

An overview of malaria elimination efforts in South Kalimantan from 2010 to 2018

Muhammad Rasyid Ridha¹, Deni Fakhri², Syarif Hidayat³, Evi Liani⁴

^{1,2,3}Tanah Bumbu Unit for Health Research and Development, National Institute of Health Research and Development, National Ministry of Health of Indonesia, Indonesia

⁴Disease Control Department, South Kalimantan Provincial Health Office, Indonesia

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ABSTRACT

Malaria elimination in Kalimantan is targeted to be completed by 2020. This study aimed to analyze efforts to eliminate malaria in South Kalimantan from 2010-2018. This research is a descriptive study of the population of South Kalimantan who is at risk of suffering from malaria. This study used a total participation technique involving all cases of malaria recorded in the malaria surveillance information system (SISMAL) 2010-2018 for South Kalimantan. The data used are secondary data obtained from the South Kalimantan Provincial Health Office in 2010-2018, namely the number of suspected malaria cases, confirmation and inspection, treatment use data, bed nets distribution, village stratification and annual parasite incidence (API) in each district. The results showed that there was the trend of malaria elimination efforts in South Kalimantan was increased from 89% of suspected patients in 2010 to 100% in 2018, and trend of API decreased from 1.5‰ in 2010 to 0.21‰ in 2018. So, with the provision of artemisinin combination therapy (ACT), from 78% in 2010 increased to 100% in 2018. All regencies/cities in South Kalimantan showed API number <1‰ in 2018. Stratification of high case incidence (HCI) villages/sub-district in 2018 decreased compared to 2010, from 211 villages to 19 villages, while malaria-free stratification from 0 in 2010 to 1,761 villages. Malaria elimination efforts in South Kalimantan showed a significant increase and it is expected that 2020 South Kalimantan will be free of malaria.

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Corresponding Author:

Muhammad Rasyid Ridha

Tanah Bumbu Unit for Health Research and Development

National Institute of Health Research and Development, National Ministry of Health of Indonesia

Loka Litbang Street, Batulicin Sub-district, Pondok Butun, Batu Licin, Tanah Bumbu District

South Kalimantan, Indonesia, 72211

Email: ridho.litbang@gmail.com

1. INTRODUCTION

Malaria is a public health problem that can increase the risk of death in pregnancy, under-five, infant mortality and can increase the risk of babies with low birth weight (LBW) if born [1]. Furthermore, this disease also impact family productivity and economy [2, 3]. The cause of this infectious disease was *Plasmodium* parasite and transmitted through *Anopheles* mosquitoes as vector. The five types of *Plasmodium* were *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi*. People affected by malaria were showing symptoms such as fever, chills, sweating accompanied by headache, nausea, vomiting, diarrhea, and muscle-aches or weary [4].

Malaria in Indonesia began in the 1900s where the number of sufferers reached 30 million and caused the death of 120000 people. Noticeable efforts on malaria control began in 1959 with the establishment of Kopem (*Komando Pembasmian Malaria* or Malaria Extermination Command) at the central government level, while in the local government level; the Malaria Extermination Officials that are integration of the Malaria Institute were established. Additionally, for the training purpose, the Ciloto Malaria Training Center established along with four field-training centers outside Java Island. In this period, malaria control mostly described as the eradication period, where the focus of eradication carried out in the islands of Java, Bali, and Lampung. The main activities carried out were insecticides-spraying, treatment with Chloroquine, and prophylaxis. Only until 1961-1964 was the spraying carried out outside Java and Bali Island. In 2000, a community movement to promote malaria eradication known as “Gebrak Malaria” (*Gerakan Berantas Kembali Malaria* or Malaria Eradication Movement) was born and the resistant Chloroquine and sulfadoxine-pyremethamine (SP) was replaced by artemisinin-based combination therapy (ACT) [5, 6].

As part of a global commitment to eliminate malaria, the Indonesian government in 2009 issued Minister of Health Decree No. 293/Menkes/SK/IV/2009 to strengthen malaria control efforts from the central government level to the Puskesmas (*Pusat Kesehatan Masyarakat* or Public Health Center) level. Elimination refers to the efforts to terminate the local transmission of malaria (indigenous) in a certain geographical area [7].

Malaria elimination programs also implemented in South Kalimantan. Cases decreased from year to year except a significant increase in 2011 by the number of 10124 cases compared to previous year by the number of 5161 cases. The number of cases in 2012 decreased from 9041 cases to 828 cases in 2018. Those progresses rewarded with 7 out of 13 regencies/cities had achieved malaria elimination certificates. It was targeted in 2023 all regencies/cities should have received elimination certificates [8].

