Risk factors associated with rabies incidence in rabies endemic areas in West Kalimantan

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Abstract

Introduction **Rabies remains a significant health problem in many parts of the world. The World Health Organization (WHO) states that rabies is a disease neglected in its management and has become a problem, especially in poor areas. It is estimated that 55,000 rabies deaths occurred worldwide in 2018. From 2015 to 2019, there were 404,306 cases of rabigenic wounds inflicted by animal bites in Indonesia, with 544 deaths. West Kalimantan Province is one of the areas endemic to rabies and one of the five provinces with the highest number of deaths due to rabies.**

Methods **This was a case-control study of patients who presented to the health service for potentially-rabigenic wounds inflicted by animal bites and being diagnosed with rabies exposure. The post-mortem examination was carried out to support the diagnosis of exposure to rabies. Cases were defined as those who had experienced dog bites from the health services medical register from 2015 to 2019. Controls were defined as those who lived in the same area as patients from the cases group and were owners of potentially rabigenic animals. The research was performed in Landak and Sanggau Regencies, West Kalimantan.**

Results **The results showed an association between the following risk factors and the incidence of rabies: animal care (p=0.033), rabies vaccine (p=0.006), and behavior (p=0.011), while other risk factors were knowledge (p=1.000) and attitude (p=0.840).**

Conclusions **The study's findings inform rabies prevention and eradication, particularly in the province of West Kalimantan, which has experienced issues related to the population power of rabies-transmitting animals, as well as the process of vaccinating rabies-transmitting animals and a lack of public awareness. These factors have a significant impact on the prevalence of rabies, as dogs in the province of West Kalimantan have rabies.**

Keywords **Risk factors, rabies, incidence, health problem.**

Introduction

Rabies is the oldest zoonotic disease in the world.[1] Transmission of rabies to humans occurs through bites and licks by infected animals, such as dogs, cats, monkeys, and bats. Rabies attacks the central nervous system and can lead to death if not treated immediately.[2-4] Rabies virus is an RNA virus from the genus *Lyssavirus* and belongs to *Rhabdoviridae*. Rabies is a cause for concern, fear, and unrest in the community in rabies endemic area. Furthermore, there is a general lack of knowledge regarding the appropriate first aid wound management after a potentially rabigenic animal bite.

In 2016, there were 86 deaths related to rabies Indonesia. Indonesia has 24 endemic provinces and nine rabies-free provinces. Of these nine provinces, five are historically rabies-free (Bangka Belitung, Riau Islands, West Nusa Tenggara, West Papua, and Papua), while the four other provinces (Central Java, DI

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Yogyakarta, East Java, and Jakarta) were declared free of rabies in 2020.[5]

West Kalimantan was initially a rabies-free region. However, an outbreak was reported in 1999 after Banjarbaru Veterinary Center's discovery of positive cases based on benign paroxysmal positional vertigo examination. Based on an epidemiological study of rabies in the West Kalimantan region, it was detected in the Ketapang Regency in people who were bitten by dogs. It is believed that it originated in one of the border areas of the central Kalimantan Province, namely the Lamandau Regency. The rabies-free status in West Kalimantan was then obtained through the Decree of the Minister of Agriculture (No. 885/Kpts/PD.620/8/2014) in 2014. On October 19, 2014, a positive case of rabies was reported in the Ketapang Regency; hence, the status was revoked.[6,7] From 2015 to 2019, in Indonesia, there were 404,306 cases of potentially-rabigenic animal bites, with 544 deaths having occurred in humans. West Kalimantan Province is thus an endemic area, one of the five provinces with the highest number of deaths from rabies.[8]

Rabies affects health and has an important economic impact; therefore, prevention practices for this disease should not be ignored.[7] The lack of data related to the burden of rabies and risk determinants is a challenge when formulating policies and strategies for controlling rabies.[9] Prevention efforts are carried out by providing vaccines to domestic animal such as dogs, animal monitoring, information and education, epidemiological surveillance, preventing bites from animals that can potentially transmit rabies, population control for animals that can potentially transmit rabies such as dogs, domestic animal health facilities and infrastructure, and postexposure to humans with wound care and prophylaxis.[7] Research analysis of the risk factors associated with the occurrence of rabies in humans is critical, with the aim of ensuring that efforts made in rabies prevention and control are effective. Rabies management is more effective if it focuses on the main risk factors that contribute to the spread of rabies in the local area.[10] This study aimed to analyze the association between the occurrence of rabies and potential risk factor, in a rabies endemic area.

