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Risk Factors Affecting The Incident of Malaria in The Working Area of The Malaimsimsa Public Health Center Sorong City

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ABSTRACT

Background: Malaria is an infectious disease caused by *Plasmodium sp*, a single-celled living creature that belongs to the group of the genus Protozoa which is parasitic. The purpose of this study was to determine the influence of environmental factors and behavioral factors on the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong City.
Methods: This research is an observational study using a case-control study . The case group in this study included people with malaria as indicated by positive malaria blood test results. Examination of malaria is carried out by means of microscopic examination by making thick and thin blood preparations, stained using Giemsa stain, then identified using a microscope. The control group includes people who are not sick with negative blood test results.
Result: The results of this study indicate that all malaria infections that occur are caused by infection with the type of *Plasmodium vivax*. The risk factors that influence the incidence of malaria are behavioral factors, namely the use of body armor and the use of insect repellent. While the risk factors that do not affect the incidence of malaria are the presence of puddles, temperature and use of mosquito nets.
Conclusion : From the results of this study it can be concluded that the factors of stagnant water, temperature and use of mosquito nets are not related to the incidence of malaria, on the contrary the use of body armor and the use of insect repellent have a relationship with the incidence of malaria.

Keywords: Malaria ; *Plasmodium vivax* ; risk factors.

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Introduction

Malaria is one of the infectious diseases which is a problem for public health in the world, it is most susceptible to afflicting ages such as children and the elderly which usually occurs during the rainy season. This disease is caused by *Plasmodium*, a single-celled living creature that belongs to the protozoa genus group which is parasitic. Malaria is easily transmitted through the bite of a female *Anopheles* mosquito that contains plasmodium, attacking all individuals regardless of sex and age [1].

Malaria is still an endemic disease in the world, each year the number of sufferers of the disease which is transmitted by Anopheles mosquitoes reaches more than 200 million. Data from the World Health Organization (WHO) stated that there were 219 million cases of malaria worldwide in 2019. However, the death rate from malaria has tended to decrease since 2004. From 759 thousand to 409 thousand deaths in 2019, this shows a decrease 46.1% within 15 years. According to the WHO report, malaria is caused by the plasmodium parasite. This disease is most commonly identified in sub-Saharan Africa. However, the Southeast Asian, Eastern Mediterranean, Western Pacific, and American regions are also at risk of contracting diseases through the bites of these mosquitoes [2].

The provinces of Papua, West Papua and East Nusa Tenggara are provinces with the highest malaria API. This is in line with the number of districts/cities in the province with high endemic status. The high API in Papua Province is 80.05 per 1,000 population which is far greater than all provinces, this can illustrate a significant contribution to API at the national level. As many as 91.2% of provinces in Indonesia have been able to suppress malaria API to less than 1 per 1,000 population [3].

Based on data from the Puskesamas Malaimsimsa City of Sorong, the number of Malaria checks in the last 3 years, namely from 2019, 2020 and 2021, was 5,184 tests with positive confirmations of 108 cases. The positive number of malaria has decreased when compared to malaria examination data in the last year, namely 2,592 examinations.

According to the theory of Hendrik L Blum 1974, there are four factors that influence the level of disease endemicity, namely behavior, environment, genetics or heredity and health services. In terms of health services, several efforts have been made by the Malaimsimsa Health Center to prevent malaria in the Malaimsimsa Health Center work area such as conducting examinations, treatment, counseling and community empowerment or mobilizing the community to maintain a clean environment with the aim of inhibiting vector development. Although the various efforts above have been made, until now malaria sufferers still exist. This is due to human factors such as people's behavior and attitudes towards treatment [4..5]

Method

The research was carried out at the Malaimsimsa Health Center Laboratory in Sorong City, which has 4 (four) sub-district working areas, namely Klabulu, Klagete, Malengkedi and Malamso sub-districts. The research was carried out in October 2022 – February 2023. The research that will be carried out is an observational study using a case-control study. This study was conducted to measure the size of the risk factors that influence the incidence of malaria. The case group includes people with malaria as indicated by positive blood smear (SD) results. The control group includes people who are not sick with malaria as indicated by negative blood smear (SD) results. The groups are then compared regarding possible causes or past experiences. The research sample was taken from the population at the Malaimsimsa Community Health Center, Sorong City. Samples for the case group were taken based on consideration criteria for the selection of researchers consisting of inclusion and exclusion. Inclusion criteria included being willing to participate in the study, being registered as a positive malaria sufferer whose blood had been taken which was stated based on the results of laboratory tests, residing in the working area of the Malaimsimsa Community Health Center, Sorong City, the period of time of new and relapsed malaria. The exclusion criterion was not willing to be a respondent. The sampling technique used in this

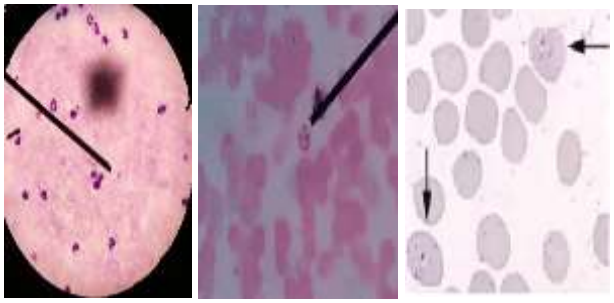
study is non-probability sampling in the form of accidental sampling, which is a method of determining a sample by taking respondents who happen to be available or available somewhere according to the research context.

