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Original Article

The Activities on Prevention of Malaria and Filariasis Vector Bites among Indonesian Society: A Nationwide Disease Prevention Survey

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ABSTRACT

Vector Borne Diseases are diseases that cause many problems. These diseases are spread by mosquitoes as the vectors. They transmit parasites to humans through their bites. The people who live in Indonesia have several characteristics that make them vulnerable to these diseases. Therefore, it is necessary to explore these characteristics in order to gain better prevention promotional targeting strategy. This study aims to determine the factors that can influence mosquito bite prevention behaviour in Indonesian society. The data from a nationwide survey research were used with a cross sectional design conducted once in every five years. The Riskesdas was conducted from April to May 2018 in all districts in Indonesia. The influencing factors observed were including experience of exposure to vector borne diseases (malaria or filariasis), gender, age group, education level and area of residence. This study conducted a multivariate test using logistic regression analysis to determine the factors that influence mosquito bite prevention behaviour. The results demonstrated that the factors of experience of exposure to vector borne diseases, gender, age group, education level and area of residence could determine the mosquitoes bite prevention behaviour in Indonesian society. Respondents who have experience of being exposed to malaria or filaria, under 60 years old, women, college graduates, and rural communities are more likely to prevent mosquito bites, therefore they could be empowered in promoting public awareness towards mosquito bites prevention.

Keywords: filaria; malaria; mosquito; prevention; sociodemographic

ABSTRAK

Penyakit Tular Vektor merupakan penyakit yang menimbulkan banyak masalah. Penyakit ini disebarkan oleh nyamuk sebagai vektornya. Ini menularkan parasit ke manusia melalui gigitannya. Masyarakat yang tinggal di Indonesia memiliki beberapa karakteristik yang membuat mereka rentan terhadap penyakit tersebut. Oleh karena itu, perlu dijajaki ciri-ciri tersebut guna mendapatkan strategi penargetan promosi pencegahan yang lebih baik. Penelitian ini bertujuan untuk mengetahui faktor-faktor yang dapat mempengaruhi perilaku pencegahan gigitan nyamuk pada masyarakat Indonesia. Penelitian ini menggunakan data dari penelitian survei nasional dengan desain cross sectional yang dilakukan setiap lima tahun sekali. Penelitian ini menggunakan data penelitian kesehatan dasar yang dilakukan pada bulan April hingga Mei 2018 di seluruh kabupaten di Indonesia. Faktor-faktor yang digunakan dalam penelitian ini meliputi pengalaman pajanan penyakit tular vektor (malaria atau filariasis), jenis kelamin, kelompok umur, tingkat pendidikan dan daerah tempat tinggal. Penelitian ini melakukan uji multivariat dengan menggunakan analisis regresi logistik untuk mengetahui faktor-faktor yang mempengaruhi perilaku pencegahan gigitan nyamuk. Hasil penelitian menunjukkan bahwa pengalaman pajanan penyakit tular vektor, jenis kelamin, kelompok umur, tingkat pendidikan dan daerah tempat tinggal merupakan faktor yang dapat menentukan perilaku pencegahan gigitan nyamuk pada masyarakat Indonesia.

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Responden yang memiliki pengalaman terkena malaria atau filaria, di bawah 60 tahun, perempuan, lulusan perguruan tinggi, dan masyarakat pedesaan lebih mungkin untuk mencegah gigitan nyamuk, sehingga mereka dapat diberdayakan dalam meningkatkan kesadaran masyarakat terhadap pencegahan gigitan nyamuk.