Methods

Study design

This was a case-control study of patients who presented to the health service for potentially rabigenic wounds inflicted by animal bites and the post-mortem examination was carried out to support the diagnosis of exposure to rabies. Data on the occurrence of rabies due to potentially rabigenic animal bites animal were obtained from the West Kalimantan Health Office, specifically for the landak and Sanggau districts.

Research sample

The case group included patients who had experienced dog bites from the health services medical register from 2015 to 2019. The control group included people who lived in the same area as patients from the cases group and who were owners of potentially rabigenic animals. People from the control group did not report an animal bite during the studied time span. Inclusion criteria for the case group included the following: people diagnosed with rabies due to a rabigenic animal bite from 2015 to 2019, living in the study area, namely the Landak and Sanggau Regencies, and were willing to sign written informed consent for participating in this study. Inclusion criteria for the control group were people living in the same area as those included as cases, in the same period keeping dogs, and willing to sign a written informed consent form. The exclusion criteria for both groups were: having died when the study was carried out or those whose addresses had changed during the data collection process.

Questionnaire interviews

Interviews were conducted with respondents who met the established inclusion criteria. The questionnaire consisted of two parts: a survey to collect household demographics and a survey of individual descriptive statistics of occurrence of rabies in the population. The prepared question components were used to assess respondents' knowledge, attitude and behavior with dichotomic answers using a Likert scale.

Knowledge regarding rabies, modes of transmission, types of rabigenic animals, methods of prevention of transmission from rabigenic animals, characteristics of animals carrying rabies, first aid when bitten by rabigenic animals was categorized as "good" if questionnaire scores were ≥75% and "poor" if questionnaire scores were <75%. Attitude efforts in the prevention of rabies, animal care, first aid efforts in wounds due to rabigenic animal bites, and medical action in handling rabigenic animal bites was categorized as "good" if questionnaire scores were ≥75% and "poor" if questionnaire scores were <75%. Behaviors regarding how to raise a dog, vaccinate pets that have the potential to carry rabies was categorized as "good" if questionnaire scores were ≥75% and "poor" if questionnaire scores were <75%. To conduct surveys, health workers conducted interviews with the local health office and health service training officials.

Data analysis

The collected data were screened, coded, and entered into a database. The analysis was carried out to examine the relationship between independent and dependent variables using the Chi-squared test with a significance level of 95% (α=0.05). P-values less than 0.05 were considered statistically significant.

Results

The case and control group included 198 patients, each. The case group had 108 male respondents, while the control group had 102. In the control group, 109 and 120 respondents had never received rabies socialization, while 89 and 78 respondents had received socialization. In the case group, 104 and 110 respondents had never received socialization, while 94 and 88 had received socialization There were 55 and 77 respondents among the case and control groups, respectively, who had unvaccinated potentially rabigenic animals, and 89 and 78 respondents among the case and control groups, respectively, who had vaccinated potentially rabigenic animals. In the case group 88 patients displayed good knowledge and 110 poor knowledge, while in the control group had 89 and 109 displayed good and poor knowledge, respectively (p=1.000). Attitude variables tended to be good in the case (92 samples) and control groups (89 samples), and poor in the case (106 samples) and control group (109 samples), respectively (p=0.840). In terms of behavior, 154 of the cases reported good behavior, compared to 174 samples in the control group (p=0.011).

To determine potential association, the risk factors translated into variables were cross-tested and compared between the case and control groups, as shown in Table 1. The analysis shows that the case group had significantly higher odds to have kept an animal that transmits rabies, (48.1%) compared to the control group (36.9%). OR=1.579, 95%CI: 1.057-2.590, p=0.003.

