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Distribution and clinical characteristic of malaria patients in Weoe Public Health Center, Malaka District, East Nusa Tenggara in 2019

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ABSTRACT

Malaria remains a health problem in Indonesia including in East Nusa Tenggara (ENT) Province where its incidence is high. Weoe Public Health Center located in Malaka District, ENT Province has an important role as the front-line in the malaria control. The high number of malaria cases in this area may induce an economic burden due to unproductiveness at workplaces even death. This study aimed to overview the distribution and clinical characteristics of malaria patients in Weoe Public Public Health Center, Malaka District. This was a descriptive cross sectional study with saturated sampling method using secondary data of patient's medical record from January-December 2019. Malaria patients treated at the Weoe Public Health Center from eight villages were selected in this study. The data of the time of ill, patient's residence, gender, age, complaints, temperature, type of malaria, therapy, treatment results, and follow up blood smear tests result were collected. Among 815 patients suspected malaria, 198 (24.3%) were confirmed malaria positive caused by *Plasmodium falciparum* (41.4%) and *P. vivax* (58.6%). The highest cases occurred in February which reached 36.4% of the total cases. The highest incidence of malaria was found in Weoe Village (2.33%), dominated by male patients (57.6%), and mostly occurred at age 6-12 years (29.3%). Patients presented with fever (100%) followed by non-classical malaria complaints such as nausea and vomiting (46%), headache (33%), chills (30.8%), and flu symptoms (14.1%). All malaria patients were treated with combination of dihydroartemisinin-piperaquine (DHP) and primaquine (PQ) with a 100% cure rate and follow up blood smear test are negative from malaria parasite.

Keywords:
clinical characteristics;
patient distribution;
malaria;
Plasmodium;
Malaka;

ABSTRAK

Malaria masih menjadi masalah kesehatan di Indonesia termasuk di Provinsi Nusa Tenggara Timur (NTT), daerah dengan insiden malari tinggi. Puskesmas Weoe, Kabupaten Malaka, NTT berperan penting sebagai sebagai garda terdepan dalam pengendalian malaria. Tingginya kasus malaria di wilayah tersebut dapat menyebabkan beban ekonomi akibat penurunan produktivitas bahkan kematian. Penelitian ini bertujuan melihat gambaran distribusi dan karakteristik klinik pasien malaria di Puskesamas Weoe, Kabupaten Malaka. Penelitian ini merupakan penelitian diskriptif potong lintang dengan metode sampling jenuh menggunakan data sekunder rekam medis pasien malaria mulai Januari-Desember 2019. Pasien malaria yang diobati di Puskesmas Weoe dari delapan desa wilayah kerja Puskesmas diambil dalam penelitian ini. Data waktu pemeriksaan, tempat tinggal pasien, jenis kelamin, usia, keluhan, suhu, jenis malaria, terapi, hasil pengobatan, dan hasil tes apusan darah lanjutan dikoleksi. Di antara 815 pasien yang dicurigai malaria, 198 (24,3%) terkonfirmasi positif malaria disebabkan *Plasmodium falciparum* (41,4%) dan *P. vivax* (58,6%). Kejadian tertinggi terjadi di bulan Februari yakni mencapai 36,4% dari total kasus. Insidensi malaria tertinggi terdapat di Desa Weoe (2,33%), didominasi oleh pasien pria (57,6%), dan dengan kisaran usia 6-12 tahun (29,3%). Pasien datang dengan keluhan demam (100%) diikuti oleh keluhan non-klasik malaria seperti mual dan muntah (46%), sakit kepala (33%), menggigil (30,8%), dan gejala flu (14,1%). Semua pasien malaria diterapi dengan kombinasi dihidroartemisinin-piperaquin (DHP) dan primaquin (PQ) dengan tingkat kesembuhan 100% dan hasil pemeriksan apusan darah lanjutan negatif dari infeksi malaria.