The procedure for examining malaria, the tools used in this study were microscopes, glass objects, pipettes, spray bottles. The reagents used in the malaria examination were Giemsa staining, distilled water, methanol, alcohol cotton and lancets. The work procedure consists of a. making a blood smear, preparing tools and materials, holding the patient's left hand with the palm facing up, choose the middle or ring finger (in infants aged 6-12 months blood is taken from the tip of the big toe and the baby), clean the finger with an alcohol swab to remove dirt and oil that sticks to the finger, after drying the finger is pressed so that a lot of blood collects at the fingertip. Pierce the fingertip (slightly on the edge, near the nail) quickly using a lancet, the first drop of blood that comes out is cleaned with dry cotton, to remove blood clots and residual alcohol, press the fingertip again until the blood comes out, use a clean glass object (hold object glass on the edges), Position the object glass under the finger, drop one small drop of blood (± 2µl) in the center of the object glass for thin blood preparations. Next 2-3 small drops of blood (± 6µl) on the tip for thick blood preparations, clean the remaining blood on the fingertips with cotton, place a glass object containing drops of blood on a table or flat surface, to make thin blood preparations, take the object a new glass (second object glass) but not a cover glass, stick the tip on the small drops of blood until the blood spreads along the object glass, with an angle of 45^0 slide the object glass quickly in the opposite direction to the thick blood drops, so you get an erased preparation (like the shape tongue), the process of drying the blood smear must be carried out slowly on a flat place, it is not recommended to use a lamp (including a microscope lamp), a hair dryer. This can cause the blood preparation to crack, thus affecting the examination results. It is best to use a fan to dry the blood preparation [6]. Thin blood preparations that have been dried are fixed with methanol, avoiding contact with thick blood preparations. Place the glass object on the staining bridge/dye rack with the blood position on top, pour Giemsa solution from the edge so that it covers the entire surface of the object glass. Leave it for 30-45 minutes, then pour back distilled water or clean water slowly from the edge of the object glass until the Giemsa solution that is wasted becomes clear. Then the blood preparation is removed and dried, after drying the blood preparation is ready to be examined. The blood preparation is dripped with immersion oil before being examined under a microscope, this aims to clarify the object and protect the objective lens [7].

Data analysis used in this study includes two types of data analysis, namely, univariate and bivariate analysis. Univariate analysis aims to describe the characteristics of each variable in this study. Analysis was performed on each of each variable, the results of this analysis show the frequency and percentage of each variable. Bivariate analysis in this study used the Chi square test to test the research hypothesis between the independent variables and the dependent variable. This analysis was carried out for variables in this study, namely environmental factors (air temperature and standing water) and behavioral factors (habits of sleeping using mosquito nets, habit of leaving the house without using skin protection, and using mosquito repellents). The results are presented in the form of a p.value which is used to determine the significance relationship of the statistical test results. If p. value < 0.05 then H0 is rejected and Ha is accepted, meaning that there is a relationship between the independent and dependent variables. Meanwhile, if it is known that p.value > 0.05 then H0 is accepted and Ha is rejected which shows that there is no relationship between the independent and dependent variables.

Result

Figure 1 showed that 3 positive cases of malaria from 84 respondents. the type of malarial plasmodium found in the working area of the Malaimsimsa Public Health Center is the type of *Plasmodium vivax*. *Plasmodium falcifarum, Plasmodium ovale* and *Plasmodium malariae* were not found.



(a) (b) (c)

Figure 1. *Plasmodium vivax* young tropozoite stage. [a] and schizont stage, [b] on thin blood smear.

The relationship between environmental factors (room temperature and water stagnation) with the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong city, can be seen in Table 1.

Table 1. The relationship between environmental factors and the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong City.

Category	Malaria		
	Yes n (%)	No n (%)	*p. value*
Presence of puddles			
Yes	3(3.6)	54(64.3)	0.225
No	0 (0.0)	27(32.1)	
Amount	3 (3.6)	81(96.4)	
Room temperature			
≥30 ^{0}C	3 (3.6)	74(88.1)	0.595
≤30 ^{0}C	0 (0.0)	7 (8.3)	
Amount	3 (3.6)	81(96.4)	

The relationship between behavioral factors (use of body armor, use of mosquito nets, and use of mosquito coils) and the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong City can be seen in Table 2.

