
ORIGINAL RESEARCH**THE EFFECT OF CAREGIVER MALARIA PREVENTION KNOWLEDGE AND BEHAVIOR ON MALARIA RATES IN TODDLERS***Pengaruh Pengetahuan dan Perilaku Pengasuh Terhadap Pencegahan Kejadian Malaria Pada Balita*

Nopia Wati¹, Agus Ramon¹, Emma Rachmawati², Al. Asyary Upe³, Hasan Husin⁴, M.Amin⁴, Oktarianita Oktarianita⁴

¹Faculty of Health Sciences, Public Health Studies Programs, University of Muhammadiyah Bengkulu, nopia@umb.ac.id

²Public Health Study Programs, Pascasarjana School, University Muhammadiyah Prof. Dr. Hamka, emma_rachmawati@uhamka.ac.id

³Health Study Programs, Pascasarjana School, University of Muhammadiyah Prof. Dr. Hamka, al.asyary13@gmail.com

⁴Faculty of Health Sciences, Public Health Studies Programs, University of Muhammadiyah Bengkulu, hasanhusin355@gmail.com

Corresponding Author: Nopia Wati, nopia@umb.ac.id, Faculty of Health Sciences, Public Health Studies Programs, University of Muhammadiyah Bengkulu, Bali Street, Bali, Segara Bay, Bengkulu City, Bengkulu, 38119, Indonesia

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ABSTRACT

Background: The morbidity rate for toddlers with malaria in Indonesia had increased from 2013. Bengkulu city is a malaria-endemic area in Indonesia. Caregivers are people who stay with toddlers daily. **Purpose:** This study intended to identify the correlation between the malaria prevention knowledge and behavior of caregivers and malaria rates among toddlers in Basuki Rahmad Health Center in Bengkulu City. **Method:** This research was conducted in the Basuki Rahmad Health Center in Bengkulu City from March to April 2018. The research design was cross-sectional. The population size was 1,575 and the sample size was 127. Data were analyzed by descriptive statistics and the chi-squared test. **Results:** The majority of caregivers were female, with a low educational background, with good knowledge of malaria that was not reflected in their behavior. There was a relationship between knowledge of the signs and symptoms of malaria ($p = 0.01$), knowledge of malaria prevention practices ($p = 0.01$), health behaviors ($p = 0.01$), and use of malaria prevention practices ($p = 0.01$) and malaria in toddlers. **Conclusion:** There was a significant correlation between caregiver knowledge of the signs and symptoms of malaria, knowledge of malaria prevention practices, health service use, use of prevention practices, and malaria incidence in toddlers.

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ABSTRAK

Latar Belakang: Angka morbiditas malaria pada balita di Indonesia pada tahun 2013 meningkat. Bengkulu salah satu daerah yang endemis malaria di Indonesia. Pengasuh adalah seseorang yang tinggal bersama dan merawat balita setiap hari. **Tujuan:** Penelitian ini bertujuan untuk mengidentifikasi hubungan antara pengetahuan dan perilaku pengasuh balita tentang pencegahan malaria di Puskesmas Basuki Rahmad, Kota Bengkulu. **Metode:** Penelitian ini dilakukan di wilayah kerja Puskesmas Basuki Rahmad Kota Bengkulu pada bulan Maret-April tahun 2018. Desain penelitian adalah cross-sectional. Populasi dalam penelitian ini berjumlah 1,575 orang, dan jumlah sampelnya adalah 127 dengan hipotesis rumus uji berbeda dua proporsi. Data dianalisis secara deskriptif, dan menggunakan uji chi square. **Hasil:** Mayoritas pengasuh adalah perempuan, memiliki latar belakang pendidikan yang rendah, dan memiliki pengetahuan yang baik tentang malaria, namun hal tersebut tidak tercermin dalam perilakunya. Uji statistik menunjukkan adanya hubungan antara tanda dan gejala malaria ($p = 0,01$), pengetahuan praktik malaria ($p=0,01$), kesehatan perilaku ($p = 0,01$), dan praktik pencegahan malaria ($p = 0,01$) dengan kejadian malaria pada balita. **Kesimpulan:** Terdapat hubungan yang signifikan antara pengetahuan pengasuh tentang perawatan, tanda-tanda, gejala penyakit, dan pencegahan malaria serta pemanfaatan layanan kesehatan dalam pencegahan malaria dengan kejadian malaria pada balita.

