Malaria Cases in Children in 2019 and 2022 at Moru Community Health Center, Alor District, East Nusa Tenggara Province, Indonesia

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ABSTRACT

Introduction: Malaria is an infection transmitted through mosquitoes infected by the Plasmodium parasite, with symptoms such as fever, hepatosplenomegaly, and anemia. Based on the data from Indonesian Basic National Health Survey (RISKESDAS) 2018, malaria prevalence in East Nusa Tenggara Province (ENTP) is the top 3 with a 2% positivity rate with blood tests. Alor district, as a part of ENTP, also an endemic area for malaria and was categorized as a mid-endemic area based on Annual Report of the Indonesian Ministry of Health in 2022. We conducted this study to describe the characteristics of malaria patients, especially in children in Moru Community Health Center (CHC), Alor District, Indonesia. **Methods**: This descriptive study used data reported on the Malaria Surveillance Information System (SISMAL) from 2019 and 2022. Parameters evaluated in sex, age, type of infection, blood test type, case finding, monthly cases, and area of transmission. **Results**: There were 33 cases (19,5%) in 2019 and 136 cases (80,5%) in 2022, 46 cases were infected by *P. falciparum*, 78 by *P. vivax*, and 45 cases were mixed infections from both plasmodium. **Conclusion**: Malaria cases in this study increased in April, May, and June, the type of infection was dominated by *P. vivax*, and most of the infected area was in the Fanating subdistrict.

Keywords: Cases, children, malaria.

ABSTRAK

Pendahuluan: Malaria adalah infeksi yang disebabkan oleh nyamuk melalui parasit *Plasmodium*, dengan gejala seperti demam, hepatosplenomegali, dan anemia. Berdasarkan data RISKEDAS pada tahun 2018, prevalensi malaria di Nusa Tenggara Timur (NTT) berada pada urutan ke-3 dengan *positivity rate* sebesar 2% dari hasil pemeriksaan darah. Kabupaten Alor sebagai bagian dari provinsi NTT juga merupakan daerah endemis malaria dan dikategorikan sebagai daerah endemis sedang berdasarkan Laporan Tahunan Kementerian Kesehatan RI tahun 2022. Penelitian ini dilakukan untuk mengetahui gambaran karakteristik penderita malaria khususnya pada anak di Puskesmas Moru, Kabupaten Alor, Indonesia. **Metode**: Penelitian deskriptif ini menggunakan data yang dilaporkan pada Sistem Informasi Surveilans Malaria (SISMAL) pada tahun 2019 dan 2022. Parameter yang digunakan adalah jenis kelamin, usia, tipe infeksi, jenis pemeriksaan darah, cara penemuan kasus, kasus per bulan, dan area terjadinya transmisi. **Hasil**: Didapatkan hasil sebanyak 33 kasus (19,5%) pada tahun 2019 dan 136 kasus (80,5%) pada tahun 2022. *P. falciparum* sebanyak 46 kasus, *P. vivax* sebanyak 78 kasus, dan 45 kasus merupakan infeksi campuran antara *P. falciparum* dan *P. vivax*. **Simpulan**: Kasus malaria pada penelitian ini meningkat pada bulan April, Mei, dan Juni, jenis infeksi didominasi *P. vivax*, dan Kelurahan Fanating menjadi tempat dengan kasus terbanyak. **Ali Susanto Sanusi, Bethseba Brontang Pulinggomang. Kejadian Kasus Malaria Anak pada Tahun 2019 dan 2022 di Puskesmas Moru, Kabupaten Alor, Provinsi Nusa Tenggara Timur, Indonesia.**

Keywords: Kasus, anak, malaria.

INTRODUCTION

Malaria is still endemic in some areas of Indonesia. WHO South-East Asia Region reported 5.4 million cases with a burden of 2% in 2021. The mortality rate in 2020 and 2021 was 0.5 deaths per 100,000 population at risk.[1] In 2022, 372 out of 514 (72%) districts in Indonesia are categorized as malaria-free areas, increased from 318 in 2020, and 347 in 2021.[2] The Indonesian Ministry of Health is targeting to develop a strategies to achieve malaria elimination by 2030.[3,4] According to the Indonesian Basic National Health Survey (RISKEDAS) 2018, the prevalence of malaria with a positivity rate of blood tests in Indonesia is 0.4% decreased from 1.4% in 2013; 2% cases are from East Nusa Tenggara Province (ENTP). *P. falciparum* is the most common infection,

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followed by *P. vivax* and mixed infections.[5] Indonesia's annual parasite incidence (API) increased from 1.12 in 2021 to 1.61 in 2022, with 443,530 cases. Alor district, as a part of ENTP, also an endemic area for malaria, reported 2,669 children cases, API 1.97, and was categorized as a mid-endemic area based on Annual Report of the Indonesian Ministry of Health in 2022.[2] We conducted this study to describe the characteristics of malaria patients, especially in children in Moru community health center (CHC), Alor District, Indonesia.