Kata kunci: filaria; malaria; nyamuk; pencegahan; sosiodemografi

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INTRODUCTION

Vector Borne Diseases are diseases that cause many problems in the world. Malaria in 2018 has caused 405,000 deaths globally.¹ Lymphatic filariasis is also a health problem globally, especially in many tropical and subtropical countries. Untreated lymphatic filariasis can lead to elephantiasis and hydrocele that cause significant social and economic burdens in a person's life.^{1,2} Indonesia is declared as one of the malaria and filariasis endemic countries.^{3,4} Indonesian society have several characteristics that vulnerable to diseases like malaria and filariasis. The characteristics are including tropical climate, population size, high migration rate, socio-economic imbalance, and regional government autonomy.^{2,5}

Diseases such as malaria and filariasis are spread by mosquitoes vectors. Mosquitoes transmit parasites Plasmodium or microfilariae to humans through their bites. Therefore, it is important for the community to make efforts to prevent mosquito bites. Several studies have shown that action to prevent mosquito bites by individuals were including the use of mosquito nets, repellents, mosquito coils, electric racquets, and electric repellents. Repellents and mosquito coils work by hiding human odors from mosquitoes. Electric racquets and mosquito nets are used for preventing mosquitoes from landing on humans. These efforts have proven useful in reducing mosquito bites.^{6,7}

Indonesian people's behaviour is still not reliable enough to prevent bites from infectious disease vectors. Despite the fact that eradicating mosquito nests is the main effort that can be done to prevent the infection

of diseases such as dengue haemorrhagic fever, a disease that is one of the highlights in Indonesia, the results of Riskesdas' report that Indonesians are not very active in eradicating mosquito nests in their environment.⁴

Nevertheless, research on the relationship between various factors and efforts to prevent mosquito bites in Indonesia is still limited. Research on the behaviour of mosquito are lacked. A research related to malaria transmission prevention efforts was found carried out only in the eastern part of Indonesia.⁸ No article that focused on the specific factors that can influence the overall mosquito bite prevention behaviour of the overall Indonesian people was found. Therefore, a study on the influencing factors in preventing mosquito bite among Indonesian society has been conducted that may contribute to build a recommendation policy to decrease the spread of mosquitoes-transmitted diseases, such as malaria and filariasis.

MATERIALS AND METHODS

Location of the Study

This is a national study conducted at all city/village in 34 provinces in Indonesia.

Data and Analysis

The data used in this study was the secondary data of basic health research (Riset Kesehatan Dasar or Riskesdas) a survey research that has been conducted and developed since 2007, and was continued in 2010, 2013, and 2018.^{9–12} The questionnaire used was little different in each year. This includes the development of questions from 2013 to 2018. This research aims to describe

the indicators of Indonesian public health situations that are used as the basis for policymaking at the national, provincial and district levels. These indicators include access to health services, environmental health, housing conditions, economy, infectious and non-infectious diseases, financial health, maternal and child health, and immunization. This research aims to describe the basic health status of the Indonesian population, therefore the sample is taken from the population, which means that all Indonesian citizens (265 million people) were taken into account (bps 2018)

Inform Consent

The survey was conducted by the Health Research and Development Institute of the Indonesian Ministry of Health (Badan Litbangkes Kemenkes). The survey was conducted by trained enumerators. Each enumerator was trained to use the questionnaire and communicate with the respondent. Enumerators are also trained to convey respondents' rights and obtain permission to collect data from respondents. Each enumerator visited each selected household, accompanied by the village head and local health workers.

Each household, spouse or their elder person was asked to sign the inform consent to participate in this survey before starting the interview. Children under 15 years old were interviewed accompanied by their parents/guardians. Each respondent was informed about the research, and their option to stop the interview at any time without coercion. Respondents who refused, gave up, decided to stop being interviewed and were not willing to be re-interviewed were excluded from the sample of this study. Data related to individual identities were removed from the data subset for further analysis. Areas with difficult access, natural disasters and conflicts were excluded in this survey.

Samples and Variables

The sample frame used in Riskesdas 2018 was the 2018 socio-economic survey

(Susenas) samples of 300,000 households from 30,000 Census Blocks (BS). Census blocks were selected using the Probability proportional to size (PPS) method with systematic random sampling in each city/village per district/city.⁴ Riskesdas 2018 conducted a survey to a total sample of 295,720 households with a total of 1,091,528 household members (individuals) in 34 provinces of Indonesia. Data collection used a paper-based structured questionnaire which was asked to all household members. The Riskesdas 2018 questionnaire consisted of a household questionnaire and an individual questionnaire. Specifically for this study, the questionnaire data used were individual data only.

