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Prevalence, knowledge, and practices of malaria prevention among Prime gravidas in Lira City, Northern Uganda. A cross-sectional study.

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Abstract

Background:

Malaria, caused by Plasmodium parasites and transmitted by infected female mosquitoes, remains a significant public health issue, particularly in malaria-endemic regions. The aim of the study is to determine the prevalence of malaria and its relationships with knowledge and practices of malaria prevention among Prime gravidas in Lira City, Northern Uganda.

Methods:

A health facility-based cross-sectional study was conducted between April and May 2024 in Lira City. Collected data were coded and entered into SPSS software version 23 and descriptively analysed for frequencies and percentages. Binary logistic Regression analysis was done to determine associations between the variables.

Results:

83.6% of the respondents were of the Lango tribe, 64.9% were in the second trimester of their pregnancy, 59.1% were in the age bracket of 20-29 years, 56.0% were married, 43.1% attained secondary level of education, 225(53.7%), were suffering from malaria diagnosed by a qualified health worker, currently or in the past 1 month and had the cardinal symptoms of malaria, 89.3% of them had headache as a symptom. 341(81.4%) had a fair overall knowledge of malaria. 407(97.1%) reported to have heard about malaria, 381(90.9%) heard about malaria from health workers, 210(50.1%) heard that malaria kills/is a killer disease, 405(96.7%) said that malaria is spread by mosquitoes, 363(86.6%) identified fever with chills and rigors as the signs and symptoms of malaria in pregnancy. Results from multivariate analysis show that a PG with poor knowledge about malaria (AOR at 95% CI:3.117) was more likely to suffer from malaria ($p<0.05$).

Conclusion:

There was a high prevalence of malaria among Prime gravidas. There was a significant association between knowledge, practices, and the prevalence of malaria among Prime Gravidas in Lira City, Northern Uganda.

Recommendation:

Health education programs should be implemented to improve PGs' knowledge of malaria.

***Keywords**: Malaria, prevalence, knowledge, Prime gravidas, preventive practices*.
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Background

Malaria is transmitted by an infected female mosquito as it bites the human host." (Mugoya, 2023).In 2020, there were 247.7 million pregnancies worldwide, of which 156.9 million (63.4%) were in 85 malaria-endemic countries. Of the 247.7 million pregnancies, 121.9 million were at risk of malaria, representing 77.7% of all pregnancies in malaria-endemic countries and 49.2% worldwide. An estimated 70.9 million (58.1%) of these 121.9 million pregnancies at risk of malaria were estimated to have resulted in live births. The remainder (41.9%) was estimated to result in pregnancy loss, with 1.4 million (1.1%) ending in stillbirths, 33.5 million (27.5%) in induced abortions, and 16.1 million (13.2%) in miscarriages (Reddy, Weiss, Rozier, Ter Kuile, & Dellicour, 2023). In 2021, in 38 moderate and high transmission countries in the World Health Organisation (WHO) African Region, there were an estimated 40 million pregnancies, of which 13.3 million (32%) were exposed to malaria infection during pregnancy (WHO, 2022). The prevalence of malaria in pregnancy from population-based studies in Uganda ranged from 8.9% in the country`s low transmission areas to over 50% in high transmission settings (Mangusho et al., 2023). The burden of malaria infection during pregnancies is highest in the north and northeastern region of Uganda (Mangusho et al., 2023). The prevalence of asymptomatic malaria among pregnant women in Lira city/Lira District was 25.5% (Acio, Omech, & Oceng, 2022), and the prevalence of placental malaria among

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pregnant women in Lira District was 4.4% (Epuitai et al., 2023).

Malaria in pregnancy is of particular concern and is associated with adverse birth outcomes, including premature birth, spontaneous abortions, maternal and newborn anaemia, low birth weight, stunting, and reduced cognitive ability in children born to such mothers (Mangusho et al., 2023). Prevention of malaria in pregnancy is beneficial to both the mother and the fetus. It prevents the occurrence of maternal and newborn anaemia, premature birth, hypoglycemia, maternal mortality, intrauterine growth retardation, delivery of low-birth-weight babies, and poor fetal mental development. Studies have been done and found that pregnant women`s knowledge and practices of malaria prevention determine their level of malaria prevention. For example, according to Okafor, Ezekude, Oluwole, and Onigbogi (2019), Nigerian pregnant women`s knowledge and preventive practices for malaria in pregnancy were not satisfactory; they should be educated to correct misconceptions. According to a study done in Lwengo district, south western Uganda, it found that even though a significant number of pregnant mothers possessed fairly satisfactory knowledge and practices towards the prevention of malaria in pregnancy, a significant percentage of pregnant mothers were reluctant to uptake ANC and ITNs, and needed extra intervention (Musimenta & Mubangizi, 2022). According to Esomonu, Ossai, Gadzama, Ashikeni, and Uzochukwu (2022), minor proportions of the pregnant women in Nigeria had good knowledge of, and good preventive practices against malaria; therefore, they should be made aware and motivated to practice malaria prevention during pregnancy.

However, there is a dearth of data regarding the knowledge and practices of malaria prevention among pregnant women in Lira City, northern Uganda. Hence, this study was conducted to assess its level in order to aid policymakers in better planning of interventions to mitigate malaria in pregnancy.

Specific Objectives

To determine the prevalence of malaria among PGs in Lira city, northern Uganda.

To determine the relationship between the prevalence of malaria, knowledge, and practices of malaria prevention among PGs in Lira City, Northern Uganda.

Methodology

Research design

This study was a health facility-based cross-sectional study in Lira Regional Referral Hospital (LRRH), Lira city, northern Uganda, and a quantitative method was employed among Prime Gravidas attending antenatal care services.

