Determinant Factors of Leptospirosis in Indonesia: Flood Prone Area Setting in Wajo District

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Abstract. The incidence of leptospirosis is caused by Leptospira bacteria. No data on the results of examination and research on risk factors of leptospirosis occurrences in the area. The study aims to determine the magnitude and risk factors of leptospirosis existed in flood-prone areas at Wajo District. The research type was analytical with cross-sectional and analysed by chi-square and Principal Component Analysis (PCA). The sample was 273 people selected through proportional random sampling and examination of serum sample by the enzyme-linked immunosorbent assay (ELISA). The research found Leptospirosis incidence was 130 people (47.6%). Socio-demographic societal conditions referred to occupation and rat urine patches associated significantly with leptospirosis (p=<0.05). PCA test that showed the distribution of risk factors based on clusters on F1, F2 and F3 discovered that the observational axes F1 and F2 was 63.36% and F1 and F3 was 55.93%. This research suggested Wajo Health Department to increase socialization of prevention and diagnosis to societies with Leptospirosis symptom/suspect and those in a flood-prone area which specific to hygiene and sanitation events.

Keywords: Leptospirosis, Flood Prone

1 Introduction

Floods can increase exposure signals through contaminated air. Many Leptospirosis outbreaks have found that occurred after floods from various parts of the world [1]. For example, 19.2% of people in India showed symptoms of Leptospirosis and gave positive serological test results after Orissa Hurricane Disaster in 1999 [2]. However, significant exposure also occurs from daily activities, and high rates of infection during heavy rain and flooding [3-5]. Leptospirosis was detected in many areas of Mumbai India relative to children with contact with air flooding [6].

Leptospirosis is a zoonotic disease that infects humans through direct contact with animal urine associated with urine-contaminated environments. It occurs in vulnerable populations such as rural farmers and urban slum dwellers, endemic especially in countries with subtropical climates or humid tropics and with potential epidemics. Bacteria enter the body through cuts or abrasions on the skin, or the mucous membranes of the mouth, nose, and eyes. Human-to-human transmission is rare. In the early stages, these symptoms include high fever, severe headache, muscle aches, chills, redness of the eyes, abdominal pain, jaundice, bleeding in the skin and mucous membranes, vomiting, diarrhea, and rashes [7], [8].

Leptospirosis causes health problems in Indonesia. In 2001, 139 human serum samples were 18.7% positive. The results of the examination showed infection from the Batavia

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serovar. In the event of flooding in Indonesia in January 2002, Leptospirosis outbreaks occurred, especially in Jakarta. In this case, 12.0% of the 418 samples were seropositive to the Batavia or Hardjo serovars. There have been problems in the number of human cases since 2006. Out of 667 human cases in 2007, 93% were cases with laboratory confirmation. The death rate is 8%. In the first beginning of 2008, 269 cases had found Leptospirosis [9].

Leptospirosis mainly attacks farmers, mine workers, a dozen, abattoir workers, and the military — unhealthy living conditions and environmental conditions associated with the occurrence of Leptospirosis. The existence of rats is the most appropriate factor for the transmission of this disease [10]. Leptospirosis occurs incidentally and is technically transmitted through mouse urine during a flood. Leptospirosis manifestations are limited to self, mild to severe syndromes, and even death if delayed treatment [11].

Leptospirosis is a disease that has symptoms with yellow fever, dengue fever, malaria, hepatitis, and other diseases related to the diagnosis. This difficulty causes Leptospirosis not to report much. Leptospirosis cases are not recorded in various regions, which consist of responsible factors. Not well reported, the case of Leptospirosis has been appealed by the Ministry of Health to pay attention to health conditions during the rainy season.

Wajo Regency is one of the regions in South Sulawesi Province, each year being a flooded subscription area. In 2016, floods in Wajo District submerged 24 villages in their respective sub-districts in Tanasitolo, Belawa, Tempe, Pammana, and Sabbangparu Sub-Districts [12]. In 2014 a flood that inundated four kelurahan lasted for one month. During that time, the height of the flood continued to fluctuate. The height of flood water from Soppeng Regency and the overflow of Lake Tempe, and the Walenae River [13]. However, there have been no reports of cases of Leptospirosis because there has never been a serological examination of symptoms of Leptospirosis that occur in communities affected by flooding (neglected diseases). Also, this study was to identify Leptospira exposure factors in flood-prone areas in Wajo District.

