Original Research Article

The Influence of Community Behavior in Disposing of Garbage on the Spread of Malaria

ABSTRACT

The existence of garbage in everyday life can not be separated from human behavior that litters. Lack of public awareness in disposing of waste results in an unhealthy environment. An unhealthy environment triggers the emergence of various diseases, one of which is a disease caused by mosquito bites, namely malaria. Malaria is one of the most deadly diseases. This study aims to see how far the influence of community behavior in disposing of waste on the spread of malaria outbreaks. The data used in this study is data from the 2018 Village Potential data collection with 83,931 villages in Indonesia. The analytical method used is Ordinary Least Square (OLS). The results obtained in this study are people's behavior in disposing of waste has a significant effect on the spread of malaria. The better the behavior of the community in waste disposal and management, the lower the spread of malaria will occur. In addition, access to and utilization of health facilities and services is also important in the process of treating malaria. The results of this study also concluded that the farther the distance to health care facilities, the greater the risk of suffering from malaria. Government participation is needed to improve public health promotion.

Key words: Trash behavior, malaria, access to health facilities, health promotion

INTRODUCTION

Garbage is a complex problem caused by a lack of public understanding of the consequences that can be caused. In addition, the problem of waste in Indonesia is increasingly complicated due to an increase in population that is not accompanied by a harmony of knowledge about waste and also the lack of community participation in maintaining cleanliness and disposing of waste in its place. [1], [2].

This behavior does not recognize the level of education or social status. Lack of public awareness of the importance of cleanliness is the most dominant factor. In addition, the community's sensitivity to the environment is relatively less [3]. People don't know what dangers will happen if they can't take care of the surrounding environment [4], [5].

The World Bank revealed that the amount of solid waste in the world's cities will continue to increase by 70% until 2025, from 1.3 billion tons to 2.2 billion tons per year [6]. The majority of the increase occurred in cities in developing countries. In Indonesia, the amount of solid waste produced nationally reaches 151,921 tons per day. This means that every Indonesian resident throws out an average of 0.85 kg of solid waste every day. World Bank data also states that of the total waste produced nationally, only 80% has been collected. Waste wasted pollutes the environment. The volume of waste in Indonesia is around 1 million cubic meters every day, but only 42% of it is transported and processed properly. [4], [7].

Disposal of garbage that is not handled properly will cause big problems. The accumulation of garbage or throwing it carelessly into open areas will result in soil pollution which will also have an impact on groundwater channels [8], [9][10]. Likewise, burning garbage will cause air pollution, dumping garbage into rivers will result in water pollution, clogged drains and flooding [11], [12].

In addition, environmental issues are often associated with waste, especially around cities. In practice, many take shortcuts to destroy waste. This phenomenon can be seen from the number of countries that burn waste, which is an alternative in waste disposal [13]. Meanwhile, the problem faced for this process is the cost of burning is more expensive than the final disposal system (sanitary landfill). [14].

The problem of waste in Indonesia can be seen from the increasing number of waste generated by the community, the lack of landfills, breeding grounds and nests of insects and rats, sources of pollution and contamination of soil, water, and air, sources and habitats for germs that endanger health. [15], [16]. In addition, direct contact with littered litter can also increase the risk of diseases transmitted by animals (such as rats and mosquitoes) [17]. Rats and mosquitoes are animals that have a habitat and "happy" with piles of garbage [18].

Increased waste will have a positive effect on the disease that will be caused. Diseases transmitted by mosquitoes include malaria and dengue fever. Malaria is a disease caused by the bite of the Anopheles mosquito [19]. In 2015, more than 210 million people contracted malaria in the world and 429,000 people were reported to have died from malaria. Indonesia holds the second highest ranking country (after India) in Southeast Asia for the highest number of malaria cases [20].

Malaria is closely related to housing sanitation that is not healthy and does not meet health requirements, thus bringing a person's risk of experiencing environmental-based diseases such as malaria [21]. The spread of malaria in South Bengkulu Regency, covers all mountainous areas and lowlands, malaria is most commonly found in coastal areas and inland areas [22].

The cause is the development of Anopheles mosquitoes as vectors of malaria in the vicinity of residential areas. The most preferred breeding places for Anopheles mosquitoes include ponds, river estuaries, and swamps. Piles of garbage and stagnant water can put a person at risk of experiencing dengue fever. Both malaria and dengue, if not treated immediately can cause various complications and even death.

There have been many studies analyzing malaria with other factors, such as climate, sanitation, settlements, etc. However, it is still limited to analyze the relationship between

waste and the spread of malaria. This study aims to see how far the influence of community behavior in disposing of waste on the spread of malaria outbreaks.

