Determinants of Malaria in Pregnant Women in Ecological Conditions of Nzaba Health Zone

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Abstract

Malaria among pregnant women constitutes a major public health problem, particularly in the Nzaba health zone in the Democratic Republic of Congo. This research focuses on the ecological and socio-economic determinants influencing the prevalence of malaria in this vulnerable population, taking into account climatic conditions and prevention practices.

A cross-sectional analytical study was conducted among pregnant women in the Nzaba health zone. A sample of 180 women was selected using non-probability convenience sampling. Data were collected via questionnaires administered face-to-face, including sociodemographic and environmental information, then analyzed statistically, notably by multivariate logistic regression to identify the determinants associated with malaria.

The results revealed that women with secondary education had an increased risk of malaria, with an adjusted odds ratio (OR) of 2.146. Additionally, women with no occupation showed an adjusted OR of 0.01 and those with trading occupation adjusted OR of 0.0595, suggesting a reduced risk, while women's age was associated with reduced malaria risk (OR = 0.4802). Furthermore, the number of children in the household (adjusted OR = 2.5) significantly influenced the occurrence of malaria in pregnant women.

This study highlights the importance of ecological and socio-economic factors in the transmission of malaria among pregnant women in the Nzaba area. It demonstrates the need to increase awareness of the use of mosquito nets and to develop targeted interventions to improve access to prevention tools.

Keywords: Malaria; Pregnant Women; Ecological Determinants; Prevention

Introduction

Status of the question

In 2019, malaria affected 229 million people in 87 countries, with 409,000 deaths, of which 67% were children under 5 years old. Nearly 95% of cases were concentrated in 29 countries, with Nigeria, DRC, Uganda, Mozambique and Niger accounting for 51% of cases. These same countries also accounted for 51% of deaths. In Southeast Asia, cases have fallen 73% since 2000, while in the Western Pacific they have fallen 43%. In the Americas, the number of cases and deaths also fell by 40% and 39% respectively [1].

Climate change is not just one of many threats to the global fight against malaria. Overall, these threats undermine progress made in the fight against this disease. In 2022, the total number of malaria cases worldwide reached 249 million, well above estimates before the COVID-19 pandemic and 5 million more than in 2021 [2].

In other words, globally, the number of malaria deaths decreased from 625,000 to 619,000 between 2020 and 2021. However, this figure remains higher than the 568,000 deaths estimated in 2019, before the arrival of the pandemic. In 2021, malaria cases continued to increase, but at a slower rate than between 2019 and 2020: they were estimated at 247 million in 2021, compared to 245 million in 2020 and 232 million in 2019 [3].

Malaria is endemic in 109 countries, mainly among the poorest in the world. Currently, this disease mainly affects tropical and subtropical regions, causing more than 350 million acute cases each year and resulting in at least one million deaths, 90% of which occur in sub-Saharan Africa [4].

Malaria among pregnant women represents a serious public health problem in Africa, with severe consequences for the mother, fetus and newborn. This disease contributes significantly to maternal and infant morbidity and mortality. According to the WHO, 30 million pregnant women live in malaria-endemic areas of Africa, and each year, 200,000 infants and 100,000 women die from the disease during pregnancy. In Niger, which has a population of 21.5 million, 50% of whom are women, the National Malaria Control Program (PNLP) reported 968,934 cases of malaria among pregnant women in 2018 [5].

Sub-Saharan Africa remains the most affected region, with more than 25 to 30 million pregnant women at risk of contracting malaria each year. However, outside this region, malaria during pregnancy can also pose a danger to the lives of both mother and child [6].

Malaria is increasingly linked to poverty and inequality, particularly affecting the most vulnerable, including pregnant women and children in sub-Saharan Africa. The decline in cases and deaths linked to this infection is slowing, and the disease continues to mainly affect these populations. Pregnancy decreases immunity to malaria, increasing risks for the woman, fetus and newborn, leading to serious and often fatal complications [7].

In areas where malaria is endemic, pregnancy is accompanied by a reduction in acquired immunity, especially in women who are pregnant for the first time (primigestes). However, malaria often remains latent, frequently leading to anemia and low birth weight in newborns. Primigests are more likely to contract malaria than women who have already given birth several times (multigravestides). In areas of low transmission, malaria can cause abortion or premature birth. In Africa, malaria is responsible for 15% of cases of anemia during pregnancy [8].

In the Democratic Republic of Congo, malaria is the leading cause of death, severely affecting children and pregnant women. This disease represents a major public health problem. According to the National Malaria Control Program (PNLP), malaria is responsible for 42% of deaths, 71% of medical consultations and 56% of hospitalizations in the country [9].

