

The Relationship between Malaria Cases as Cause of *P. falciparum* and *P. vivax* against Demographic Factors from Symptomatic Patients in Jayapura General Hospital, Papua Province, Indonesia

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Abstract: *Background:* Malaria is ancient disease who transmitted through Anopheles mosquitoes to the human. It is still a poses of major public health problem in Papua. Malaria is caused by Plasmodium parasites that lives and multiplay in human red blood cells. *Objective:* The aim of this study was to determine of relationship between malaria cases were infected through *P. falciparum* and *P. vivax* against demographic factors of Symptomatic patients at Jayapura general hospital. *Methods.* Type of this study is descriptive research who is using cross sectional design. *Result:* Total of sample 600 patients after having thick and thin blood smear examination which were 179 patients found to be positive was infected. It was consisting 131 (73.2%) patients carried by *P. falciparum* and 48 (28%) patients carried with *P. vivax*. *Conclusion:* Based on the result study indicated that there was not relationship between malaria cases with almost all of demographic factors from symptomatic patients but only genders. The majority malaria symptomatic patients were infected through *P. falciparum* than *P. vivax*. Generally the malaria patients that illness from ages group over 20 years old which were male. They were not working and having habits that always outside of the house all the night by education level with senior high school and sleeping without mosquito nets.

Keywords: *P. falciparum*, *P. vivax*, Demographic factors, Jayapura general hospital

1. Introduction

Malaria has attacked 106 countries in the world including Indonesia and still there are approximately 3.2 billion people or nearly half of the world's population at risk of contracting malaria^[1]. There are about 214 million new malaria cases with mortality rates of around 438 thousand people in the worldwide.

The World malaria report 2017 draws on data from 91 countries and areas with ongoing malaria transmission^[2]. In 2016, there were an estimated 216 million cases of malaria occurred worldwide compared with 237 million cases in 2010 and 211 million cases in 2015, an increase of about 5 million cases over 2015 and they were an estimated 445,000 deaths globally from malaria a similar number to the previous year^[3]

Malaria is an infectious disease caused by protozoan parasites from the *Plasmodium* family that can be transmitted by the bite of the *Anopheles* mosquito. *Falciparum* malaria is the most deadly type. The symptoms of malaria include cycles of chills, fever, sweats, muscle aches and headache that recur every few days. There can also be vomiting, diarrhea, coughing, and yellowing (jaundice) of the skin and eyes. Persons with severe *falciparum* malaria can develop bleeding problems, shock, kidney and liver failure, central nervous system problems, coma, and die^[4,5].

Malaria is still a public health problem in Indonesia, but now the problem of malaria in Indonesia is getting better^[6]. In Indonesia, populations were living in endemic areas of malaria, local transmission is still at risk of malaria. By 2014 there are 74% of the population living in

malaria without risk areas and 3% living in high risk areas. In the last 4 years most of the population lives in Malaria free areas and the population shows an increase. While people in high endemic areas have the lowest percentage and level to fall from 4.7% in 2012 to 2.2% in 2015^[6]

In Papua, malaria is a major health problem because this area is one of malaria endemic areas with hyper-endemic category in Indonesia, and reported that malaria treatment failure with standard chloroquine medicine in Arso Vir Jayapura. (Sumawinata *et al*, 2003). A preliminary study in Genyem subdistrict of Jayapura, show that on the effectiveness test of the use of sulfadoxine pyrimethamine, it was reported that both of these medicines combined were still relatively effective in *falciparum* without complications^[7].

Malaria is disease that still high in Papua Province of the 100 people there are 43 people there are 43 people^[8]. While for more than 100 people there are 27 people that infected parasite of malaria (Dinas Kesehatan Jayapura, 2017). The Annual Parasite Incidence (API) for Jayapura District still was 200 per 1000 populations that suffer of malaria^[9].

