KEMAS 20 (4) (2025) 724-730

Jurnal Kesehatan Masyarakat

http://journal.unnes.ac.id/nju/index.php/kemas

Malaria Infection Among Pregnant Women of Abau District in Papua New Guinea

Susina Yatapya[1,4],Dwi Sarwani Sri Rejeki[2,4]✉, Siwi Pramatama Mars Wijayanti[2], Radi[3]

[1]Nurse Consultant at International SOS Papua New Guinea and Master of Public Health, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

[2]Departmen of Public Health, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

[3]Bachelor of Public Health, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto, Indonesia

[4]Research Centre of Rural Health, Institute for Research and Community Service, Jenderal Soedirman University, Indonesia

Article Info

Article History:
Submitted July 2024
Accepted October 2024
Published: April 2025

Keywords:
malaria; pregnant women; Papua New Guinea

DOI
https://doi.org/10.15294/kemas.v20i4.10714

Abstract

Malaria is a communicable disease that poses a serious problem in Papua New Guinea, with the country recording the highest incidence of malaria in the Asia-Pacific region each year. However, research on the risk factors for malaria in Papua New Guinea is still minimal, especially among pregnant women. This study aims to investigate the correlation between malaria incidence in pregnant women in Papua New Guinea. This study is an observational study with a cross-sectional approach conducted on 200 pregnant women from January to March 2024 in Abou District, Papua New Guinea. Data collection used questionnaires and Rapid Diagnostic Tests (RDT) to diagnose malaria infection in pregnant women. The independent variables in this study are healthcare-seeking behavior, prevention of malaria, knowledge of malaria, maternal age, marital status, occupation, education level, and residential location. The dependent variable in this study is the incidence of malaria in pregnant women. In this study, the data analysis used included univariate analysis, bivariate analysis with chi-square, and multivariate analysis with logistic regression. The results showed that the risk factors for malaria incidence in pregnant women in Papua New Guinea are malaria prevention (p-value 0.014; OR= 4.426) and healthcare-seeking behavior (p-value 0.033; OR= 4.033), meaning that pregnant women with poor malaria prevention behavior and poor healthcare-seeking behavior are four times more likely to suffer from malaria. It is hoped that pregnant women will increase their awareness of malaria prevention during pregnancy and make full use of healthcare facilities during pregnancy.

Introduction

This study is an analytical observational study with a cross-sectional design to determine the prevalence of malaria in pregnant women (Capili, 2021). The location of the study is in Abau District, Central Province in Papua New Guinea. The research study was conducted in three healthcare facilities that were accessible at the time, Moreguina Station Health Centre, Kupiano Station Health Centre, and Domara Aid Post. This study was carried out from January to March 2024. The research was conducted in Abau District where the healthcare facilities serving as the research sites did not require ethical approval. The research proceeded with verbal consent from the hospital head and the healthcare facility. The healthcare facility only required informed consent for the research.

The questionnaire used in this study is the Intervention on Malaria Knowledge, Motivation, and Behavioral Skill (IMB) questionnaire on malaria in pregnancy, which has been tested for validity and reliability (Balami et al., 2020). The population of pregnant

✉ Correspondence Address:
Departmen of Public Health, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto, Indonesia
Email: dwi.rejeki@unsoed.ac.id

pISSN 1858-1196
eISSN 2355-3596

women in Abau District is not precisely known due to poor record-keeping in health service facilities. Therefore, the sample size for the study is calculated using the Lameshow formula with a 95% confidence level and a standard error of 0.07, which is expected to represent the entire population (Pourhoseingholi et al., 2013). The calculation results in 196 respondents, which is rounded to 200 respondents. The selection of respondents was based on inclusion and exclusion criteria. The inclusion criteria in this study were pregnant women aged 15-45 years, residing in Abau district, willing to be tested for malaria with rapid diagnosis test (RDT), and willing to participate as research respondents. The exclusion criteria in this study were respondents who could not be reached during home visits. The process started at Moreguina Health Center with 70 respondents, followed by Kupiano with 100 respondents, and finally Domara Aid Post with 30 respondents. All pregnant women who meet the inclusion and exclusion criteria will then be asked to provide their consent by signing an informed consent form. For all respondents who agree, an interview and RDT will be conducted.