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INTRODUCTION

Malaria remains a health problem in Indonesia including in East Nusa Tenggara (ENT). A total of 261,617 confirmed malaria cases were reported across Indonesia in 2017 with incidence reached 6.77 per 1000 population and 47 patients in Indonesia died from malaria.[1–3] In 2018, ENT Province ranked third (2%) for the highest prevalence of malaria after Papua (12%) and West Papua (8%).[4] This data shows that the top 3 most of malaria cases are reported in the eastern Indonesia. Malaria can be a burden for Indonesia due to it causes disability for the patients and loss of the unproductiveness at work. The malaria patients could lose their productive days by one day and lose their income based on regional minimum wage amounting from 75,253 to 83,407 rupiahs per day.[5]

Five species of Plasmodium are known to cause malaria disease in Indonesia include *Plasmodium falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi*.[6] The prevalence of *P. falciparum* infections in Indonesia detected using the rapid diagnostic test (RDT) is slightly lower than non-*P. falciparum* and mixed infections.[4] *Plasmodium vivax* dominates malaria in ENT, especially in the districts of West Manggarai, Ende, Belu, Lembata and East Flores. Between 2009 and 2014, the annual parasitic index (API) in ENT decreased from 27.86 to 12.81. However, the number of slide positivity rate (SPR) in ENT in 2014 was still at 20.09%. The SPR in ENT has not reached the target of the stage of maximum malaria elimination which is <5%.[7]

Malaria frequently has no specific symptoms, certain classical symptoms of malaria are shivering followed by acute fever and then profuse sweating. Non-immune patients (from the non-endemic area) usually experience these classical symptoms while immune patients usually have symptoms other than classical symptoms.[6] Malaria patients in Mgr. Gabriel Manek, SVD District Public Hospital, Atambua, ENT had main complained of fever and weakness, whereas the other complaints consisted of headache (50.7%), vomiting (67.6%), pale/yellowish (36.6%), and other accompanying complaints.[8] Classical symptoms due to malaria infection such as chills followed by high fever and sweating can be found in many non-immune patients from non-endemic areas, whereas in immune patients from endemic areas come with other symptoms such as headache, nausea and vomiting, diarrhea, and body aches. These non-classical symptoms are the challenges that make it difficult for clinicians to make the decision whether to conduct a malaria laboratory tests on patients or not, resulting in delays and difficulties in diagnosing malaria.[6]

This study was conducted to overview the distribution and clinical characteristics of malaria patients in Weoe Public Public Health Center, Malaka District. More than 200 malaria cases caused by *P. falciparum* and *P. vivax* were reported annually in this Sub District. However, advanced study concerning epidemiology of malaria in this area is limited. The results of the study may be used to determine the programs in malaria elimination and drug procurement by the Public Health Office of Malaka District.

MATERIALS AND METHODS

Design and area of study

This was a descriptive cross sectional study with saturated sampling method using secondary data of patient's medical record obtained Weoe Public Health Center from January-December 2019. Weoe Public Health Center is located in Wewiku Subdistrict, Malaka District, ENT Province. Weoe Public Health Center has service coverage area of eight nearby villages which involved in this study. Geographically, Malaka District is bordered by Belu District in the north,

and South Central Timor District and Timor Sea in the south.

Collection of data

The secondary data of patient's medical record of malaria patients treated at the Weoe Public Health Center from eight villages i.e. Lorotolus, Weulun, Weoe, Webriamata, Badarai, Halibasar, Rabis, and Biris were collected. The data included the time of ill, patient's residence, gender, age, complaints, temperature, type of malaria, therapy, treatment results, and follow up blood smear tests. This study was approved by the Research Ethics Committee, the Faculty of Medicine, Universitas Nusa Cendana, ENT (Ref No: 06/UN15.16/KEPK/2020).

Analysis of statistic

All the data obtained were presented as tables of distribution and clinical characteristics and were descriptively analyzed.

RESULTS

Eight hundred and sixty laboratory tests for malaria were conducted during 2019 at Weoe Primary Health Care. We excluded 44 data of patients due to they came from outside service coverage area of Weoe Public Health Center and 1 sample whose medical record data was incomplete. Therefore, only 815 samples were included in this study. Among 815 patients (336 males and 479 females), 198 (24.3%) samples had positive malaria laboratory test and 617 (75.7%) samples were not infected with malaria. The highest number of blood smear samples checked and the number of positive blood smear test occurred in February as many as 297 and 108 (36.4%) patients, respectively. The lowest number of blood samples checked was 12 that occurred in December and the least malaria case with one positive case was in June. The distribution of malaria incidence per month is presented in TABLE 1.