The species of *Plasmodium* was found more in Papua are *P. falciparum* and *P. vivax*. The parasite density of *P. falciparum* is proportional in to the internal Blood vessels and the led to attack suddenly so that can because shock, cerebral malaria, acute renal failure and malaria cerebral and pulmonary edema that potentially give fatal complications^[4]. Besides two species of *Plasmodium* above there are areas Village such as Genyem especially Lereh village was found *P. malariae* and in the Arso XIV region of Keerom District also was found in the blood of

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an asymptomatic patient there is a mixture of all three species of *Plasmodium* such as *P. falciparum*, *P. vivax* and *P. malariae* or could be also with *P. ovale* or four species of *Plasmodium* such as *P. falciparum*, *P. vivax*, *P. Ovale* and *P. malariae*^[10]

Clinical Manifestation of malaria is influenced by various factors in the human host, parasite and environment. In human, age, immunity, pregnancy and genetic factors have been shown to determine the malaria clinical outcome whereas in the malarial parasite, drug resistance, multiplication rate, invasion pathway, cytoadherence and rosetting, antigenic variation and polymorphisms, and malaria toxin are among other factors that have been identified^[11].

Efforts malaria control in Indonesia is characterized by decreasing incidence of malaria and based on Natinality as much as 0.85 per 1000 populations per year^[12]

2. Material and Method

Description of Study Sites: This study was conducted in March, 2017. The location of the Jayapura Municipality within the Papua Province of Indonesia shown in Figure 1. Jayapura Municipality its wide territory covering 442, 540 km². It is in the condition at 137° to 141° Eastern Longitude and 1° to 3° South term latitude. Jayapura Municipality is divided into mainland, swamp (146, 576 ha), river areas and large heading to the Pacific Ocean. The Municipality is bordered in the North through Pacific ocean and in the east with Papua New Guinea. The populations of Jayapura Municipality is mainly Papuan, migrants Java, Sulawesi, Mollucas and the other parts of Indonesia. The municipality is geographically consisting of marshy land and highland and rivers. The climate is typically tropical with average temperature between 25 - 35 °C. The dry and wet seasons is not distinctly separated, with drier season between May to November and the monsoon between December to April. The Majority of population work as farmer and fisherman.

Sample collection: A malariometric survey was conducted during on March 2017 in Jayapura general hospital. The target population was the village inhabitants that joined voluntarily and the blood sample was taken through finger prick and prepared for thick and thin blood smear. The patient from located around the hospital and referral patients from a community health center away from the hospital such as sub-district Depapre, Dosai, Genyem, Sentani, West and East Koya, and Keerom District. This study was carried out with the approval by the Ethics Committees at the Faculty of Medicine, University of Hassanudin 2017.



Figure 1: A sketch map of the Jayapura Municipality (red circle), and its geographic location within the Indonesia archipelago.

Parasite detection: Thick and thin blood smears taken during the malariometric survey were stained with Giemsa, and subsequently examined by light microscopy. Parasite density was determined by counting the number of parasites per leucocytes in 100-high power microscopic fields in a Giemsa-stained thick film, assuming an average of 20 leucocytes per microscopic field and 8000 leucocytes/ μ L of blood. Slides were declared negative if parasite could not be detected in 100 microscopic fields. The parasite count was classified such as: (+) if 1 - 10 parasites were found per 100 thick film fields, (++) if 11-100 parasites per 100 microscopic thick film fields, (+++) if 1-10 parasite per one thick film fields and (++++) if more than 10 parasites per one thick film fields [13;14]

3. Results

Malariometric survey

Total of samples obtained of passive case detection as much as 600 patients. 179 patients were found to be positive for malaria, consisting 131 (73.2%) patients carried *P. falciparum* and 48 (26.8%) patients carried *P.*

vivax (Table 1). Based on parasite, falciparum malaria cases were higher than vivax malaria.

