

Tropical Medicine Journal

Volume 03, No. 1, 2013

- Risk Factor of HIV Infection Among Young Age in Voluntary Counseling Testing (VCT) Clinics of Yogyakarta
- Evaluation of the Performance of Malaria Microscopist in Primary Health Center and Cross Checker in Belu East Nusa Tenggara
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- The Effect of *Pandanus conoideus* Lamik Extract to the Serum Level of TNF- α , IL-10 and Parasitemia of *Plasmodium berghei* Infected in Mice
- Comparison of Immunochromatography Method and Immunocytochemistry Method in Rapid Detection of NS-1 Antigen in Dengue Infection
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- Training of Sputum Microscopy Improves the Smear Quality and Slide Positivity Rate for Pulmonary Tuberculosis Diagnosis
- Integrated and Comprehensive Action to Reduce and Control Dengue Hemorrhagic Fever: A Survey in Pekalongan City, Central Java

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| TMJ | Volume 03 | Number 01 | Page 1 - 93 | ISSN 2089 - 2136 |
|-----|--------------|--------------|----------------|---------------------|

Center for Tropical Medicine, Faculty of Medicine, Universitas Gadjah Mada
in collaboration with Indonesian Society of Tropical Medicine and Infectious Disease (PETRI)

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TROPICAL MEDICINE JOURNAL

ISSN : 2089-2136

Center for Tropical Medicine, Faculty of Medicine, Universitas Gadjah Mada in collaboration with
Indonesian Society of Tropical Medicine and Infectious Disease (PETRI)

Volume 03, Number 01

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The Relationship of Behavior and Environment to the Incidence of Malaria in the Work Area of Oesao Public Health Center (PHC) of East Kupang Sub-District of Kupang District in 2013

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ABSTRACT

Introduction: Oesao PHC is one of three PHCs in Kupang District experiencing increased malaria cases. According to API figure, its rate in 2008 was 7.01% and in 2009 it decreased to 4.04%; however, the rate showed an increase again in 2010 up to 7.67% (Kupang District Health Office, 2010). The work area of Oesao PHC has a heterogeneous society with high malaria cases in each year; it is because the residents have habits to sleep without using nets, people perform activities at night without the use of mosquito repellent, there is an availability of mosquito *breeding place* and *resting place* and there is a lack of compliance in taking medication.

Objectives: To analyze the relationship between behavior and the environment and the incidence of malaria.

Methods: This was an observational analytic study with a case-control study design². The samples in this study were part of the populations residing within the work area of Oesao PHC of East Kupang Sub-District of Kupang District. The sample size was 116 people³ selected using a random and matching method. Data were analyzed by chi-square test for calculating the value of OR (odds ratio) to determine the magnitude of the risk².

Results: There was a significant association between the use of nets (OR = 0.061 with $p = 0.000$, $p < 0.05$), the use of mosquito repellent or anti-mosquito drugs (OR = 3.417 and $p = 0.003$, $p < 0.05$), the use of wire gauze on ventilation (OR = 7.187 with $p = 0.000$, $p < 0.05$), the condition of home walls (OR = 2.318 with $p = 0.041$, $p < 0.05$), the availability of ceiling OR = 2.657 with $p = 0.000$, $p < 0.05$), the presence of cattle sheds (OR = 4.742 with $p = 0.001$, $p < 0.05$), the presence of puddle around the home (OR = 2.007 and $p = 0.047$, $p < 0.05$), and the presence of shrubs around the home (OR = 2.706 with $p = 0.000$, $p < 0.05$) and the incidence of malaria in Oesao PHC.

Conclusion: The incidence of malaria in the work area of Oesao PHC was related to behavior and physical environment inside and outside the house.

Keywords: behavior, environment, malaria

INTISARI

Pendahuluan: Oesao Public Health Center (PHC) adalah satu dari tiga Puskesmas di Kabupaten Kupang yang sering mengalami peningkatan kasus malaria. Menurut data dari Dinas Kesehatan setempat, Annual Parasite Incidence (API) pada tahun 2008 adalah 7,01% dan pada tahun 2009 menurun menjadi 4,04% dan pada tahun 2010 meningkat lagi menjadi 7.67%. (Dinas Kesehatan Kabupaten Kupang, 2010). Wilayah kerja Puskesmas Oesao memiliki berbagai macam tempat perindukan nyamuk dengan kasus malaria yang relatif tinggi setiap tahunnya, komposisi masyarakatnya heterogen, warga memiliki kebiasaan tidur tanpa menggunakan kelambu dan banyak warga melakukan aktivitas di malam hari tanpa menggunakan pencegah gigitan nyamuk.