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INTRODUCTION

Malaria is an infectious disease caused by a parasitic genus of plasmodium, consisting of four species –plasmodium vivax, plasmodium falciparum, plasmodium malariae, and plasmodium ovale. Malaria can be transmitted through Anopheles mosquitoes that have been infected with malaria parasites (Arwati, Yotopranoto, Rohmah, & Syafruddin, 2018). Malaria infections lead to symptoms such as fever, chills, anemia, and jaundice (Sucipto, 2015).

In Indonesia alone, there were 417,819 positive cases of malaria in 2012, which declined by almost half in 2016 to 218,450 cases. Indonesia has made progress in eradicating malaria. Out of a total population of 258.90 million in 2016, 178.70 million (69%) were living in malaria-free areas, but 16.50 million people still live in high and medium risk areas. Compared to the previous year, there was an increase in the percentage, along with the number, of cities/regencies that had eliminated malaria in 2016 (as many as 247 cities/regencies). In 2013, the malaria morbidity rate of children in

Indonesia under the age of five was 1.9%; this figure was quite high compared to other age groups and had doubled from the previous year (Ministry of Health RI, 2017).

The under-five period is an important period in the process of human development. At this time, the immune system has not been fully formed. Therefore, children under the age of five are more susceptible to infection. This leads under-five children to be vulnerable to various infectious diseases, such as malaria (Saputro & Siwiendrayanti, 2015).

Malaria in under-five children can cause growth and developmental disorders. Plasmodium damages red blood cells and anemia may occur. When the red blood cells rupture, the parasite is released into the bloodstream. Normally, the body's mechanisms to fight parasites through an inflammatory reaction will occur. When an inflammatory reaction occurs, the child's body temperature will increase. If not immediately addressed, the child can experience spasms and spontaneous oxygen supply to brain cells will be reduced. If this occurs repeatedly, it can affect the

development and intelligence of the child (Chourasia et al., 2017).

A caregiver is the person who accompanies under-five children in everyday life. It can be a mother, grandmother, father, or other caregiver who takes care of the child. These caregivers must have good knowledge and behaviors in relation to malaria prevention, to ensure the child is not easily affected by malarial infectious diseases. According to some studies of malarial prevention, behaviors that are not conducive to prevention include outdoor activities at night (Arsin, 2016).

Bengkulu city is a malaria-endemic area in Indonesia. The cause of a number of malaria cases in Bengkulu City in February 2018 was the transition period (seasonal change). Based on data from 17 Public Health Centers (Puskesmas), it was revealed that most malaria patients lived in slum areas. In 2015, the Basuki Rahmat Health Center saw 2,180 cases of malaria. In 2016, the Basuki Rahmat Health Center treated the highest incidence of malaria in Bengkulu city, with 2,311 cases (826 men and 1,485 women). The highest level of malaria morbidity in Basuki Rahmat Health Center in 2016 was caused by malaria, with 645 cases (26%). In 2017, the monthly report data from Puskesmas Basuki Rahmat of malaria incidence from January to May identified 589 malaria cases, 240 of which were toddlers (Bengkulu Health Office, 2018). The purpose of this research is to determine the relationship between caregiver malaria prevention knowledge and behavior and the incidence of malaria in under-five children in Puskesmas Basuki Rahmat in Bengkulu City.

METHOD

This research used a cross-sectional design. Sampling was conducted using a proportional simple random sampling system. This research was conducted in Basuki Rahmat Public Health Center of Bengkulu City, from 21 March to 21 April 2018. The population in this study was 1,575 people. Determination of the number of samples taken based on the calculation of the different hypothesis formula of two proportions in the cross-sectional study which is 127 caregivers. Primary data was gathered using a questionnaire. Secondary data were gathered from the data reports of the Basuki Rahmat Public Health Center. The dependent variable was malaria incidence; the independent variables were age (advanced adult: >45 years; adult: 18–45 years), gender, education (high: high school–college;

low: <high school), knowledge (low: <70% correct answers; high: ≥70% correct answers), health services use (not good: mean <21; good: mean ≥21), and malaria prevention practices (not good: mean <20; good: mean ≥20). Inclusion criteria for this research was caregivers who lived in the Basuki Rahmat Public Health Center area, who cared for toddlers, and who were willing to participate in research as evidenced by informed consent. Exclusion criteria for this research were caregivers who lived outside the Basuki Rahmat Public Health Center area. Univariate and bivariate analyses were used, as well as a chi-squared test.