Indonesia government is targeting to eliminate malaria from Sumatra Island, West Nusa Tenggara Province, Kalimantan Island, and Sulawesi by 2020 and by the end of 2030 Indonesia will be malaria-free nation [9]. Efforts made to support this goal were cases founding, medical treatment, and prevention using mosquito nets. Effective medical treatment was administering artemisinin combination therapy (ACT) in the first 24 hours of a fever patient and must be complete within three days. Regency, city, province, and island are declared malaria-free if no indigenous cases found for three consecutive years, supported with good surveillance capability [10, 11]. Based on this background, we have analyzed the situation of malaria elimination strategy in South Kalimantan based on the number of treatments using ACT, the use of mosquito nets, number of endemic villages, and the decline of annual parasite incidences (API) within 2010-2018.

2. RESEARCH METHOD

We have completed a descriptive study with people who are at risk of suffering malaria in South Kalimantan as the population sample. Based on data from the BPS (*Badan Pusat Statistik* or Statistics Indonesia), population in South Kalimantan on 2018 was 4,182,695 people with a poverty rate of 4.7%. There are two cities and eleven regencies in South Kalimantan spanning of 38,352.26 km² administrative area. There are 48 hospitals, 235 public health centers, 182 clinics, 571 satellite public health centers, 1049 village health station/post, and 2075 integrated services station/post.

This study used total-participation method including all cases recorded in the E-Sismal (*Elektronik Sistem Informasi Surveilans Malaria* or Electronic Malaria Surveillance Information System) data of South Kalimantan Province from 2010-2018. Secondary data obtained from the South Kalimantan Provincial Health Office from 2010-2018 were data on suspected malaria cases; confirmation and checking; medical treatment with ACT; distribution of mosquito nets, stratification of villages/subdistrict; and API of each regency/city. Statistical analysis used was multiple linear regression statistical tests to see the correlation between elimination efforts and malaria incidences in South Kalimantan. Research activities include the processing of library materials to the preparation of research reports conducted from March to June 2020. No ethical approval was required as this study did not involves human subjects and use secondary data.

3. RESULTS AND DISCUSSION

3.1. Malaria elimination efforts

The stages of malaria elimination in South Kalimantan are in accordance with the national stage, which are acceleration, intensification, elimination, and maintenance. Acceleration in malaria elimination done by active case-finding and appropriate medical treatment. The acceleration carried out by conducting active surveillance through detection of suspect patients and mass blood survey. After microscopic analysis

completed, providing ACT treatment to the positive patients is mandatory. Detailed number of the acceleration within 2010-2018 in South Kalimantan summarized in Figure 1.

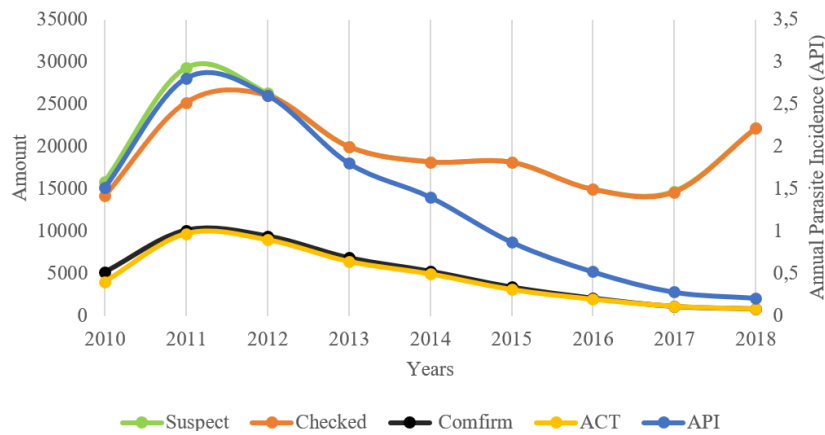


Figure 1. Efforts to accelerate malaria elimination (case detection, ACT treatment) and API in South Kalimantan

Highest case of malaria in South Kalimantan was in 2011 with 10,076 cases. This incidence caused the distribution of ACT in the same year higher than other years. The trend of malaria elimination efforts in South Kalimantan was increased from 89% of suspected patients in 2010 to 100% in 2018, and trend of API decreased from 1.5 in 2010 to 0.21 in 2018. So, with the provision of ACT, from 78% in 2010 increased to 100% in 2018. In 2010, the most *Plasmodium falciparum* (51.4%) compared to other *Plasmodiums*, there was a change in 2018 where *Plasmodium vivax* (42.6%) was more. Active surveillance has proven effective in rapid case finding and early detection of malaria in an area [12]. Combination with serological surveillance in health facilities to detect malaria receptive areas was recommended [13].

Selective and massive distribution of mosquito nets to pregnant women in areas with high transmission was intense in South Kalimantan. This focus taken since malaria can effect on nutritional status and stunting either disrupting infant cognitive and motor development, increasing morbidity and mortality in mothers and babies [14].