Tujuan: Penelitian ini bertujuan untuk menganalisis hubungan antara perilaku dan lingkungan dan kejadian malaria.

Metode: Penelitian ini merupakan penelitian observasional analitik dengan studi kasus-kontrol design. Sampel dalam penelitian ini adalah penduduk yang berada dalam wilayah kerja Puskesmas Oesao Kupang Timur Kecamatan Kabupaten Kupang. Jumlah sampel sebanyak 116 orang yang dipilih secara random Data dianalisis dengan uji chi-square untuk menghitung nilai OR (odds ratio) untuk menentukan besarnya risiko tersebut.

Hasil: Ada hubungan yang bermakna antara penggunaan kelambu (OR = 0,061; $p < 0,01$), penggunaan obat anti-nyamuk (OR = 3,417; $p < 0,05$), penggunaan kawat kasa pada ventilasi (OR = 7,187; $p < 0,01$), kondisi dinding rumah (OR = 2,318; $p < 0,05$), ketersediaan langit-langit (OR = 2,657; $p < 0,01$), keberadaan kandang ternak (OR = 4,742; $p < 0,01$), adanya genangan air di sekitar rumah (OR = 2,007; $p < 0,05$), dan adanya semak di sekitar rumah (OR = 2,706; $p < 0,01$) dengan kejadian malaria di Puskesmas Oesao.

Simpulan: kejadian malaria di wilayah kerja Puskesmas Oesao sangat berkaitan dengan perilaku dan lingkungan fisik baik di dalam maupun di luar rumah.

Kata kunci: perilaku, lingkungan, malaria

INTRODUCTION

Based on data from Indonesia Ministry of Health in 2011, there were 396 malaria endemic districts out of 495 districts in Indonesia. It is estimated that 45% of the total populations live in areas with high risk of contracting malaria. From 2007-2009, the malaria control efforts are monitored using an indicator 'Annual Parasite Incidence' (API). From 2008 to 2009 API had decreased from 2.47 to 1.85 per 1,000 populations; in fact, there are currently 12 provinces in Indonesia with API rate still above the national figure, one of which is the Province of East Nusa Tenggara (NTT)¹.

Elimination of malaria is the biggest challenge for regions with high morbidity rates. NTT is a province in eastern Indonesia that still has the highest morbidity rate in addition to Papua and Maluku.

Based on the result of mass blood survey (MBS) in 2008, NTT was the province with the highest malaria positive cases (32.321 people) and the highest maternal infection cases (624 people)².

Oesao Public Health Center is one of three PHCs in Kupang District experiencing increased malaria cases. According to API figure, the rate in 2008 was 7.01% and in 2009 it decreased to 4.04%; however, the rate showed an increase again in 2010 up to 7.67%³.

Most of the land in the work area of Oesao PHC and in the Sub-district of East Kupang is dominated by rice field area with a good irrigation system and rain-fed systems. The area is an area with few hills, rice fields, seasonal rivers, and in the dry season there are puddles formed from sand quarry. The population in Oesao is heterogeneous in its habit and behavior,

and also the condition of the environment⁴. Judging from the geographical conditions, East Kupang Sub-District is very likely to have abundant mosquito breeding places for *Anopheles sp*, and therefore, in this region every year there are always cases of malaria. The work area of Oesao PHC has a heterogeneous society, with high malaria cases each year; it is because the residents have habits to sleep without using bednets, people perform activities at night without the use of mosquito repellent, there is an availability of mosquito breeding place and resting place and there is a lack of compliance in taking their medication. Therefore, prevention of mosquito bites is needed, such as the use of mosquito nets and anti-mosquito repellents at the time of activities or sleep at night, improved environmental conditions in the home (installation of wire gauze, ceiling and good walls), and improved outside home environment (keeping cattle sheds away from the house, draining stagnant water and trimming the bushes around the house).

