

**Article Review**

***Important measures for public health caused by malaria (Nyamuk Anopheles) in Eastern Kalimantan and accelerating the elimination of malaria in the New Capital area***

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**Abstract**

Malaria is a serious public health problem in the eastern Kalimantan province of Indonesia, and the main source of infection is the bite of the Anopheles mosquito. This article gives a brief overview of the causes, impacts, and efforts to control cases of malaria in Eastern Kalimantan. Malaria cases in Eastern Kalimantan are mainly caused by *Plasmodium falciparum* and *Plasmodium vivax*. That's the two kinds of parasites that cause malaria that spread to humans through the bite of the female Anopheles mosquito. Rural areas with environmental conditions that support the development of Anopheles mosquitoes, such as slow-flowing waters and dense forests, are centers of the spread of the disease. Malaria has a serious public health impact, including deaths, especially among vulnerable groups such as children and vulnerable adults, and has an impact on productivity. Malaria control efforts in Eastern Kalimantan include the provision of antimalaria drugs, the distribution of insecticide molds, awareness campaigns to avoid mosquito bites, and an effort to control the population of Anopheles. Prevention such as the use of insecticidal molds and anti-malaria medicines, as well as the control of mosquito populations of Anopheles play an important role in efforts to control disease spread and protect public health in East Kalimantan. Although efforts to combat malaria have been made, the problem remains a major health problem in the region. To more effective malaria control and eradication in East Kalimantan, improved access to health services, public education, and sustainable funding are needed. Malaria elimination strategies are faster done with early detection of active/inactive cases and treatment with standard treatment. Demobilization programmes contribute to local capacity-building and have an impact on improved public health. Accelerating the elimination of malaria in line with the national elimination objectives requires intervention in priority programmes and greater involvement of all stakeholders. A number of information has been found related to malaria cases in Kaltim and accelerated annihilation of the Anopheles mosquitoes in the New Capital Area. Here's a summary of the information found: According to the Ministry of Health, there is one district/city in Eastern Kalimantan that is an endemic malaria area namely Penajam Market North. Currently, four districts/cities in East Kalimantan have achieved malaria-free status (1). As of April 2023, more than 1,000 cases of malaria were recorded in East Kalimantan. This data comes from E-Sismal 2023 collected by the Health Service of East Kalimantan. (2). East Kalimantan has a concentration. High-rise districts with high malaria endemic rates. This can be seen from the number of malaria-positive cases in the region and the annual parasite disease (API) cases. (3). Efforts to accelerate malaria eradication in Indonesia are carried out through the Revision of the National Accelerated Malaria Eradication Action Plan in Indonesia (RANPEM) 2020-2024 (4).

**Keywords:** Anopheles mosquito, IKN, East Kalimantan Public Health Action

## INTRODUCTION

Anopheles mosquitoes are malaria vectors and play an important role in the spread of the disease. Anopheles mosquitoes are known to be major malaria vectors in various regions including East Kalimantan.

Significant cases of malaria occurred in Eastern Kalimantan. Several areas in East Kalimantan contributed the biggest cases, including East Kutai, Berau, Penajam North Market, and Paser. By 2021, East Kalimantan ranked the fifth case of malaria in Indonesia. It is a serious concern of the authorities, including the East Kalimantan Provincial Health Service, which continues its efforts to control and contain the spread of malaria.

In addition, efforts to accelerate the eradication of malaria in the territory of the New Capital are also under way. Malaria eradication is an attempt to reduce the number of people infected with malaria to a very low level or even prevent the spread of the disease. Accelerating the eradication of malaria in the New Capital District is part of the government's efforts to create a healthy and disease-free environment.



Figure 1 : <https://www.istockphoto.com/id/foto-foto/nyamuk-anopheles>

Malaria remains one of the major public health problems that can cause deaths, especially in high-risk groups, namely infants, young children, and pregnant mothers. In addition, malaria directly causes anemia and can reduce labor productivity. As of 2010 there were 65% of endemic districts in Indonesia where only about 45% of the population was at risk of malaria. According to a 2007-2010 community survey, the prevalence of malaria in Indonesia decreased from 1.39% (Risikesdas 2007) to 0.6% (Risikesdas 2010). Meanwhile, according to reports received during the 2000-2009 period, the malaria incidence rate tended to decrease from 3.62 per 1,000 inhabitants in 2000 to 1.85 per 1000 in 2009 and 1.96 in 2010. In the meantime, the mortality rate from malaria reached 1.3%. Although there has been a decline in the Annual Parasite Incidence (API) nationally, in areas with high malaria cases the API rate is still very high compared to national figures.