Table 1: Frequency of malaria patients based on species of *Plasmodium* was treated at Jayapura General Hospital on March 2017

| Species of <i>Plasmodium</i> | Malaria cases | Percentage (%) |
|------------------------------|---------------|----------------|
| <i>P.falciparum</i> | 131 | 73, 2 |
| <i>P. vivax</i> | 48 | 26, 8 |
| Total | 179 | 100 |

The result indicated that based on age group, the majority of falciparum malaria cases occurred at age group over 20 years old as much as 73 (55.72%) patients more high than age group 10 -20 years old as much as 32 (24.43%). The majority of vivax malaria cases occurred of age group over 20 years old as much as 24(50.0) more than age group 10 – 20 years old as much as 14 (29.2%). The age group 1-9 years old 26 (19.85%) were infected by falciparum malaria slightly high and this cases the same with the age group 1-9 years were infected by *P. vivax* as much as 10 (20.8%) patients. (Table 2). Based on Pearson chi-squared test shown that *P. value* = 0.765 > 0.05, there is not relationship between malaria cases and age groups.

Table 2: Frequency of malaria cases based on age groups were treated at Jayapura General Hospital on March, 2017

| Ages (years old) | Malaria cases | | Percentage (%) | P. value |
|------------------|-------------------------|--------------------|----------------|----------|
| | <i>P.falciparum</i> (%) | <i>P.vivax</i> (%) | | |
| 1 – 9 | 26 (19.85) | 10 (20.8) | 36 (20.11) | 0.765 |
| 10- 20 | 32 (24.43) | 14 (29.2) | 46 (25.70) | |
| >20 | 73 (55.72) | 24 (50.0) | 97 (54.19) | |
| Total | 131 | 48 | 179 | |

The result of study above shown that based on gender, Male was infected by *P.falciparum* consisting 74 (56.49%) and more high than female as much 57 (43.51%) and for male was infected of *P. vivax* as much 37 (77.08%) more high than female 11 (22.92%) with the *P. value*: 0.012 (Table 3). Based on Pearson chi-squared test indicated that *P. value* 0.012 < 0.05, there is relationship between gender and Plasmodium parasite.

Table 3: Frequency of malaria cases based on gender of patients were treated at Jayapura general hospital on March 2017

| Gender | Malaria cases | | Frequency | P. value |
|--------|-------------------------|--------------------|-----------|----------|
| | <i>P.falciparum</i> (%) | <i>P.vivax</i> (%) | | |
| Male | 74 (56.49) | 37 (77.08) | 111 | 0, 012 |
| Female | 57 (43, 51) | 11 (22.92) | 68 | |
| Total | 131 | 48 | 179 | |

The result shown that malaria cases base on level of education, the patients senior high school were infected by *P.falciparum* as much as 43 (32.82) patients more than who were infected by *P. vivax* as much as 16 (33.33) patients whereas at primary school were infected by *P.falciparum* as much as 22 (16.79) patients high more than who were infected through *P. vivax* as much as 6(12.50) patients (Table 4). Based on Pearson chi-squared test shown that *P. value* 0.105 > 0.05, there is not relationship between malaria cases and education of patients.

Table 4: Frequency of Malaria cases based on education of patients were treated at Jayapura General Hospital on March 2017

| Education of patient | Malaria cases | | Frequency | % | P. value |
|----------------------|-------------------------|--------------------|-----------|-------|----------|
| | <i>P.falciparum</i> (%) | <i>P.vivax</i> (%) | | | |
| Illiterate | 18 (13.74) | 9(18.8) | 27 | 15, 1 | 0, 105 |
| Elementary school | 22 (16.79) | 4 (29.2) | 26 | 14,5 | |
| Junior high school | 29 (22.14) | 6 (12.5) | 35 | 19,5 | |
| Senior high school | 43 (32.82) | 16(33.3) | 59 | 32 | |
| University | 19 (14.50) | 13(27.1) | 32 | 17,9 | |
| Total | 131 | 48 | 179 | 100 | |