We mainly observe in Kinshasa that malaria affects 88 million pregnant patients annually. First-time mothers are most affected, while the majority of newborns of mothers who have suffered from malaria are also victims of congenital malaria [10].

In Mbujimayi, April 27, 2021 (ACP) – In 2020, the Kasai Oriental province recorded 1,015,367 cases of malaria, with children under 5 years old and pregnant women being the most affected. This information was communicated by the coordinating doctor of the National Malaria Control Program (PNLP), who emphasizes that malaria, a tropical infectious disease transmitted by the bite of Anopheles mosquitoes, can become fatal if not properly treated [11].

Over the past two weeks, 5,016 cases of malaria, including 14 deaths, were reported in the Kabinda health district, located 153 km east of Mbuji-Mayi, in eastern Kasai. According to the doctor responsible for epidemiological surveillance in this region, the majority of patients are children under 10 years old and pregnant women. The head doctor of the health district attributes the increase in malaria cases to the unsanitary conditions present in the area.

Problematic

Malaria is a parasitic disease transmitted by mosquitoes of the Anopheles genus, constituting a major public health problem in many regions of the world, particularly in sub-Saharan Africa. Pregnant women represent a particularly vulnerable group to this disease, due to their physiological changes which can affect the immune response and increase the risk of complications for them and their children. Malaria during pregnancy can lead to serious consequences, such as severe anemia, premature delivery, intrauterine growth retardation and high neonatal mortality.

In the Nzaba health zone, the prevalence of malaria remains worrying despite prevention and treatment efforts. Ecological conditions, such as climate, hydrology, vegetation, and agricultural practices, play a crucial role in malaria transmission dynamics by influencing the population of mosquito vectors and their contact with humans. In addition, socio-economic and cultural factors, such

as the level of knowledge about malaria, prevention practices, and access to health services, are also determining factors in the exposure and susceptibility of pregnant women to the disease.

This study aims to explore and understand the ecological determinants of malaria among pregnant women in the Nzaba health zone. It seeks to identify the specific factors that contribute to the high incidence of the disease in this population. Understanding these determinants is essential to develop targeted and effective interventions, which could reduce the impact of malaria on pregnant women and improve maternal and neonatal health in this region.

From the above, we ask ourselves the question of: What are the ecological factors that explain the increased prevalence of malaria among pregnant women in the Nzaba health zone and how do these determinants interact with pregnancy status to influence disease risk and outcomes?

Assumption

To the question formulated above, the hypothesis is worded in these terms: Sociodemographic characteristics, practices of pregnant women on malaria prevention and ecological conditions would be the determinants of malaria among pregnant women in the health zone of Nzaba.

Objective
General objective

To identify the determinants of malaria among pregnant women under ecological conditions in the NZABA health zone.

Specific objectives

- Describe the sociodemographic characteristics of pregnant women
- Determine the prevalence of malaria among pregnant women
- Evaluate the level of knowledge of pregnant women on the use of mosquito nets
- Identify the explanatory factors of malaria in pregnant women

Materials and Methods
Study framework

This study was carried out in the Nzaba health zone, which is located in the province of Kasaï Oriental precisely in the division which bears the same name. The Nzaba health zone has a total population of 379,724 inhabitants. It is subdivided into 18 health areas, all of which have a health center.

Geographic location

The Nzaba health zone has a humid tropical climate with a rainy season lasting at least 9 months (mid-May to mid-August), and a dry season lasting from mid-May to mid-August. The average annual temperature is 027°C, this ecosystem favors the outbreak of most tropical diseases. Access to this health zone is by road whose condition is acceptable.

The area is demarcated as follows:

- To the North, via the Mpokolo health zone and Inga Avenue;
- To the south, by the Tshishimbi health zone and the Kanshi river;
- To the east, by the Bonzola health zone and Kanshi Avenue;
- To the west, by the Mukumbi health zone and the circle of the Miabi road as well as the village of Bakwanga Bena Kansele.

Target populations

Women living in the Nzaba Health Zone.

Study populations

Pregnant women residing in the Nzaba health zone.

Type of study

This study is of a transversal analytical type.

Study period

This study took place over a period from June 14 to August 14, 2024, i.e. 2 months.

Selection criteria
Inclusion criteria

All pregnant women from the Nzaba health zone who attended the prenatal consultation services of the targeted structures during the investigation period and who agreed to freely participate in the study were included in this study.

Exclusion criteria

Were excluded from our study: all pregnant women who were not not present at the time of our study.