Whereas in areas with low malaria cases, there are often extraordinary cases (KLBs) as a result of import cases. In 2011, the number of deaths from malaria was 388. Efforts to curb the number of pain and deaths are carried out through malaria eradication programmes whose activities include, among other things, early diagnosis, prompt and timely treatment, as well as vector surveillance and control in terms of public education and understanding of environmental health, all aimed at

breaking the chain of malaria transmission. Cases of malaria parasite resistance to chloroquin were first found in East Kalimantan in 1973 for *P. falciparum*, and in 1991 to *P. vivax* in Nias. Since 1990, cases of such resistance have been to be widespread throughout the province of Indonesia. In addition, there are also reports of resistance to sulfadoxin-pirimethamine (SP) in some places in Indonesia. This condition can increase the morbidity and mortality of malaria. Therefore, in order to address the problem of multiple drug resistance and the presence of new anti-malaria drugs that are more patented, the government has recommended alternatives to chloroquin and SP, a combination of artemisinin derivatives with other anti-malaria drugs commonly referred to as Artemisinin based Combination Therapy. (ACT). Malaria is an infectious disease caused by the parasite *Plasmodium* that can be characterized by fever, hepatosplenomegaly and anemia. The disease is naturally transmitted through the bite of a female *Anopheles* mosquito.

Species *Plasmodium* in humans are: a. *Plasmodium falciparum* (*P. falciperum*). b. *Plasmodium vivax* (*P. vivax*) c. *Plasmodium ovale* (*p. ovale*) d. *Plasmodium malariae* (*ppm*) e. *Plasmodium knowlesi* (*pp. knowlesi*) The most common types of *Plasmodium* found in Indonesia are *P. falciparum* and *P. vivax*, whereas *P. malariae* can be found in several provinces including Lampung, Southeast Nusa, and Papua. *P. ovale* has been found in southeastern Nusa East and Papua in 2010. In 2010 in the eastern Kalimantan Island, *P. Knowlesi* was to be able to infect humans, which previously only infected primates/monkeys and to this day continues to be studied.

The treatment given is the radical treatment of malaria by killing all the stages of parasites in the human body, including the gametocyte stage, with the aim of radical treatment to obtain clinical and parasitological healing and break the chain of transmission. All anti-malaria medications should not be given on an empty stomach because of the irritating nature of the stomach. Therefore, the patient should eat first every time he is going to take anti-malaria medication. The dosage should be based on body weight.

Malaria treatment in Indonesia using combination Anti-Malaria Medicine (OAM). The combination treatment of malaria is the use of two or more anti-malaria drugs that are pharmacodynamically and pharmacokinetically compatible, synergistic and different ways of occurrence of resistance. The aim of this combination therapy is for better treatment and prevention of *Plasmodium* resistance to anti-malaria drugs. Malaria combination treatment should:

- a. safe and tolerable for all ages.
- b. effective and fast;
- c. resistant and/or cross resistance has not occurred; and
- d. cheap and affordable.

Currently the national program used is an artemisinin derivative with a group of aminoquinolines, namely: Fixed Dose Combination (FDC) consisting of

Dihydroartemisinin and Piperakuin (DHP). (one) FDC tablet contains 40 mg dihydroartemisinin and 320 mg piperakuin. (1).

The drug is administered orally for three days with the following single daily dose range: Dihydroartemisinin doses 2-4 mg/kgBB; Piperakuin doses 1632mg/kgBT. Artesunat - Amodiakuin A package of artesanal amodiakuins that is included in the malaria control program with 3 blisters, each blister consists of 4 tablets of artesunat @50 mg and 4 150 mg amodiakine tablets (2).