MATERIALS AND METHODS

This was an observational analytic study with a case-control study design to identify the causal relationship between the disease and risk factors retrospectively⁵. The sample of the study was 116 people who were determined randomly from all the population in Oesao PHC. The respondents were divided into 58 cases and 58 controls⁶. The data were statistically analysed using chi square (χ^2)-test, and to determine the influence of each independent variable to the malaria incidence, the risk factors analysis was done and the OR (odds ratio) value were calculated⁵.

RESULTS AND DISCUSSION

To analyse the relationship between factor that might contribute to the occurrence of the diseases (malaria), some behavior/habit variables were studied namely the use of mosquito/bed nets and anti-mosquito repellents. The analysis of the contribution of the used of anti mosquito net and anti mosquito repellent on the incidence of malaria infection are shown in Table 1.

Table 1. Analysis of the contribution of the used of antimosquito net and repellent to malaria incidence in Sub-District of Oesao

| Variable | Criteria | Group | | | | p value | OR (95% CI) |
|------------|----------|-------|------|---------|------|---------|---------------------|
| | | Case | % | Control | % | | |
| Mosqt-nets | Yes | 8 | 6.9 | 42 | 36.2 | >0.05 | 0.061 (0.024-0.156) |
| | No | 50 | 43.1 | 16 | 13.8 | | |
| Repellents | Yes | 41 | 35.3 | 24 | 20.7 | <0.01 | 3.417 (1.582-7.378) |
| | No | 17 | 14.7 | 34 | 29.3 | | |

Source: primary data

As shown in Table 1, the use of anti-mosquito nets has no significant contribution to the malaria incidence $p > 0.05$, which means that there was no significant relationship between the incidence of malaria and the used of anti-mosquito nets in the population of Oesao. The value of OR = 0.061

indicates that the people who do not used of anti-mosquito netting has only 0.061 times risk to have malaria diseased as compared to those used anti-mosquito net.

In othe malaria endemic area the use of mosquito nets might be the most effective efforts to

prevent mosquito bites at bedtime compared to the method such as the use of mosquito repellents. The used of insecticide containing repellent also has dissadvatage because the use of insecticide could be risky when entering the human body through inhalation or skin tissue as well as other risks from burning of anti-mosquito coil, especially those who had a respiratory system disorder¹. The non significant of the correlation between the used of anti-mosquito net to the malaria incidence in this study may also indicated that the malaria transmission in this area is occuring outside the house, such as in the rice field when people still have activities to inspect irrigation or guarding the crops or rice field during down to night time.

On the variable of the use of anti-mosquito coil or mosquito repellents, the results of the analysis showed that the p value is <0.05, which means that there was a significant relationship between the incidence of malaria and the used of mosquito repellents. The variable of the use of mosquito repellents showed significant contribution to the

incidence of malaria infection, that is, those who did not use mosquito repellents in their activity were at 3.417 times of having risks to contract malaria infection compared with those who used mosquito repellents in their activity.

Besides, considering that Oesao PHC as a malaria endemic area, mosquito bites were regarded as a common natural phenomenon and not a serious problem⁷. Thus, the government had to pay attention to the use of mosquito repellents specially when people performed activities at night, through counseling on the prevention of malaria or those who wished to go out of the house in the evening to protect them from mosquito bites by wearing long pants as well and using mosquito repellent applied to their skin surface.

The contribution of the environment factor inside the house to the malaria incidence were also studied. The result of the statistical analysis of the correlation between the used of mosquito wire, wall condition and the used of ceiling to the incidence of malaria shows in Table 2.

Table 2. Analysis of the contribution of environment factor inside the house to the incidence of malaria in Sub-District of Oesao.

| Variable | Criteria | Group | | | | p value | OR (95% CI) |
|----------------|------------|-------|------|---------|------|---------|----------------------|
| | | Case | % | Control | % | | |
| Mosqt-wire | Yes | 49 | 42.2 | 25 | 21.5 | <0.01 | 7.187 (2.979-17.335) |
| | No | 9 | 7.8 | 33 | 28.5 | | |
| Wall condition | Cement | 34 | 29.3 | 22 | 19,0 | <0.05 | 2.318 (1.101-4.881) |
| | Wood/Bambo | 24 | 21.7 | 36 | 31,0 | | |
| Ceiling | Yes | 12 | 10,0 | 13 | 11,0 | <0.05 | 2.190 0.372-0.903) |
| | No | 46 | 40,0 | 45 | 39,0 | | |