TABLE 1. Malaria incidence distribution by months in 2019

Month	Number of blood samples	Malaria	
		Positive (n/%)	Negative (n/%)
January	51	12 (23.5)	39 (76.5)
February	297	108 (36.4)	189 (63.6)
March	130	30 (23.0)	100 (77.0)
April	74	5 (6.8)	69 (93.2)
May	49	2 (4.1)	47 (95.9)
June	21	1 (4.8)	20 (95.2)
July	42	11 (26.2)	31 (73.8)
August	48	10 (20.8)	38 (79.2)
September	37	6 (16.2)	31 (83.8)
October	37	7 (18.9)	30 (81.1)
November	17	4 (23.5)	13 (76.5)
December	12	2 (16.7)	10 (83.3)
Total	815	198 (24.3)	617 (75.7)

The service coverage area of the Weoe Public Health Center consists of eight villages with a total population of 15,171 inhabitants.[9] The entirety incidence of malaria in the Weoe Public Health Center in 2019 was 1.3% (TABLE 2). The highest malaria incidence was 2.33% from Weoe Village, in addition, Weoe Village had the largest population with 5,567 inhabitants.

TABLE 2. Malaria distribution according to location of residency in the service coverage areas of the Weoe Public Health Center

Location of residency	Total population	Number of blood samples checked	Positive (n/%)	Negative (n/%)	Incidence (%)
Lorotolus	1956	65	13 (20.0)	52 (80.0)	0.66
Weulun	1259	67	9 (13.4)	58 (86.6)	0.71
Weoe	5567	478	130 (27.2)	400 (72.8)	2.33
Webriamata	1255	50	11 (22.0)	39 (78.0)	0.87
Badarai	2045	43	15 (34.9)	28 (65.1)	0.73
Halibasar	1297	39	9 (23.1)	31 (76.9)	0.70
Rabis	859	40	4 (10.0)	36 (90.0)	0.46
Biris	933	33	7 (21.2)	26 (78.8)	0.75
Total	15,171	815	198 (24.3)	617 (75.7)	1.30

TABLE 3 shows a clinical characteristics of malaria patients. The patients were dominated by male patients as many as 114 patients (57.6%) and in the age range of 6-12 y.o (29.3%) followed by age range 13-17 y.o (21.7%). Malaria patients came to the Weoe Public Health Center with complaints of fever (100%), followed by other complaints of nausea and vomiting (46%), headache (33%), and chills (30.8%). In addition, there were many other complaints such as dizziness, cough, runny nose, heartburn, decreased appetite, and pale. The table also shows there were 139 patients (70.2%) had febrile (37.5 – 40 °C), and 59 patients (29.8%) had normal temperatures (36.5 -37.5 °C).

The Weoe Public Health Center used thick and thin blood smears laboratory tests for malaria diagnosis. The test results showed 2 types of infectious malaria species, namely *P. falciparum* (41.4%) and *P. vivax* (58.6%). The antimalaria therapy used in the Weoe Public Health Center was a combination of DHP and PQ using a reference dose of the patient's body weight in the amount of 0.25 mg/kgBW/day.[6] For falciparum malaria, the duration of treatment was 3 days (DHP for 3 days, PQ as gametocidal was only given the first day), whereas for vivax malaria was 14 days (DHP for the first 3 days, PQ as gametocidal was given during the first day to day 14). All of the patients (100%) diagnosed with malaria received DHP and PQ combination for the treatment of malaria and underwent 100% recovery. The follow-up blood smear test to ensure 100% recovery after completing treatment resulted in all patients (100%) negative from malaria.

TABLE 3. Clinical characteristics of malaria patients

Characteristic	n (%)
Sex	
• Male	114 (57.6)
• Female	84 (42.4)
Age (y.o.)	
• 0-5	26 (13.1)
• 6 -12	58 (29.3)
• 13-17	43 (21.7)
• 18-35	40 (20.2)
• 36 -55	23 (11.6)
• 56-64	6 (3.03)
• ≥ 65	2 (1)
Symptom	
• Fever	198 (100)
• Chills	61 (30.8)
• Headache	66 (33.3)
• Dizziness	14 (7.1)
• Nausea and vomiting	91 (46)
• Cough	14 (7.1)
• Cold/flu	28 (14.1)
• Heartburn	16 (8.1)
• Decrease of appetite	13 (6.6)
• Pale	5 (2.5)
Temperature (^{o}C)	
• Hypothermia (<36)	0 (0)
• Normal (36.5 -37.5)	59 (29.8)
• Febrile (37.5 -40)	139 (70.2)
• Hyperthermia (>40)	0 (0)
Type of malaria	
• *P. falciparum*	82 (41.4)
• *P. vivax*	116 (58.6)
Therapy	
• DHP	198 (100)
• PQ	198 (100)
Result	
• Recover	198 (100)
• Referred	0 (0)
• Died	0 (0)
Follow-up test	
• Negative	198 (100)
• Positive	0 (0)