Treatment of malaria ovale (1). First line for malaria oval The treatment of malária ovale currently uses Artemisinin Combination Therapy (ACT), namely Dihydroartemisinin Piperakuin (DHP) or Artesunat + Amodiakuin. The dosage of the drug is the same as for malaria vivaks. (2). Treatment of *P. malariae* is sufficient to give ACT once a day for 3 days, at the same dosage as other malaria treatments and does not give primakuin.

Treatment of mixed infection *P. falciparum* + *P. vivaks*/*P. Ovale* (3). The treatment of severe malaria at the Puskesmas stage is performed by administering an artemeter or china hydrochloride intramuscularly as an initial dose before referring to the referral hospital. When referral is not possible, treatment is continued with the administration of a full dose of artemetar intra-muscular. The treatment for severe Malaria for pregnant mothers in Pushesmas is carried out by giving HCl in the 1st trimester in a muscular way and an Artemeter in an injection for the 2nd and 3rd trimesters. In the treatment of malaria in the hospital it is recommended to use an intravenous artesunat.

Anopheles Mosquitoes: Anopheles mosquitos are the main vector of malaria disease. They bite humans in search of blood as a source of nutrients for the development of their eggs. Female mosquitoes of this species can carry the parasite Plasmodium and transmit it to humans through bite. (1).

Malaria in Eastern Kalimantan: East Kalimantan is one of the provinces in Indonesia that has a malaria problem. Malaria in this region is caused by several species of Plasmodium, including Plasmodium falciparum and Plasmodium vivax. Rural areas with environmental conditions that support the development of Anopheles mosquitoes, such as slow-flowing waters and dense forests, tend to be places of spread of malaria. (2).

Malaria Impact: The malaria can have a serious impact on public health and the economy. It can lead to death, especially in children and weak adults, as well as cause chronic illnesses and impede productivity. Especially, in the rural areas of East Kalimantan, where health facilities are limited, malaria can be a significant health burden. (3). Malaria Control Efforts: The Indonesian Government and the World Health Organization have undertaken various efforts to control malaria in East Kalimantan. This includes the delivery of anti-malaria drugs, the distribution of insecticide molds, awareness-raising campaigns on mosquito bite prevention, and efforts to control the Anopheles Mosquito population. It is important to note that efforts to prevent, diagnose, and treat malaria are ongoing to reduce the burden of the disease in East Kalimantan and across Indonesia. Prevention, such as the use of insecticide molds and antimalaria drugs, as well as the control of the Anopheles mosquito population, plays an important role in efforts to reduce the spread of the disease and protect public health. (4).

Although the proportion of Indonesians living in malaria-free areas is rising, the flow of mobilization in and out of high-endemic areas is large enough that the potential for the spread of malaria remains high. As an endemic malaria region for a

long time, East Kalimantan Province has implemented malaria eradication programmes nationally. Kemenkes aims to eradicate malaria in Kalimantan and North Maluku by 2027. The 2020 data shows that the number of areas with high and moderate malaria endemic status that has changed to low and free increases means the elimination road map program is running well. Despite this, there are still three districts with moderate and high endemic rates, namely Penajam Paser North district, Paser district and West Kutai district with a total of 2356 cases and 5 deaths. In line with Roosiermatie, the implementation of the national policy of malaria elimination in malaria-endemic areas varied even some areas showed no progress due to weak commitment and funding. The high endemic status of malaria in the northern district of Penajam Paser, which borders directly with the location of the country's capital, is one of the issues that needs to be addressed comprehensively. This paper aims to analyze strategies for implementing priority programmes in accelerating the elimination of malaria in high endemic villages Around the new state capital. What is the cause of the increase in the Anopheles mosquito population in Eastern Kalimantan? 1. How does the increase in the Anopheles mosquito population affect public health in Eastern Kalimantan? 2. What efforts are being made to control the Anopheles population in Eastern Kalimantan? (3) Why was the new capital chosen as the location of the Anopheles rebellion in Eastern Kalimantan? 4. What program is being implemented to eliminate the Anopheles mosquitoes in the new capital? (5). Objective: To understand the causes of the Anopheles population growth in Eastern Kalimantan and its impact on public health in the region

(1). Increase public awareness of the risks of diseases transmitted by the Anopheles mosquitoes and how to prevent them (2). Improve coordination between the government, local communities, and health facilities in efforts to control the population of the Anopheles in Eastern Kalimantan (3). Reducing the number of cases of disease transmitted by the Anopheles mosquito in Eastern Kalimantan (4). Maintaining the success of the Anopheles control program in the new capital and preventing the mosquito population in the region from rising again (5).

