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Review of the implementation of malaria elimination program in East Indonesia

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***Abstract*---**Malaria is still one of the health problems with the highest cases in eastern Indonesia. The Indonesian Ministry of Health urges the entire community to be actively involved in preventing the spread of Malaria. It is hoped that by 2030, the Government can achieve the Malaria Elimination target in Indonesia. This study aimed to describe the implementation of malaria elimination in Eastern Indonesia in 2019-2021. We used a literature review method with problem identification stages, data search using the Google Scholar database using the keyword "malaria elimination in Eastern Indonesia," screening stages based on the criteria for annual journal publications in the last three years, the original type of article, accessed in full text and the form of national journal articles, then the stages of summarizing and analyzing the data using PICO, illustrated in prism charts and analysis tables. There were 12 articles analyzed with the results that there is an overview of the implementation of the malaria

elimination program to realize a society free from malaria transmission in the malaria-free Indonesia movement in 2030. Malaria elimination efforts through the Global Malaria Program, diagnosis and treatment through the provision of malaria diagnosis guidelines, activities malaria surveillance, Flying Health Care, health development and implementation of malaria control in the community. An overview of the implementation of malaria elimination in Eastern Indonesia has been carried out with various types of malaria elimination programs.

***Keywords*---**Malaria, malaria control, malaria elimination program.

Introduction

The endemic disease of Malaria has long been one of the highest causes of death in the world, and Indonesia is one of the tropical countries in Southeast Asia where almost every province still has malaria cases, especially in the eastern part of Indonesia. The transmission of Malaria occurs through the bite of the Anopheles mosquito containing the protozoa of the genus Plasmodium that infects humans, causing symptoms such as frequent fever, periodicity, anaemia, enlarged spleen and various collections of symptoms in several organs such as the brain, liver and kidneys (Selasa et al., 2017). Four types of plasmodium (P) (P. falciparum, P. vivax, P. malariae, P. ovale, P. knowlesi) in the world infect red blood cells in humans (Fitriany & Sabiq, 2018); (Nosten et al., 2022).

According to data from the Ministry of Health (Kemenkes), in 2021, the total number of malaria cases in Indonesia reached 94,610 and compared to the previous year, malaria cases reached 226,364 cases. In 2021 also, malaria cases decreased by 58.2%. The downward trend in malaria cases in Indonesia has occurred since 2018, but although the data tends to decrease, malaria cases still increased in 2019 by as many as 250,628 cases. Malaria rates will decline again in 2020 and 2021. Indonesia, especially the eastern part, is still concentrated with the highest malaria cases, such as Papua province, which is the province with the highest malaria cases to date, reaching 86,022. The proportion of malaria cases in Papua Province reached 90.9% of the total population. They were followed by East Nusa Tenggara Province, with malaria cases reaching 2,393 (2.5%). After that, West Papua had 1,841 malaria cases or 1.94% (Kemenkes, 2021).

Meanwhile, the lowest malaria cases were in Bengkulu, Banten, and DI Yogyakarta Provinces. The province in Indonesia that is free of malaria cases is Bengkulu Province—followed by Banten with only 1 Malaria (0.001%) and 4 Malaria (0.004%) in DI Yogyakarta. From the data that has been described regarding the high number of malaria cases in Indonesia, Malaria should be an important spotlight in the world of health because the average annual case reaches hundreds of thousands of malaria cases (Kemenkes, 2021).

The high number of malaria cases in Indonesia threatens the community's survival, so efforts are needed to prevent, reduce and control endemic malaria

diseases to reduce malaria transmission (Kemenkes, 2021). To control malaria elimination, the Ministry of Health urges the Indonesian people to jointly prevent the spread of Malaria by cleaning the surrounding environment with running water, closing water reservoirs, sleeping using mosquito nets, and avoiding night activities near waters so that the malaria elimination target by 2030 can be achieved. Therefore, researchers are interested in conducting a literature review study on the description of the implementation of the malaria elimination program in eastern Indonesia in 2019-2020.