The dependent variable is the malaria infection status of the pregnant women with the independent variables being age, marital status, residence, occupation, education, knowledge of malaria, healthcare-seeking behavior, and prevention of malaria. The research data was collected using a questionnaire to gather data on respondent characteristics, healthcare-seeking behavior, malaria prevention, knowledge of malaria, maternal age, marital status, occupation, education level, and residential location. Malaria data among pregnant women was obtained by conducting a rapid diagnostic test on 200 pregnant women at the research location. The collected research data is then analyzed using univariate analysis to determine the frequency distribution of respondents' answers. Bivariate analysis with chi-square is used to examine the relationship between independent variables and dependent variables. Multivariate analysis with logistic regression is used to identify the variables that are risk factors for malaria incidence in pregnant women (Tukey, 1977). Data analysis is performed using SPSS version 23 (IBM, 2016).

TABLE 1. Characteristics of Respondents

Category		N	%
Age	Teenagers (15-<18 years old)	85	42.5
	Adult (>18-45 years old)	115	57.5
Marital status	Single	1	.5
	Married	199	99.5
Residence	Rural	196	98.0
	Urban	4	2.0
Occupation	Farmers	35	17.5
	Housewife	156	78.0
	Student	3	1.5
	Entrepreneur	3	1.5
	Other	3	1.5
Education	Non-formal education	9	4.5
	Primary school	117	58.5
	Secondary school	66	33.0
	Collage/University	8	4.0
	Received	38	79.2
Malaria status	Positive	14	7.0
	Negative	186	93.0

Result and Discussion

In Papua New Guinea's Central Province, the Abau District, a region rich in biodiversity with diverse landscapes, is situated about 283 kilometers from the main city, Port Moresby. The tropical climate of the area, conducive to mosquito breeding, poses significant public health implications, as mosquitoes are vectors for diseases, including malaria, which remains prevalent despite control efforts. The study covered a target population of 200 pregnant women. The respondents, predominantly adults aged between 18 and 45 years old (57.5%), were mostly married (99.5%) and lived in rural areas (98%). The majority were housewives (78%), and had primary school education (58.5%). Regarding malaria status, a small percentage (7%) tested positive for malaria which translates to 14 out of 200 surveyed individuals testing positive, or 70 cases per 1000 individuals, while the majority (93%) tested negative. The distribution of the research respondents' characteristics is presented in TABLE 1 as follows.

The bivariate analysis with the Chi-square test as shown in TABLE 2 reveals no significant association between malaria status and age, marital status, residence, education level, or occupation, as indicated by p-values greater than 0.05. However, individuals with poor knowledge of malaria, poor healthcare-seeking behavior, and poor malaria prevention practices have a significantly higher prevalence of malaria, as indicated by p-values less than 0.05. These findings suggest that interventions aimed at improving knowledge about malaria, promoting better healthcare-seeking behavior, and encouraging effective malaria prevention practices could potentially reduce malaria prevalence. However, these are observational

TABLE 2. Relationship Between Independent Variables and Dependent Variables

No	Variable	**Positive**	**Negative**	***p-value***
		n=14	n=78	
1.	Age			
	Teenagers (15-<18 years old)	7 (8.2%)	78 (91.8%)	0.758
	Adults (>18-45 years old)	7 (6.1%)	108 (93.3%)	
2.	Marital status			
	Single	0 (0%)	1 (100%)	0,783
	Married	14 (7.0%)	185 (93.0%)	
3.	Residence			
	Rural	14 (7.1%)	182 (92.9%)	0,579
	Urban	0 (0%)	4 (100%)	
4.	Education level			
	Low	10 (7.9%)	116 (92.1%)	0.783
	High	4 (5.4%)	70 (94.6%)	
5.	Occupations			
	High risk	13 (6.8%)	178 (93.2%)	0,621
	Low risk	1 (11.1%)	8 (88.9%)	
6.	Knowledge of malaria			
	Bad	9 (13.6%)	57 (86.4%)	0.010*
	Good	5 (3.7%)	129 (96.3%)	
7.	Healthcare-seeking behavior			
	Bad	11 (11.3%)	86 (88.7%)	0.040*
	Good	3 (2.9%)	100 (97.1%)	
8.	Prevention of malaria			
	Bad	8 (17.8%)	37 (82.2%)	0.001*
	Good	6 (3.9%)	149 (96.1%)	

TABLE 3. Last Model of Multivariate Analysis

No	Variables	Standard error	p-value	POR	95%CI	
					Lower	Upper
1.	Prevention of malaria	0.606	0.014	4.426	1.350	232.127
2.	Healthcare-seeking behavior	0.689	0.033	4.033	1.122	168.148
3.	Knowledge of malaria	0.616	0.097	2.778	0.831	5.598

findings, and further research is needed to establish causality.