## RESEARCH METHOD

Understanding "Anopheles mosquito species diversity and bionomics" "In malaria endemic areas in Indonesia" - This study uses literary study methods to find out the variety of species and bionomics of Anopheled mosquitos in malaria-endemic regions in Indonesia Advanced. "Evaluation of Malaria Eradication Program in Indonesia: A Library Review". This study evaluates the implementation of malaria eradication programmes in Indonesia. The research approach used is a library survey method.

The method used is the method of literary study. The study of literature is the process of research and analysis of relevant written works in a particular field of

knowledge or topic. Literature studies are used to support research, identify trends, formulate theoretical foundations, and understand the development of knowledge in a field. In the study of literature, researchers gather and present information in the form of papers, scientific articles, journals, and various sources from the Internet of Google, Pubmed and Google Scholar. The research focuses on environmental factors that have an influence on the decline in malaria disease. Literature search based on articles from 2010 to 2023.

## RESULTS AND DISCUSSION



Figure 2 (Nyamuk Anopheles): <https://kaltimkece.id/green/health/forests-disappeared-malaria-crazy> .

Factors that may cause an increase in the Anopheles mosquito population in Eastern Kalimantan include: The humid land environment is an ideal breeding place for the Anopheles (1). Climate change and extreme weather events can affect the life cycle of the Anopheles Mosquito and increase its population (2). Human activities such as deforestation, planting, and mining can change the environment and create an ideal spreadplace for the anopheles. (3). Lack of public awareness about the dangers of the Anopheles mosquitoes and how to prevent the spread of diseases transmitted by them (4). (5). High population mobility can increase the prevalence of Anopheles mosquitoes and increase the risk of spreading diseases transmitted by these mosquitos. (6).

The increase in the Anopheles mosquito population in Eastern Kalimantan can have a significant impact on public health in the region. Anopheles mosquitoes are considered to be vectors or carriers of diseases that can threaten human health, malaria.

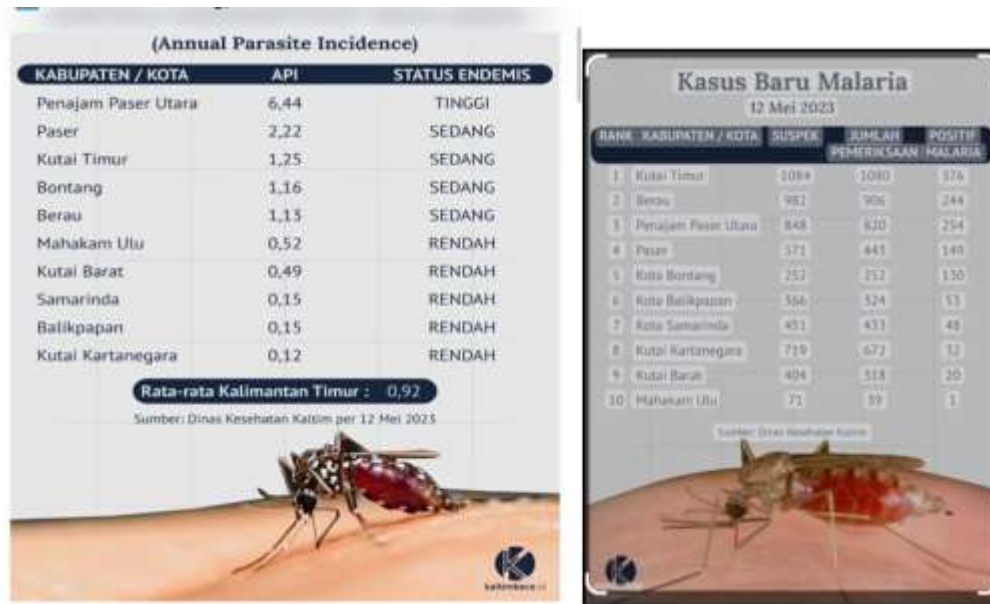


Figure 3 and 3 <https://kaltimkece.id/green/health/forests-disappeared-malaria-crazy>.