In general, distribution of long-lasting insecticidal nets (LLINs) mosquito nets was high in 2010 and 2014. Whereas if this number focused on distribution in pregnant women, distribution of LLINs mosquito nets was high in 2011 as shown in Figure 2. A total of 41908 LLINs have been distributed to pregnant women during 2012 - 2018. The largest number of mosquito nets (31.5%) were distributed in 2012 because there were still many malaria endemic villages. There was a tendency to decrease the number of LLINs distributed to pregnant women since then. Statistical tests was done between interventions mosquitoes net (x1) and ACT distribution (x2) to malaria incidences (y) in South Kalimantan, resulted a linear equation $y = a + b_1x_1 + b_2x_2$ or $y = -288.838 + 0.006 + 1.043$ (p-value= 0.000<0.05) as shown in Table 1. Consequently, distribution of mosquito nets and ACT significantly reduce the incidence of malaria in South Kalimantan.

Table 1. Effect of mass mosquito nets and treatment with ACT on the incidence of malaria in South Kalimantan

Y	Model	Regression coefficient	R	R square	Sign
Malaria incidence	Constant	-288.838			
	mass mosquito nets (x1)	0.006	0.995	0.99	0.000
	ACT treatment (x2)	1.043			

Risk factor that associated mostly to malaria incidence in Indonesia was the use of mosquito nets. Thus, higher use of mosquito nets mean less risk to malaria infection [15]. Within distribution of mosquito nets, it is important to consider socio-demographic, behavioral, and environmental factors that effecting the use of mosquito nets [16]. Furthermore, it is necessary to educate community understand by counseling through health promotion [17].

Long-lasting insecticide nets (LLIN) mosquito net was the most common and durable net used. It uses Pyrethroid insecticide and last up to three years with 20 times washing [18]. In early 2018 the "New types of Insecticide-Treated Nets" was discovered [19], but only in 2019 was recognized by World Health Organization Pesticide Evaluation Scheme/WHOPEPES (a part of the World Health Organization dealing with vector and pesticide control issues). This type of mosquito net was insecticide-treated nets (ITN) that contain synergistic Pyrethroid and piperonyl butoxide (PBO) insecticide [20]. The addition of PBO was intended to increase the effect of Pyrethroid insecticide activity, especially in mosquito populations that show metabolic resistance [21]. The malaria vectors in South Kalimantan are the mosquitoes *Anopheles leucosphyrus*, *Anopheles balabacensis* [22], *Anopheles vagus*, *Anopheles peditaeniatus* and *Anopheles tessellatus* especially in residential areas near forests and forests [23]. The use of LLIN is to prevent vector mosquitoes from infecting humans at night [24].

Malaria incidents in an area divided into 4 classes: villages with high incidents (HCI), villages with moderate incidents (MCI), villages with low incidents (LCI), and malaria-free villages as shown in Figure 3. Since 2007, malaria elimination in Indonesia has been monitored using the API (cases of clinical malaria for one year in an area per 1,000 population). This indicator replaces the previous indicator annual malaria incidence (AMI) [7]. In the same year, every malaria case requires test results from a positive blood sample and all positive cases must be treated with ACT. The resistant of chloroquine and kina pills was one of the causes for high malaria morbidity and mortality, therefore the government has recommended the use of ACT since 2004 [25, 26]. API number of regencies/cities in South Kalimantan described in Table 2.

API number in South Kalimantan decreased from 2010-2018. All regencies/cities in South Kalimantan showed API number <1% in 2018. In accordance with the 2010-2011 strategic plan of the Indonesia Ministry of Health, API must be decreased to one per 1,000 by 2014 [27]. However, this goal can only be achieved the following year.

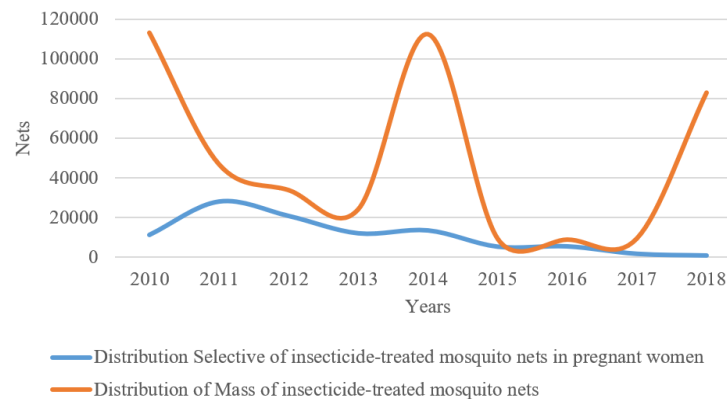


Figure 2. Distribution of insecticide-treated mosquito nets in South Kalimantan from 2010-2018