Study site and setting

The study was conducted at the Antenatal Care Clinic of LRRH located in Lira city, West Division, Northern Uganda. Lira city is about 342.5 km away from Kampala, which is the capital city of Uganda; the coordinates are 2º 14′ 59.6400″ N and 32º 53′ 59.4600″ E. The population of the city is approximately 478,500 people (UBOS, 2022). LRRH serves Lira city and districts in the Lango sub-region, like Lira, Oyam, Dokolo, Otuke, Alebtong, Apac, Amolotar, Kole, Kwania, and other people who can have access with an estimated population of 2.2 million people. It is the biggest hospital in the Lango sub-region with a 350-bed capacity. It is among 13 current regional referral hospitals in Uganda, though with time, development, and technology can change the settings above. The facility has many medical personnel found in both general and specialised clinics, offering a variety of services like surgery, dentistry, medicine, orthopaedics, obstetric care, and gynecology, and well-established outpatient care services such as an outpatient department specifically for consultations, immunisation of various immunisable diseases, HIV testing, counselling, and initiation of treatment if positive, family planning. Antenatal care services are offered every Monday to Friday, and they attend to approximately 370 PGs in a month. This study was conducted between April and May 2024.

Study population

Target population

PGs aged 15 - 49 years in Lira city, Northern Uganda.

Accessible population

PGs aged 15 - 49 years who were attending ANC at LRRH during the time of the research study (April 2024 –May 2024).

Eligibility criteria

Inclusion criteria

1. Prime Gravida
2. Resident of lira city, northern Uganda
3. Aged 15 - 49 years

Exclusion criteria

All PGs from Lira city, attending ANC services at LRRH who were:

1. Mentally and medically ill during the time of the study. This is because they would not be in a position to comprehend and understand the questions and give authentic answers.
2. Scheduled visit for an obstetric complication destined to a special obstetric clinic because they would not have ample time to answer the questions, and also some would be in pain, which

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would make them uncomfortable to undergo the study procedure.

Sample size calculation

This was calculated using the Kish and Leslie formula (Kish, 1965),

$$n = \frac{p\,(1-p)\,Z2}{d2}$$

Whereby;

d = margin of error, 5%

p = prevalence of malaria among PGs, which is 54.8% in Eastern Uganda (Mugoya, 2023) = 0.548

Z = standard deviation corresponding to 95% confidence interval, 1.96 from the standard normal distribution table

n = the desired sample size

q = 1-p

q = 0.452

$$n = \frac{(0.548)\,(0.452)\,(1.96)2}{(0.05)2}$$

n = 380.62

n=381

Considering 10% non-response rate of n (381), which is 38. Therefore, the desired sample size, n = 419 PGs

Sampling technique and procedure

The study participants were selected through a consecutive sampling method. The pregnant women who had come for the antenatal care were screened by the researcher, researcher assistants, and the midwife on duty; those who met the inclusion criteria were selected. The researcher clearly explained the study purpose, objectives, and benefits to them, and those who accepted to participate in the study were made to sign an informed consent form.

Recruitment of study participants

Participants were obtained from the Antenatal Care Clinic of LRRH. The Researcher and the midwives sorted the pregnant women and got those who met the inclusion criteria. The study purpose, objectives, and benefits were clearly explained to the participants, and those who agreed to participate in the study were made to sign an informed consent form.

Data collection

Data collection methods

Interviewer administration of the questionnaires was the data collection method used. The questionnaire was administered through face-to-face interviews by the researcher to participants.

Data collection instruments

The questionnaire was the data collection instrument. Data on the prevalence of malaria, knowledge, and practices of malaria prevention among PGs were collected using a structured questionnaire written in English and translated into Lango during the data collection process for those participants who did not know English. This was administered by the researcher and the research assistants. The questionnaire comprised of five sections where section A: consisted of socio demographic information (age, marital status, education level, marital status, religion, occupation, among others), section B1: had questions about Health History, Section B2: had questions that determined knowledge on malaria (cause, signs and symptoms, treatment and prevention), section B3: sources of information about malaria, section C: had questions that determined the malaria preventive practices undertaken by the woman (use of ITNs, clearing bushes around the house, draining stagnant water, among others), section D: had questions that determined the malaria prevention status of the PG.

The measure of malaria prevention status of the participant was based on their malaria status in the past month and during the course of the pregnancy, as tested by a qualified health worker. Any PG who was without a past history of malaria in the past 1 month, was not currently suffering from malaria diagnosed by a qualified health worker, without any of the cardinal symptoms of malaria, and was not currently taking antimalarial drugs was regarded as having prevented malaria.

The measure of knowledge on malaria prevention was classified as good, fair, poor, or did not know any of the malaria prevention methods. Knowledge was determined based on the participant's number of correct answers to the malaria knowledge questions. The total expected correct answers were 20. Therefore, any PG who scored 15-20, 9-14, 3-8, and 0-2 was regarded as good, fair, poor, and no malaria knowledge, respectively.

The measure of practices of malaria prevention was classified as good, fair, poor, or did not know any of the malaria prevention methods. There were seven malaria prevention methods. Therefore, a PG who practised 6-7, 3-5, 1 or 2, and 0 of the malaria prevention method was regarded as having good, fair, poor, or no malaria prevention practices, respectively.

Data collection procedure

An approval letter was obtained from Lira University Research Ethics Committee (LUREC) to allow data to be collected from the study site. Permission from the hospital administrator of Lira Regional Referral Hospital was sought.

After sampling, the participants were given adequate information about the study, and those who agreed to take

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part in the study were asked to sign an informed consent form. They were then interviewed by the researcher and the research assistant, and their responses were filled in the questionnaire. The questionnaire was translated into the Lango language for those who didn't understand English, and their responses were recorded. Each questionnaire administration took about 25 minutes. This was repeated consecutively based on the arrival time; that is to say, those who came first were interviewed first. This was done daily until the desired sample size was achieved. This process took place in the LRRH ANC waiting area. This process of data collection took 4 weeks.

Data management
The data collected was kept under lock and key for safety. Data collected was entered into Microsoft Excel. The data was cleaned by checking for the completeness of the questionnaires, then necessary corrections were made, coded, and exported to Statistical Package for Social Sciences (SPSS) version 23 for analysis.

Data analysis
The quantitative data collected were analysed in a descriptive and inferential analysis. Statistical Package for Social Sciences (SPSS) version 23 was used for analysis. Percentages for the prevalence of malaria, knowledge of malaria, and malaria prevention practice were obtained. The outcome was illustrated using tables, pie charts, and bar graphs. A multivariate analysis was done using binary logistic regression analysis to measure the association/ relationship between the prevalence of malaria and knowledge and practices of malaria prevention. The 5% significance level, and 95% confidence level, and 95% confidence interval were used for all statistical tests and estimates.