Table. Characteristic of samples.

Characteristics	2019 (n = 33)	2022 (n = 137)
Sex		
Male	20	70
Female	13	67
Age (Years)		
<2	0	3
2-10	14	74
11-18	19	60
Type of Infection		
P. falciparum	31	15
P. vivax	2	78
Mixed Infection	0	44
Type of Test		
RDT	6	0
Microscopy	27	137
Case Finding		
PCD	33	126
EI	0	1
MBS	0	10
Monthly Cases		
January	3	2
February	0	5
March	1	7
April	3	10
May	9	20
June	6	36
July	5	13
August	4	22
September	1	15
October	0	3
November	0	2
December	1	2
Area of Transmission		
Outside CHC	2	0
Fanating	3	70
Moramam	1	5
Morba	2	13
Moru	9	17
Pailelang	15	32
Wolwal Barat	1	0

Abbreviations: RDT: Rapid diagnostic test; PCD: Passive case detection; EI: Epidemiologic investigation; MBS: Mass blood survey; CHC: Community health center (*Puskesmas*).

METHODS

This descriptive study was conducted in January 2023. Total sampling was used in this study, and 170 subjects were included. Data from 2019 and 2022 were obtained from the Malaria Surveillance Information System (SISMAL) Moru CHC. Total cases of malaria are 63 cases in 2019, and 230 cases in 2022. A hundred and twenty three adult patients were excluded - 30 in 2019 and 93 in 2022 because this study focused on child cases. This study was based on 33 cases in 2019, and 137 cases in 2022 available through SISMAL from Moru CHC, Alor District. Seven parameters were evaluated: gender, age, type of infection, blood type, case finding, monthly cases, and area of transmission. Inclusion criteria were children with positive malaria blood tests (microscopy and rapid diagnostic test/RDT) with complete data. The exclusion criteria is children with malaria and other comorbidities or severe illness. No children were excluded. Data were analyzed using the Statistical Packages for Social Sciences (SPSS) version 26 software. This study was approved by Badan Kesatuan Bangsa dan Politik and Dinas Kesehatan of Alor District with no. BKBP.070/52/II/2023.

RESULTS

Table shows the characteristics of the samples. Most subjects were male in 2019 (60.6%) and 2022 (51%). Most infected cases by age were 11-18 years old in 2019, but 2-10 years old dominated in 2022. Most cases in 2019 were caused by *P. falciparum*, but in 2022 shifted to *P. vivax* and mixed infection. A microscopic blood test is the most commonly used test. Most cases were found through passive case detection during the CHC visit. Monthly cases in 2022 significantly increased in April, May, and June and decreased from August to December. The 2019 data also showed almost the same trend. Most cases in 2019 was found Pailelang subdistrict, but cases in Fanating incredibly increased from 3 cases in 2019 to 70 cases in 2022.

DISCUSSION

Malaria can cause death, mainly in babies and children, classified as a high-risk disease.[6] In 2022, Indonesia reported 443,530 malaria cases, with 393,801 cases in Papua province, followed by East

Nusa Tenggara Province with 15,812 cases, and West Papua province with 13,080 cases in second and third place. Moru CHC in Alor district, East Nusa Tenggara was the contributor to malaria cases based on data inputted on SISMAL.