2 Materials and Methods

This type of research is analytic with a cross-sectional approach. Leptospirosis events in Wajo District. The cross-sectional study is called a prevalence study or survey. The number of samples in this study was 257 people, but to reduce the bias added 10% so that the total sample in this study were 273 people using proportional random sampling in Tempe and Sabbangparu Subdistricts. Primary data is obtained by direct observation and interview of respondents in the field. Biomedical data in the form of serum samples from blood taken in household members were examined by the Enzyme-linked immunosorbent assay (ELISA) method in the microbiology laboratory of Animal-Based Prevention and Disease Research and Development (P2B2), Republic of Indonesia Ministry of Health - Banjarnegara, Central Java. This study obtained ethical clearance issued by the Ethics Committee of the Faculty of Medicine of Makassar University of Health No 487 / H4.8.4.5.31 / PP36-COMETIC / 2017.

3 Results

This research was conducted for three weeks by collecting data in two sub-districts of flood-prone areas in Wajo District. The researcher was assisted by enumerators who were very capable of collecting data in the community. The district has an area of 2,056.19 km² and has a

population of approximately 400,000 people. Wajo District has 14 sub-districts and sub-districts located near the river and Tempe lake which are the areas most frequently affected by flooding. The location of this study is shown in figure 1 below.

3.1 Characteristics of demographics

Socio-demographic conditions in the study were the characteristics of respondents such as gender, age, education level, occupation, and total income. The measurement scale is the nominal scale (gender, age, occupation) and ordinal scale (education level and total income). Respondents in this study amounted to 273 respondents. Characteristics of respondents are presented in Table 1

Table 1 Characteristics of Respondent in Wajo District

Variable	n	%
Sex		
Male	120	44,0
Female	153	56,0
Age (Year)		
12-16	2	0,7
17-25	24	8,8
26-35	58	21,2
36-45	90	33,0
46-55	44	16,1
56-65	34	12,5
>65	21	7,7
Occupation		
Jobless	28	10,3
Teacher	2	0,7

Housewives	92	33,7
Government officers	7	2,6
National BUMN staff	2	0,7
Non-government staff	9	3,3
Trader	61	22,3
Farmer	47	17,2
Fisherman	25	9,2
Education		
Not school	16	5,9
Unfinished school	25	9,2
Elementary School	138	50,5
Scondary School	45	16,5
High School	33	12,1
Undergraduate	16	5,9

Source: Primary Data, 2017

The results of the analysis showed that more female respondents than male respondents were as many as 153 respondents (56%). Respondents were more than 36-45 years old, 90 respondents (33.0%), and at least 12 16 years old, 2 respondents (0.7%). Homemakers constitute the highest number of respondents' jobs at 33.7%.

The highest level of education of the respondents was graduating from elementary school/equivalent by 50.5%, and the education level of the respondents who had the least amount was never going to school and graduating from college, which was 5.9%. A total of 196 respondents (71.8%) were married, and 2 respondents (0.7%) were divorced. In terms of economic status, it can be seen that family income and expenditure each month, there are 155 respondents (56.8%) who have less than Rp. 1,000,000 and there are 166 respondents (60.8%) having spent less than Rp. 1,000,000.

