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Research Report

A STUDY OF CORRELATION BETWEEN AGENT, HOST, ENVIRONMENT AND VACCINE FACTORS WITH PREVALENCE OF RABIES IN INDONESIA 2015

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ABSTRACT

A zoonotic disease has been global threat related to health and one of them is rabies. More than 150 countries around the world has infected by rabies disease problem and the case fatality rate (CFR) reaches 100%, which there are 55,000 people died every year because of rabies. In Indonesia, there are 25 from 34 province, which has endemic of rabies disease. The purpose of this study is to know the correlation between the factors of the agent, host, and environment and also anti rabies vaccine with the prevalence of rabies in Indonesia at 2015. The study used correlation design which using Indonesian zoonotic reported data by Ministry of Health and also used other secondary data, which is provided by central bureau of statistic Indonesia (BPS). The provinces that included in this study are the endemic provinces associated with the rabies incident that reported to Ministry of Health and have the completeness of data in 2015. A total of 22 provinces was included in this study, which only use Rabies cases from dog's bite only. Rabies that source from others animal's bite could not included in this study because of data limitations. This study used simple linear of regression statistical tests through provincial as unit analysis. The result of this study showed that there were correlations between agent that have positive specimens (r=0.606, P value =0.0003), status of working participation rate (r=0.435, P value 0.004) and also coverage of rabies vaccine (r=-0.567, P value =0.041) with the prevalence of rabies disease. In summary, there are a positive correlation between positive specimen of agent and also status of working participant rate with the prevalence of rabies disease. However, rabies vaccine coverage has negative correlation. Furthermore, there is no correlation between environment factors and prevalence of rabies disease in this study. It still need further research to be more research on a smaller level with variables that varied.

Keywords: *rabies, agent, host, environment, ARV*

ABSTRAK

Penyakit zoonosis telah menjadi ancaman global dalam kesehatan, salah satunya adalah penyakit rabies. Lebih dari 150 negara di dunia terjangkit rabies dan memiliki Case Fatality Rate (CFR) sebesar 100% dimana sebanyak 55.000 orang meninggal setiap tahunnya akibat penyakit ini. Di Indonesia, terdapat 25 provinsi dari 34 provinsi endemis penyakit rabies. Tujuan dari penelitian ini adalah mengetahui korelasi antara faktor agen, pejamu dan lingkungan serta vaksin anti rabies dengan prevalensi kejadian rabies di Indonesia tahun 2015. Desain studi yang digunakan adalah korelasi dengan menggunakan data yang bersumber dari laporan kementerian kesehatan bidang penyakit zoonotic serta data Badan Pusat Statistik (BPS) di Indonesia. Adapun Provinsi yang diikutkan dalam studi ini adalah Provinsi endemik terkait kejadian rabies yang mengirimkan laporan kepada Kementrian Kesehatan dan memiliki kelengkapan data yang dibutuhkan pada studi ini pada tahun 2015. Sebanyak 22 Provinsi yang diikutkan dalam studi ini sampai kepada tahap analisa data. Pada studi ini hanya menganalisis kejadian Rabies dari gigitan anjing saja sedangkan Rabies yang berasal dari gigitan hewan lainnya tidak diikutsertakan oleh karena keterbatasan data. Analisis yang dipergunakan yaitu uji statistik regresi linier sederhana dengan unit analisisnya adalah Provinsi. Hasil studi menggambarkan bahwa adanya korelasi antara antara agen dengan spesimen positif (r=0,606, Pvalue=0,003) status kerja pada host (r=0,435, Pvalue=0,004), dan cakupan vaksin anti rabies (r= -0,567, Pvalue=0,041) dengan prevalensi rabies. Dapat disimpulkan bahwa adanya korelasi positif antara spesimen positif dan status kerja

pada host. Sedangkan cakupan vaksin anti rabies memiliki korelasi negative terhadap besaran prevalensi kejadian rabies. Selain itu faktor lingkungan dinilai tidak memiliki korelasi pada studi ini. Perlu penelitian lebih lanjut pada tingkat yang lebih kecil dengan variabel yang bervariasi.