Source: primary data

As shown in Table 2, there was a significant relationship between the used of anti mosquito wire on the house ventilation, the condition of the walls and the used of ceiling to the incidence of malaria infection in the Sub-District of Oesao. The analysis

of the used of anti mosquito wire on the house ventilation factor shows value of p < 0.05 and OR of 7.187. These means that people who lived in the house without anti mosquito wire on their ventilation were at 7.187 times risk of contracting malaria

compared with those who lived in the house with anti mosquito wire. Therefore, installation of anti mosquito wire on each ventilation in the house was recommended in malaria endemic regions such as in Papua, Nusa Tenggara and Maluku⁸. The availability of anti mosquito wire on house ventilation may prevented mosquito to enter the house to seek bloodmeals, and consequently will minimized or reduced the frequency or protect the residents from mosquito bites.

Analysis of the contribution of wall condition shows that people who lived in houses with non-permanent wall such as made of wood or bamboo were at 2,318 times risk of contracting malaria compared with those who lived in the house with permanent walls made of brick and cement. Good house wall construction which was made of bricks and cement resulted in a solid wall that had no holes

that could be used as a way for the entrance sites for Anopheles mosquitoes into the house, so that this condition could reduce human contact and minimize the risk of malaria transmission.

People who lived in houses without ceiling were at 2,190 times risk of contracting malaria compared with those who lived in the house with ceiling. Houses without ceiling would allow mosquitoes to enter the house easily through the top of the house so that if the occupants in the house slept without the use of mosquito nets, the mosquito could bite and the occupants could suffer from *Anopheles* bites.

Analysis of the contribution of environment variable outside the house to the incidence of malaria infection were also studied. Three variables had been examined in this study, namely cattle shed, puddles and the presence of bushes around the house. The result of such analysis was shown in Table 3

Table 3. Analysis of the contribution of environment outside the house to the incidence of malaria in Sub-district of Oesao.

| Variable | Criteria | Group | | | | p value | OR (95% CI) |
|---------------|----------|-------|------|---------|------|---------|----------------------|
| | | Case | % | Control | % | | |
| Cattle sheds | Far | 49 | 42.2 | 31 | 26.7 | 0.000 | 4.742 (1.970-11.413) |
| | Near | 9 | 7.8 | 27 | 23.3 | | |
| Puddles | No | 34 | 29.3 | 24 | 21.7 | 0.000 | 2.007 (0.959-4.202) |
| | Yes | 24 | 21.7 | 34 | 29.3 | | |
| Shrubs/bushes | No | 8 | 7,0 | 16 | 14,0 | 0.000 | 1.0782 (0.164-0.420) |
| | Yes | 50 | 43,0 | 42 | 36,0 | | |

Source: primary data

As shown in Table 3, there was a significant contribution of the presence of cattle sheds, puddles and shrubs/bushes to the incidence of malaria with a value of $p < 0.05$. The statistical analysis of the correlation between the availability of cattle shed around the house and malaria incidence has OR value of 4,742. This means that people who lived near cattle sheds were at 4,742 times risk of contracting malaria compared with those who lived far from cattle sheds. Cattle sheds were one of the risk factors

for the spread of malaria in the community. Some Anopheles mosquito may have host preference to bite human (anthropophylic) and the another may have host preference to bite animal (Zoophylic). However if both host are available most of the mosquito will prefer human host than the animal. In this instances if the cattle sheds is closed to the house will act as attractant, and when mosquito already come they will prefer to bite human then the cattle itself. However, if the Anopheles mosquito population

in certain area has an absolut zoophylic habit, the presence of cattle sheds arround the houses might be act as barrier for malaria transmission.

The presence of some puddle arround the house is also an important variable for malaria transmission. Puddle is a common breeding places of Anopheles mosquito in a high and clay lands such as in Papua and East Nusatenggara. In the current study shows that people living close to the puddles were at 2,007 times risk of contracting malaria compared with those who lived in the house with no water stagnation. Puddles were one of the risk factors for the spread of malaria in the community because the stagnation of water served as breeding places for malaria vectors. Efforts should be made to eliminate the stagnation of water arround the houses. This effort will be successful if a very stake-holder participated such as the community, local government, public health officials as well as other related institutions.