The multivariate analysis results with logistic regression test suggest that individuals with poor malaria prevention practices are about 4.4 times (POR=4.426) more likely to have malaria, a statistically significant finding with a p-value of 0.014. Similarly, individuals with poor healthcare-seeking behavior are about 4 times (POR=4.033) more likely to have malaria, another statistically significant finding with a p-value of 0.033. However, while individuals with poor knowledge of malaria are about 2.8 times (POR=2.778) more likely to have malaria, this result is not statistically significant with a p-value of 0.097. The wide confidence intervals for these estimates indicate some uncertainty. These findings suggest potential areas for intervention, such as improving malaria prevention practices and healthcare-seeking behavior, but further research is needed to establish causality and consider potential confounding factors. The final multivariate modeling in this study is presented in TABLE 3 as follows.

In this study, malaria prevention was the most influential factor in the incidence of malaria among pregnant women in Papua New Guinea (p-value 0.014; POR= 4.426 95%CI= 1.35-232.12). This means that pregnant women with poor malaria prevention are four times more likely to suffer from malaria compared to those with good malaria prevention. Table 2 shows that the percentage of pregnant women who suffer from malaria with poor malaria prevention behavior (17.8%) is higher compared to pregnant women with good malaria prevention behavior (3.9%). Most pregnant women who suffer from malaria have poor malaria prevention; most only use bed nets when sleeping. However, the bed nets used are mostly older than four years, which may reduce their effectiveness. Additionally, women in the Abou District often go to the fields until late afternoon without using mosquito repellent or wearing long clothing. This condition increases the risk of pregnant women being bitten by mosquitoes and becoming infected with malaria.

The results of this study are consistent with research conducted in Ghana, which showed that malaria prevention affects the incidence of anemia in pregnant women (p-value 0.044 AOR= 1.57 95%CI= 1.01-2.47). This means that pregnant women who do not have the habit of sleeping under a mosquito net are 1.5 times more likely to suffer from malaria compared to those who sleep under a mosquito net (Ampofo et al., 2023). Another study conducted in Ethiopia showed that the malaria prevention variable significantly influences malaria infection in pregnant women (p-value 0.000 POR= 14.89 95%CI= 5.24-42.27). This means that pregnant women who do not have the habit of sleeping under a mosquito net are 1.5 times more likely to suffer from malaria compared to those who sleep under a mosquito net (Gontie et al., 2020). However, the results of this study are not consistent with research in the Lihir Group of Islands, Papua New Guinea, which showed no significant effect of malaria prevention, specifically sleeping under bed nets, on malaria incidence (p-value 0.675) (Millat-Martínez et al., 2023).

Healthcare-seeking behavior is also an influential factor in the incidence of malaria among pregnant women in Papua New Guinea (p-value 0.033; POR= 4.033 95%CI= 1.22-168.148). This means that pregnant women with poor healthcare-seeking behavior are four times more likely to suffer from malaria compared to those with good healthcare-seeking behavior. Table 2 shows that the percentage of pregnant women who suffer from malaria with poor healthcare-seeking behavior (11.3%) is higher compared to pregnant women

with good healthcare-seeking behavior (2.9%). The high number of pregnant women with poor healthcare-seeking behavior is due to limited access to healthcare facilities. The community in the Abou district, which lives in rural areas, has difficulty accessing healthcare facilities during pregnancy due to long distances and a lack of transportation. Additionally, inadequate road infrastructure, still consisting of dirt roads, makes it difficult for the community to travel, especially during the rainy season. Another reason is the community believed they could self-treat if they got malaria and could seek treatment themselves by buying anti-malarial drugs at the black-market sales or street market.