Quality control OR Rigour

Reliability
The data was collected by the researcher using a pre-tested structured questionnaire to ensure reliability. The questionnaire was administered to all prime gravidas found in LRRH seeking antenatal care services following the inclusion criteria, and so any variation in the tool was identified and corrected, such that relevant data of interest were collected from the study participants.

Validity
The researcher used face validity to assess the validity of the questionnaire. To ensure face validity, the research supervisor reviewed the questionnaire to check whether the items in the questionnaire were a valid measure of the concept being measured.

Ethical considerations
Approvals
This research was approved by the Faculty of Nursing and Midwifery and the Research Ethics Committee, Lira University, and a letter allowing the researcher to carry out data collection was obtained. Administrative clearance was obtained from the Hospital Administrator of LRRH.

Informed consent
Consent was provided to every participant after a thorough explanation of the participant`s rights. The participants were informed about the study, its aims, and benefits, and they were requested to sign the consent forms if they agreed. Therefore, all the participants voluntarily participated in the research study and were able to withdraw at any time if they felt uncomfortable.

Privacy and confidentiality
Confidentiality of the information obtained from the research participants was assured to them as the questionnaires had only codes and not particulars of the participants, and were only accessible by the researcher.
The questionnaires were filled in a quiet and free environment to ensure privacy.

Results
Response rate
Data was collected from 419 participants, which corresponds to a response rate of 100%.
Sociodemographic characteristics of the respondents
Socio-demographic characteristics included: age, occupation, marital status, level of education, religion, address within Lira city, estimated distance to the nearest health facility, Ethnicity/tribe, Monthly income in UGX, family size, and reproductive history. Most of the respondents 249(59.4%) were in the age bracket (20-29) years, 163(38.9) of the respondents were self-employed, most of the respondents 252(60.1%) were married, 165(39.4%) of the respondents attained secondary level of education, 172(41.1%) of the respondents were Anglican, 212(50.6%) resided in Lira City East, most of the respondents 295(70.4%) moved less than 5 kilometers to the nearest health facility, Majority of the respondents 354(84.5%) were Langi, 181(43.2%) of the respondents earned between 100,000-500,000 Uganda shillings, 327(78.0%) of the respondents had a family size of 1-4, all the respondents were prime gravidas, had no miscarriages or abortions and had no living children, majority of the respondents 256(61.1%) were in second trimester of their pregnancy (shown in table 1 below).

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Table 1: Socio-demographic characteristics of the study participants in Lira City (n=419)

Variable		Frequency(f)	Percentage (%)
Age (years)	15-19	140	33.4
	20-29	249	59.4
	30-39	30	7.2
	40-49	0	0
Occupation	Employed	76	18.1
	Self-employed	163	38.9
	Housewife	38	9.1
	Peasant farmer	142	33.9
Marital status	Married	252	60.2
	Divorced	16	3.8
	Single	151	36.0
	Widow	0	0
Level of Education	Primary	158	37.7
	Secondary	165	39.4
	Tertiary	80	19.1
	Never went to school	16	3.8
Religion	Catholic	152	36.3
	Anglican	172	41.1
	Muslim	31	7.4
	Born again	64	15.3
Address within Lira city	Lira city, west division	207	49.4
	Lira city east division	212	50.6
Estimated distance (km)	0-5	295	70.4
	6-10	114	27.2
	11-15	10	2.4
Tribe	Lango	354	84.5
	Muganda	16	3.8
	Acholi	16	3.8
	Itesot	13	3.1
	Others	28	4.8
Monthly income (UGX)	0 -9,000	122	29.1
	10,000-100,000	90	21.5
	100,100-500,000	181	43.2
	500,100-800,000	26	6.2
Household size	1-4	327	78.0
	5-10	92	22.0
REPRODUCTIVE HISTORY			
Gravida	1	419	100
Miscarriages or abortion	0	419	100
Number of living children	0	419	100
Weeks of amenorrhea	1-12	125	29.8
	13-27	256	61.1
	>28	38	9.1

Health history of the respondents

Most of the respondents 275(65.6%) tested positive for malaria and treated it in the past 1 year, 149(35.6%) of the respondents were hospitalized for malaria treatment in the past 1 year, 12(2.9%) of the respondents treated for sickle cell disease in the past 1 year, most of the respondents 247(58.9%) suffered from malaria during the course of pregnancy, 122(29.1%) of the respondents suffered once from malaria during the course of the pregnancy, majority of the respondents 311(74.2%) had attended health education talk on malaria, 125(29.8%) of the respondents were very susceptible to malaria infection during their

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pregnancy, 96(22.9%) of the respondents mentioned going late to bed/being exposed to mosquito as a reason for their perceive susceptibility to malaria, majority of the respondents 379(90.5%) sought for treatment first after feeling for symptoms of malaria from Health workers, 224(53.5%) of the respondents attributed their first choice of the cadre of health provider to the facility being near to them, majority of the respondents 367(87.6%) mentioned Drug shops or pharmacies as the most available nearest type of health facility where services for malaria treatment or prevention can be sought from in the residential address.

Table 1: Showing the health history of the participants in Lira city (n=419)

Variable	Response	Frequency (f)	Percentage (%)
Tested positive for malaria and treated in the past 1 year	Yes	275	65.6
	No	144	34.4
Hospitalized for malaria treatment in the past 1 year	Yes	149	35.6
	No	270	64.4
Treated for sickle cell disease in the past 1 year	Yes	12	2.9
	No	407	97.1
Suffered from malaria during the course of pregnancy	Yes	247	58.9
	No	172	41.1
If yes, how many times?	1	122	29.1
	2	95	22.7
	3	20	4.8
	4	8	1.9
Attendance at any health education talk on malaria	Yes	311	74.2
	No	108	25.8
Perceive susceptibility to malaria infection during the course of pregnancy.	Extremely susceptible	34	8.1
	Very susceptible	125	29.8
	Moderately susceptible	110	26.3
	Slightly susceptible	114	27.2
	Not at all susceptible	36	8.6
Reason for perceived susceptibility to malaria	Lives near a swampy area	52	12.4
	Goes to bed late/exposed to mosquitoes	96	22.9
	Pregnancy	86	20.5
	Lives in a bushy area	34	8.1
	Weak immunity	37	8.8
	Sleeps under a mosquito net	100	23.9
	Don't know	14	3.3
The cadre of health providers from whom the first malaria treatment was sought	VHT	34	8.1
	Traditional healer	6	1.4
	Health workers (nurses, midwives, laboratory technicians, pharmacists, or doctors)	379	90.5
Reason for the first choice of the cadre of health providers for malaria treatment	Near her	224	53.5
	Trusts them	178	42.5
	Cheap	17	4.1
Available nearest type of health facilities where services for malaria treatment or prevention can be sought from, at the residential address	VHT	50	11.9
	Traditional healers (herbalists)	6	1.4
	Drug shops or pharmacies	367	87.6
	Medical clinics or centres (private ones)	182	43.4
	Government health centres (II, III, or IV)	269	64.2
	Private hospitals	121	28.9
	Government hospitals	181	43.2