This study included 170 patients, 33 cases in 2019 and 137 in 2022. Patients with malaria may have fever, headaches, and body aches. The fear of contracting the COVID-19 virus during the pandemic may have encouraged a greater number of patients to seek medical attention, resulting in more cases of malaria.[7] Also, the symptoms of malaria mimicking COVID-19 motivates the parents to seek help in a health facility to get medication. The cases were predominantly male. Khan reported that 65% of cases were male.[8] Age 11-18 years old dominated in 2019 cases, but 2022 cases, were mostly 2-10 years old (74 patients). Agusta reported 127 patients (from 0-17 years old) with 58 cases from 6-12 years old.[9] Activities outside the home at nighttime that can expose adolescents to malaria vectors. Also, toddlers are at higher risk of malaria because their immune systems react to the illness more slowly than those of adolescents.[10] Alor District is also an endemic area for malaria, some patients already have immunity against the infection, and do not always come with classic symptoms. Sometimes they might be asymptomatic.[2] Asymptomatic malaria is defined as the presence of malaria parasites in the blood without any symptoms. Asymptomatic malaria parasitemia has been found to serve as both a reservoir for the transmission of malaria and a precursor in the progression of symptomatic disease. On the other hand, asymptomatic infections have been linked to adverse effects on children's health, including anemia, malnourishment, and delayed intellectual development.[11,12] Akiyama in Lao People's Democratic Republic reported that stunted children tend to be infected with asymptomatic malaria and also have anemia.[13] Mensah, *et al*, in Ghana, also reported a significant incidence of asymptomatic malaria linked to older children, males, anemia, and stunted growth in youngsters.[14] A survey in Mimika District, Southern Papua, Indonesia, found that the risk of anemia in asymptomatic malaria significantly increased; two-thirds of detectable parasitemia are caused by *P. falciparum and P. vivax*.[15] Sakwe, *et al*, reported a noteworthy correlation between malaria, anemia, and nutritional status. Malnourished children are twice as likely to get malaria.[16] Simultaneous infections have the potential to change the course of symptoms by modifying immune system activity. It has been shown that HIV-1 infection increases malarial fever rates in a dose-response manner, accompanied by a decline in CD4 T-cell numbers. Several asymptomatic infections could be persistent or recrudescent parasitemia that developed again after a clinical episode was treated.[17] It is widely recognized that malnutrition impairs immunity, increasing a child's exposure to infectious diseases. A study in Ethiopia showed that children who were malnourished had a higher chance of contracting malaria than children who were not.[18]

P. falciparum was the most common cause in 2019 with 31 cases. But in 2022 *P. vivax* cases were increased to 78 cases, 44 cases of mixed infection, and only 15 *P. falciparum* cases. A study from Agusta, *et al*, in 2019 at Weoe CHC, Malaka district, ENTP, also got the same result, *P. vivax* dominated with 116 cases (58.6%) and *P. falciparum* with 82 cases (41.4%).[9] This change is possible because of no regular training and equipment availability for all healthcare workers, lack of knowledge of analysts, and errors in determining the type of infection. Ayandipo, in her study in Oyo State, Southwest Nigeria reported the poor diagnosis practices by the healthcare workers who had been trained and had good knowledge about malaria, as well as the availability of equipment.[19] Lower parasite levels make it more complicated to detect *P.vivax*, and relapse cases contribute significantly to the rise in cases.

Microscopic test is the most common blood test for malaria cases, especially in rural areas. A Rapid Diagnostic Test (RDT) was also performed if the microscope was out of service or had an electrical issue. Kristina's study from Lewoleba and Waipukang CHC in Lembata district also used microscopic tests to diagnose malaria.[20] Polymerase Chain Reaction (PCR) is mainly used in areas with advanced facilities. Inderati, *et al,* used nested PCR to identify *P. vivax*.[21]