DATA AND METHODOLOGY

The data used in this study is the result of the 2018 Village Potential (Podes) data collection, which describes the condition of the spread of malaria at the village level. The method used in this study is the Ordinary Least Square (OLS) method. In this study, the independent variable used is the behavior of the community in disposing of waste. While the dependent variable in this study is the amount of malaria spread. The models that will be formed in this research are:

$$spread\ of\ malaria\ = \alpha\ + \beta_1 littering\ behavior + \beta_i X_i + \varepsilon$$

RESULTS AND DISCUSSION

In this study, the regression results are shown in table 1 to table 5. The results of the data processing are done by adding several control variables to support the analysis process carried out. The addition of control variables to the model to determine the strength of the model, both in terms of direction and significance.

Table 1a. The Effect of Community Waste Disposal Behavior on Facilities Provided by the Government on the Number of People Affected by Malaria Outbreaks

r709dk3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0740077	.0150945	-4.90	0.000	-.1035929	-.0444226
_cons	.178617	.0090014	19.84	0.000	.1609743	.1962598

Table 1b. The Effect of Community Waste Disposal Behavior on Facilities Provided by the Government on the Number of People Who Died Due to Malaria Outbreaks

r709dk4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0011083	.000354	-3.13	0.002	-.0018021	-.0004144
_cons	.0018689	.0002471	7.56	0.000	.0013845	.0023532

Based on Tables 1a and 1b, community waste disposal behavior has a significant effect on the spread of malaria. This result is seen in the coefficient of the resulting variable is negative. The better the behavior of the community in disposing of waste, it can reduce the spread of malaria. The good behavior of the community is represented by the behavior of the community in disposing of waste in facilities that have been provided by the government. Facilities that have been provided by the government will usually be transported using vehicles, and disposed of in landfills located far from settlements. Various forms of community waste disposal patterns such as throwing in places that should not be and burning garbage. However, not a few people also dispose of their garbage by regularly transporting the garbage, assisted by cleaning staff to the final waste disposal site. It can be seen that households disposing of waste and then transporting it provide good results for the

spread of the malaria epidemic. This behavior reduces the spread of malaria, both the number of sufferers and the number of sufferers who die from the outbreak.

To deal with the waste problem as a whole, it is necessary to do alternative management. There are three assumptions in waste management that must be replaced with new principles. Disposed waste must be segregated, so that each part can be composted or recycled optimally, rather than being dumped into the current mixed waste disposal system [23]. The industrial sector must redesign their products to facilitate the process of recycling these products.

Table 2a. The Influence of Community Waste Disposal Behavior on Facilities Provided by the Government on the Spread of Malaria Outbreaks by Island

r709dk3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0448537	.0157661	-2.84	0.004	-.0757552	-.0139523
pulau						
2	-.1121469	.0127825	-8.77	0.000	-.1372005	-.0870934
3	.5211065	.0682626	7.63	0.000	.3873124	.6549006
4	-.018601	.0250734	-0.74	0.458	-.0677447	.0305427
5	.0688008	.027589	2.49	0.013	.0147266	.122875
6	.0700562	.0282884	2.48	0.013	.0146111	.1255012
_cons	.1577235	.0118398	13.32	0.000	.1345176	.1809293

Table 2b. The Effect of Community Waste Disposal Behavior on Facilities Provided by the Government on the Number of People Who Died Due to Malaria Outbreaks by Island

r709dk4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0007967	.0003611	-2.21	0.027	-.0015043	-.000089
pulau						
2	-.0006736	.0004067	-1.66	0.098	-.0014707	.0001236
3	.0024042	.0013937	1.73	0.085	-.0003275	.0051359
4	.000645	.0008555	0.75	0.451	-.0010317	.0023217
5	-.0003208	.0005443	-0.59	0.556	-.0013876	.0007459
6	.0018536	.0008803	2.11	0.035	.0001281	.003579
_cons	.0016139	.0003424	4.71	0.000	.0009428	.002285

When compared regionally, where the island of Sumatra is the basis, then the island of Java has a significantly lower influence. This is because Java is the center of the economy and government, so this will have a positive impact on other aspects, including health. The islands of Nusa Tenggara and Bali, as well as the islands of Maluku and Papua, have a significantly higher influence than the islands of Sumatra. Islands that are still full of trees tend to have a big impact. This is due to the malaria breeding process which tends to be faster in areas with high humidity.