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Prevalence of malaria among the respondents

More than half of the respondents, 225(53.7%), were suffering from malaria diagnosed by a qualified health worker currently or in the past 1 month and had the cardinal symptoms of malaria (shown in Figure 2 below). Of those who had malaria; 89.3% had headache as a symptom, 83.6% were of Lango tribe, 64.9% were in second trimester of their pregnancy, 59.1% were in the age bracket of 20-29 years, 58.2% lived in Lira City West, 56.0% were married, 45.3% were Anglican, 43.1% attained secondary level of education, 38.2% were peasant farmers.

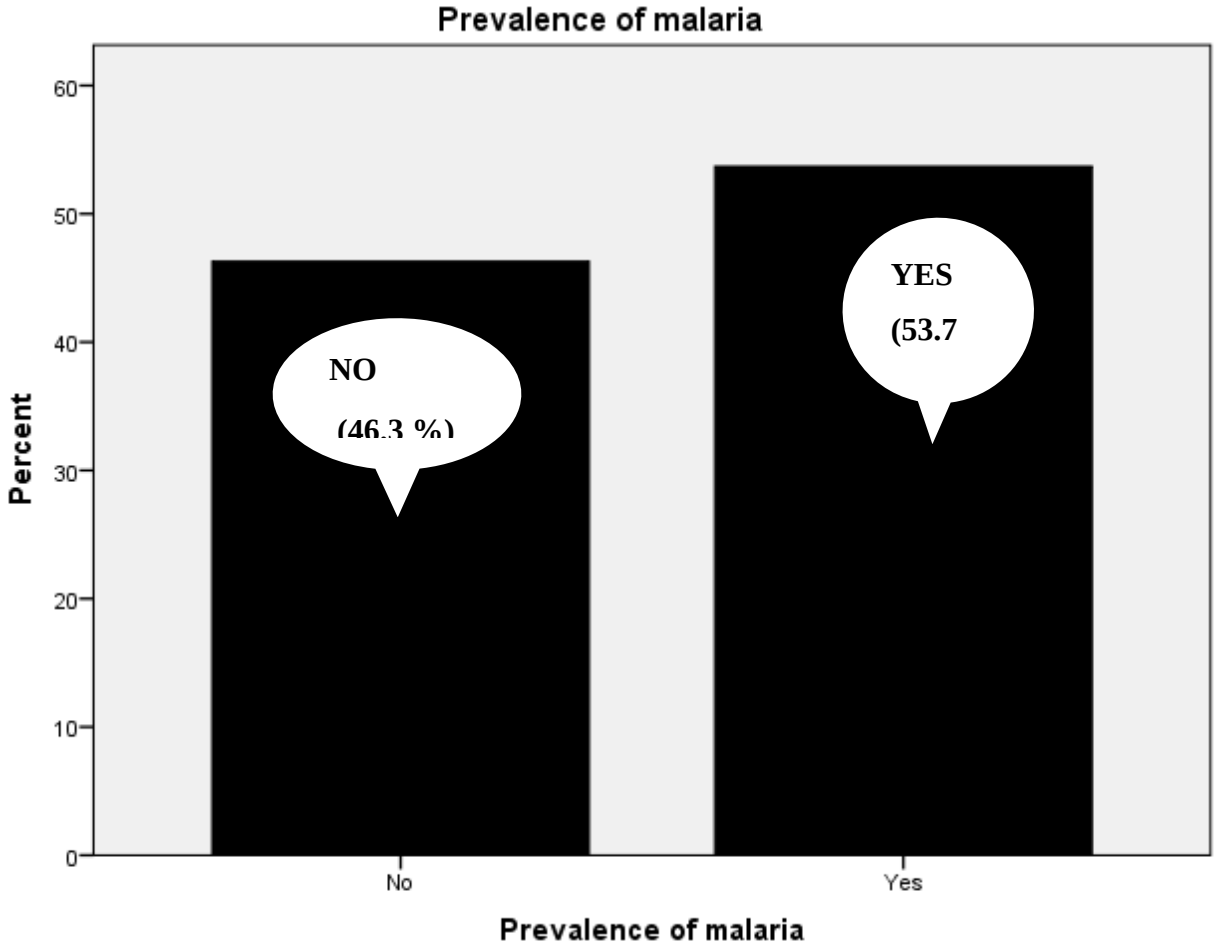

Figure 1: Prevalence of malaria among the respondents

Knowledge about malaria

The majority of the respondents, 341(81.4%), had a fair overall knowledge about malaria. Most of the respondents 407(97.1%) reported to have heard about malaria, most 381(90.9%) of the respondents heard about malaria from health workers, half 210(50.1%) of the respondents heard that malaria kills/is a killer disease, most of the respondents 405(96.7%) said that malaria is spread by mosquitoes, majority of the respondents 363(86.6%) identified fever with chills and rigors as the signs and symptoms of malaria in pregnancy, majority of the respondents 367(87.6%) identified Artemether-Lumefantrine aka Coartem (ACT) as a treatment for malaria infection, most of the respondents 383(91.4%) said clearing of bushes around the house prevent breeding of mosquitoes, majority of the respondents 371(88.5%) said closing of doors and windows early prevent malaria attack, most of the respondents 383(91.4%) said clearing of stagnant water around the house prevent breeding of mosquitoes, more than half of the respondents 292(69.7%) said taking of antimalarial drug fansidar during

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pregnancy prevents malaria, more than half of the respondents 254(60.6%) said Indoor residual spray with insecticides prevents malaria attack, 102(24.3%) of the respondents said use of mosquito sprays and lotions prevent mosquito bites, most of the respondents 407(97.1%) said sleeping under insecticide treated net prevent malaria attack.