The data used in this study was only the 2018 Riskesdas data in the prevention of disease transmission due to mosquito bites (Ministry of Health Research and Development Agency 2019). The independent variables studied included experience of exposure to malaria or filaria, age group, gender, recent education level, and area of residence. The dependent variable was including the use of repellents/materials to prevent mosquito bites, mosquito nets, and electric mosquito repellent device (example: electric mosquito racket) or not. The data were categorized into 2 categories, "Yes" for respondents who prevented mosquito bites and "No" for respondents who did not use mosquito bite prevention at all.

The first independent variable was the variable related to the experience of being exposed to malaria or filariasis, respondents who have been positive for malaria/have been tested for malaria/ have been given filarial medicine/have been positive for filaria were classified as having been exposed to vector-borne disease information. The second independent variable is the age group variable. This variable is categorized into 4 categories ranging from the age group 0-20 years old, 21-40 years old, 41-60 years old to older than 60 years old. Gender variables include men and women, and the last variable, the area of residence which consisted of urban and rural areas. Another

independent variable was the level of education which was divided into 7 categories including never attended school, did not graduate from elementary school, graduated from elementary school, graduated from middle school, graduated from high school, graduated from diploma degree and graduated from college.

Data Analysis

This study conducted a multivariate test using logistic regression analysis to determine the factors that influence the behaviour in preventing mosquito bites. Multivariate analysis was performed using logistic regression with a backward Wald method to determine the relationship of the response variable (mosquito bite prevention behaviour) and each explanatory variable (exposure experience, age group, education level, gender, and regional characteristics). The relationship between variables was described by the value of the Odd ratio (OR) along with the value of the confidence interval (95% CI). The analysis was carried out to find the most optimal equation model. The difference in OR was >10% between the previous model and the model after the variable was removed then used to determine whether the variable can be included in the final model or not. All data were analysed using SPSS version 15 (IBM Inc., Chicago, IL, USA).

Ethic Statement

Riskesdas 2018 has received ethical approval from the National Ethics Commission (Ethics Commission of the Ministry of Health Research and Development Agency) number LB.02.01/2/KE.024/2018.

RESULTS AND DISCUSSION

This research was conducted to measure people's behaviour in preventing mosquito bites by several factors among Indonesian society. The data of various factors was significantly associated with the mosquito bite

prevention behaviour as p-values were <0.05 as shown in Table 1.

The Experience of Exposure

The experience of exposure to vector borne disease was the factor that significantly influenced prevention efforts. Respondents who had never been exposed to malaria or filaria were less likely to make an effort in preventing mosquito bites compared to respondents who had been exposed (0.609 times) (CI = 0.601-0.616; p <0.001).

Age

The age group factors influenced prevention efforts. Respondents below 20 years old were more likely to undertaken a bite prevention effort compared to those over 60 years old (1,261 times) (CI = 1,240-1,283; p <0.001). Respondents between 21-40 years old also have a higher probability in taking mosquito bite prevention than respondents over 60 years old (1,385 times) (CI = 1,361-1,411; p <0.001). In the 40-61 years old age group, more people did bite prevention compared to the respondents who were over 60 years old (1,037 times) (CI = 1,000-1,076; p <0.001).

Gender

Apart from experience of exposure to disease and age group, gender also has a significant role in influencing prevention efforts. Male respondents were less likely to take prevention compared to female respondents (0.906 times) (CI = 0.897-0.915; p <0.001).