This study's findings are consistent with research conducted in East Nusa Tenggara Indonesia, which showed that healthcare-seeking behavior affects the incidence of anemia (p-value 0.000 POR= 1.87 95%CI= 1.19-2.96). It means that individuals who do not have good healthcare-seeking behavior are 1.87 times more likely to suffer from malaria compared to those who have good healthcare-seeking behavior (Guntur et al., 2022b). Another study conducted in the Republic of Democratic Congo showed that healthcare-seeking behavior significantly affects malaria infection in pregnant women (p-value 0.017) (Olapeju et al., 2023). However, this study's results are not in line with research in Nigeria, which showed no significant influence of healthcare-seeking behavior on the incidence of malaria in pregnant women (OR= 0.51 95%CI= 0.468-0.649) (Udenweze, 2019).

Age did not affect malaria infection in pregnant women in Papua New Guinea. The results of the data analysis showed that the majority of pregnant women were in the adult age group. The results of this study are not in line with research in Ghana which shows that age influences the incidence of malaria in pregnant women (p-value 0.000). This research shows that the older a pregnant woman is, the more she will protect herself from the risk of being infected with malaria during pregnancy(Alhassan, 2021). Age does not directly influence malaria infection in pregnant women, malaria infection is caused by various complex factors resulting from a combination of habits and environmental conditions (Andegiorgish et al., 2023).

Residence did not affect malaria infection in pregnant women in Papua New Guinea. The results of the data analysis showed that almost all pregnant women lived in rural areas. The results of this study are not in line with research in Guinea which showed residence influenced the incidence of malaria in pregnant women (p-value <0.001). This research shows that pregnant women who live in rural areas are more at risk of experiencing mosquito bites because there are many mosquito habitats in rural areas(Diallo et al., 2021). The proportion of research respondents who were almost entirely in rural areas meant that it was impossible to compare the prevalence of malaria in rural and urban residents(Yimam et al., 2021).

Marital status did not affect malaria infection in pregnant women in Papua New Guinea. The results of the data analysis showed that almost all pregnant women were married. The results of this study are not in line with research in Guinea which showed that marital status influenced the incidence of malaria in pregnant women (p-value <0.001)(Diallo et al., 2021). Marital status is indirectly related to the division of women's roles in the household, married African women spend more time at home so the risk of experiencing mosquito bites is lower (Frempong et al., 2023). Knowledge of malaria did not affect malaria infection in pregnant women in Papua New Guinea. The data analysis results showed that most pregnant women had a good knowledge of malaria. The results of this study are not in line with research in Burkina Faso which showed that knowledge influenced the incidence of malaria in pregnant women (p-value 0.033). Pregnant women with a lack of knowledge of malaria are 2.54 times more likely to be infected with malaria during pregnancy(Yaro et al., 2021). Research in Nusa Tenggara Indonesia shows that knowledge does not affect the incidence of malaria, this condition is caused by the community's customary habit of using natural ingredients to prevent mosquito bites (Guntur et al., 2022a).

In this study, occupation did not affect malaria infection in pregnant women in Papua New Guinea. The results of the data analysis showed that the majority of pregnant women worked as farmers who were susceptible to

mosquito bites. The results of this study are not in line with research in Guinea which showed that a person's job influences the incidence of malaria in pregnant women (p-value <0.001) (Diallo et al., 2021). Pregnant women with knowledge of working in gardens or fields are more at risk of being infected with malaria during pregnancy (Guntur et al., 2022b). Level of education did not affect malaria infection in pregnant women in Papua New Guinea. The results of the data analysis showed that almost all pregnant women had a low level of education. The results of this study are not in line with research in Guinea which showed that a person's job influences the incidence of malaria in pregnant women (p-value <0.001). Pregnant women with a low level of knowledge are more at risk of being infected with malaria during pregnancy because there is a possibility of continuing to carry out activities that carry a high risk of being bitten by mosquitoes that cause malaria (Diallo et al., 2021; Oyerogba et al., 2023).

Conclusion

In this study, there was a significant influence between malaria prevention and healthcare-seeking behavior on the incidence of malaria. The malaria infection was not significantly influenced by factors such as age, marital status, residence, education level, knowledge of malaria, and occupation. The findings of this research are expected to provide a strong foundation for the government of Papua New Guinea in formulating policies related to effective and efficient malaria management in pregnant women.

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