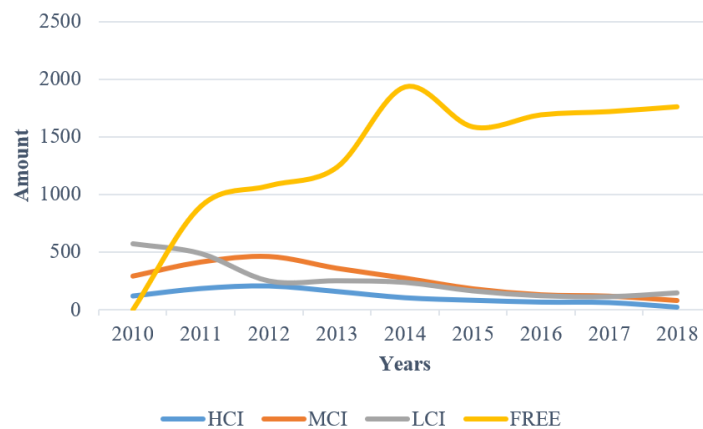


Figure 3. Malaria stratification based on villages in South Kalimantan

Table 2. Annual parasite Incidence (API) values are based on districts in South Kalimantan

No.	Districts	Years								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
1	Banjarmasin *	0	0.1	0	0.1	0.05	0.01	0.01	0.01	0.01
2	Banjarbaru *	1.13	1	1.3	0.8	0.34	0.59	0.03	0.06	0.10
3	Banjar	0.8	1.4	1.2	1.3	1.05	0.32	0.31	0.32	0.21
4	Tanah Laut	2.3	3.9	3.4	1.5	0.92	0.37	0.22	0.24	0.33
5	Tapin*	0.5	2.2	2.1	2.4	1.19	0.61	0.56	0.18	0.17
6	HS. Selatan *	0.8	1.6	1.7	1.3	0.83	0.31	0.13	0.25	0.13
7	HS. Tengah*	0.3	0.8	0.8	0.7	0.77	0.44	0.25	0.08	0.05
8	HS. Utara *	0.4	0.5	0.8	0.4	0.32	0.2	0.18	0.13	0.11
9	Tabalong	4.1	3.4	5.6	5.1	7.4	7.15	3.9	1.25	0.85
10	Barito Kuala *	0.4	1.5	1.7	0.8	0.3	0.15	0.06	0.09	0.06
11	Kotabaru	5.7	6.3	4.8	4.6	3.61	0.95	0.55	0.42	0.20
12	Tanah Bumbu	3.9	11.4	12.2	5.6	1.59	0.83	0.53	0.44	0.28
13	Balangan	0.4	1	0.8	1.1	2.18	2.55	2.42	0.77	0.84
	South Kalimantan	1.5	2.8	2.6	1.8	1.37	0.87	0.52	0.28	0.21

* *districts with malaria free certificates*

API number showed decreasing trend from 0.87‰ in 2015 to 0.21‰ in 2018. This is due to the massive malaria elimination effort carried out either by the interrelated official program or cross programs and community participation. Community participation has been implemented in breaking malaria transmission chain in Cameroon, Iran, and Cambodia by implementing community mobilization through social groups and village officials, cadres and mother training, and health promotion [28-30].

To achieve a malaria-free certificate, API number must be under one per 1,000 for at least three consecutive years, no indigenous cases or local transmissions, and less than 5% of Slide Positive Rate [7, 31]. By 2018, there were already seven regencies/cities in South Kalimantan that receive malaria elimination certificates: Banjarmasin; Banjarbaru; Hulu Sungai Selatan, Hulu Sungai Utara, Hulu Sungai Tengah, Barito Kuala, and Tapin [8]. Local government commitment and community participation are required to reduce malaria endemicity in malaria-free areas and need to be more aggressive and massive, systematic and structured in areas with high endemism. maintenance of malaria-free areas, namely the need to carry out research surveillance, 1-2-5 epidemiological investigations, strengthening the network of case management, observing receptive areas and controlling local evidence vectors After reaching the elimination phase, funding was still needed to maintain the ability of health workers to test and prevent the extent of malaria caused by imported case. Maintenance aimed to prevent re-emergence of cases with local transmission targeting individual positive laboratory cases or imported cases.

4. CONCLUSION

Success in decreasing malaria incidence in South Kalimantan was affected by the distribution of mosquito nets and ACT. Furthermore, malaria elimination also was supported by participation cross-sector and community. API numbers of all regencies/cities in South Kalimantan in 2018 were less than one per 1000, with seven regencies/cities have received malaria elimination certificates.

The success in decreasing API number under the standard in South Kalimantan needs to be maintained so that all regencies in South Kalimantan able to achieve malaria elimination certificates. Regencies that have received a malaria elimination certificates should maintain the capability of health workers in the examination and prevention of malaria cases caused by imported cases.

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