Kata kunci: *rabies, agen, pejamu, lingkungan, VAR*

INTRODUCTION

Zoonotic disease has become a global threat because of its spread and allows the emergence of new infectious diseases or reappearance of old infectious diseases. In addition, zoonotic disease has a broad impact, not only on the health sector but also on the sectors of the economy, tourism and wildlife conservation. One of the zoonotic diseases that is a public health concern around the world is rabies.[1]

Rabies is an acute infection of the central nervous system (brain), which is caused by Lyssa-virus (rabies virus) and is transmitted to humans through the bites of rabid animals (dogs, apes, weasels, wild dogs, cats etc.). The rabies virus entered the body through a bite wound and persists for 2 weeks around the bite wound as well as replicates in the muscle tissue around the bite wound. The virus will travel to the central nervous system through peripheral nerves without clinical signs and symptoms. After reaching the brain, the virus replicates rapidly and spreads throughout the brain nerve cells/neurons, especially the cells of the limbic system, the hypothalamus and the brain stem. The virus runs toward the periphery through the efferent nerve fibers of both the voluntary and autonomic nervous systems after multiplying in the brain neurons. The virus attacks almost every organ and tissue in the body and will also multiply in tissues such as salivary glands, kidneys and others organ.[2,3]

About 150 countries in the world was infected with rabies and about 55,000 people died from rabies annually. The average number of human rabies cases per year in Asian countries such as India 20,000 cases, China 2,500 cases, Philippines 20,000 cases, Vietnam 9,000 cases and Indonesia 80,433 cases.[4]

In Indonesia, there are 25 provinces out of 34 Indonesian provinces was infected by rabies. Number of animal bites related to rabies transmitters in Indonesia increased by 86.3%, which was from 45,466 cases (2009) to 84,750 cases (2012) caused by rabies outbreaks in 2009-2012 in Bali.[4] As in other parts of the world, the incidence of human rabies in Indonesia was influenced by age-related, socio-demographic and ecological factors. In addition, the risk of human rabies occurrence is directly proportional to the density of population.[5,6]

Most of the human cases in Indonesia caused by rabies was infected by dog bites (98%) and others by apes and cats.[7] Case Fatality Rate (CFR) of rabies was 100% and until now, there is no effective medicine to cure rabies. Once clinical signs and symptoms occur, always ends as mortality. However, rabies can be prevented by early recognition of rabies-transmitted animal bites, washing the bites by soap/detergent under flowing water for 15 minutes, antiseptic around bite wounds and anti-rabies vaccine or anti-rabies serum.[2,3]

Previous study showed that that in general 50% of human rabies occurs in children under 15 years of age and occurs mostly in men (sex ratio). Men do more activities outside the room at night than women, which tends to be the reason of increased risk of rabies.[5,8]

The incidence of rabies is also influenced by employment (labor force participation rate). Jobs make people stay outdoors more (especially in the night), so interaction with animals transmitting rabies will be higher than those who do not work.[9] In addition, rabies is also associated with educational level (literacy rate). A high level of education and awareness is believed to reduce the incidence of rabies in humans.[10]

This study aim to determine the correlation of agent, host, environment and anti-rabies vaccine with the prevalence of rabies among humans in Indonesia by the provincial level. The results of this study can be the basis for future analytic research at the individual level and can be used as a basis for the development of interventions for a larger research.

MATERIAL AND METHOD

The study design was using descriptive correlation study. The study also included agent factor, host, environment, anti-rabies vaccine coverage as determine of rabies prevalence. The agent factor was portrayed by positive specimen variable. The host factor is depicted in the sex ratio variable and environmental factors were described in population density, labor force participation rates and literacy rates. The incidence of rabies is described in the prevalence of rabies.

The study population was 25 provinces of rabies endemic area in Indonesia 2015, which was set by the ministry of health, based on the provinces whose completed data. Exclusion criteria were provinces whose have no complete data related to agent, host, environment and coverage of anti-rabies vaccine. Based on the inclusion and exclusion criteria, there were 22 provinces of rabies endemic in Indonesia.

The rabies data of each province was obtained from the reported cases of animal bites and Lyssa in the year of 2015 by Ministry of Health (Zoonotic division), which provided the agent factor data (positive specimens) and the anti-rabies vaccine coverage. This study also explored

the data related to host factors (sex ratio), environmental factors (population density, labor force participation rate and literacy rate) that obtained from Provincial Reports, Figures were published by BPS.

Data analysis was performed to obtain an overview of each variable (minimum, maximum, average, median, SD and 95% CI mean) and correlation picture (r, R2, line equation, p value and stock diagram) of each variable with rabies prevalence at Provincial level. The correlation used is Spearman correlation because the data is not normally distributed. This study already passed the ethical review issued by the Public Health Faculty, University of Indonesia with letter of reference number: 355 / UN2.F10 / PPM.00.02 / 2017.