3.2 Multivariate Principal Component Analysis (PCA)

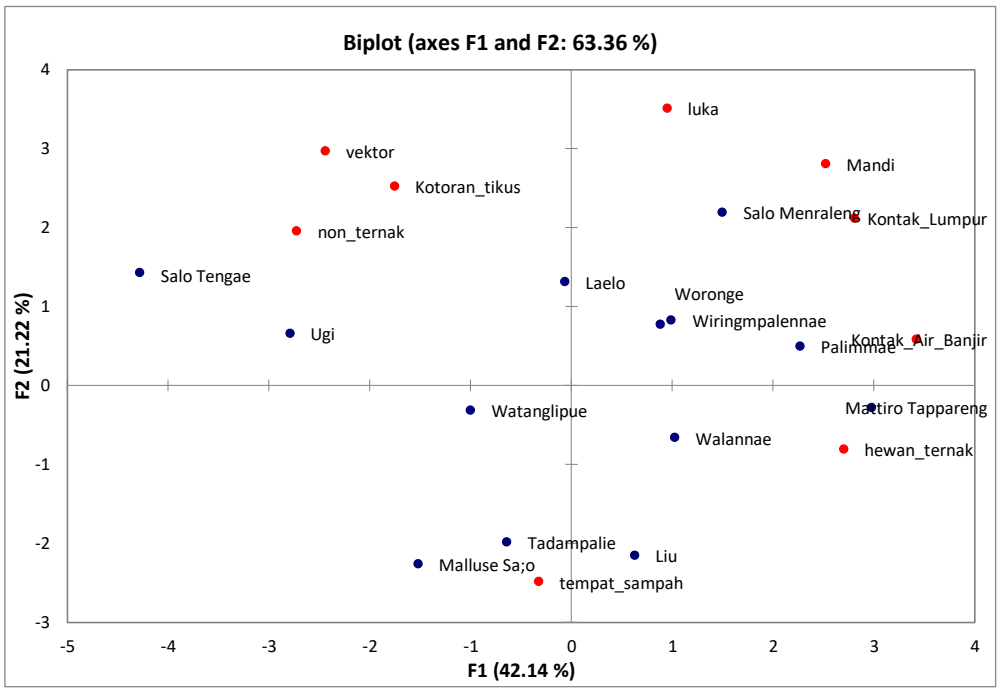

Fig 2. Distribution of Events and Risk Factors on the three axes F1, F2, F3 in flood-prone areas in Wajo District

The results of the PCA analysis showed that there were three groups of locations based on the prevalence of events and the risk factors that characterized them. The groups are:

1. Group I, location of Woronge Village, Walennae Village, Salomenraleng Village, Wiringpalennae Village, Pallimae Village, Mattirotappareng Village with risk characteristics are finding wounds, bathing, contact with flood water, contact with mud, and the presence of livestock.
2. Group II, the location of leptospirosis in Mallusesalo Village, Watallipue Village, Tadangpalie Village, Laelo Village with a risk characteristic is the absence of trash bins.
3. Group III, the location of leptospirosis, namely Salotangae Village and Ugi Village with risk characteristics such as the presence of vectors, the discovery of rat droppings and the risk of non-livestock

4 Discussion

4.1 Discussion of demographic characteristics

The proportion of people who suffer/have a history of leptospirosis in this study is greater in women. Traditionally, the link between gender problems and the emergence of disease is closely related to the biological and physiological factors of the body and the activities carried out by each gender. In surveillance data, it was explained that the percentage of men suffering from leptospirosis was greater than women. This is because men are more vulnerable to exposure to leptospira bacteria due to their work and other field activities [14-16]. Events in the Philippines from 1998 to 2001 showed that among 840 suspected cases of seropositivity, 87% of these cases were male. 70% of these cases occur in people involved in outdoor activities, with 80% of them exposed to water or dirt. Although there was a significant reduction in the incidence of leptospirosis in Japan caused by measures to control occupational exposure among paddy workers), however, 16/20 reported cases from November 2003 to April 2005 stated that the majority of patients were male, with the type of work dominated by waste workers [16].

In line with this, around 88% of cases from 1999 to 2008 that occurred in New Zealand were cases that occurred in men with 72% of whom were livestock/meat processing workers [14]. For respondent education, the proportion of leptospirosis cases was the most common among respondents with low education. This indicates that the high level of education has a better influence on the aspect of getting information, processing, and interpreting information about healthy behavior. Research in the Philippines found that agricultural workers who had completed their education up to the stage of senior high school and tertiary education had

more links to the prevention of leptospirosis when compared to workers who did not complete their education in the middle to high school stage [17]. This is also supported through research conducted in Peru, where the level of education is a factor associated with the incidence of leptospirosis. From age risk factors, it can be seen that the age of the adult category with the greatest proportion suffers/has a history of leptospirosis.

Seroprevalence of leptospirosis can increase with age. This can occur due to the influence of different immune systems between adults, adolescents, and children [18]. Also, in another study in Bulgaria, information was obtained that patients aged 45 years were closely associated with the incidence of acute leptospirosis and a high risk of death and the need for intensive treatment. This is in line with several other studies which state that acute levels of leptospirosis occur more frequently in the adult age group than children. However, it relies on the host's immune response and habits. In the adult age group, the severity of leptospirosis cases in the study was exacerbated by tobacco use (cigarettes) [6], [19-22].

The type of work in the study was related to the incidence of leptospirosis with a value of $p = 0.04$. The types of jobs that are risky in research are jobs that have a lot of contact with land, dirty water such as farmers and fishermen while jobs that are not at risk are workers who spend more time indoors to work. Based on job status, the tendency of respondents to work to have a history of leptospirosis is greater than those who do not work. The results of the study showed that there was a relationship between activity in the water and the incidence of leptospirosis obtained a value of $p = 0.010$ (<0.05) with OR = 6.303. These results indicate that there is a relationship between activity in water and the incidence of leptospirosis and respondents who have activities in water have a risk of 6.303 times greater exposure to leptospirosis compared to respondents who do not have activity in water. Although the results of statistical tests conducted by Maharani, 2013 in the community in the Bandarharjo Community Health Center area, there was no relationship between the type of work and the incidence of leptospirosis ($p = 0.713$ and OR = 1.3).