Other environment factor that was studied is the presence of shrubs or bushes arround the house. In Table 3 shows that people living close to bushes were at 1,078 times risk of contracting malaria compared with those who lived in house with no shrubs or bushes. After Anopheles mosquito succing bloodmeals, they will resting for a certain periode to allow the the eggs in the ovary developed. In this case the shrubs or bushes might become an important resting place for the Anipheles mosquito in the area. However, the low of the OR value in this study might also indicated that other factor such as river bank, or outside house wall might also important resting places for the mosquito. Alternatively, the Anopheles mosquito in this study may have preference of resting inside of the house such as in the wall, curtaint, cealing, the backside of the cupboard, and others (endophylic). Therefore, the Anopheles mosquito behavior in this area are need to be studied in more detail.

CONCLUSION

The incidence of malaria infection in Oesao Public Health Center, Sub-district of East Kupang was related to the human behavior and the physical environment. The behavior factor that give significant contribution to malaria incidence are the used of mosquito repellent, the envirotnment factor inside house are the mosquito wire on ventilation, permanent wall and cealing and environment outside house are cattle shed, paddle and bushes.

RECOMMENDATION

To the community:

Socialization of the important human behavior to malaria infection: used protective meassure of mosquito bite during activity outside houses during down to night time such as using anti-mosquito repellent, long sleves coat and trouser. It is important for the community to improve environmental conditions in the house, such as, the installation of anti-mosquito wire on ventilation, the installation of ceiling and building a permanent wall of the house, and for environment outside the house are to keep cettle sheds away from houses, draining stagnant water or puddles arround the houses and trimming the bushes arround the house.

To the department of health:

Increase public knowledge about malaria and some risk factors for malaria infection, accompanied with sosializing the various method to prevent and lowered the risk using major media such as daily magazine, radio and television.

ACKNOWLEDGMENTS

The author would like to thank the Head of NTT Provincial Health Office who has given funding, Regent of Kupang, Head of Kupang District Health Office, Head of East Kupang Sub-district, Head of village, village midwives and Head of Oesao PHC

along with all staff who have given permission and assistance for the author to conduct research in their territory, and also my colleagues in Tropical Medicine of Universitas Gadjah Mada in academic year of 2011 for their support.

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Tropical Medicine Journal

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Jl. Teknik Utara, Berek, Yogyakarta 55281
0274-588483, email: tropmedjournal@gmail.com
Published by Faculty of Medicine, Universitas Gadjah Mada

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- f. Results and Discussion:** The Results should be presented with clarity and precision and explained without referring to the literature. The original and important findings should be stated. The Results should be illustrated with figures or tables where necessary but these should be kept to the minimum. The Discussion should interpret the findings in view of the results obtained against the background of existing knowledge. The Discussion should highlight what is new in the paper. Any assumption on which conclusions are made must be stated clearly
- g. Conclusions:** State the Conclusions in a few sentences at the end of the paper.
- h. Acknowledgments:** The Acknowledgments should be presented at the end of the text and before the references. Technical assistance, financial support and advice may be acknowledged.
- i. Tables:** The tables should be kept to a minimum and be designed to be as simple as possible. Each table should be numbered consecutively in Arabic numerals and supplied

with a heading and a legend. Tables should be self-explanatory without reference to the text.

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k. References: References should be numbered consecutively in the order in which they are first mentioned in the text (Vancouver style). Identify references by Arabic number as superscript in order of appearance. A number must be used even if the author(s) is named in the text. The original number assigned to the reference is reused each time the reference is cited in the text, regardless of its previous position in the text. For example :

..... it has been reported¹

..... according to Sardjito²

..... Winstein & Swartz³ conducted

..... by Avon *et al.*⁴

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Sample References

Scientific Journal

1. *Standard journal article*

You CH, Lee KY, Chey RY, Menguy R. Electro-gastro-graphic study of patients with unexplained nausea, bloating and vomiting. *Gastroenterology* 1980; 79(2):311-14.

Goate AM, Haynes AR, Owen MJ, Farral M, James LA, Lai LY, et al. Predisposing locus for Alzheimer's disease on chromosome 21. *Lancet* 1989;1:352-55.

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We thank to the reviewers of this edition:

dr. Abu Tholib, M.Sc., Ph.D., Sp.MK

dr. Ahmad Hamim Sadewa, Ph.D

dr. Arta Farnawati, Ph.D

dr. Elizabeth Henny Henningtyas, M.Si, Ph.D

dr. Hanggoro Tri Rinonce, Ph.D

Prof. Dr. Mustofa, Apt., M.Kes

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