We have assessed whether there is an association between animal care practices and the incidence of rabies. By analyzing the relationship between maintenance methods and rabies occurrence, we identified a 52.5% percentage for rabid dog bites in the control group. Statistical analysis revealed no significant relationship, OR=0.719, 95%CI: 0.483-1.072, p=0.128.

We have assessed the association between animal vaccination and the occurrence of rabies: the analysis showed that the case group had a tendency not to vaccinate its pet dogs (76.8%) compared to the control group (63.6%), OR=1.888, 95%CI: 1.217-2.929, p=0.006.

By analyzing the association between knowledge and the occurrence of rabies, we found a tendency for rabid dog bites in the case group. Respondents with poor knowledge comprised 55.6% compared to 55.1% in the control group. Statistical analysis revealed no significant relationship, OR=1.021, 95%CI: 0.687-1.517, p=1.000.

An analysis of the relationship between attitude and the occurrence of rabies showed that there is a tendency for the incidence of dog bites in the case group; most (53.5%) of the respondents in the case group displayed poor attitude, compared to those in the control group (55.1%). Statistical analysis didn't show a significant relationship, OR=0.941, 95%CI: 0.633-1.397, p=0.840.

An analysis of the relationship between rabies prevention behavior and rabies incidence showed that there is a tendency for dog bites to

Table 1. Relationship of variables with rabies occurrence in West Kalimantan Province

Variable	Rabies occurrence				Total		p-value	OR (95% confidence interval)
	Cases		Controls					
	n	%	n	%	n	%		
Animal Care								
Once	95	48	73	36.9	168	42.4	0.033	1.579 (1.057-2.590)
Never	103	52	125	63.1	228	57.6		
How to care for animals								
Cage and release	104	52.5	120	60.6	224	56.6	0.128	0.719 (0.483-1.072)
Not maintaining	94	47.5	78	39.4	172	43.4		
Animal's rabies vaccination								
Not vaccinated	152	76.8	126	63.6	278	70.2	0.006	1.888 (1.217-2.929)
Vaccinated	46	23.2	72	36.4	118	29.8		
Knowledge								
Poor	110	55.6	109	55.1	219	55.3	1,000	1.021 (0.687-1.517)
Good	88	44.4	89	44.9	177	44.7		
Attitude								
Poor	106	53.5	109	55.1	215	54.3	0.840	0.941 (0.633-1.397)
Good	92	46.5	89	44.9	181	45.7		
Behaviors								
Poor	44	22.2	24	12.1	68	17.2	0.011	2.071 (1.204-3.564)
Good	154	77.8	174	87.9	328	82.8		

Knowledge refers to rabies, modes of transmission, types of rabigenic animals, methods of prevention of transmission from rabigenic animals, characteristics of animals carrying rabies, first aid when bitten by rabigenic animals.
Attitude refers to efforts in the prevention of rabies, animal care, first aid efforts in wounds due to rabigenic animal bites, and medical action in handling rabigenic animal bites.
Behaviors refer to how to raise a dog, and vaccination of pets that have the potential to carry rabies.

occur in the case group. Respondents in the case group who behaved poorly represented 22.2% compared to 12.2% in the control group. Statistical analysis showed a significant relationship, OR=2.071, 95%CI: 1.204-3.546, p=0.011.