Table 2: Showing knowledge about malaria among the respondents in Lira city (n=419)

Variable	Response	Frequency (f)	Percentage (%)
Heard about malaria	Yes	407	97.1
	No	12	2.9
Heard about it from	Radio	291	69.8
	Television	103	24.6
	Health workers	381	90.9
	VHTs	70	16.7
	Family members	283	67.5
	Friend	273	65.2
If yes, what exactly have you heard about malaria	It kills/killer disease	210	50.1
	Signs and symptoms	60	14.3
	Preventive measures	90	21.5
	Spread by mosquitoes	47	11.2
What spreads malaria?	Mosquitoes	405	96.7
	Others	6	1.4
	Don't know	8	1.9
Signs and symptoms of malaria in pregnancy	Fever with chills and rigors	363	86.6
	Headache	375	89.5
	Fatigue and general body weakness	245	58.5
	Muscle aches and joint pain	191	45.6
	Loss of appetite, abnormal discomfort, nausea, or vomiting	255	60.9
	Don't know	18	4.3
Treatment of malaria infection	Artemether-Lumefantrine, aka Coartem (ACT)	367	87.6
	Artesunate-Amodiaquine	233	55.6
	Dihydroartemisinin-piperaquine (ACT)	82	19.6
	Chloroquine	45	10.7
	Quinine plus clindamycin	78	18.6
	Artemisinin-Mefloquine (ACT)	18	4.3
	Others	2	0.5
	Don't know	4	1.0
Malaria prevention methods			
Clearing of bushes around the house prevents the breeding of mosquitoes.	True	383	91.4
	False	36	8.6
Closing doors and windows early prevents malaria attacks.	True	371	88.5
	False	48	11.5
Clearing of stagnant water around the house prevents the breeding of mosquitoes.	True	383	91.4
	False	36	8.6
Does taking the antimalarial drug Fansidar during pregnancy prevent malaria?	True	292	69.7
	False	127	30.3
Indoor residual spray with insecticides prevents malaria attacks?	True	254	60.6
	False	165	39.4

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Use of mosquito sprays and lotions prevents mosquito bites	True	102	24.3
	False	317	75.7
Sleeping under an insecticide-treated net prevents malaria attacks.	True	407	97.1
	False	12	2.9

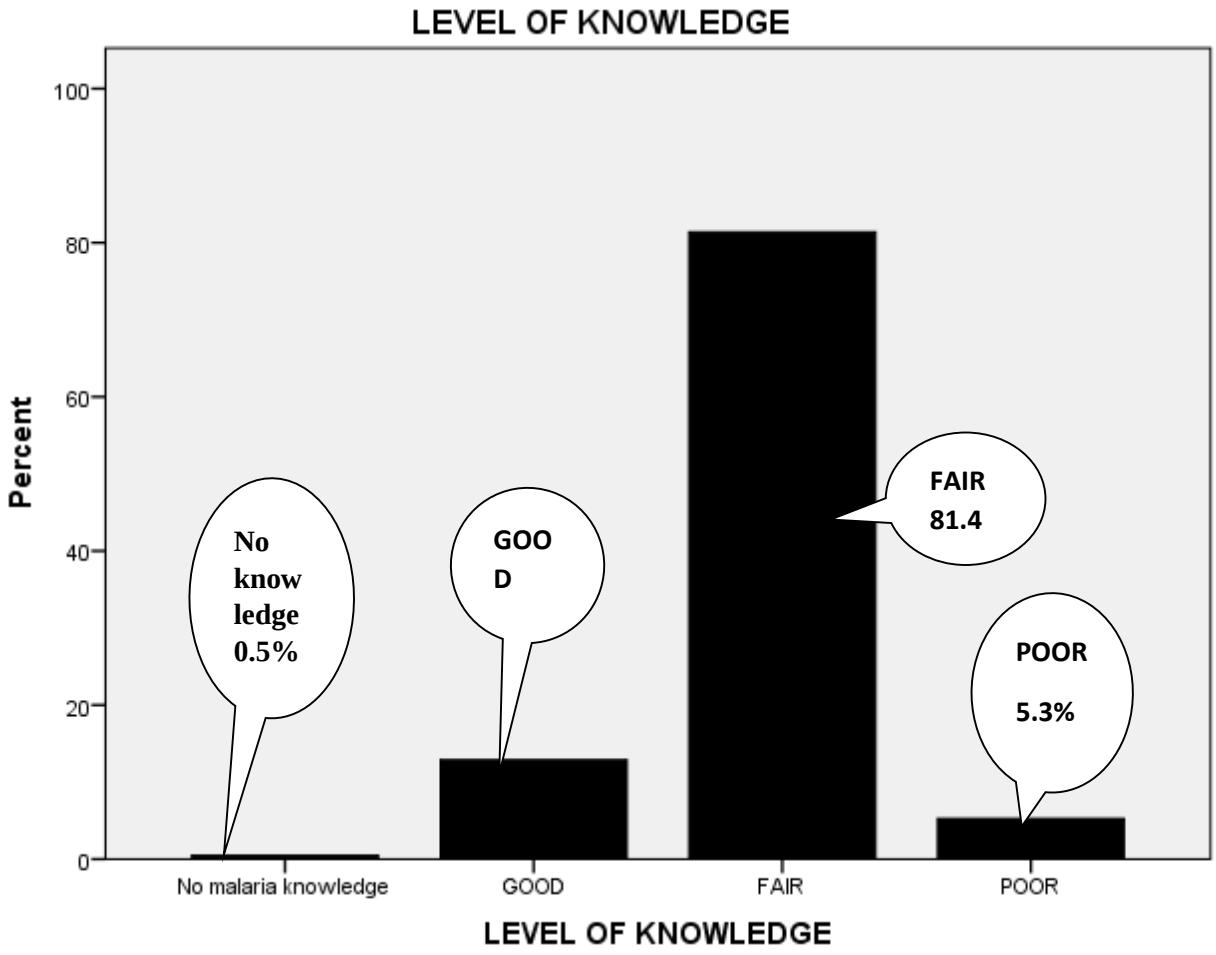

Figure 2: Showing Overall knowledge about malaria of the participants in Lira city (n=419)