The trend of positive cases of malaria and the number of malaria sufferers (Annual Parasite Incidence/API) shows a high concentration of malaria endemic districts or cities in Eastern Indonesia [24]. Based on data from the Ministry of Health, around 86% of malaria cases occurred in Papua Province with a total of 216,380 cases in 2019 [25], [26]. Then, followed by East Nusa Tenggara Province with 12,909 cases and West Papua Province with 7,079 cases [27]. However, there are still high endemic areas in central Indonesia, precisely in North Penajaman Paser Regency, East Kalimantan Province [28].

Meanwhile, there are about 300 districts and cities (58%) that have entered the elimination category, or about 208.1 million people (77.7%) live in malaria-free areas. Several provinces in Indonesia, 100% of their territory was successfully included in the elimination category, namely DKI Jakarta, East Java, and Bali [29], [30].

The highest malaria cases in 2021 are still concentrated in eastern Indonesia. Papua is the province with the highest malaria cases in the country, reaching 86,022 cases to date. The proportion of malaria cases that occurred in the province reached 90.9% of the total [31]. Then, followed by East Nusa Tenggara with malaria cases reaching 2,393 cases (2.5%). After that, there was West Papua with 1,841 cases of malaria (1.94%) [31].

Meanwhile, Bengkulu, Banten, and DI Yogyakarta are the provinces with the lowest malaria cases. Currently Bengkulu is a province free from malaria cases. Then, in Banten there was only 1 case of malaria (0.001%), and in DI Yogyakarta there were only 4 cases of malaria (0.004%).

The weather factor is one of the main causes of the spread of malaria in the eastern region [32], such as in Mimika, Papua. Weather in Mimika is difficult to predict, even by the Meteorology, Climatology and Geophysics Agency (BMKG) in the region. Even though the rainy season is expected to last several months, sometimes intense heat can overwhelm Mimika [33]. This makes people's bodies more susceptible to malaria.

Symptoms of malaria, which are similar to symptoms of mild illness, also make it difficult for people in high endemic areas to identify that they are infected with malaria, so medical treatment takes a long time. In addition, the difficulty of identification also makes the source of the cause of infection too late to be handled and transmission to many people already occurs; such as water reservoirs that have become nests of parasite-carrying mosquitoes and are still used for consumption. People who have been infected and recovered are also easily re-infected with malaria due to not taking precautions. Then, community settlements themselves are also still prone to being surrounded by mosquito nests because there are lots of puddles when the rainfall is high, coupled with an unsanitary environment.

Table 3a. The Effect of Distance to Health Centers and Ease of Access on the Spread of Malaria Outbreaks

r709dk3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0571224	.016035	-3.56	0.000	-.0885509	-.0256939
r704dk3	.0008553	.0004375	1.95	0.051	-2.25e-06	.0017129
r704dk4	.0137006	.0107653	1.27	0.203	-.0073994	.0348005
_cons	.1319966	.0210881	6.26	0.000	.0906641	.173329

Table 3b. The Effect of Distance to Health Centers and Ease of Access on the Number of Malaria Patients Who Died

r709dk4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0009727	.0003851	-2.53	0.012	-.0017276	-.0002179
r704dk3	.0000294	.000014	2.10	0.035	2.02e-06	.0000567
r704dk4	-.0002875	.000297	-0.97	0.333	-.0008696	.0002945
_cons	.0019141	.0005996	3.19	0.001	.000739	.0030893

If you look at the condition of health facilities, especially health centers, the distance from the village to the puskesmas has a positive impact on the spread of malaria. The farther the village is from the health facilities, in this case the puskesmas, the worse the spread of malaria in an area will be. Besides, if you look at the ease of access to reach, the more difficult the access will worsen the spread of malaria. Access and quality of health services, which are used as intermediate results, greatly affect the achievement of final results in the implementation of development in the health sector.

The farther the distance to health care facilities, the greater the risk of suffering from malaria. There are various reasons why people do not go to the facilities provided by the government because the clinic's opening hours are not in accordance with the community's free time, long queues that waste time, distance from home or expensive transportation costs, perceptions of service quality, including the availability of drugs, and so on. other.

Table 4a. The Effect of Distance to Auxiliary Health Centers and Ease of Access on the Spread of Malaria Outbreaks

r709dk3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0726834	.0150925	-4.82	0.000	-.1022646	-.0431023
r704ek3	.0009068	.0004341	2.09	0.037	.0000559	.0017576
r704ek4	-.0048	.0080334	-0.60	0.550	-.0205454	.0109454
_cons	.1785465	.0138884	12.86	0.000	.1513253	.2057676

.