Sampling
Sampling type

For the effective completion of the study, non-probability convenience sampling was used.

Sample size
The sample size was 180 pregnant women.

Sampling technique

Drawn up the list of all the 18 health areas of the Nzaba health zone we cite:

- Airport = 20967 inhabitants
- Dinanga = 20118 inhabitants
- From the market = 20,877 inhabitants
- Jérémie = 22,422 inhabitants
- Kadima Diba = 19,653 inhabitants
- Luaba = 23,732 inhabitants
- Lutulu = 23,798 inhabitants
- Mayiba = 21,335 inhabitants
- Mbikayi = 22,796 inhabitants
- Misericordia = 20,680 inhabitants
- Mukankala = 22774 inhabitants
- Mutombo Katshi = 21,781 inhabitants
- PMKO = 14,098 inhabitants
- Tarmac 1 = 22,853 inhabitants
- Tarmac 2 = 17,567 inhabitants
- Tatu muya = 18,267 inhabitants
- Tudi kolela = 22795 inhabitants
- Zimbabwe = 23,211 inhabitants.

We carried out a random draw for the 7 health areas in the Nzaba zone.

The survey was carried out in the following 7 health areas:

- Click Card
- Spoon
- Maybe
- Mercy
- Yellow Cat
- Pmko
- Zimbabwe

Study parameter

- Sociodemographic characteristics (Age, marital status, profession, Level of education, Residence, Number of children, Religion)
- Use of the LLIN
- Environmental sanitation
- Ecological factors

Data collection organization

For field data collection we needed a research form. then, the head doctor of the zone gave his approval for the field trip.

Data collection source

Households in the NZABA health zone.

Specific technical equipment

Data collection was done through a face-to-face interview using a survey questionnaire.

Analysis plan and statistical data processing

Our data was entered using Excel software version 2013 and analysis using Jamovi software version 2.4.8. In the descriptive analyses, categorical variables were represented in numbers and percentages. A bivariate analysis was carried out using the Chi-square test (χ^2), and the Fischer test to make associations between the explanatory variables and the variable of interest (Presence of malaria). The significance threshold was set at 5%. All variables with a P value less than 5% were considered as potential factors associated with malaria in pregnant women.

Ethnic considerations

The study was carried out with the approval of the Nzaba health zone. In addition, to preserve the confidentiality of the subjects, the questionnaires were made anonymous and coded. All information collected was kept in a secure place and accessible only to people authorized by those responsible for the study.

Operational definitions

- **Malaria:** Malaria is a parasitic disease transmitted by the bites of infected Anopheles mosquitoes, characterized by symptoms such as fever, chills, and anemia. Its diagnosis in pregnant women can be confirmed by a blood test revealing the presence of Plasmodium.
- **Pregnant women:** Any woman who is pregnant, confirmed either by a medical test or by self-declaration, living in the Nzaba health zone during the study period.
- **Nzaba Health Zone:** A specific geographic region with precise administrative boundaries, where health data and medical interventions are centralized and managed.
- **Ecological conditions:** The specific environmental characteristics of Nzaba, including climate, precipitation, and vegetation, which can influence the proliferation of Anopheles mosquitoes and the risk of malaria transmission.

Results

Results of descriptive analyses.

Table 1: Distribution of pregnant women according to socio-demographic characteristics.

	Effective	%
Age		
≤ 25 years	92	51,11
> 25 ans	88	48,89
Level of study		
Primary	66	36,7
Secondary	55	30,6
Higher	2	1,1
None	57	31,7
Marital status		
Bride	172	95,6
Not married	8	4,4
Religion		
Others	62	34,4
Christian	118	65,6
Profession		
None	97	53,9
Shopkeeper	55	30,6
Teacher	9	5
Housewife	19	10,6
Household size		
≤ 7 peoples	95	52,78
> 7 peoples	85	47,22
Number of children		
≤ 5	123	68,3
> 5	57	31,7

The majority of respondents or 92 out of 180 subjects or 51.11% were aged less than or equal to 25 years. More than half of the respondents were married with 172 out of 180 subjects or 95.6%. Most of the respondents were Christian with 118 out of 180 subjects or 65.6%. The respondents with a primary education level were the majority with 66 subjects out of 180 subjects or 36.7%. More than half of the respondents had no profession with 97 out of 180 subjects or 53.9%. Most of the respondents live in households with less than 7 people with 95 out of 180 subjects or 52.78%. The majority of women had up to five children with 123 out of 180 subjects or 68.3%.

Table 2: Distribution of respondents according to mosquito net use.