Source of information about malaria

This study found that Health workers (doctors, nurses, midwives, laboratory workers) were the commonest source of information about malaria among the respondents, 389(92.8%). Family members were on the second with 327(78.0%) of the respondents, Radio and friends 315(75.2%), Relatives 203(48.4%), Television 119(28.4%), Village health teams 118(28.2%), Newspapers 111(26.5%), social media like WhatsApp, twitter 81(19.3%)

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Table 3: Showing Sources of information about malaria of the respondents in Lira city (n=419)

Variable	Response	Frequency (f)	Percentage (%)
Radio	Yes	315	75.2
	No	104	24.8
Television	Yes	119	28.4
	No	300	71.6
Newspapers	Yes	111	26.5
	No	308	73.5
Friends	Yes	315	75.2
	No	104	24.8
Family members	Yes	327	78.0
	No	92	22.0
Relatives	Yes	203	48.4
	No	216	51.6
Social media like WhatsApp, Twitter	Yes	81	19.3
	No	338	80.7
Village health teams	Yes	118	28.2
	No	301	71.8
Health workers (doctors, nurses, midwives, laboratory workers)	Yes	389	92.8
	No	30	7.2
Others		10	2.4

Malaria prevention practices

The majority of the respondents, 333(79.5%), had a fair overall malaria prevention practice Most of the respondents 409(97.6%) used insecticide treated net daily, majority of the respondents 361(86.2%) practiced closing of doors and windows daily, 34(8.1%) of the respondents used mosquito sprays, 58(13.8%) of the respondents used mosquito lotions, majority of the respondents 361(86.2%) cleared bushes around their houses, more than three quarters of the respondents 319(76.1%) drained stagnant water around there houses, 128(30.5%) of the respondents practiced indoor residual spray, 101(24.1%) of the respondents took antimalarial tablets (Sulfadoxine-Pyrimethamine) when feeling feverish, 14(3.3%) of the respondents burnt anti mosquito candle smoke.

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Table 4: Showing Malaria prevention practices of the respondents

Variable	Response	Frequency (f)	Percentage (%)
Use of insecticide-treated net	Yes	409	97.6
	No	10	2.4
Frequency of use of insecticide treated net	Daily	409	97.6
Closing of doors and windows early	Yes	361	86.2
	No	58	13.8
Frequency of closing doors and windows	Daily	361	86.2
Use of mosquito sprays	Yes	34	8.1
	No	385	91.9
Frequency of mosquito spray use	Daily	12	2.9
	Weekly	10	2.4
	Whenever need be	12	2.9
Use of mosquito lotions	Yes	58	13.8
	No	361	86.2
Frequency of mosquito lotion use	Daily	48	11.5
	Whenever need be	10	2.4
Clearing bushes around the house	Yes	361	86.2
	No	58	13.8
Frequency of clearing bushes around the house	Weekly	111	26.5
	Monthly	94	22.4
	Whenever bushes grow	156	37.2
Draining stagnant water around the house	Yes	319	76.1
	No	100	23.9
Frequency of draining stagnant water around the house	Daily	26	6.2
	Weekly	12	2.9
	Whenever water collects	281	67.1
Indoor residual spray	Yes	128	30.5
	No	291	69.5
Frequency of indoor residual spray	Weekly	2	0.5
	Whenever the government offers	126	30.1
Taking antimalarial tablets (Sulfadoxine-pyrimethamine) when feeling feverish	Yes	101	24.1
	No	318	75.9
Frequency of taking antimalarial tablet (Sulfadoxine-pyrimethamine)	Monthly	12	2.9
	Whenever feeling feverish	89	21.2
Burning an anti-mosquito candle produces smoke	Yes	14	3.3
	No	405	96.7
Frequency of burning anti-mosquito candle smoke	Daily	6	1.4
	Weekly	8	1.9
	Whenever need be	2	0.5

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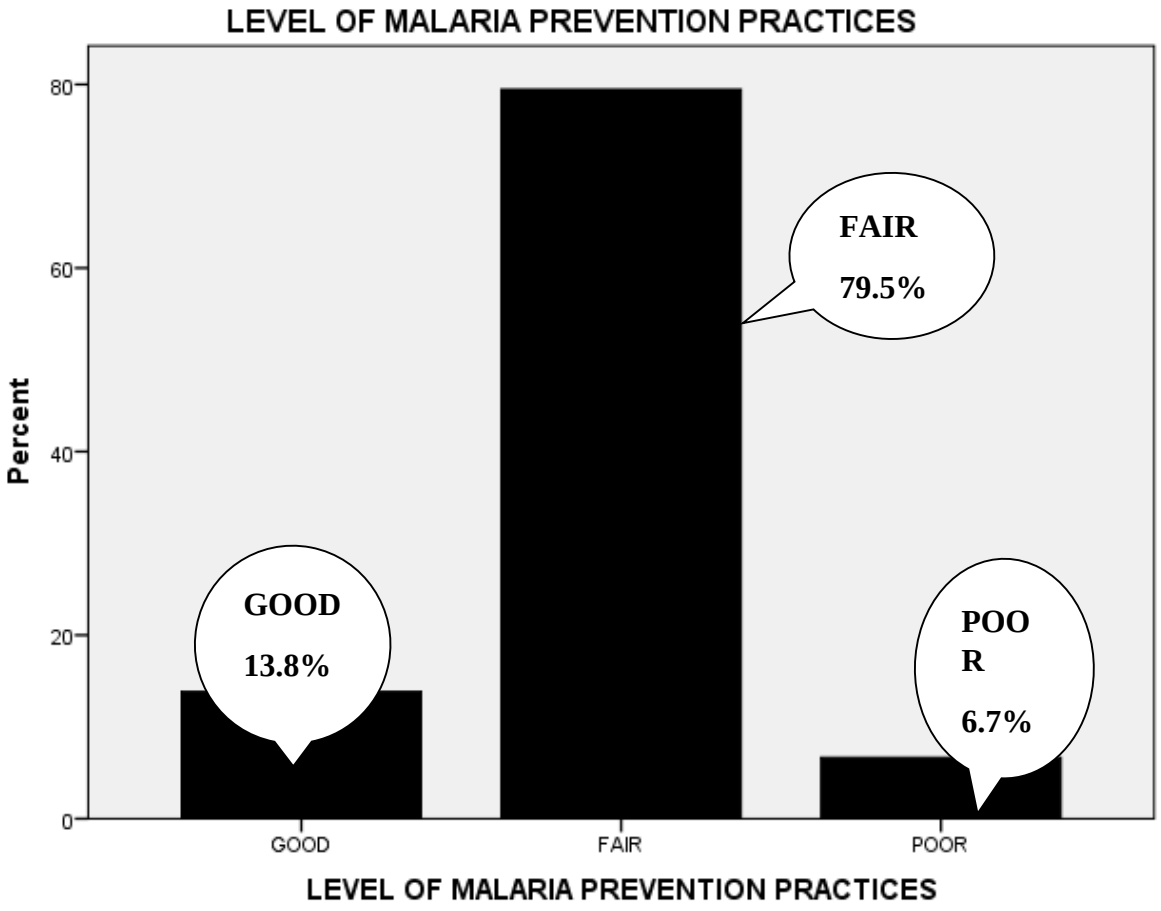