Table 2. Relationship between behavioral factors and malaria incidence in the work area of the Malaimsimsa Community Health Center, Sorong City.

Category	Malaria		
	Yes n (%)	No n (%)	*p. value*
Use of body Armor			
Yes	1 (1.2)	69 (82.1)	0.018
No	2 (2.4)	12 (14.3)	
Amount	3 (3.6)	81 (96.4)	
Use of mosquito nets			
Yes	0 (0.0)	25 (29.8)	0.251
No	3 (3.6)	56 (66.7)	
Amount	3 (3.6)	81 (96.4)	
Use of Mosquito Repellent			
Yes	0 (0.0)	51 (60.7)	0.028
No	3 (3.6)	30 (35.7)	
Amount	3 (3.6)	81 (96.4)	

Discussion

Based on Table 1, it can be seen that the presence of standing water has a p value (0.225), which means that the presence of standing water is not related to the incidence of malaria. Mosquito breeding sites are places that mosquitoes use to breed. The research results showed that all respondents (3.6%) of the population suffering from malaria had standing water around their house.

Potential places for mosquito breeding include clear rivers with slow flowing water, ponds with clear water, clear springs, lagoons, puddles or water basins, rice fields, irrigation canals with slow flowing lakes, fish ponds, shrimp ponds, mining and mangrove forests [8]. The mosquito breeding sites found in the research were puddles of water around people's homes.

Statistical tests show that the presence of standing water around people's residences is not related to the incidence of malaria in the Malaimsimsa Community Health Center working area, Sorong City. Several previous studies stated that mosquito breeding sites are

not related to the incidence of malaria. The factor of water stagnation around people's houses occurs due to the lack of people cleaning the gutters around the house, apart from that, people's habit of collecting water in water reservoirs and leaving them open makes this a breeding ground for mosquitoes inside and outside the house. The existence of mosquito breeding sites within a close radius of the community, as well as the ability of mosquitoes to fly 0.5 – 2 km are risk factors for people contracting malaria. This research is in line with [9] who explained that mosquito breeding sites are a risk factor that is not related to the incidence of malaria. However, this research is not in line with [10] research which states that standing water is related to the incidence of malaria with p.velue = 0.000. [8] supports the statement that standing water affects the incidence of malaria with p. speed = 0.001.

The results of this study show that all respondents (3.6%) who suffer from malaria have a house temperature of ≥300C. In Table 1, the statistical test for room temperature shows a p value (0.595), which means that room temperature is not related to the incidence of malaria in the community in the working area of the Malaimsimsa Health Center, Sorong City. This research is in line with research by [11] that there is no relationship between temperature and the incidence of malaria and p. value = 0.432. [12] supports this statement that there is no relationship between the incidence of malaria and the physical environment (temperature) with p.veleu = 0.280. However, research is not in line with [13] who stated that there is a correlation between air temperature and the incidence of malaria p.value = 0.049.

At the time of the research, it was found that the average room temperature in people's homes was cool or not too humid or too hot. The temperatures obtained in this study ranged from 27^0C to 35^0C. The temperatures that influence the development of parasites in mosquitoes were around 20^0C and 30^0C, indicating that mosquitoes are cold-blooded animals and therefore their metabolic processes and life cycles depend on the environment. Low humidity will shorten the life of mosquitoes, whereas high humidity will prolong the life of mosquitoes. In high humidity, mosquitoes will bite more often, thereby increasing malaria transmission.

Mosquito growth will stop completely if the temperature is less than 10^0C or more than 40^0C. Mosquitoes can survive in low temperatures, but their metabolic processes decrease or even stop if the temperature drops below the critical temperature at very high temperatures, their physiological processes will change. The speed of mosquito development depends on the speed of metabolic processes, partly regulated by temperature. The effect of this temperature is different for each species, at a temperature of 26.7ºC the extrinsic incubation period is 10 – 12 days for P. *falciparum* and 8 – 11 days for *P. vivax*, 14 – 15 days for *P. malariae* and *P. ovale*.

Table 2 shows the relationship between behavioral factors, namely the use of personal protective equipment, use of mosquito nets and use of anti-mosquito medication with the incidence of malaria in the working area of the Malaimsimsa Health Center, Sorong City. Where the use of body protection when leaving the house at night has a p value (0.018) and the use of mosquito repellent has a p value (0.028), which means it is related to the incidence of malaria. This research is in line with research by [14] which shows that community behavior regarding the use of mosquito coils is related to the incidence of malaria with a p value of 0.000. [15] also stated that there is a significant relationship between the use of mosquito repellent and the incidence of malaria. This research is not in line with [9] who stated that there is no relationship between the use of mosquito coils and the incidence of malaria p.value = 1,000.