Method

This research is a literature study with the stages of identifying the problem, namely the elimination of Malaria in Eastern Indonesia. The next step is to search the literature on the Google Scholar database using the keywords "malaria elimination in eastern Indonesia", "prevention efforts", "malaria elimination", "eastern Indonesia", and "influence factors". The research problem analysis uses the PICO worksheet (see Table 1). There were 12 articles reviewed based on a selection process with inclusion and exclusion criteria, so the articles reviewed only discussed the implementation of malaria elimination programs in each region of Eastern Indonesia (see Table 2). The literature search was carried out from March to June 2022. The next step in this literature review is Quality assessment, which is not only looking for articles based on their titles but also looking at abstracts, content and conclusions from previous articles for review. The screening stages based on inclusion criteria include appropriate free and full-text accessible national articles about the description of the implementation of the malaria elimination program in Indonesia in 2019-2021, published in the last three years, and the exclusion criteria are full texts that do not match the search. Next is summarizing and analyzing the data (see Table 1.2 Results of Journal Article Analysis). The literature search process is illustrated in a prism chart (see Figure 1.1 Prisma Chart).

Table 1. PICO Worksheet

PICO Concepts	Search Terms (include synonyms, alternate spellings, acronyms, abbreviations...)
P (Patient Population)	Population: Society Inclusion Criteria: - Communities in Eastern Indonesia Region - Rural area
P (Problem)	The number of malaria incidence in Eastern Indonesia continues to increase
I (Intervention)	Prevention of malaria transmission by implementing government programs (malaria elimination): - Distribution of mosquito nets (long lasting insecticidal net) - House spraying - Abate share - Health promotion with malaria elimination education

C (Comparison)	Malaria treatment
O (Outcome)	Decrease in malaria cases in Eastern Indonesia