RESULTS

Characteristics of Respondents

Almost children under five suffer from malaria was 57 of 127 children (44.88%) (see Table 1). The majority of caregivers of toddlers are female (94.49%), adults (62.99%), and have a low level of education (59.84%). Most respondents had a good level of knowledge about the signs, symptoms, and cause of malaria (55.90%). Approximately half the respondents had a good level of knowledge about health service use (50.40%). Most of the respondents had a good level of knowledge about malaria prevention practices (63.00%). Most respondents displayed behavior in relation to the use of health service that was not good (53.50%). Most respondents engaged in a level of malaria prevention practices that were classified as not good (52.00%).

Relationship between caregiver knowledge and malaria incidence in toddlers

The caregivers with less knowledge of the signs, symptoms, and causes of malaria, 37 had under-five children (29.13%) suffering from malaria. The 71 caregivers with a good level of knowledge, 51 had under-five children (40.16%) who did not suffer from malaria. The chi-squared test provided a p value of 0.01 (<0.05), which means there is a significant correlation between caregiver knowledge of the signs, symptoms, and cause of malaria and the incidence of malaria in children under five. The prevalence ratio (PR) value was 4.97 (2.33–10.59), which means that children under five with a caregiver with less knowledge are 4.97 times more at risk of developing malaria than children under five with a caregiver with good knowledge (see Table 2).

The caregivers with less knowledge of health services, 32 had under-five children (25.20%) suffering from malaria. The caregivers who had a

good level of knowledge, 39 had under-five children (30.71%) who did not suffer from malaria. The chi-squared test provided a p value of 0.32 (>0.05), which means there is no significant correlation between caregiver knowledge of health services and the incidence of malaria in children under five.

The caregivers with less knowledge of malaria prevention practices, 34 had children under five (26.77%) with malaria. The caregivers who had a good level of knowledge, 57 had children under five (44.88%) who did not suffer from malaria. The chi-squared test provided a p value of 0.01 (<0.05), which means there is a significant correlation between caregiver knowledge of malaria prevention practices and the incidence of malaria in under-five children. The PR value was 6.48 (2.91–14.45), which means that children under five with caregivers with less knowledge are 6.48 times more at risk of developing malaria than children under five with caregivers with a good level of knowledge (see Table 2).

Relationship between caregiver behavior and malaria incidence in toddlers

The caregivers who engaged in behavior related to healthcare use that was classified as not good, 13 had under-five children (10.24%) who suffered from malaria. The caregivers who engaged in good behavior, 15 had under-five children (11.81%) who did not suffer from malaria. The chi-squared test provided a p value of 0.01 (<0.05), which means there is a significant correlation between the behavior of healthcare use and the incidence of malaria in toddlers. The PR value was 0.08 (0.04-0.19), meaning that children under five with caregivers who do not engage with health services are 0.081 times more likely to develop malaria. Caregivers do not take advantage of health services that have been provided by the government due to a lack of understanding (see Table 2).

The caregivers who engaged in behavior related to malaria prevention practices that was classified as not good, 15 had under-five children (11.81%) who suffered from malaria. The caregivers who engaged in good behavior related to malaria prevention practices, 19 had children under five (14.96%) who did not suffer from malaria. The chi-squared test provided a p value of 0.01 (<0.05), which means there is a significant correlation between malaria prevention practice and the incidence of malaria in under-five children. The PR value was 0.13 (0.06–0.29),

which means that children under five who have caregivers who do not engage in malaria prevention behaviors are 0.13 times more likely to develop malaria (see Table 2).

DISCUSSION

Relationship between Caregiver Knowledge And Malaria Incidence in Toddlers

Signs, Symptoms, and Causes of Malaria

The knowledge of the caregivers about the signs, symptoms, and causes of malaria was quite good, as many caregivers answered these questions correctly. Many caregivers were aware that malaria is a disease transmitted by mosquitoes that contain malaria plasmodium parasites; however, they were not aware of the type of mosquitoes because they do not receive this information. Caregivers also know that malaria arises because of a dirty environment and are aware of the early signs and symptoms – high fever, sweating, headache, bone and muscle pain, nausea, and vomiting. However, caregivers cannot distinguish between malaria and other diseases, meaning the responses of caregivers to the signs and symptoms of malarial disease in children vary.