	Effective	%
Possession of the mosquito net (n = 180)		
Yes	114	63,3
No	66	36,7
Origin of the mosquito net (n = 114)		
CPN	6	5,3
Distribution campaigns	70	61,4
by a loved one	3	2,6
Purchased	35	30,7
Daily use of the mosquito net (n = 114)		
Yes	57	50
No	57	50

Most of the respondents had a mosquito net with 114 out of 180 subjects or 63.3%. Half of the respondents who had the mosquito net used the mosquito net daily with 57 out of 114 subjects or 50%. A large majority had received their mosquito net during the distribution campaigns with 70 out of 180 subjects or 61.4%.

It appears from this graph that less than half of the respondents had malaria with 70 out of 180 subjects or 38.9%.
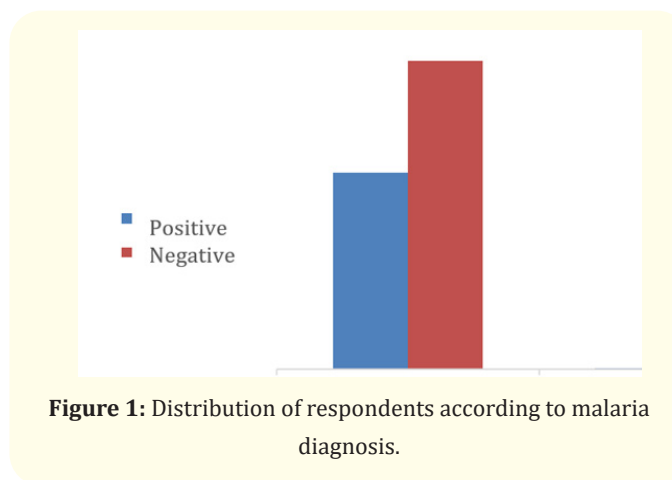
Malaria

Figure 1: Distribution of respondents according to malaria diagnosis.

The results of the bivariate analysis show that there is no statistically significant association.

	Malaria n (%)	OR (C95%)	P
Level of study			
Educated	23(33,8)	1,415[0,756-2,649]	0,277
Not educated	47(42,0)		
Marital status			
Bride	68(39,5)	0,51[0,1-2,6]	NA
Not married	2(25)		
Religion			
Others	29(46,8)	1,65[0,882-3,088]	0,117
Christian	41(34,7)		
Profession			
Worker	47(38,2)	1,094[0,576-2,079]	0,784
Not hard working	23(40,4)		
Knowledge about the importance of the mosquito net			
Sufficient	30(44,8)	1,48[0,799-2,742]	0,213
Insufficient	40(35,4)		
Possession of the mosquito net			
Yes	37(33,3)		
No	33(47,8)	1,83[0,991-3,39]	0,052
Daily use of the mosquito net			
Yes	18(31,6)		
No	19(33,3)	1,083[0,494-2,374]	0,841
Presence of stagnant water near the household after rain			
Yes	50(35,2)		
No	20(52,6)	2,04[0,991-4,21]	0,05
Frequency of clearing in households surrounded by bush			
Once a week/once a month	30(42,3)	1,262[0,685-2,326]	0,455
Once every 6 months	40(36,7)		

Table 3: Explanatory factors for malaria in pregnant women.

between sociodemographic characteristics, knowledge about the importance of the mosquito net, and daily use of the mosquito net and the presence of malaria in women. pregnant (p > 0.05).

Possession of a mosquito net (p = 0.052) and the presence of stagnant water in households (p = 0.05) were explanatory factors for malaria in pregnant women.

The level of secondary education (p = 0.027), being without a profession (p = 0.004) or having a commercial profession (0.045), the age of the pregnant woman (0.004) and the number of children in the household were factors.

Conclusion

In conclusion, the general objective of this study was to identify the determinants of malaria among pregnant women in the ecological conditions of the Nzaba health zone. Remember that the determinants of malaria in pregnant women were: the level of secondary education, the absence of a profession or having a commercial profession, the age of the pregnant woman and the number of children in the household. Thus, these results confirm the hypothesis according to which ecological conditions and sociodemographic characteristics are the determinants of malaria in pregnant women.

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	OR$_a$ (IC95%)	P
Level of study		
Secondary	2,146 [0,33 – 14,066]	0,027
Profession		
None	0,01 [0,00048-0,239]	0,004
Shopkeeper	0,0595 [0,00376 – 0,942]	0,045
Age of pregnant woman	0,4802 [0,2923 – 0,789]	0,004
Number of children	2,5 [1,029-6,072]	0,043

Table 4: Determinants of malaria among pregnant women in the Nzaba health zone.

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