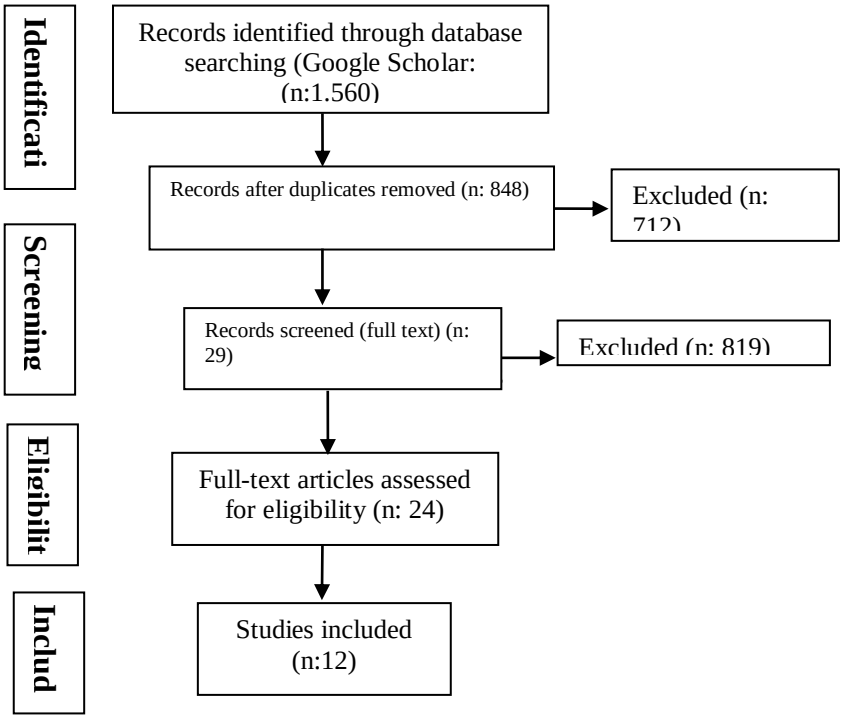

Table 2 Article Analysis Results

No	Author's name, and Year of publication	*Description of the Topic/Issue being reviewed*
1.	Winda Dwi Yuliyanti, (Yuliyanti, 2016)	Based on the analysis results, it is known that the description of the implementation of elimination has been carried out well with the results of the study that WHO made various efforts to deal with malaria in Indonesia. These efforts are divided into various aspects: prevention and control, diagnosis and treatment, education and research, and elimination and evaluation.
2.	Eni Nuraini, 2021 (NURAINI et al., 2021)	Based on the results of the analysis, it is known that the description of the implementation of malaria elimination has been carried out. However, E-SISMAL at the Lahat district health centre has not been used optimally because of human resources, methods, and abilities constraints. This study suggests a method that regulates ESISMAL operations (regional policies, guidelines and SOPs) in the Lahat district and increases human resources through operating E-SISMAL and providing a smooth internet network in cooperation with telecommunications. The study results show that the accuracy of reports on E-SISMAL at the Lahat district health centre is still below the national target of an average of 36.43% (<80%) in 2020.
3.	Nita Rahayu, Gusti meliyanie, Harninda Kusumaningtyas, 2019 (Rahayu et al., 2019)	Based on the results of the analysis, it is known that the description of the implementation of malaria elimination has been carried out well. The Tanah Bumbu District Health Office has carried out malaria control efforts through the early detection of patients and treatment.
4.	Riyani Setiyaningsih, et al., 2019 (Districts et al., 2019)	Based on the results of the analysis, it is known that the description of the implementation of malaria elimination has been carried out well. One of the activities carried out to support malaria elimination is vector surveillance.
5.	Maria Yosephina Desita, et al., 2020 (Desita et al., 2021b)	The results obtained from this study show that the implementation of malaria elimination has been carried out quite well, with malaria surveillance activities formed by a system of inputs, processes, and outputs that support the objectives of the activities.
6.	Eliza Zihni Zatihulwani, 2019 (Eliza Zihni Zatihulwani,	The results from the study show that the implementation of malaria elimination has been carried out with an optimal controlling malaria vector program.

	2019)	
7.	Margaretha Pati Kaka, 2021 (Margaretha Pati Kaka, 2021)	Based on the results obtained from the study, it shows that the description of the implementation of malaria elimination has been carried out by early detection of Plasmodium spp in humans and Anopheles spp through community empowerment efforts based on available local resources can achieve the target of malaria elimination in Southwest Sumba Regency.
8.	Lenny Gannika, 2019 (Lenny Gannika, 2019)	The results obtained from the study show that the implementation of malaria elimination has been carried out with malaria control efforts through Flying Health Care (FHC) activities.
9.	Andika Isranugraha, 2021 (Andika Isranugraha, 2021)	Based on the results of the analysis, it is known that the description of the implementation of malaria elimination has been carried out with improvements to laboratory services that need to be carried out in order to improve the quality of diagnosis through elements of human resources, facilities and infrastructure as well as the quality of consumables in the laboratory, which are fulfilled properly and thoroughly according to standards.
10.	Lalandos Natria, et al., 2019 (Lalandos et al., 2019)	Based on the results obtained from the study indicating that a description of the implementation of malaria elimination has been carried out with the results of this study, it can be concluded that the implementation of malaria elimination program in the Talaud Islands Regency has been implemented quite well. However, there are still some obstacles encountered in its implementation.
11	Deasy Erawati, et al., 2021 (Erawati et al., 2021)	The results obtained from the study show that the implementation of malaria elimination has been carried out with a laboratory approach, namely microscopic examination of thin and thick blood preparations using a microscope.
12	Henny Sesanti Budi Hastuty, 2021 (Sesanti & Hastuty, 2021)	The results obtained from the study show that the description of the implementation of malaria elimination has been carried out using an observation and survey approach with a Geographic Information System (GIS).

Discussion

Based on the results of the analysis of 12 articles related to the description of the implementation of malaria elimination in Eastern Indonesia, the following results were obtained:

Types of malaria elimination activities

Implementing malaria elimination program activities is carried out with various program activities. Implementing malaria elimination with the Global Malaria Program to prevent and control malaria transmission is carried out by providing related guidelines such as larviciding efforts aimed at controlling Anopheles mosquito larvae chemically, namely by spraying insecticides on mosquito larvae. Implementation of a good environmental management program, larvae-eating fish to reduce the breeding of mosquito larvae, zooprophylaxis, use of insecticidal nets to avoid mosquito bites, and Indoor Residual Spraying (IRS). Other efforts to control and eliminate malaria through diagnosis and treatment of malaria are carried out by providing guidelines for malaria diagnosis, namely Rapid Diagnostic Tests (RDTs) and confirmation of diagnosis using a microscope (Microscopy) (Yuliyanti, 2016); (Rahayu et al., 2019); (Nlinwe et al., 2022).