The behavior of leaving the house at night without wearing long-sleeved clothing and anti-mosquito medication as body protection is one of the risky actions that can cause humans to be bitten by mosquitoes. Anopheles sp is a vector that actively searches for food at night so that humans who leave the house at night have the possibility of contracting malaria.

However, there are several previous studies which stated that the behavior of leaving the house at night is not related to the incidence of malaria, namely research by [16]. In line with this statement,[17]also said that there was no

relationship between the behavior of leaving the house at night without using body protection and the incidence of malaria.

Conclusion

House temperature is not a risk factor for malaria incidence in the working area of the Malaimsimsa Community Health Center, Sorong City. The presence of puddles around people's homes is not a risk factor for malaria incidence in the working area of the Malaimsimsa Public Health Center, Sorong city. The use of mosquito nets is not a risk factor for the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong City. The behavior of leaving the house at night without wearing body armor is a risk factor for malaria incidence in the working area of the Malaimsimsa Community Health Center, Sorong City. The use of mosquito coils is a risk factor for the incidence of malaria in the working area of the Malaimsimsa Community Health Center, Sorong City.

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References

1. Melda, A.S. 2020. The effect of health promotion through video media on knowledge and attitudes about malaria. Thesis. Bengkulu Ministry of Health Polytechnic.
2. WHO. 2021. World Health Organization Malaria Report. https://reliefweb.int/report/world/world-malaria-report-2021.published 2 Dec 2021
3. West Papua Health Office. 2019. Health Profile of West Papua Province, Ministry of Health of the Republic of Indonesia.
4. Sidik, N. K., Asrina, A., and Syam, N. 2022. Disbursement behavior for malaria Treatment in the Muari Village Community, Oranbari District, South Manokwari Regency. Window Pub Heal J. 3(4): 761-770.
5. Astin, N. Alim, and A. Zainuddin. Qualitative study of community behavior in malaria prevention in Manokwari, West Papua, Indonesia. Ind J Heal Prom Heal Edu, 8(2): 132-145.
6. Subun, M, H. 2017. Technical guidelines for malaria examination. Directorate General of Disease Prevention and Control. Ministry of Health of the Republic of Indonesia
7. Rahayuni, N. 2018. Comparison of Plasmodium sp between Rapid Diagnostic Test (RDT) examination and microscopic examination of suspected malaria at the Jati Raya Health Center. 2018. Thesis. Kedari Health Polytechnic Department of Health Analyst.
8. Apriliani. 2022. Analysis of risk factors for malaria in Indonesia. Thesis. Faculty of Public Health, North Sumatra Islamic State University, Medan
9. Atikoh, N.I. 2015. Factors associated with the incidence of malaria in Selakambang Village, Kaligondang District, Purbalingga Regency in 2014. Thesis. Faculty of Medicine and Health Sciences, Syarif Hidayatullah State Islamic University.
10. Palupi, W.N. 2010. The relationship between the existence of mosquito breeding places and malaria incidence at the Hanura Health Center in Pesawaran Regency in 2010. Thesis. Faculty of Public Health, University of Indonesia.
11. Alamsyah, A., and Gustina, T. 2013. Implementation of the surveillance system and epidemiological description of malaria at the Indragiri Hulu District Health Service 2008-2010. J Comm Heal, 2(2): 61-66.
12. Wulandari, A. 2018. The relationship between the physical environment of the house and the incidence of malaria in the Working Area of the Hanura Health Center, Teluk Pandan District, Pesawaran Regency. Thesis. Faculty of Medicine, University of Lampung. Bandar Lampung.
13. Widyanti, S.A., and Mukono, J. 2022. The relationship between air temperature and

malaria cases in Ende Regency in 2017. J Pub Heal. 13(3): 403-405.
14. Prachelia, A.M. 2021. The relationship between physical environmental factors and community behavior and malaria disease in the Working Area of the Silau Laut Health Center, Asahan Regency. Thesis. Public Health Study Program, Faculty of Public Health, UIN North Sumatra, Medan.
15. Prihatin, D. 2012. Malaria incidents in the working area of the Mantangai Health Center, Kapuas Regency, Central Kalimantan Province, 2012. Thesis. Faculty of Public Health. Bachelor of Public Health Program.
16. Lumolo, F., Pinontoan, R, O., and Rattu, M, J. 2015. Analysis of the relationship between behavioral factors and malaria incidence in the work area of the Mayumba Health Center in Central Sulawesi Province. J e-Biomed (eBm). (3)3: 866-871.
17. Trapsilowati, W. 2016. Behavioral and environmental risk factors in malaria transmission on Sebatik Island, Nunukan Regency, East Kalimantan. BALABA, 12(2): 99– 110.