The result of this study shown that based on socio culture was found malaria falciparum patients as much 81 (61.83%) people more high there are living outside the home at all the night than the patients who is living inside home 50 (38.17%) patients. Based on socio culture patients who was infected by *P. vivax* as much 28(58.3%) people who is living outside the home at all the night slightly more than they were living inside the home all the night 20 (41.7%) people, see (Table 5). Based on Pearson chi-squared test indicated that *P. value* = 0.731 > 0.05, there is not relationship between the malaria cases and socio cultural.

Table 5: Frequency of Malaria cases based on socio-cultural that treated at Jayapura general hospital on March 2017

| Socio cultural | Malaria cases | | | P. value |
|---------------------------|---------------------------|--------------------|-------------|----------|
| | <i>P P.falciparum</i> (%) | <i>P.vivax</i> (%) | Frequency | |
| Patients outside the home | 81 (61.83) | 28 (58, 3) | 109 (60, 9) | 0, 731 |
| Patients inside the home | 50 (38.17) | 20 (41.7) | 70 (39.1) | |
| Total | 131 | 48 | 179 | |

The result study shown that malaria cases based on occupations of patients, malaria cases were infected through *P.falciparum* as much as 71(54.2%) higher than private 37 (28.2%) and Government employees 16(12.2 %) and lower were found of patients were working as businessman as much as 1(0.76), farmers as much as 2 (1.52) and Fisherman 1(0.76) people, see (Table 6). Based on Pearson chi-squared test shown that *P.value*= 0.492 > 0.05, there is not relationship between malaria cases and occupation but the majority patients were infected by *P.falciparum* higher who is staying at outside home than by *P. vivax*.

Table 6: Frequency of malaria patients based on place of occupation that treated at Jayapura General Hospital on March 2017

| Occupation | Malaria cases | | Frequency | % | P. value |
|---------------------|-------------------------|--------------------|-----------|-------|----------|
| | <i>P.falciparum</i> (%) | <i>P.vivax</i> (%) | | | |
| private | 37 (28.24) | 10(20.8) | 47 | 26, 3 | 0, 492 |
| Government employee | 16 (12.21) | 8 (16.7) | 24 | 13, 4 | |
| Bisnesman | 4 (3.05) | 0 (0.0) | 4 | 2, 2 | |
| Farmers | 2 (1.52) | 0 (0.0) | 2 | 1, 1 | |
| Fisherman | 1 (0.76) | 1 (2.1) | 2 | 1, 1 | |
| Not working | 71 (54.2) | 29 (60.4) | 100 | 55, 9 | |
| Total | 131 | 48 | 179 | 100 | |

The result shown that malaria cases based on mosquito net, the patients who is sleeping without using mosquito net all the night as much 99 (75.6%) higher were infected by *P. falciparum* than they were sleeping with use mosquito net as much 32 (24.4%) people whereas the patients that sleeping without mosquito net were infected by *P. vivax* as much 39 (81.2%) more than patients were using mosquito net as much as 9 (18.8 %) people see (Table 7). Base on Pearson chi-squared test shown that *P. value*= 0.548 > 0.05, there is not relationship between malaria cases and Mosquito nets.

Table7: Frequency of malariacasesbased on mosquito nets were using by patientsat Jayapura general hospitalon March2017

| Mosquito net | Malaria cases | | Frequency | % | P. value |
|---------------------|---------------------|----------------|-----------|-----|----------|
| | <i>P.falciparum</i> | <i>P.vivax</i> | | | |
| Use Mosquito net | 32 (24.4%) | 9 (18.8%) | 41 | 23 | 0, 548 |
| withoutmosquito net | 99 (75, 6%) | 39 (81, 2%) | 138 | 77 | |
| Total | 131 | 48 | 179 | 100 | |

4. Discussion

Total sample that were obtained around 600 patients. 179 patients were found to be positive for malaria, consisting 131 (73.2%) patients carried *P. falciparum* and 48 (26.8%) carried *P. vivax* because of primary malaria vectors are species of Anopheles that carried *P. falciparum* were *Anopheles Punctulatus* and *An. koliencis* more dominant than *P. vivax* in Jayapura Municipality, Papua Province^[15].