RESULT AND DISCUSSION

A total of 22 Provinces (88%) out of 25 Provinces in Indonesia was examined in this study. The results of this study can only describe the condition of the Province included in the investigation and cannot be generalized as conditions in the Province outside the research area.

Tabel 1. Distribution of rabies event, agent, host environment and anti rabies

Variabel	Mean	SD	95% CI
Rabies prevalence	0,2	0,3	0,05 – 0,28
Positive specimens	25,4	47,8	4,19 – 46,54
Sex ratio	1,0	3,8	1,01 – 1,04
Population density	181,2	276,1	58,82 – 303,63
Labor force participation rate	66,3	3,9	64,50 – 68,01
Literacy rate	98,6	1,3	98,06 – 99,21
Anti-rabies vaccine coverage	0,8	0,2	0,75 – 0,88

Table 1 showed the mean, median, SD and 95% CI mean values of all the variables studied. The highest prevalence of rabies in Indonesia is 1.16 per 100,000 populations and there are some provinces were not sent the report related to rabies cases in 2015. The provinces with the highest rabies prevalence was North Sulawesi, while provinces that reported zero rabies cases are Lampung, Banten, West Sulawesi, South Kalimantan and East Kalimantan. Based on Table 1, it can be noticed that there are some difference condition among the Provinces.

Based on correlation test results, there are several variables that showed significant correlation with rabies prevalence, i.e. positive specimen variable, labor force participation rate and anti-rabies vaccine coverage.

The positive specimen variable has a strong relationship (r = 0.606) and is the positive pattern. This means that the higher the positive specimen, the higher the prevalence of rabies.

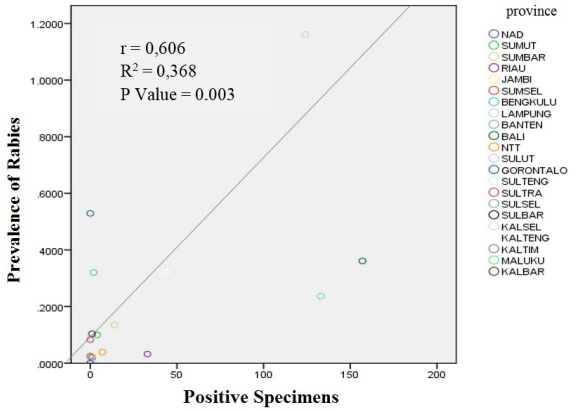

Figure 1. Correlation of positive specimens on the agent on the prevalence of rabies in Indonesia in the year 2015

The positive specimen data was used the number of rabies-transmitted animal specimens that were tested positive for rabies at the provincial level in Indonesia. This study showed that Rabies Infected Animals depicted with positive specimens had strong positive correlation (r = 0.606) and statistically there was a significant correlation (P-value=0.003) (Figure 1). This figure shows that an increase in the number of positive specimens will be followed by an increased prevalence of rabies.

This research is in line with research conducted by Mau and Desato in East Nusa Tenggara Province (2011), which stated that rabies deaths cases in some (Health facilities) Puskesmas in NTT province are caused by high rabies positive dog population. The causative agent of rabies is the lyssa-virus that enters the body through an exposed skin. About 99% of deaths from rabies are caused by dog bites all over the world. Some developing countries, dogs are the main reservoir for rabies, as well as in Indonesia, which 80% source of rabies transmission of all rabies infected by dog bite.[11] Cases from other animals cases could not included in this cases, such as bat's bite, rat's bite, etc.

Positive animal specimens can be controlled by animals' vaccinations that have the potential to transmit Rabies. The failure to control rabies in developing countries was caused by the low of vaccination coverage.[12] Therefore, the cycle of rabies disease, especially in dogs cannot be broken yet. Previous study in the Bali Province in 2012 revealed that the coverage of dog vaccination reached 91%, but it still cannot prevent the spread of rabies disease in this province because there are still many wild dogs that can spread rabies virus.

Number of vaccination coverage should be increased to prevent the spread of rabies disease. Vaccination programs should be conducted regularly so that immunity to rabies virus in proprietary dogs in endemic provinces can remain high.[11]

Figure 2 describe about the coverage of anti-rabies vaccine has a strong relationship (r = -0.567) with negative pattern. This means that the higher of the coverage of anti-rabies vaccine, it will reduce the prevalence of rabies.