In relation to questions about the severity of malaria in children under five, caregivers were aware that symptoms begin to appear 10 days to four weeks after being bitten, and include weakness, lack of appetite, and fever. For the signs of malaria in children under five, such as the appearance of red spots on the skin, bleeding, vomiting, abdominal pain, and diarrhea, many caregivers were aware that these related to malaria, but are also related to other diseases, such as dengue fever (Sucipto, 2015).

This research showed that there is a significant correlation between caregiver knowledge of the signs, symptoms, and causes of malaria and the incidence of malaria in under-five children. Similar results were also presented by Arsin (2016), who stated that the level of public knowledge about malaria is related to malaria incidence (p value = 0.00). However, the level of public knowledge about malaria had no relationship with the incidence of malaria in Shashogo District, Southern Ethiopia (Gone, Lemango, Eliso, Yohannes, & Yohannes, 2017).

Health Service Use

This research found no correlation between caregiver knowledge of health service use and the incidence of malaria in under-five children. This

study is inconsistent with Thandar, Kyaw, Jimba, & Yasuoka (2015) who found that public health service knowledge becomes the decisive factor in the search for treatment and reduces the incidence of malaria in under-five children. Healthcare is an effort that is self-administered or administered jointly within an organization, to maintain and improve health, prevent and cure disease, and restore the health of individuals, families, groups, or communities (Baiden et al., 2016).

Knowledge of Malaria Prevention Practices

The results of this research indicate that there is a correlation between caregiver knowledge of malaria prevention practices and the incidence of malaria in under-five children in the Basuki Rahmad Health Center area of Bengkulu City. Some caregivers still engage in the burning of cardboard, coconut husks, and egg cartons to repel mosquitoes malaria. Some caregivers believe that malaria can be prevented by burning garbage near the house, so that the combustion fumes will go into the house and repel mosquitoes. These caregivers are unaware of the side effects of incomplete smoke burning, which can produce toxic substances that interfere with health. The caregivers were also unaware of the types of plants that can repel malaria mosquitoes, such as lavender, geranium, rosemary, and citronella (Harijanto, Gunawan, & Nugroho, 2017).

Most caregivers had a good level of knowledge in relation to preventing mosquito bites, including sleeping with mosquito nets, mosquito-proofing the house using wire mesh, use

of mosquito coils, and spraying the bedroom with mosquito spray. They were also aware that keeping fish that feed on mosquito larvae, such as tin head fish, guppy fish, indigo fish, and mujair fish, can help in prevention (Freeman et al., 2017).

Knowledge is the result of human understanding of an object through their senses (eyes, nose, ears). Knowledge is strongly influenced by the intensity of attention and the perception of the object. Therefore, individual knowledge greatly affects public health, especially knowledge that is closely related to the prevention of malaria (Sari, 2016). Caregivers who have a higher level of education will have good knowledge and behavior in relation to malaria prevention, meaning it will be easier to implement in everyday life. The most effective efforts to prevent malaria involve avoiding *Anopheles* mosquito bites. These efforts include personal protection, behavior modification, and environmental modification. Personal protection includes the use of insecticides and repellent, long-sleeved shirts, and long pants. Behavior modification includes reducing activities outside the home between dusk and dawn (Oluwasogo, Henry, Abdulrasheed, Olawumi, & Olabisi, 2016).

Environmental modification includes removing stagnant water, eliminating mosquito breeding spots (such as used tins, bathtubs, scrap tires), removing reeds or shrubs, reducing mosquito breeding, eradicating adult *Anopheles* vectors, preventing human contact with vectors, eradicating malaria parasites, and social participation (Lumolo, Pinontoan, & Rattu, 2015).

Table 1
Characteristics of Respondents

| Characteristics | Malaria Incidence | | | | | |
|----------------------------|-------------------|--------------|-----------|--------------|------------|---------------|
| | Yes | | No | | Total | |
| | n | % | n | % | n | % |
| Age | | | | | | |
| Adult advanced (>45) | 30 | 23.62 | 17 | 13.39 | 47 | 37.00 |
| Adult (18–45) | 27 | 21.26 | 53 | 41.73 | 80 | 62.99 |
| Gender | | | | | | |
| Male | 0 | 0.00 | 7 | 5.51 | 7 | 5.51 |
| Female | 57 | 44.88 | 63 | 49.61 | 120 | 94.49 |
| Education | | | | | | |
| Low (<high school) | 35 | 27.56 | 41 | 32.28 | 76 | 59.84 |
| High (high school–college) | 22 | 17.32 | 29 | 22.83 | 51 | 40.16 |
| Status of caregiver | | | | | | |
| Other caregiver | 38 | 29.92 | 16 | 12.60 | 54 | 42.52 |
| Parent | 19 | 14.96 | 54 | 42.52 | 73 | 57.48 |
| Total | 57 | 44.88 | 70 | 55.12 | 127 | 100.00 |