DISCUSSION

The Weoe Public Health Center is located in Weoe Village, Wewiku Subdistric, Malaka District, ENT which has service coverage area of 8 nearby villages. Geographically, Malaka District is bordered by Belu District in the north, and South Central Timor District and Timor Sea in the south. The Malaka district has a tropical climate with a very short rainy season from December to March and long dry season that lasts from April to November.[10] The highest malaria cases (108 cases) occurred in February which coincides with the rainy season. The rainy season can increase malaria infection because humidity can affect the density of anopheles mosquitoes.[11] High humidity extended the life of mosquitoes and increased mosquito activity, especially in coastal areas bordering the sea due to large evaporation of sea water[12] which this convenient with the Malaka District. Previous study conducted in malaria endemic area, Lampung reported a significant relationship between the rainfall index and Anopheles mosquitos density calculated by man biting rate (MBR) method per night. The denser Anopheles mosquitos in the region, the more cases of malaria would occur in the next month.[12] The other factor that has the potential to increase the incidence of malaria is the habit in harvest season. Farmers in Malaka District spend a lot of time working in the fields during planting and harvesting season which falls from December to April. During the harvest season, farmers choose to sleep in their fields to protect their crops from thieves. Agricultural field has potency as a breeding grounds for Anopheles mosquitoes where mosquitoes prefer to live in trees with high humidity and in a place surrounded by shrubs or plants that can cover a puddle of water underneath from the sun.[13,14]

The Weoe Public Health Center has reported the highest malaria incidence (2.33%) occurring in the Weoe Village where it has the largest population (5567 people) and the highest population density of 278.35 people per square km compare to the other 7 villages.[9] Similar to the study in Africa by Kabaria *et al*.[15] that found a low risk of malaria in areas with a low population (<10 people per square km) furthermore the risk of malaria infection increased in line with an increase in population to 100 people per square kilometer and decreased in populations of more than 1000 people per square kilometer. The Weoe Village also has quite a lot of water sources compared to other villages which tend to be drier, but unfortunately, the sewerage was rarely cleaned so the water becomes stagnant. This water puddle can become a nest and breeding ground for Anopheles mosquitoes according to several studies that found locations of puddles such as swamps, rice fields, trenches, bushes, former excavations, and plantations as breeding grounds for Anopheles mosquitoes.[14]

Men and women have the same susceptibility to malaria infection, but the results of this study (TABLE 3) showed that men (57.6%) suffer malaria infection more than women (42.4%). Men have a higher vulnerability due to working risks and the habits of preferring to sleep outside their house thereby increasing the risk of being bitten by Anopheles mosquitoes.[16] Malaka District adheres to matrilineal culture but in practice the role of man remains dominant in daily life and work. Man will do more physical work than woman, including farming to provide food for their families.[17] This is consistent with previous study conducted at the Sumpiuh Public Health Center where the male had a higher positive number of malaria infection than women because men were more active outside than women.[18]

Most malaria patients in the Weoe Public Health Center were 6-35 y.o (TABLE

3) with details of age 6-12 y.o (29.3%), 13-17 y.o (21.7%), and 18-35 y.o (20.2%). In childhood, children actively play outside in gardens, fields, and swamps. This activity can increase the risk of malaria when children are actively playing in places close to Anopheles mosquitoes breed. The result of a study in Malawi found that ages 6-15 were more easily infected with malaria than younger ages because school-age children used mosquito nets less often than younger children and older adults.[19] People who lived in malaria endemic areas and were exposed to malaria stably had higher blood parasitic densities in younger age groups (5-20 years)[11] and more than half of *P. falciparum* and *P. vivax* gametocyte carriers were from the younger age group.[20] According to a study by Cohee and Laufer, children in endemic areas had been repeatedly exposed to malaria infection since childhood, giving rise to partial immunity. This immunity caused a decrease in the number of blood parasites when they were re-infected and decreased the risk of malaria when they became adults later.[21]