Figure 3: Showing the overall malaria prevention practices of the respondents.

Association between the knowledge, malaria prevention practice, and prevalence of malaria among PGs

There was a significant association between the level of knowledge about malaria among PGs and the prevalence of malaria (p-value<0.05). There was no significant association between the prevalence of malaria and the level of malaria prevention practices.

Table 5: Showing the association between the level of knowledge about malaria and the level of malaria prevention practice with the prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		X^2	df	p-value
	Yes	No			
Level of Knowledge					
Good	28(12.4%)	26(13.4%)	8.387	3	0.039*
Fair	189(84.0%)	152(78.4%)			
Poor	6(2.7%)	16(8.2%)			
No malaria knowledge	2(0.9%)	0(0.0%)			
Level of Practice					
Good	28(12.4%)	30(15.5%)	2.471	2	0.291

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Fair	185(82.2%)	148(76.3%)			
Poor	12(5.3%)	16(8.2%)			

Legend: X^2 -Pearson Chi square value *significant p-value

There was an association between the knowledge of taking antimalaria drug Fansidar during pregnancy, Indoor residual spray with insecticides, and fever with chills and rigors, with the prevalence of malaria among PGs. However, there was no significant association between the knowledge of sleeping under an insecticide-treated mosquito net and the use of Artemether-Lumefantrine, aka Coartem (ACT), as a drug for treating malaria infection, with the prevalence of malaria among PGs.

Table 6: Showing the association between knowledge of taking antimalarial drug Fansidar during pregnancy, sleeping under an insecticide-treated mosquito net, indoor residual spray, use of Artemether-Lumefantrine, and Fever with chills and rigors, with prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		X^2	Df	COR (95% CI)	p-value
	Yes	No				
Taking Fansidar prevents malaria.						
True	140(62.2%)	152(78.4%)	12.829	1	0.455(0.295-0.703)	<0.001*
False	85(37.8%%)	42(21.6%)				
Sleeping under a treated net prevents malaria.						
True	217(96.4%)	190(97.9%)	0.836	1	0.571(0.169-1.926)	0.361
False	8(3.6%)	4(2.1%)				
Indoor residual spray prevents malaria.						
True	130(57.8%)	124(63.9%)	1.645	1	0.772(0.521-1.146)	0.200
False	95(42.2%)	70(36.1%)				
Artemether-Lumefantrine, aka Coartem Treats malaria						
Yes	203(90.2%)	164(84.5%)	3.099	1	1.688(0.938-3.037)	0.078
No	22(9.8%)	30(15.5%)				
Fever with chills and rigors are signs and symptoms of malaria.						
Yes	203(90.2%)	160(82.5%)	5.401	1	1.961(1.103-3.484)	0.020*
No	22(9.8%)	34(17.5%)				

Legend: CI- confidence interval, COR- Crude odds ratio *significant p-value

There was an association between the practice of taking Fansidar (Sulfadoxine-pyrimethamine) and the prevalence of malaria. However, no significant association was found between the use of insecticide-treated mosquito nets and indoor residual spray with the prevalence of malaria (Table 8)

Table 7: Showing the association between the practice of taking Fansidar, the use of mosquito net and indoor residual spray with the prevalence of malaria

Variable	Prevalence of malaria: Freq (%)		df	COR (95% CI)	p-value
	Yes	No			
Takes Fansidar to prevent malaria					
Yes	63(28.0%)	38(19.6%)	1	1.596(1.009-2.526)	0.045*
No	162(72.0%)	156(80.4%)			
Uses of insecticide-treated net					
Yes	219(97.3%)	190(97.9%)	1	0.768(0.214-2.764)	0.686
No	6(2.7%)	4(2.1%)			
Uses Indoor residual spray to prevent malaria					
Yes	60(26.7%)	68(35.1%)	1	0.674(0.444-1.023)	0.063

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No	165(73.3%)	126(64.9%)			

Legend: CI- confidence interval, COR- Crude odds ratio *significant p-value

There was a strong association between the overall level of knowledge about malaria and the overall malaria prevention practice.

Table 8: Showing the association between the knowledge about malaria and malaria prevention practice

Variable	Level of Practice: Freq (%)			X^2	df	p-value
	Good	Fair	Poor			
Level of Knowledge						
Good	26(44.8%)	28(8.4%)	0(0%)	94.393	6	<0.001*
Fair	32(55.2%)	289(86.8%)	20(71.4%)			
Poor	0(0%)	14(4.2%)	8(28.6%)			
No malaria knowledge	0(0%)	2(0.6%)	0(0%)			

Legend: X^2 -Pearson chi-square value *significant p-value

Multivariate analysis of the level of knowledge and practice with the prevalence of malaria

Results from multivariate analysis show that a PG with poor knowledge about malaria (AOR at 95% CI:3.117) was more likely to suffer from malaria ($p<0.05$).

