Nangu,** a postgraduate student in public health. I am conducting a study to ascertain the malaria infection prevalence and associated factors among pregnant women attending their first antenatal care attendees at Nakivale refuge settlement.

This study is being carried out on consenting pregnant women at their first antenatal care attending clinical units at Nakivale refuge settlement. Malaria is the global number one killer disease of all the parasitic infections. With an estimation of at least 1 million people dying annually especially children under 5 years of age. It’s caused by five plasmodium parasites which are spread to humans and animals

through bites by infected mosquitoes with the plasmodium falciparum species being the deadliest. Gestational malaria is still a major public health problem in Uganda it's therefore important to accurately diagnose it early will help to prevent risks of miscarriages, intrauterine demise, premature delivery severe anemia and maternal death, low-birth-weight neonates, and neonatal death. This study will be important in assessing the efficiency of utilizing both indoor residual spraying and insecticide-treated nets in reducing the epidemiology of malaria among first antenatal care attendees at Nakivale refuge settlement.

PROCEDURES:

If you accept to participate in this Study the following procedure will be followed:

1. Questions will be asked about your personal detail, current and past illness, visit of antenatal care and current measures used to prevent malaria.

2. A complete physical examination will then be conducted on you.

3. Blood sample of about 50µl will be collected from your capillary vein for both thin and thick smears preparation.

4. The blood samples will be collected and tested using both the thick and thin smears which will be prepared on all the collected blood samples for plasmodium parasites identification using thick blood smears and speciesion using the thin blood smears. Those which will test positive for plasmodium parasites the results will be availed to the health facility for your better clinical management,

Your medical records will be handled with confidentiality. Your identity will not be used in any reports or publications of this study.

BENEFITS:

1. You will receive a thorough and careful medical examination.

2. Results of this study will be given to you and your health care providers and they will be used for your better management. All investigations for this study will be done at no cost to you.

RISKS AND DISCOMFORTS:

1. The procedure of drawing blood from a capillary vain will cause some minor pain and discomfort.

2. You may bleed a little from the site where blood is taken, and drawn blood will be too little to pose any health problem.

RIGHTS:

You are free to decline to participate in this study or withdraw your consent to participate in it at any time during the study, even in case where consent had been given initially.

Refusal to participate or withdrawal from the study will neither affect your access to medical care nor lead to victimization at all.

QUESTIONS:

In case of problems or questions regarding this study, you can ask them now or at any time during the study. You are free to contact Mr. Jowali Nangu on Phone number 0700697454.

STATEMENT OF CONSENT:

I do understand that participation in this study is voluntary and that no consequences arise from my withdrawal from it.

I have read the information provided and had time to discuss with the above-named medical personnel.

My signature below will indicate that I have voluntarily accepted to participate in this study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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This study was self-funded by the student researcher.

Authors'contributions

JN: conceived and designed the study, obtained ethical approvals, funded and conducted data collection, performed data analysis and interpretation, developed data collection software, and drafted and revised the manuscript.
AY: supervised the study, provided guidance during concept development, proposal writing, budgeting, and data interpretation, reviewed and revised the manuscript, and approved the final version.
FEK: co-supervised the study, reviewed the research protocol, and approved the study for data collection.
TO: contributed to data collection software development, data analysis, interpretation, and report writing.
All authors read and approved the final manuscript.

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Figures

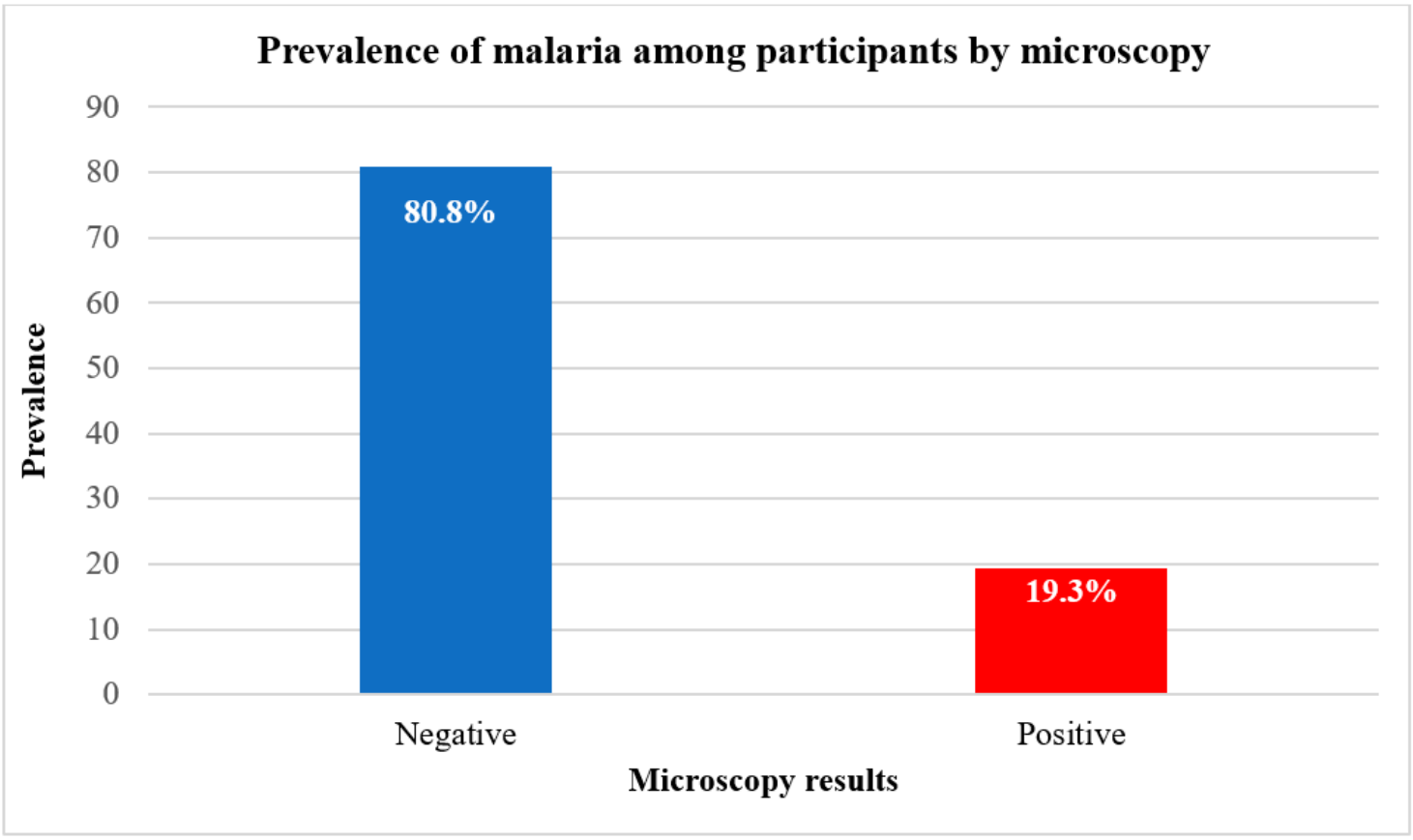

Figure 1

Figure 2: Prevalence of malaria among participants