Based on age's group, the majority of falciparum malaria cases and vivax malaria cases were from the age group over 20 years old and the remaining were from age group of 10 – 20 less than 10 years old. The finding are in accordance with the common phenomenon in man malaria endemic areas where the younger age group is most vulnerable and also shown that malaria transmission occurred in all selected villages. Malaria falciparum and malaria vivax infection in infant and young children is generally associated with local transmission as they mostly stay at home and have not frequency traveled as that the elder age^[14] because of almost the populations are working as Pamer and fisherman and only slightly people are working as government employees so that they are having opportunity for bite by Mosquitoes Anopheles sp^[4, 5]: whereas the patient more high suffered falciparum malaria than malaria vivax because of generally malaria does not recognize age only children are more susceptible to malaria infection. Adult with a variety of activities outside the house, especially in the dark place mosquito breeding at the time of the dark or night would be possible to contact the mosquito^[16]

Malaria often attack children and seniors and [16] they are more likely to be infected by malaria because of the power of the immune children and seniors have not been perfect, while in the elderly, as easy sick of malaria because endurance decrease^[5]. Based on Pearson chi-squared test shown that *P. value* 0, 890 > 0.05, there is not relationship between age groups and species of Parasite but based on malaria cases, data of malaria falciparum were found

higher of age groups over twenty years old than less twenty years old^[14].

Based on gender, Male was infected by *P.falciparum* higher than female the same cases with patients were infected through malariavivax. According^[16] that malaria could be attack male and female with opportunities the same but the difference density malaria parasites in the blood based on gender related to the degree of the immune because the variation of exposure to the mosquito bites.

Based on occupation, the majority malaria cases were infected through *P.falciparum* more higher to patients who does not work, private and government employees whereas lower we were found of patients were working as businessman, farmers and fisherman, because of the adult people with variety of activities at outside the home especially working in breeding places and the development of mosquitoes at the time of the dark or night would be possible to contact and bitten by mosquito Anopheles than they were living and work at inside home^[16].

Based on mosquito net, majority malaria cases were infected by *P. falciparum* more higher who is sleeping without use mosquito net all the night than they were sleeping with use mosquito net the same of was infected by *P. vivax* because of lifestyle a person or group of people will affect the occurrence of malaria transmission like sleep habits without the use of mosquito nets, often are out home on the night without close the body could be a risk factor for the occurrence of malaria transmission^[10]

The result of this study shown that based on data of socio cultural was found malaria cases were infected of *P. falciparum* most high to they are living at outside room the house at all the night than the patients who is living inside house. The malaria cases were infected by *P. vivax*. The cases happening because of the behavior of life is influence by the socio-cultural, socio-economic, education, race and ethnicity. Based on social environment culture is a form of social life humans. Habits human live outside the home late will make it awareness being bitten by mosquito Anopheles. In addition is the community will danger of malaria. The level of awareness this will affect the willingness of the community to prevent and combat malaria by using the mosquito nets, using gauze ventilation home and use the mosquito repellent. Migration of endemic areas could be also result in increase the malaria cases taken from outside the areas^[10, 16]

5. Conclusion

Based on the result of this study indicated that were not relationship between malaria cases with almost all demographic factors from symptomatic patients except genders. The majority malaria symptomatic patients were infected through *P. falciparum* than *P. vivax*. Generally the malaria patients that illness from age's group over 20 years old, male, not working, and always outside room all the night, not working, with the education level

senior high school and they were sleeping without mosquito nets.

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