4.2 PCA discussion

The characteristics of the study location are explained based on the spatial distribution of environmental parameters using principal component analysis or PCA. PCA analysis is a multivariate analysis that applies a data reduction system that aims to find parameters (characters) that characterize a group of observations that can easily be seen from the ordinance in the main component plot (axis). This analysis uses multiple regression analysis of all parameters and observations in calculating the main components so that it can identify the main character (character) of each observation group which is aggregated based on the similarity of its characteristics.

This study analyzes various types of variables in 13 flood-prone areas in Wajo District. Furthermore, in PCA analysis, there were nine variables included in the analysis. The variables are bathing with flood water, contact with flood water, contact with mud, the presence of wounds, the presence of trash bins, the presence of vectors, the presence of non-livestock animals, the discovery of rat feces and the presence of livestock. This variable is a variable which is estimated to have a major contribution to the incidence of leptospirosis in flood-prone areas of Wajo Regency.

The correlation matrix between environmental parameters shows that several significant parameters are linearly correlated both positively and negatively. The positive and strong correlation values are indicated by the correlation of vectors with non-livestock and correlation of flood water with mud contact with a fairly strong correlation value with the

value of the correlation coefficient> 0.8. while the other variables have a correlation value <0.8 that contributes to the formation of the main axis.

In this study indicate that the cumulative value of the character (eigenvalue) is indicated by the value of 77.14%. This shows that the risk factors studied gave an effect of 77.14% of the incidence of Leptospirosis in flood-prone areas of Wajo Regency while the remaining remainder could be influenced by other factors that had not been revealed in this research model. The study with the same analysis showed that these factors gave a cumulative proportion of 59.145%, meaning that the three factors according to the perceptions of students who were respondents in this study could influence Juliarti Hardika et al. –Application of Principal Component Analysis 516 student achievement in Medan 1 Public High School amounted to 59.145% [23].

Analysis of patterns of distribution of Leptospirosis sites with the magnitude of risk factors that occur in flood-prone areas of Wajo Regency. The results of the PCA analysis showed that there were three groups of locations based on the prevalence of events and the risk factors that characterized them. The first group was Mattirotappareng Village (63.2%), Tadangpalie Village (60.0%), Woronge Village (42.1%), Walennae Village (47.4%), Salomenraleng Village (55.0%), Wiringpalennae Village (41.2) and Pallimae Village (25.5%), with risk characteristics being found in wounds, bathing in flood water, contact with mud, and the presence of livestock. The results of observations at the location of this group indicate areas where the people raise livestock and have jobs as farmers.

Group II is in Laelo Village (50.0%), Mallusesalo Village (43.8%), Watallipue Village (46.7%) with risk characteristics are livestock. Whereas, Group III is Salotangae Village (37.5%) and Ugi Village (58.3%) with risk characteristics such as the presence of vectors, the discovery of rat droppings and the risk of non-livestock. This research is in line with research conducted on the characteristics of Tanjung Api-api mangrove waters for Station I (sea area) characterized by environmental variables such as temperature, salinity, DO and high pH, Station II (estuary area) more characterized by TOM and TSS values which is high while Station III (back area of estuary/river) is slightly characterized by physical-chemical parameters of water compared to stations located in the sea and estuary area [24].

Research using the ELISA technique for the diagnosis of Hog Cholera has been widely developed because this test is capable of examining large quantities of samples in a short time, making it ideal for screening. This study also took serum samples in the last 4 years and showed a positive case of Hog Cholera [25]. This shows the effectiveness of ELISA in measuring the history of infection in the last 4-5 years. However, this study showed that the measured environmental parameters did not affect the value of ELISA because at the time this study was carried out the environmental conditions supported the non-exposure of the community to the causative agent of leptospirosis in flood-prone areas.

5 Conclusion

The results of the PCA analysis showed that there were three groups of locations based on the prevalence of events and the risk factors that characterized them. The groups are Group I, location of Woronge Village, Walennae Village, Salomenraleng Village, Wiringpalennae Village, Pallimae Village, Mattirotappareng Village. Group II, the location of leptospirosis in Mallusesalo Village, Watallipue Village, Tadangpalie Village, Laelo Village. Group III, the location of leptospirosis, namely Salotangae Village and Ugi Village. Wajo Health Department to increase health education of prevention and diagnosis in society with Leptospirosis symptom/suspect and to society in flood-prone area.

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