Here's the impact of an increasing number of Anopheles mosquitoes on the Eastern Kalimantan community: An increase in cases of malaria transmitted by the Anopheles Mosquito. If not treated immediately, the disease can cause fever, headaches, nausea, vomiting, even death. (1). Increased medical costs and costs for patients infected with malaria (2). Decreased productivity of the community due to malaria-related diseases and absence (3). Decrease in the quality of life of the population due to the risk of transmission of diseases transmitted by the Anopheles mosquito (4). (5). Therefore, efforts are needed to effectively control the Anopheles mosquito population and to raise public awareness of the dangers and ways to prevent the spread of diseases transmitted by these mosquitos in order to reduce the population and the risk of spreading diseases in Eastern Kalimantan.

Increased coordination between government, local communities, and health facilities is crucial in efforts to control the Anopheles population in Eastern Kalimantan. Measures taken to enhance three-party cooperation among others: The Government should prioritize the Anopheles population control program, including adequate budget allocation and adequate human resources (1). (2). Government should cooperate with health facilities to monitor outbreaks of diseases transmitted by Anopheles mosquitoes (3). Health facilities should provide adequate and quality health services to communities affected by diseases infected by Anopheles Mosquitos (4). Citizens should play an active role in population control programmes of Anopheles by carrying out preventive efforts such as the use of worms, use of anti-mosquito medicines, and hygiene (5). Citizens are obliged to report cases of disease transmitted by anopheled mosquitos to the government and local healthcare facilities

(6). Increased collaboration between the government, the community, and health care facilities is expected to make the population control programme of Anhelophes more effective and reduce the risk of the spread of the diseases contained by such mosquitoes in Eastern Kalimantan.



Figure 5 (government and community coordination):  
<https://www.kaltimprov.go.id/news/malaria-elimination-produced-six-deal>.

In order to suppress the number of cases of disease transmitted by the Anopheles mosquitoes in Eastern Kalimantan, various efforts can be made to control the population of the Anopheles and prevent the spread of diseases transmitted by these mosquitoes, among others. Use an insecticide-provided mosquito-bite-resistant anopheles (1). Use an anti-mosquito drug containing DEET or other active ingredients. (2). Maintain hygiene in the area by disposing of garbage at its place and avoiding water stagnation that may become the breeding site of Anopheles mosquitoes (3). (4). Increasing public awareness through socialization and public education on the dangers of Anopheles mosquitoes and how to prevent the spread of diseases transmitted by them (5). Enhanced coordination between the government, the community and health agencies in efforts to control the population of Anopheles Mosquitos and prevent the Spread of Diseases Transmitted By These Mosquitos (6).

To maintain the success of the Anopheles population control program in the new capital and prevent the mosquito population from rising again in the region, the following steps can be taken:



Figure 6 and 7 (President, state staff and local residents treating anopheles mosquitoes in ikn) : <https://www.ikn.go.id/autorita-ikn-past-no-there-cases-malaria-di-IKn>

Regular monitoring and evaluation of the Anopheles population control programmes that have been implemented to determine whether they are still effective and to improve the programmes if necessary (1). Provide education and education to the public on the dangers of Anopholes mosquitoes and how to prevent the spread of diseases transmitted by them (2). (3). Spray insecticides regularly and sufficiently to control the Anopheles population (4). Optimize collaboration between governments, communities and health agencies in efforts to control the Anopheles mosquito population and prevent the spread of diseases transmitted by them. (5). Conducting more technical research and development. Effective and environmentally friendly to control the Anopheles population (6). Through these measures, the Anopheles mosquito population control program in the new capital is expected to run effectively and the growth of new mosquito populations in the region can be prevented. It can cover various aspects such as: public health programmes, medical research, disease control and development. Here are some points that may be relevant in this context:

Anopheles mosquito case identification: Identifying and studying the Anopheles mosquitoes is an early step towards understanding the potential mosquitos to transmit diseases such as malaria. The mosquito discovery was made

possible through entomological surveillance that included the capture, testing, and analysis of mosquitos in the East Kalimantan region. Potential transmission of the disease: Anopheles nymphs are the main vector of malaria disease. Therefore, it is important to study the potential transmission by mosquitoes in Eastern Kalimantan. Accelerating Elimination: Eliminating Anopheles mosquitoes is an important step in malaria control. These efforts may involve: The use of insecticides to control mosquito populations. Public education on mosquito bite prevention, such as the use of insecticide molds, use of anti-malaria drugs, and the importance of seeking early treatment. Monitoring and treating cases of malaria. Collaboration between public and environmental health authorities to identify and address sources of Anopheles mosquitoes. New Metropolitan Territory: If you plan to build a state capital or relocate to a new area, health issues such as the control of Anopheles should be considered. Building infrastructure that takes this aspect into account will help prevent the spread of diseases like malaria. Collaboration and coordination: Anopheles mosquito eradication efforts and malaria prevention require the collaboration of various stakeholders, including governments, health institutions, scientists, and local communities. Proper coordination is crucial to achieving meaningful results.

#### KESIMPULAN

Anopheles mosquitoes play an important role in the spread of malaria in Eastern Kalimantan. Significant cases of malaria occurred in Eastern Kalimantan, with some areas such as Eastern Kutai, Berau, Northern Market Survey, and Paser having the highest cases. As part of the effort to create a healthy and disease-free environment, efforts have been made to accelerate the eradication of malaria in the New Capital District. A series of studies have been carried out to identify the Anopheles mosquitoes, malaria cases in Eastern Kalimantan, and eradicating efforts in the new capital area. I Factors that may lead to an increase in the Anopheles mosquito population in Eastern Kalimantan among others The humid land environment is an ideal breeding place for the Anopheles Mosquito. Climate change and extreme weather events can affect the life cycle of the Anopheles mosquitoes and increase the population of mosquitos. Lack of public awareness about the dangers of the Anopheles mosquitoes and how to prevent the spread of diseases transmitted by them. Here's the impact of an increasing number of Anopheles mosquitoes on the East Kalimantan community: An increase in cases of malaria transmitted by the Anopheles Mosquito. If not treated immediately, the disease can cause fever, headaches, nausea, vomiting, even death. Increased costs of treatment and costs for patients infected with malaria. Decreased community productivity due to malaria-related diseases and absences. The decline in the quality of life of the population is due to the risk of the disease transmitted by the Anopheles mosquitoes. Therefore, efforts are needed to effectively control the Anopheles mosquito population and to raise public awareness of the dangers and ways to prevent the spread of diseases transmitted by these mosquitos in order to reduce the population and the risk of spreading diseases in Eastern Kalimantan. Increased coordination between government, local communities, and health facilities is crucial in efforts to control the Anopheles population in Eastern Kalimantan. Steps taken to enhance cooperation between the three parties: The government should prioritize the Anopheles population control program, including adequate budget allocation and adequate human resources. The government should involve the public in the Anopheles

population control program by socializing and educating the public about the dangers of the Anopheles mosquito and how to prevent the spread of diseases transmitted by the mosquitos. The government should work with health facilities to monitor the outbreak of the disease transmitted by the Anopheles mosquito. Health facilities must provide adequate and quality health care to communities affected by this disease. transmitted by the Anopheles mosquito. The public must play an active role in the Anopheles population control program by undertaking preventive efforts such as the use of worms, use of anti-mosquito drugs, and maintenance of environmental hygiene. The public is obliged to report cases of disease transmitted by the Anopheles mosquito to the government and local health facilities. Identification of Anopheles mosquito cases: Identifying and studying the Anopheles mosquitos is an early step towards understanding the potential mosquito transmission of diseases such as malaria. Accelerating the elimination of mosquitoes Anopheles is an important step in malaria control, this effort may involve the use of insecticides to control mosquitos populations. Public education on mosquito bite prevention, such as the use of insecticide molds, use of anti-malaria drugs, and the importance of seeking early treatment. Monitoring and treating cases of malaria. Collaboration between public and environmental health authorities to identify and address sources of Anopheles mosquitos.

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