WHO conducts research and education through ECAMM (External Competency Assessment Malaria Microscopy) for Microscopy and malaria surveillance personnel in Indonesia. An activity program by being interviewed and taking blood from patients to check for malaria parasites, an activity program by analyzing the presence of malaria vectors and pathogens, and an activity program by malaria surveillance (Yuliyanti, 2016); (Rahayu et al., 2019); (Setiyaningsih, 2020); (Desita et al., 2021a). Program activities with the implementation of malaria vector control with Flying Health Care activities with data covering cases of malaria transmission, mosquitoes and Anopheles larvae, breeding sites and vector control efforts (Mahdalena & Wurisastuti, 2021); (Ramadhani et al., 2021); (Lenny Gannika, 2019); (Eliza Zihni Zatihulwani, 2019). Activities with health development programs, namely by revamping survey laboratory services on the profile of Center of Health Services laboratories, activity programs with Patient Discovery and Management, Risk Factor Management, Epidemiological Surveillance and Outbreak Management are by conducting SKD-KLB, this is done through weekly reports as well as monthly reports (Kenjan, Maria, I, 2019); (Lalandos et al., 2019); (Erawati et al., 2021); (Desita et al., 2021a); (Districts et al., 2019).

The program of activities with a laboratory approach is by microscopically examining thin and thick blood preparations using a microscope and program types of activities by observing and surveying with Geographic Information Systems (GIS) (Sesanti & Hastuty, 2021); (Juni et al., 2021). The program for the implementation of malaria elimination activities in which information is collected using the application, there is one journal, namely, Report Accuracy on the Electronic Malaria Surveillance Information System (E-SISMAL) (Erawati et al., 2021); (Sesanti & Hastuty, 2021); (NURAINI et al., 2021). The program for implementing malaria elimination activities is carried out by empowering the community itself; there is one journal, namely, the implementation of malaria

control including case finding and finding the use of Artemisinin Combination Treatment (ACT) as an anti-malarial drug, and prevention efforts by the community through the use of anti-malarial drugs mosquito (Pamuji et al., 2018); (Margaretha Pati Kaka, 2021); (Marques-da-silva et al., 2022); (Birkholtz et al., 2022); (Yang et al., 2021); (Wangmo et al., 2022).

There are efforts to implement malaria elimination through applications that empower the community. Malaria elimination activities through various programs malaria elimination activities that have been established through the Global Malaria Program, diagnosis and treatment through the provision of malaria diagnosis guidelines, malaria surveillance activities, Flying Health Care, health development and implementation of malaria control in the community (Yuliyanti, 2016); (Rahayu et al., 2019); (Setiyaningsih, 2020); (Desita et al., 2021a), (Mahdalena & Wurisastuti, 2021); (Ramadhani et al., 2021); (Lenny Gannika, 2019); (Eliza Zihni Zatihulwani, 2019); (Pamuji et al., 2018); (Margaretha Pati Kaka, 2021); (Astuti et al., 2019); (Suryapranata et al., 2022). Prevention efforts in malaria elimination activities are with diagnostic and treatment programs, malaria vaccine, education and research, prevention efforts using the E-SISMAL application, early detection of patients, prevention efforts with vector surveillance activities, prevention efforts with laboratory service approaches and improvements, prevention efforts by evaluating the implementation of the Malaria program, prevention efforts using observation and survey approach with geographic information systems (GIS) (Sesanti & Hastuty, 2021); (NURAINI et al., 2021); (Egbewande, 2022); (Olugbenga et al., 2022); (Moon et al., 2021); (Mahittikorn et al., 2022). This program is in line with the opinion of the Ministry of Health, which urges the Indonesian people to prevent the occurrence of malaria (Kemenkes RI, 2021). Then the Decree of the Minister of Health of the Republic of Indonesia Number 293/MENKES/SK/IV/2009 dated 28 April 2009 concerning the Elimination of Malaria in Indonesia was issued to create a healthy society free from malaria transmission in stages until 2030 (Pamuji et al., 2018); (Margaretha Pati Kaka, 2021); (Kemenkes RI, 2020).