Table 2
Relationship between Caregiver Knowledge and Behavior with Malaria Incidence in Toddlers

| Knowledge and Behavior | Malaria Incidence | | | | Total | | P | OR 95% CI |
|---------------------------------------|-------------------|-------|----|-------|-------|--------|------|----------------------|
| | Yes | | No | | n | % | | |
| | n | % | n | % | | | | |
| Knowledge | | | | | | | | |
| Signs, symptoms, and cause of malaria | | | | | | | | |
| Not good | 37 | 29.13 | 19 | 14.96 | 56 | 44.09 | 0.01 | 4.97 (2.33–0.59) |
| Good | 20 | 15.75 | 51 | 40.16 | 71 | 55.91 | | |
| Health service use | | | | | | | | |
| Not good | 32 | 25.20 | 31 | 24.41 | 63 | 49.61 | 0.48 | |
| Good | 25 | 19.68 | 39 | 30.71 | 64 | 50.39 | | |
| Malaria prevention practice | | | | | | | | |
| Not good | 34 | 26.77 | 13 | 10.24 | 47 | 37.00 | 0.01 | 6.48 (2.91–14.45) |
| Good | 23 | 18.11 | 57 | 44.88 | 80 | 62.99 | | |
| Behavior | | | | | | | | |
| Health service use | | | | | | | | |
| Not Good | 13 | 10.24 | 55 | 43.31 | 68 | 53.54 | 0.01 | 0.08 (0.04–0.19) |
| Good | 44 | 34.64 | 15 | 11.81 | 59 | 46.46 | | |
| Malaria prevention practice | | | | | | | | |
| Not Good | 15 | 11.81 | 51 | 40.16 | 66 | 51.97 | 0.01 | 0.13 (0.06–0.29) |
| Good | 42 | 33.07 | 19 | 14.96 | 61 | 48.03 | | |
| Total | 57 | 44.88 | 70 | 55.12 | 127 | 100.00 | | |

The study is in line with Lario, Bidjuni, & Onibala (2016) who found that knowledge of malaria prevention should be intensified by the National Malaria Control Program in all regions of Indonesia to reduce the prevalence of malaria, especially among children under the age of five in Ghana. Humans are an intermediate host, as asexual cycles of plasmodium occur in the human body. Mosquitoes are the definitive host, as the plasmodium sexual cycle occurs in the mosquito body. In principle, anyone can be infected with plasmodium, as the human body is a breeding ground (Sucipto, 2015).

Relationship between Caregiver Behavior and Malaria Incidence in Toddlers

Health Service Use

Based on the results of this research, there is a significant correlation between the health service use behavior of caregivers and the incidence of malaria in children under the age of five in the Basuki Rahmad Health Center area of Bengkulu City. Not all caregivers engage in good behavior related to the use of health services; there are still many cases of malaria in children under five because some caregivers only occasionally check the health of the children they are caring for and only bring them to healthcare facilities if the child is sick. There are also caregivers who treat

malnourished under-five children using traditional food stalls and medicines (shamans) because the caregivers sometimes do not have the time to take the child to be treated at a health center or by a midwife or doctor, because of the distance to remote service facilities (Keptiyah, Martini, & Saraswati, 2017). This result is in line with Thandar, Kyaw, Jimba, & Yasuoka (2015) research which states that behavior searching research, who found that the behavior of caregivers at the time the baby was cared for had a malaria fever was not good. It caused an increase in the incidence of malaria in children under five in rural Myanmar. Only one-third of caregivers showed appropriate treatment-seeking behavior.

Malaria Prevention Behavior

This research indicates that there is a significant correlation between caregiver malaria prevention behavior and the incidence of malaria in children under five. The risk of children under five who have caregivers who do not engage in good prevention behavior against contracting malaria is 0.13 times higher than those that do. This is because caregivers are not engaging in malaria prevention behaviors, such as using mosquito nets and mosquito repellent during the night, spraying insecticide indoors, removing wild plants or shrubs around the home, and not using mosquito repellent plants (such as lavender,

geranium, rosemary, and citronella). This study is in line with previous research, which found a correlation between the behavioral factors of malaria prevention (nighttime habits, the use of mosquito nets) and malaria incidence in Silian Raya District and Minahasa Tenggara District (Akay, Tuda, & Pijoh, 2015). Other research by Roberts & Matthews (2016) found that malaria prevention through indoor residual spraying (IRS) and safe living habits (reducing outdoor activity during peak biting hours) significantly reduced the risk of malaria in children under five in Uganda.