Education

Education was also a factor influencing prevention efforts. Respondents with education level of 'never attended school' were more likely to take precautions than respondents who graduated from college education level (1,164 times) (CI = 1,132-1,196; p <0.001). Respondents who did not complete elementary school were also more likely to take precautions than respondents who graduated

from college (1,303 times) (CI = 1,271-1,336; $p < 0.001$). Respondents with elementary education level were more likely to take precautions than respondents who graduated from college (1,221 times) (CI=1,192-1,250; $p < 0.001$). Respondents who graduated from middle school also showed a tendency to take precautions compared to respondents who graduated from college (1,137 times) (CI = 1,110-1,165; $p < 0.001$). Respondents with a high school education level also showed a tendency to take precautions compared to respondents who graduated from college (1,066 times) (CI = 1,042-1,091; $p < 0.001$) based on table 1 it can also be seen that respondents who graduated from diploma education were more likely to do prevention compared to respondents who graduated from college (1,037 times) (CI= 1,000-1,076; $p = 0.053$).

Regional

The regional factors in Table 1 shows that respondents in urban areas were less likely to take bite prevention efforts compared to respondents from rural areas (0.607 times) (CI = 0.601-0.613; $p < 0.001$).

The Findings

This study's findings show that the percentage of respondents who did not do bite

prevention was higher than who did it. These findings are in line with studies elsewhere.¹⁶ Several studies in Indonesia stated that inconvenience in practicing mosquito bite prevention is the main reason why many Indonesians do not make efforts to prevent mosquito bites. For example, mosquito nets were reported to cause people to feel stifflingly hot.¹³ The reason for the inconvenient feeling was also reported by research related to mosquito repellent.^{14,15}

Besides the feeling of inconvenient there were other factors that might affect bite prevention practice. This current study revealed that experience of exposure to vector borne diseases (malaria or filariasis), gender, age group, education level, and area of residence were associated with mosquito bite prevention behaviour in Indonesian society.

Experience of exposure to disease can affect a person's belief and knowledge of a disease. The experience of each individual's exposure to disease is closely linked to the public and private sectors. Cooperation and participation or community involvement between the public (government) and private sectors are very important in order to create continual promotional messages related to bite prevention.¹⁶

Table 1. The Estimated Association Between Mosquito Bite Prevention Behaviour with Various Factors by Logistic Regression.

Factors	Prevention Behaviour		OR	95%CI	p-value
	Yes (%)	No (%)			
Vector diseases experience					
No	20.2	54.2	0.609	0.601-0.616	<0.001
Yes	4.4	21.1	1		
Age Group					
0-20 years old	9.2	30,1	1.261	1.240-1.283	<0.001
21-40 years old	6.7	20.7	1.385	1.361-1.411	<0.001
41-60 years old	6.2	18.4	1.296	1.273-1.319	<0.001
>60 years old	2.6	6.1	1		

Gender					
Men	12.5	36.5	0.906	0.897-0.915	<0.001
Women	12.2	38.9	1		
Level of Education					
Never attended school	2.1	6.3	1.164	1.132-1.196	<0.001
Did not finish elementary school	5.1	17.4	1.303	1.271-1.336	<0.001
Elementary school Graduate	5.7	18.7	1.221	1.192-1.250	<0.001
Middle school Graduate	4.2	12.6	1.137	1.110-1.165	<0.001
High school graduate	5.8	14.9	1.066	1.042-1.091	<0.001
Diploma Graduate	0.7	1.7	1.037	1.000-1.076	0.053
College graduate	1.4	3.3	1		
Area					
Urban	13.2	29.1	0.607	0.601-0.613	<0.001
Rural	11.5	46.3	1		

In this study, people with exposure experience were the people who had their blood drawn to be tested for malaria/people who were positive for malaria/people who were given filariasis prevention drugs/ people diagnosed with filariasis by health workers. Therefore, the delivery of health promotion presented by health workers when they were taking blood for malaria test or administering filariasis drugs is very important to encourage these individuals to take efforts in mosquito bites prevention.