Table 4b. The Effect of Distance to Auxiliary Health Center and Ease of Access on the Number of Malaria Patients Who Died

r709dk4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0010537	.0003491	-3.02	0.003	-.0017379	-.0003696
r704ek3	.0000238	.0000195	1.22	0.222	-.0000144	.0000621
r704ek4	-.0000282	.0002055	-0.14	0.891	-.000431	.0003746
_cons	.0017232	.0003468	4.97	0.000	.0010435	.0024029

.

In the case of malaria transmission, delaying the time to get the right treatment can result in an increase in the number of new sufferers because (old) malaria sufferers can become a source of transmission. This delay became a critical time in the spread of malaria. The Plasmodium gametocyte stage in the patient's body will be sucked in by the vector mosquito and undergo a development process until the appearance of sporozoites in the mosquito's salivary glands and ready to be transmitted when biting [22]. As a comparison, several studies of treatment seeking behavior of dengue fever sufferers (treatment seeking behavior) provide an illustration that, in general, at first, patients will treat themselves or go to the puskesmas or general practitioner.

Table 5a. The Effect of Distance to Polyclinics/Medicine Centers and Ease of Access on the Spread of Malaria Outbreaks

r709dk3	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0354717	.0176715	-2.01	0.045	-.0701077	-.0008356
r704fk3	.0014616	.0003906	3.74	0.000	.000696	.0022273
r704fk4	.0108704	.0111066	0.98	0.328	-.0108985	.0326393
_cons	.1053725	.0206638	5.10	0.000	.0648716	.1458734

.

Table 5b. The Effect of Distance to Polyclinic/Medicine Center and Ease of Access on the Number of Malaria Patients Who Died

r709dk4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
r504a1	-.0005929	.0004224	-1.40	0.160	-.0014207	.0002349
r704fk3	.0000231	9.41e-06	2.45	0.014	4.64e-06	.0000415
r704fk4	.0000668	.0002721	0.25	0.806	-.0004665	.0006001
_cons	.0009582	.0005421	1.77	0.077	-.0001042	.0020207

Public health services in principle prioritize promotive and preventive health services. Promotive services are efforts to improve public health in a better direction and preventive ones prevent people from falling ill in order to avoid disease. Therefore, public health services are not only focused on treating individuals who are sick, but what is more important are prevention (preventive) and health promotion (promotional) efforts.The form of health services is not only Puskesmas or Community Health Centers, but also other forms of activity, either directly to improving health and preventing disease, or indirectly affecting health improvement. The forms of health services include Posyandu, health funds, polindes (village polyclinics), village medicine posts (POD), community development or community development, environmental sanitation improvements, income generating efforts and so on.

CONCLUSION

Community behavior in disposing of waste has a significant effect on the spread of malaria. The better the behavior of the community in waste disposal and management, the lower the spread of malaria will occur. In addition, access to and utilization of health facilities and services is also important in the process of treating malaria. In addition, the results of this study concluded that the farther the distance to health care facilities, the greater the risk of suffering from malaria. Government participation is needed to improve public health promotion.

REFERENCES

[1] R. P. Mahyudin, “Study of waste management issues and environmental impacts in TPA (Final Processing Sites),” Jukung (Journal of Environmental Tech), vol. 3, no. 1, 2017.
[2] R. Pushch, Waste disposal in rock. Newnes, 2013.
[3] T. Suryati, Wise and intelligent in managing waste. AgroMedia, 2009.
[4] E. R. Purwana, "Factors Influencing Community Behavior in Disposing of Garbage in the High Basin of Karang Anyar Pagesangan Timur Mataram Environment," J. Anal. Med. Bioscience, vol. 2, no. 2, pp. 181–190, 2019.
[5] N. Fauziyah, S. Sukaris, A. R. Rahim, and R. Jumadi, "Increasing Public Concern for the Environment, Especially in Waste Problems," Dedication MU J. Community Serv., vol. 2, no. 4, pp. 561–565, 2020.
[6] H. R. Sudrajat, Managing municipal waste. Self-Help Commerce, 2006.
[7] H. J. Kristina, “A Conceptual Model for Measuring the Adaptability of Waste Banks in Indonesia,” J@ti Undip J. Tek. Ind., vol. 9, no. 1, pp. 19–28, 2014.
[8] E. Damanhuri and T. Padmi, “Waste management,” Diktat TL lectures, vol. 3104, pp. 5–10, 2010.
[9] S. F. Azzahra and F. Faradiba, “Impact of Soil Pollution on Increasing Temperature in Indonesia,” Asian J. Adv. res. Reports, vol. 15, no. 7, pp. 43–49, 2021.
[10] R. Hasibuan, “Analysis of the impact of household waste/garbage on environmental pollution,” J. Ilm. Advocacy, vol. 4, no. 1, pp. 42–52, 2016.
[11] D. Indrawati, “Efforts to control river pollution caused by garbage,” Indonesia. J. Urban Environment. Technol., vol. 5, no. 6, pp. 185–192, 2011.