Human behavior associated with malaria can be explained as a way of life. Our way of life has an effect on the transmission of malaria, such as the habit of not wearing mosquito repellent while sleeping. As has been seen in the Central Sulawesi Province, people who do not engage in anti-mosquito behaviors are 0.144 times more likely to contract malaria than people who do (p value <0.05). This result is in line with Lario et al (2016) research, who showed that the actions to protect family members from mosquito bites has a significant with malaria incidence with the result of OR = 6.891 (Lario et al., 2016). Caregiver education greatly determines the health status of children under five in the community. Research has shown that children who are malnourished and have uneducated caregivers are more likely to contract malaria (Romay-Barja et al., 2015).

The use of insecticide-treated bed nets to prevent malaria incidence in pregnant women is influenced by the high-cost factor of insecticide-treated nets and the public perception that insecticides are harmful to pregnant women. Another factor that can reduce the coverage of mosquito nets in pregnant women are husbands who are not interested in using mosquito nets (Iwuafor et al., 2016). Several studies have shown that regular use of bed nets at night can reduce the incidence of malaria. Research in Africa found that the use of insecticide-treated bed nets is one of the best ways to protect children from malaria. Due to the slow distribution of bed nets, nearly 90 million children under the age of five have not used mosquito nets (Shah, Emina, Eckert, & Ye, 2015).

Prevention of Anopheles mosquitoes through simple means can be done by all levels of society, such as avoiding or reducing bites from malaria mosquitoes by sleeping inside a mosquito net, avoiding outdoor activities at night, using mosquito repellent (repellent or coils), installing gauze on vents, keeping cattle livestock at least 200 meters from the home, cleaning mosquito nesting places (such as shrubs or shade trees

around the house), folding hanging fabric, trying to keep the house sufficient lighting and not in humid conditions, and removing puddles from around the house. Interventions through the use of mosquito nets are often carried out by the community and are one of the main intervention types in the malaria control program (Sucipto, 2015).

Malaria is spread through three interrelated components – host, agent, and environment. This chain of transmission means the efforts to prevent and control malaria through the termination of one component of the chain are very effective (Oyekale, 2015). Vector eradication efforts should be conducted more thoroughly, by killing adult mosquitoes, spraying houses, and installing insecticide-treated mosquito nets. Eradication of larvae is conducted through larvicide activities and eliminating or reducing mosquito breeding places (Sucipto, 2015).

Education is the determinant factor for knowledge. From the results of this study, it can be seen that education level is not related to knowledge of malaria prevention, as many caregivers were highly educated but lacked knowledge. This is because they only consider malaria prevention in urgent situations, such as during the rainy season and in the presence of many mosquitoes. Knowledge of the use of mosquito nets, mesh on windows, and mosquito repellent substances differ according to the social status of the community and can affect the morbidity rate of malaria. These three factors comprise the behavior of people in malaria-endemic areas. Another factor that can also be a factor influencing the incidence of malaria is the factor of community perception that malaria prevention and treatment is an urgent matter that must be done (Sutarto, 2017).

If caregivers who have a higher level of education also possess knowledge and engage in behaviors targeted towards malaria prevention, this will be easier to implement in everyday life, as the most effective method of preventing malaria is by avoiding Anopheles mosquito bites. These efforts include personal protection, behavior modification, and environmental modification (Rachman, Harahap, Alanuari, & Suhermanto, 2017).

Research Limitation

The limitations of this study include that the questionnaire used closed question, that this research took a significant amount of time to complete because respondents had to complete a questionnaire, and that this study did not examine the characteristics of the children under five,

instead measuring only the knowledge and behavior of their caregivers. The data obtained from the research results are not maximal.

CONCLUSION

There is a significant relationship between caregiver knowledge of the signs, symptoms, and causes of malaria and malaria prevention practices, between caregiver knowledge of health services and health service use, and between malaria prevention practices and the incidence of malaria in children under five.

CONFLICT OF INTEREST

The authors declare that no conflict of interest in this study.

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