Table 9: Showing multivariate analysis for the association between knowledge and practice with malaria prevalence

Variable	COR (95% CI)	AOR at 95% CI	p-value
Level of knowledge			
Good			0.999
Fair	3.6(1.071-12.062)	3.064(0.970-9.676)	0.056
Poor	4.121(1.366-12.430)	3.117(1.179-8.560)	0.022*
No malaria knowledge	1.00	1.00	
Level of practice			
Good	0.889(0.509-1.554)	0.936(0.347-2.523)	0.896
Fair	0.804(0.324-1.993)	1.283(0.563-2.926)	0.553
Poor	1.00	1.00	

Legend: CI- confidence interval, AOR- Adjusted odds ratio *significant p-value

Discussion

Prevalence of malaria

Of the 419 participants, 53.7% were suffering from malaria diagnosed by a qualified health worker, currently or in the past 1 month, and had the cardinal symptoms of malaria. This implies that approximately 5 out of 10 pregnant women in Lira city have malaria, with 59.1% being in the age bracket of 20-29 years. This is a high prevalence of malaria. The results of this study are consistent with those of Eastern Uganda-54.8% (Mugoya, 2023). This could be attributed to the syndromic approach used via history taking in the past month, which is prone to false positives, reduced immunity during pregnancy, exposure to mosquitoes, as some of them live in bushy and swampy areas, since these places favour breeding of mosquitoes, thus their increased numbers. It could also be due to the rainy season during the period of data collection, as mosquitoes are more prevalent during this period. This high prevalence is a clear indication that prevention and control measures have to be put in place to combat these high numbers.

Much as this study revealed a higher prevalence, a similar study conducted at Large Referral Hospitals in Northeastern Uganda showed a lower prevalence, 24.8%(Mangusho et al., 2023). This could be due to the use of the Rapid Diagnostic Test used in the study to detect malaria parasites in the blood of PGs, since it is more accurate. Also, it could be due to the regional variation in the climate. It could also be due to better malaria prevention interventions. Other studies among pregnant women reported a lower prevalence compared to this study. For example, in Ghana, 17.1% (Dwumfour et al., 2023), 12.72% in Ethiopia (Tegegne et al., 2019),11.4% in India (Jain et al., 2022). These could be attributed to different geographic locations, good malaria

preventive practices, and advanced health care in these countries in comparison with Northern Uganda.

Association between the knowledge and practices of malaria prevention among PGs

This study found a significant association between the knowledge about malaria and the prevalence of malaria among the respondents(p-value<0.05), whereby primiparous women with a good level of knowledge demonstrated a lower prevalence of malaria compared to those with fair or poor knowledge. This suggests that empowering PGs with accurate information about malaria transmission, signs, symptoms, prevention, and treatment could contribute to reducing malaria burden in this population. However, no related studies were done to determine the association between knowledge, practice, and the prevalence of malaria among Prime Gravidas.

Further analysis revealed specific aspects of knowledge that were significantly associated with malaria prevalence. PGs who were knowledgeable about taking antimalarial drug Fansidar during pregnancy, indoor residual spray with insecticides, and fever with chills and rigours demonstrated a lower prevalence of malaria. These findings underscore the importance of targeted health education on specific malaria preventive measures in the fight against malaria.

Interestingly, the practice of taking Fansidar was strongly associated with malaria prevalence, suggesting that adherence to preventive medication (Fansidar) could be an effective strategy in reducing malaria burden among PGs.

There was a strong association between the overall level of knowledge about malaria and malaria prevention practice. PGs with good knowledge were more likely to engage in malaria prevention practices. This emphasises comprehensive education about malaria in promoting preventive practices.

Results from multivariate analysis showed that a PG with poor knowledge about malaria (AOR 3.117, 95% CI 1.179-8.560, p<0.05) was 3 times more likely to suffer from malaria. This is because poor knowledge about malaria may lead to inadequate use of malaria preventive measures such as Insecticide-treated nets, indoor residual spraying, and prophylactic antimalarial medication, delayed health-seeking behaviour, as they might not recognise early signs and symptoms. However, there were no related studies done.

Conclusion

This study highlights a high prevalence of malaria and a significant association between knowledge, practices, and the prevalence of malaria among Prime Gravidas in Lira City, Northern Uganda. The findings emphasise the importance of education in malaria control efforts, as PGs with better knowledge demonstrated lower malaria prevalence rates. However, this study also reveals gaps between knowledge and practice, indicating the complexity of behaviour change in adopting malaria prevention measures. Targeted interventions aimed at improving specific knowledge areas and promoting adherence to preventive practices could contribute to reducing malaria burden in this vulnerable population.

Recommendations

The health team should implement targeted health education programs to improve PGs' knowledge about malaria transmission, prevention, and treatment, with a focus on specific preventive measures such as taking antimalarial medication during pregnancy and recognising malaria symptoms.

The health team should develop interventions to address barriers to practising malaria prevention measures, such as promoting adherence to antimalarial medication, increasing access to insecticide-treated mosquito nets, and encouraging indoor residual spraying.

The community health workers and the local leaders should be engaged to disseminate malaria-related information, conduct community outreach activities, and facilitate behaviour change communication sessions.

The MoH should integrate malaria prevention education and services into routine antenatal care visits to reach PGs and pregnant women effectively.

Further research should be conducted to explore the underlying factors influencing knowledge, attitudes, and practices related to malaria prevention among PGs in Northern Uganda.

The MoH should monitor the impact of interventions on malaria prevalence rates to inform future programming.

Study Limitations

The cross-sectional nature of the study limits the ability to establish causality between knowledge, practices, and malaria prevalence.

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Abbreviations

ACT: Artemisinin-based Combination Therapy
ANC: Antenatal care
HIV: Human Immunodeficiency Virus
ITN: Insecticide Treated Net
LRRH: Lira Regional Referral Hospital
MoH: Ministry of Health
PG: Prime Gravida
UBOS: Uganda Bureau of Statistics
UN: United Nations
VHT: Village Health Team
WHO: World Health Organisation

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Conflict of interest

The author did not declare any conflict of interest.

Data availability

Data is available upon request.

Author contribution

Emmanuel Ojok Obura collected data and drafted the manuscript of the study.
Dr Edward Kumakech supervised the study.

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Emmanuel Ojok Obura is a student of a Bachelor of Science in Midwifery at Lira University.
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