Passive case detection (PCD) is a method to detect malaria when the patient comes to CHC. There is a significant increase (3.8 times) between 2019 and 2022. With a significantly high number of cases in 2022 from PCD, the population was exposed more to malaria. It is still challenging to educate the community after the COVID-19 pandemic. In Africa, the COVID-19 pandemic caused severe disruptions to numerous health services, including programs for the prevention and treatment of malaria, and placed excessive pressure on already precarious healthcare infrastructure.[22] The number of malaria RDTs performed in communities in Rwanda increased while those conducted in institutions decreased, underscoring the necessity of reaching out to people during times of crisis. The study also indicated that the incidence of positive test for malaria rose during the pandemic, indicating the rise in morbidity. [23] In Zimbabwe, cases between pre and post-COVID-19 pandemic are doubling, from 1,376 in 2019 to 2,981 in 2020. This was caused by several factors, such as variations in the behaviour of vectors, a high rate of rejection of Indoor Residual Spraying (IRS) activities, resistance to insecticides and anti-malarial medications, vector invasion to new areas, variations in the proportions of vectors, outdoor transmission, climate change, misuse of LLINs (Long Lasting Insecticidal Nets/Kelambu), spray operators carelessness, and a lack of digital resources to educate affected communities about malaria and IRS activities.[24] Iskandar reported decreased cases based on PCD during 2006-2008. The reason is that the health care center's location is far from residences and difficult to access.[25] In our site, after malaria detection, environmental health staff counselled parents to increase awareness, alertness, and prevention of malaria. A study in Sri Lanka showed that PCD is the most successful detection method, and should be maintained and reinforced as the primary malaria monitoring approach. To implement PCD, healthcare workers must receive frequent and ongoing education on the importance of malaria testing in febrile travelling patients. To guarantee a high-quality malaria diagnosis, diagnostic services must be bolstered throughout the healthcare system in both the public and private sectors.[26]

Cases increased in May 2019 and in June 2022. Our limitations to our study not accompanied by rainfall and climate data; a study by Selasa, *et al,* reported that climate might influence case frequency. December to March is a high rainfall season in East Sumba district, and April to November is the opposite. Standing


water as an ideal condition for malaria vectors will rise throughout the dry season when there is less rain.[10] Meta-analysis by Minawati, *et al,* showed the presence of standing water around the house has a major impact on the rise in malaria cases. In comparison to no standing water, having standing water nearby can raise the incidence of malaria by 4.10 times.[27] In Northern Uganda, Simple, *et al,* found significant positive correlations between rainfall and relative humidity to malaria infection. Rainfall considerably boosts the number of infective *Anopheles* mosquitos containing *P. falciparum* malaria parasites. Throughout rainfall, unexpected pools of standing water formed in bogs, ditches, and abandoned containers surrounding houses.[28] Human activities such as soil excavation and road construction also resulted in temporary pools of standing water that served as active breeding areas for mosquitos and encouraged transmission. Other research has indicated that living near standing water and having farms or houses close to swamps increases the risk of malaria infection.[29,30] A study designed to measure the effect of rainfall in Indonesia showed that rainfall will increase the spread of malaria.[31] Mau reported in East Sumba that there is a correlation between rainfall and malaria incidence. Rainfall and temperature factors also increase API scores.[32] Hutasoit in Jayapura also reported that climate (air temperature and humidity) and malaria cases have a significant relationship.[33] Rainfall develops numerous numbers of tiny puddles, which expands the amount of breeding sites for mosquitoes and improves mosquito survivability by raising humidity levels. However, a lot of rain may have destroyed or washed away the breeding sites of mosquitoes, which would have decreased mosquito density.[34] Munthe, in his study in Runut village, Sikka district, Indonesia reported *Anopheles sp.* larvae mainly obtained from a puddle and harbored in aquatic habitats.[35] Deo's study in Amfoang District in Indonesia concluded that the risk of malaria is in the lowland near the beach and river's estuary. The use of LLIN during the evening (6 pm to 6 am) is a prevention method to reduce malaria cases.[36]

In terms of area of transmission, Fanating and Pailelang subdistricts contribute to most of the cases. Fanating and Pailelang subdistricts are next to each other. The Fanating area has a swamp as a breeding site for malaria vectors. Furthermore, we found out that most populations misuse LLIN. It is not applied in a suitable method. Case increases also occurred in the Moramam, Morba, and Moru subdistricts. Moru is the nearest to the Fanating and Pailelang subdistricts, and as the capital subdistrict, more activities take place in this area. They even use it as a fish net, food cover, and many more. Olin discovered malaria cases increased in Lembata district, Indonesia because of low education, poor knowledge, negative attitude, unhealthy behavior, poor housing, and being close to the swamp.[37] Another part of Indonesia in the West Sumba district study from Adnyana reported that the risk factors in this area are environmental factors such as house construction, biological environment, and availability of fauna.[38]

CONCLUSION

Malaria cases in this study increased in April, May, and June. The type of infection is dominated by *P. vivax*, the most infected area is in the Fanating subdistrict. The study area should effectively implement current preventive and control methods such as health education, environmental management practices, larviciding, use of LLIN and application of IRS for vector control, prompt diagnosis and treatment, and use of Artemisinin Combination Therapy (ACT).

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