Obstacles in implementing malaria elimination

Based on the results of each journal's review, several journals in the implementation of malaria elimination activities experience problems in gathering information. The obstacles experienced are the low competence of human resources, the methods used, and the ability to carry out the program. This study suggests a method that regulates the operation of E-SISMAL (regional policies, guidelines and SOPs) in the Lahat district and increases human resources through operating E-SISMAL and providing a smooth internet network in cooperation with telecommunications. Implementing the malaria elimination program in the Talaud Islands Regency has been done quite well, but there are still some obstacles to its implementation, such as the absence of microscopic tools and untrained personnel (Lalandos et al., 2019); (NURAINI et al., 2021).

There are several obstacles in collecting information on malaria, such as the constraints on human resource capabilities, methods, capabilities and availability of microscopic tools and inexperienced personnel (Lalandos et al., 2019); (NURAINI et al., 2021). In addition, there are challenges in efforts to achieve

malaria elimination in Indonesia by 2030, such as some of the malaria endemic areas are in the eastern part of Indonesia, the process requires a special approach socially and culturally, customs, high mobility of the population from high endemic areas to low endemic areas, and adapting to geographical conditions, the majority of which are still difficult to reach (Kemenkes RI, 2020). the Government has set targets to achieve the national malaria elimination target in 2030 as follows: by 2010, all health care facilities are capable of carrying out malaria parasite examinations (all clinical malaria sufferers are examined for blood preparation/laboratory confirmation), and by 2020 all regions of Indonesia have been entered the pre-elimination stage. By 2030 the entire territory of Indonesia has achieved malaria elimination (Kemenkes RI, 2020).

Influence factors in the implementation of malaria elimination

The influencing factor in implementing malaria elimination is the process of implementing malaria elimination through existing programs and the spread of endemic diseases, which are one of the health problems for a country and even the world, including Indonesia, especially the eastern region, which is an endemic malaria area. Based on data from the Ministry of Health of the Republic of Indonesia, 70% of malaria cases are found in Eastern Indonesia as a high malaria endemic area, namely Papua, West Papua, Maluku, and North Maluku, Sulawesi, and Nusa Tenggara. This predicate can be seen from the high number of malaria cases and Annual Parasite Incidence (API) in eastern Indonesia, ranging from 5 to 30. This data shows a high gap in malaria issues between eastern Indonesia and other parts of Indonesia (Kemenkes RI, 2021); (Yuliyanti, 2016); (Andika Isranugraha, 2021); (Fadilah et al., 2022).

Influence factors in the implementation of malaria elimination involve the process of implementing various malaria elimination programs that have been determined such as inadequate human resources in the health sector, surveillance officers not focused on one task and have not attended training, budget for surveillance activities that support malaria elimination are not adequate, increase activities malaria data collection and the annual epidemiological surveillance data reporting system has not been maximized (Yuliyanti, 2016); (Desita et al., 2021a); (Kemenkes RI, 2021); (Andika Isranugraha, 2021). Researchers realize that there are limitations in this study, namely that they have not studied or analyzed in more depth and have not described all the data about implementing the malaria elimination program in Eastern Indonesia in 2019-2021.

An overview of the implementation of malaria elimination in Eastern Indonesia through the Global Malaria Program to prevent and control malaria by providing malaria control guidance (Larvaciding, environmental management, larvae-eating fish, zooprophylaxis, use of insecticide nets, Indoor Residual Spraying (IRS)), control and elimination of malaria through diagnosis, treatment, research and education carried out by WHO through ECAMM (External Competency Assessment Malaria Microscopy), Flying Health Care activities, health development programs and epidemic control, laboratory approach activities, program accuracy activities Reports on Electronic Malaria Surveillance Information Systems (E-SISMAL), and community empowerment programs. The constraints and influencing factors in implementing malaria elimination are

human resources, methods, availability of program supporting infrastructure (Bayode & Siegmund, 2022), and reporting systems for each program's results. This step can be a consideration for policymakers and all sectors involved in implementing malaria elimination to improve malaria elimination programs in Indonesia to achieve the malaria elimination target by 2030. Suggestions for further researchers to analyze the factors related to and affect the implementation of malaria elimination in Indonesia.

Conclusion

The malaria elimination program has been carried out with various methods and activities aimed at the success of the Global Malaria Program. However, various obstacles and other factors affect the successful implementation of the malaria elimination program.

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