Discussion

Our study has shown that in a rabies-endemic area respondents who have kept dogs are at a 1.579-fold greater risk of being bitten by potentially rabigenic dogs than those who did not have dogs. Keeping dogs in the Landak and Sanggau Regents is influenced by people's habits, such as hunting animals, consuming their meat, and believing in alternative (cultural) medicine, and these have become inseparable parts of life. Dogs have a high economic value for the community, as guard and hunting dogs but are also eaten as side dishes at weddings and at other formal events.[11] To break the chain of rabies transmission from animals to humans, dog owners must be aware that they are among the determinants that favor transmission, which can be prevented by vaccinating, caring for, and controlling the dogs.[12]

Respondents who kept dogs in cages and then released them were at a lower risk of being bitten by a potentially rabigenic dog (OR=0.719) than those who didn't. According to interviews with dog owners, their dogs were allowed to roam because it became a habit for them to look for food. Owing to lack of time, owners would leave the house without feeding their dogs. Owners objected to the use of a cage for several reasons, including the cost of making the cage and the belief that the dog or animal would be nervous because it was confined in the cage. This requires a shift toward empowering the community by prioritizing local culture and wisdom, with the support of community leaders and the community itself, and health education ongoing socialization.

Our study indicated that respondents who did not vaccinate their pet dogs were at 1.89 times higher risk of rabies than those who vaccinated their pet dogs. Mass vaccination for potentially rabigenic animals is the most effective way to prevent and control rabies. The government is carrying out intensive efforts to vaccinate, sterilize, and euthanize stray dogs, and monitor the movements of potentially rabigenic animals.[13] In line with the study in 2012 by Suartha et al., rabies can be controlled when vaccination covers approximately 70% of the dog population, and by controlling the population of stray or street dogs.[14] Safe standards have not been set for the mobilization or transportation of potentially rabigenic animals between regions. Even in the endemic areas and rabies-free areas, supervision is difficult. There are inadequate human resources for vaccinators and animal health quarantines, and low community participation, especially among dog owners.

Respondents with poor knowledge were 1.021 times more likely to have been bitten by a dog than those with a good understanding. The ability to measure the causes, transmission, and symptoms of rabies to help those bitten by rabies carrier animals, and increasing our knowledge are some of the strategies used to prevent and eradicate rabies. Another strategy is increasing community involvement through counseling. This is consistent with the findings of Ira et al.,[15] who discovered that most people had a good understanding of symptoms, signs, modes of transmission, prevention, and treatment.

Based on these results, lacking knowledge, and not goodwill, constitutes a risk for dogs and dog owners as decision-makers on how to handle and maintain dogs. In a study by Nugroho et al., increased public knowledge, marked by awareness of seeking medical treatment and reporting after being bitten, and the existence of post-exposure prophylaxis for humans, will reduce the numbers of cases of bites and deaths from rabies in humans.

Respondents who displayed attitudes at risk of being bitten by a rabid dog were 0.941 times more likely than respondents with good attitudes. This shows the attitude of dog owners and the community regarding high awareness and desire to participate in preventing rabies. For instance, they are reporting when a dog or animal with symptoms of rabies infection is encountered. Attitudes result from a socialization process that describes how humans react to the stimulus they receive. The correct attitude is the awareness of giving pets vaccines and keeping them chained to prevent them from roaming. This is in line with Malahayati's research that rabies transmission begins with the condition of well-kept dogs and stray dogs as a characteristic of rural areas. These conditions make the site an endemic rabies area.[16]

Respondents who had poor rabies prevention behaviors had a higher risk of rabid dog bites, 2.071 times higher than those who had better behaviors.

The behavior carried out by the community is good, namely by checking their dogs, both biting and non-biting. This is related to maintenance to prevent dogs from getting rabies. This influences public health in preventing the spread of the disease. If health knowledge continues to improve, it will affect behavior and social conditions for a healthy environment.

West Kalimantan is still an endemic rabies area where rabies cases are still found in several areas in West Kalimantan until 2022. The government continues to carry out control with promotive and preventive efforts to become the main program in reducing rabies cases in West Kalimantan to make West Kalimantan region rabies free, an area that is free of rabies, if rabies is no longer found or in other terms, to lead to the elimination of rabies.[17]

Conclusions

Prevention and eradication of rabies, especially in West Kalimantan Province, has encountered obstacles related to the culture of the community that keeps dogs, which are potentially rabigenic animals, and public awareness of potentially rabigenic animals regarding knowledge, attitudes, and behavior. These factors are supported by the results of our analysis for dogs.

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