For respondents who have been exposed to vector-borne diseases, suffering from the disease is likely lead to behavioural changes in preventive measures to avoid the same infection. Action theory states that the individual takes an action based on the experience, perception, understanding or emerges from certain situations, as well as the existence of a stimulus object.¹⁶ individuals' behaviour could also be influenced by their experience, acceptance/understanding of information, existing traditions and religion.¹⁷ The results of the study in table 1 show that the frequency of mosquito bites prevention is higher in respondents who have

been exposed to vector-borne diseases than respondents who have never been exposed to it. The positive effect of the suffering experience has also been reported respondents who have been infected with malaria gave them a strong urge to recover.¹⁸

The results of this study indicate that women are more likely to make efforts to prevent mosquito bites than men. This in line with the health belief model theory that behaviour can be influenced by one's gender.¹⁹ This is probably because the Indonesian women are commonly doing household chores, such as cleaning the house and therefore, mosquito control at home mostly done by housewife. Better practice scores among women might be affected by their role and their sense of responsibility in taking care of their family and household needs.²⁰

The same results were also reported by Vannayong²¹ that female respondents were more willing to carry out activities to prevent mosquito bites, such as cleaning water reservoirs. The result of this study is also consistent with a study in Ecuador, which reported that Ecuadorian women had better

knowledge and doing better measures in disease prevention than men.²²

A person's educational background might affect their job. People with college graduate backgrounds are more likely to have active jobs. A person's job status can inhibit or encourage a person's actions to live healthy, therefore a job status is defined as a predisposing factor.²³ Another possibility is that people at this level are reluctant to do the bite prevention since they feel that they do not have time to do it. A high level of activity makes someone who has malaria symptoms reluctant to take prevention action because of their busy schedule¹⁸. The results of analysis are similar to the results of Wong's research²⁴ that dengue prevention behaviour is mostly carried out by respondents who do not work or workers who do not need skills (unskilled workers).

Unusual finding showed that the respondents from urban areas had significantly lower probability in doing bite prevention than those who live in rural areas. The high availability of vector's habitat in rural areas might cause this finding. The malaria and filaria vector mosquitoes prefer the outdoor areas. Water is an important factor in the life cycle of these mosquitoes, mosquitoes leave their larvae which then develop into adult mosquitoes. The Anopheles mosquito, which acts as a vector for malaria, is commonly found in rice fields, brackish water, swamps, and mountainous areas. Mosquitoes can live in clear water and come into direct contact with the ground. Meanwhile, the Culex mosquito, which is the vector for filariasis, can be found living in polluted water, such as ditches, rivers full of garbage, and standing water, but can also be found living in clear water.²⁵

Rural communities are more likely to have larger yards than urban communities. The size of the yards can sometimes cause rural communities to be more active in controlling the mosquito breeding places. When the rainy season comes, the leaves will filled with water and become a mosquitoes breeding

place. The lush plants also affects the mosquito population because mosquitoes prefer to perch.²⁵ Plants will block sunlight and make the place even more humid and suitable for resting place.²⁶ This increases the risk of being bitten by mosquitoes, which may make the village community more active in carrying out mosquito bite prevention activities.

Limitations of the Study

In practice, this study was inseparable from several limitations. The education variable in this study did not have an even number of respondents at each level, the higher education variable tended to be less than the other respondents. Therefore, interpretation must be carried out with caution. In addition, this study did not include occupational factors as one of the explanatory factors, therefore further studies are needed to show a direct association between work and mosquito bite prevention practices.

We conceptualized the general picture by taking into account urban and rural disparities based on a study conducted by Wilson²⁷ and Asingizwe.²⁸ Communities living in less developed areas or rural areas might have a lack of access to improved housing, essential health services, effective and timely diagnosis and treatment that might contribute to the higher risk of the transmission of malaria. Studies also have shown that financial problems have been a significant challenge in delivering malaria prevention and treatment program in rural communities. Other disparities from Riskesdas can be seen in other publications.²⁹

CONCLUSIONS

Respondents who have experience of being exposed to malaria or filaria, under 60 years old, women, college graduates, and rural communities are more likely to perform mosquito bites prevention, therefore they could be empowered in promoting public

awareness towards mosquito bites prevention. The results of this study suggest the need for future research regarding Information, education and communication strategies along with current implemented intervention efforts evaluation.

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CONFLICT OF INTEREST

All authors declared that they do not have any conflict of interest in both the research and also in the article writing process.

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