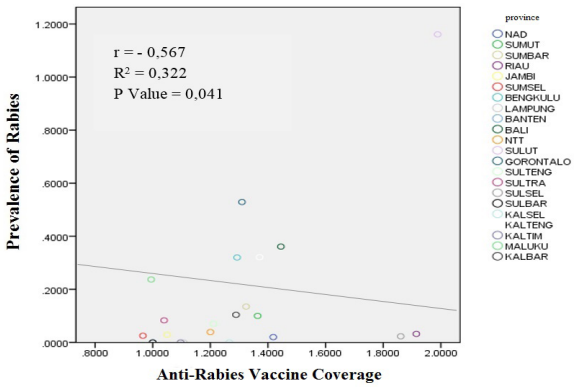

Figure 2. Correlation of anti-rabies vaccine coverage against rabies prevalence in Indonesia 2015

The anti rabies vaccine coverage is the amount of anti-rabies vaccine that given to people who have been potential transmitted by animal bites. This study showed that the Anti-Rabies Vaccine described with Anti-Rabies Vaccine coverage had strong negative correlation (r=-0.567) and statistically there was a significant correlation (p-value=0,041) with rabies prevalence. This suggests that Anti Rabies Vaccine coverage will be followed by a decrease in rabies prevalence.

Another research conducted in Tanzania 2008 showed that 68% rabies-transmitted bite cases that did not receive Anti Rabies Vaccine died of rabies. Rabies infection cannot be treated, but the infection can be prevented by post-exposure prophylaxis using Anti Rabies Vaccine. Anti-rabies vaccine is almost 100% effective in preventing human deaths from exposure to rabies-transmitted animals.[13]

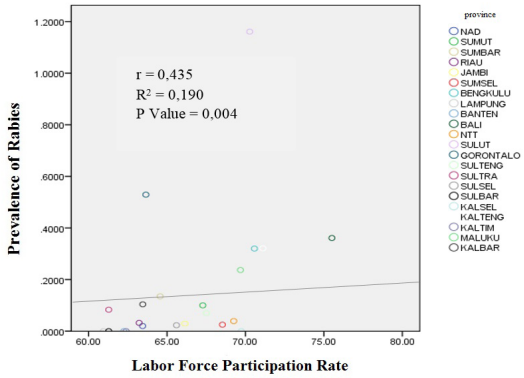

Figure 3. Correlation of host work status based on labor force participation rate on rabies prevalence in Indonesia 2015

The labour force participation rate is the proportion of economically active worker in age population (the productive age group). This study revealed that labour force participation rate was moderately proportional to the correlation (r=0.44) and there is significant correlation (P-value=0,004) statistically. This suggests that an increase in labour force participation rate is followed by an increase in rabies prevalence.

A previous study in New York and Dallas in 1999 proved that someone who has a job with high mobility is more exposed to rabies. Although everyone may be exposed to rabies, but in his research found that working as a courier is more risk to get rabies. Courier work spends more time on the road on motorcycles or bicycles, thereby increasing the risk of being bitten by rabid animal.

Work as a courier is an outdoor job that is similar to the working conditions that is more often outdoors in Indonesia, such as in the field of agriculture is more often outdoors. Therefore, It is important to increase knowledge to outdoor workers about rabies in order to reduce the spread of rabies disease.[14,15]

Other studies that conducted in Bhutan in 2011 and Iran in 2015 also showed that there was a significant relationship between work and rabies events (P-value <0.01). A worker will be more active outside, thus increasing the risk of being bitten by a rabies-transmitting animal.[9,16]

This study has some limitations especially in the related to correlation analysis, so there is a disruption in taking the causal conclusion of ecological bias due to the use of aggregate/group data as uni-analysis. Therefore, this study can only be concluded in the population level (Province), not in the individual level.

CONFLICT OF INTEREST

There is no conflict of interest with relevant parties in this study.

CONCLUSION

Overall, in rabies endemic provinces in Indonesia, there was a tendency for an increased number of rabies cases to be reported from rabies positive animal specimens and also an increase in the number of labour force (employment), therefore will increase the prevalence of rabies. In addition, there is also a tendency for a low anti-rabies vaccine coverage, which will tend to increase the prevalence of rabies.

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