[12] E. Naryono and S. Soemarno, “Design of a system of sorting, drying and burning household organic waste,” Indonesia. Green Technol. J., vol. 2, no. 1, pp. 27–36, 2013.
[13] T. P. Ps, Handling and processing of waste. Group Self-Help Spreader, 2008.
[14] M. N. I. Nur, “Waste Damages the Environment.”
[15] S. Wahyono, “Management of paper waste in Indonesia,” J. Teknol. Lingkung., vol. 2, no. 3, 2011.
[16] P. Malmros, T. Sigsgaard, and B. Bach, “Occupational health problems due to garbage sorting,” Waste Manag. Res., vol. 10, no. 3, pp. 227–234, 1992.
[17] Z. Sholichah, “Rat Free House,” BALABA J. RITBANG Controller. BANJARNEGARA ANIMAL SOURCE DISEASES, p. 29, 2008.
[18] M. Musrifah, “The Relationship Between Organic Waste Generation And The Number Of Parasitic Worms In Rats At Dr. Hospital. Kariadai Semarang." Diponegoro University, 2005.
[19] A. F. Cowman, J. Healer, D. Marapana, and K. Marsh, “Malaria: biology and disease,” Cell, vol. 167, no. 3, pp. 610–624, 2016.
[20] W. H. Organization, World malaria report 2015. World Health Organization, 2016.
[21] S. T. T. Sutarto, “Environmental factors, behavior and malaria disease,” AGROMEDICINE UNILA, vol. 4, no. 1, pp. 173–184, 2017.
[22] L. Handayani and S. Pebrorizal, “Risk factors for transmission of vivak malaria,” Ber. Doctor. Masy., vol. 24, no. 1, pp. 38–43, 2008.
[23] A. Kahfi, “Overview of waste management,” Jurisprud. Jur. Law Science. Fac. Sharia and Law., vol. 4, no. 1, pp. 12–25, 2017.
[24] F. Mau, “The relationship between rainfall and temperature with malaria in Southwest Sumba Regency, East Nusa Tenggara Province, Indonesia,” Bul. researcher. Health., vol. 46, no. 2, pp. 129–134, 2018.
[25] E. Kenangalem et al., “Malaria morbidity and mortality following the introduction of a universal policy of artemisinin-based treatment for malaria in Papua, Indonesia: A longitudinal surveillance study,” PLoS Med., vol. 16, no. 5, p. e1002815, 2019.
[26] S. Dini et al., “The risk of morbidity and mortality following recurrent malaria in Papua, Indonesia: a retrospective cohort study,” BMC Med., vol. 18, no. 1, pp. 1–12, 2020.
[27] L. Hananta, I. Astuti, A. H. Sadewa, J. Alice, and J. Hutagalung, “The prevalence of CYP2B6 gene polymorphisms in malaria-endemic population of Timor in East Nusa Tenggara Indonesia,” Osong public Heal. res. Perspect., vol. 9, no. 4, p. 192, 2018.
[28] L. Waris and Y. Suryatinah, “Knowledge, Attitudes and Behavior of the Community towards Malaria in Kekayap Village, Nunukan Regency, East Kalimantan Province,” J. Buski, vol. 4, no. 1, p. 21431, 2012.
[29] B. Roosihermiatie and R. Rukmini, “Analysis of Malaria Elimination Policy Implementation in Bali Province,” Bul. researcher. Sis. Health., vol. 15, no. 2, p. 21338, 2012.
[30] R. Mayasari, D. Andriayani, and H. Sitorus, “Risk factors associated with the incidence of malaria in Indonesia (continued analysis of Riskesdas 2013),” 2016.
[31] H. S. B. Hastuty and D. W. Setyowati, “SPATIAL DISTRIBUTION OF MALARIA PATIENTS IN EAST SENTANI DISTRICT, JAYAPURA REGENCY,” Sebatik, vol. 25, no. 1, pp. 68–73, 2021.
[32] F. Faradiba, “The effect of rainfall on the spread of malaria in Indonesia,” Int. J. Community Med. Public Heal., vol. 8, no. 3, pp. 1146–1150, 2021.
[33] S. Suwito, U. K. Hadi, S. H. Sigit, and S. Sukowati, “Climate relationship, Anopheles mosquito density and incidence of malaria,” J. Entomol. Indonesia., vol. 7, no. 1, p. 42, 2010.