Malaria patients at the Weoe Public Health Center complained of fever (100%) but only 70.2% had febrile temperature, the others complaints such as chills, headaches, dizziness, nausea, and vomiting, coughing, colds, heartburn, decreased appetite, and pale. This showed that not all patients presented with high fever that was classical symptom of malaria. Malaka District is a malaria endemic area so patients do not always come with classical symptoms (shivering followed by fever and sweating) because they already have immunity against malaria infection.[6] The study result in South Eastern Nigeria found malaria endemic areas like Malaka had malaria patients with non-classical malaria symptoms, such as a bitter taste in the tongue due to an inflammatory reaction to malaria infections, stomatitis, nightmares, sore throat, and eye pain that the patient allegedly previously infected with recurrent malaria but appeared asymptomatic.[22] Patients who came with normal temperature and non-classical symptoms were still more likely to have malaria. This is a challenge for clinicians at the Weoe Public Health Center in diagnosing suspected patients of malaria and ordering laboratory tests.

The Weoe Public Health Center found the malaria infections in the service coverage area caused by *P. falciparum* (41.4%) and *P. vivax* (58.6%). There are 5 types of malaria plasmodium in Indonesia, namely *P. falciparum, P. vivax, P. ovale, P. knowlesi,* and *P. malariae*. Based on studies by Elyazar *et al.*, from recorded data 1900 to 2008, all types of Plasmodium could be found in ENT except *P. knowlesi* which the most numbers were species *P. falciparum* and *P. vivax*.[23] Another study by Lee and Ryu, *P. falciparum* and *P. vivax* had an equivalent caseload and the symptoms of infection by *P. vivax* were lighter than *P. falciparum*. However *P. vivax* had a higher relapse event in Indonesia.[24]

The first line malaria therapy in Indonesia is a combination DHP and PQ which has replace chloroquine (CQ) due to CQ resistance.[6] Based on research by Lidia *et al*.[25] in Kupang District, ENT, a combination of DHP and PQ therapy provided better therapeutic response compared to the combination of CQ and PQ in the decrease the number of the parasites in the blood. The results also reported that therapeutic failure was more than 10% in the DHP group. It was probably to have DHP resistance in Kupang District causing a decrease in effectiveness.[25] There are other studies that reported resistance to DHP occurring in several countries and trials have been conducted on other regimens that can replace DHP in the future although until now it has still not gotten the desired results. This can be a consideration and preparation for malaria endemic

areas such as Malaka to see that the resistance to DHP can occur and there is a possibility of other drugs that replace DHP as the first line therapy of malaria in the future.[26]

Dihidroartemisinin - piperaquin (DHP) and PQ still had a high efficacy as malaria therapy in South Papua. This is due to the strict regulation of DHP-PQ treatment by the Indonesian government so that DHP-PQ can only be accessed in health facilities and cannot be accessed by the public for self-medication.[27] A study in Kulon Progo compared artemeter-PQ and CQ-PQ in children aged 6 months-14 years old, the result showed artemeter-PQ therapy gave better clinical and parasitological response than CQ-PQ therapy.[28] According to the meta-analysis study, DHP is more effective than CQ and artemeter-lumefentrine in the treatment of *P. vivax* malaria in malaria endemic areas, in addition DHP as a fixed drug combination and taken once a day increases adherence to taking medication in patients.[29] The Weoe Public Health Center uses DHP and PQ treatment orally for all malaria patients. This treatment can still be continued in the future because from the results of this study showed all patients (100%) recovered after treatment using DHP and PQ and have not found any reports of resistance where the results of following blood tests were not found in all patients (100%) of malaria after treatment is complete.

This study has several limitations namely author did not visit patients to find out the factors that influence the risk of malaria infection from the environment around the patient. The severity of malaria could not be determined because there was no checking for the density of parasites in the patient's blood due to limitations of the health care. The Malaka Public Health Office is expected to prepare more adequate malaria medicines and laboratory support equipment at the primary health care, especially during the rainy season such as January to March. The Malaka Public Health Office and the clinicians are expected to give the massive education about malaria prevention through media about environmental cleanliness, the usage of mosquito nets, and clean and healthy living behavior to the community. Finally, the clinicians, who work at The Weoe Public Health Center, should be more alert to the symptoms that are not typical of malaria patients in order to establish a malaria diagnosis.

CONCLUSION

In conclusion, *P. vivax* is the most common caused of malaria followed by *P. falciparum* in area covered by the Weoe Public Health Center, Malaka District, ENT. The highest of malaria cases occurs in February, whereas the lowest occurs in June. Male aged 6-12 y.o. are mostly infected malaria with the most common symptoms are fever, nausea and vomiting. Combination between DHP and PQ are still sensitive for the treatment of malaria in this area.

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