Climate as the Early Warning of Outbreaks of Leptospirosis in the District of Sampang Madura Island Indonesia

Ririh Yudhastuti
Department of Environment Health, School of Public Health, Airlangga University, Surabaya 60115, Indonesia

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Abstract: In Indonesia, most transmission of leptospirosis occurs through the rat under conditions of high rainfall or flooding. Sampang is endemic leptospirosis, during March-May 2013, there were 55 patients with 8 of them died. The purpose of this study was to analyze risk factors for outbreaks leptospirosis by climatic factors. Study is cross-sectional design of variable causes or risks that occur due to the object of research are measured simultaneously. The results showed that the distribution of events is based on epidemiological characteristics of leptospirosis in districts Sampang both rainy and dry season. Analysis of climatic factors show support to the continuation of leptospirosis whose temperatures ranged from 29.35 °C-30.62 °C, humidity range between 63.4%-80.5%. Rainfall ranges from 183-190 mm. Incidence of leptospirosis in Sampang shows the distribution of leptospirosis cases from 18 subdistricts, 14 subdistricts are at risk of the occurrence of leptospirosis. Results obtained rat trapping species caught in the neighborhood residential home patients were mice (Rattus tanezumi and Rattus novergicus) and the identification of the leptospira in rat urine sewers rat positive standing of the potential risk of leptospirosis in the community. The conclusions are climatic conditions, rainfall remarkable effecting on the incidence of leptospirosis.

Key words: Temperature, relative humidity, rainfall, outbreaks of leptospirosis, Sampang district Madura island, Indonesia.

1. Introduction

Leptospirosis is an acute infectious disease that can infect humans and animals (zoonosis). It caused by spiral-shaped leptospirosis bacteria which move actively, therefore, leptospirosis is a zoonotic disease which has the largest distribution in the world. The disease was first reported in 1986 by Adolf Weil with symptoms of high fever accompanied by symptoms of neurological disorders as well as enlargement of liver and spleen, which then known as “Weil’s disease”. In 1915, Inada managed to prove that “Weil disease” was caused by bacteria leptospirosis Ichtero hemorrhagiae, since then several types of leptospirosis can be isolated from human and animal [1]. Leptospirosis infection is rarely found in subtropical countries. The suitable climate for the development of leptospirosis is warm air, moist soil and alkaline acidity. Such circumstances can be found in countries with tropical climate throughout the year. In tropical countries, the incidence of leptospirosis is 1,000 times higher than in the sub-tropical countries, and the risk for having more severe leptospirosis disease is higher [2-4]. The incidence of leptospirosis in tropical countries was 20/100,000.

Leptospirosis is a public health problem in Indonesia. This disease scattered in several provinces and districts. It is a re-emerging disease that can arise sporadically and has potential to cause an outbreak. The incidence of leptospirosis in Indonesia is quite high. The International Leptospirosis Society (ILS) states that Indonesia was at the third ranks of mortality rate due to leptospirosis in the world. Mortality due to leptospirosis in Indonesia reached from 2.5% to
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16.45% (the average was 7.1%). Meanwhile, among those at the age of 50 years old and above, the incidence was about 3%-54%, depends on the infected organ, and could reach 56% [2, 3].

Leptospirosis event data in Sampang year 2013—the incidence of leptospirosis occurred in Sampang regency reported that 55 patients and 8 died (CFR = 0.145%). Discovery system running leptospirosis incidence has not implemented optimally. This is due to the data mostly from patients from health care facilities such as hospitals (hospitally based). Most people do not know the causes, risk factors and methods of controlling leptospirosis, making efforts to control the disease of leptospirosis in Sampang is generally limited to the treatment of patients. People search (active case detection) leptospirosis prevention and control rat as the main transmitters do not yet optimal. Leptospirosis has aspects of climate and epidemiology in its incidence [1, 5, 6].

2. Methods

The purpose of this study was to analyze risk factors for outbreaks leptospirosis by climatic factors. Study is cross-sectional design of variable causes or risks that occur due to that the object of research are measured simultaneously (at the same time). The research location is in Sampang regency, where the study carries out during May-December 2013. The population in this study was total population of all districts in Sampang Madura island risk of transmission of leptospirosis occurred since January-December 2013 which is 15 urban/rural. Data climate factors such as temperature, humidity, rainfall and solar radiation were obtainable length of the Great Hall of the Meteorology and Geophysics Agency Region Perak Surabaya station, east Java province, Indonesia [6-8].

3. Results

The research results obtained distribution events in Sampang regency based epidemiological characteristics evently on region/districts/urban/rural with dominant male population that occurs in the wet season and dry season. Mapping temperature, humidity, rainfall, solar radiation, altitude and insecurity flooded area,

Table 1 Distribution of patients with leptospirosis per village in 2013 in Sampang Madura island.

| Village   | Health centers | Banyuanyar | Camplong | Kamoni ng | Robatal | Torjun | Total |
|-----------|----------------|------------|----------|-----------|---------|--------|-------|
| Aengsareh | 1              |            |          |           |         |        | 1     |
| Banyuanyar| 5              | 5          |          |           |         |        | 5     |
| Camplong  | 1              | 1          |          |           |         |        | 2     |
| Dalpenag  | 11             |            |          | 11        |         |        | 22    |
| Gn Sekar  | 25             |            |          | 25        |         |        | 50    |
| Gunung Maddah | 1             |            |          | 1         |         |        | 1     |
| Mandangan | 1              | 1          |          | 1         |         |        | 3     |
| Paseyan   | 1              | 1          |          | 1         |         |        | 3     |
| Polagan   | 4              |            |          | 4         |         |        | 8     |
| Robatal   | 1              |            |          | 1         |         |        | 2     |
| Rong Tengah | 32            |            |          | 32        |         |        | 64    |
| Taman Sareh | 1             |            |          | 1         |         |        | 2     |
| Tanggumong| 2              |            |          | 2         |         |        | 4     |
| Torjun    |                |            |          |          | 2       |        | 2     |
| Total     | 55             | 5          | 30       | 1         | 2       |        | 89    |
| Population| 55,184         | 4,1205     | 46,360   | 4,3424    | 3,4226  |        | 220,399|
| IR/10,000 | 9.97           | 0.24       | 6.47     | 0.23      | 0.58    | 4.04   |
vegetation in Sampang regency on the incidence of leptospirosis showed very varied and did not show a specific distribution pattern.

3.1 Association between Temperature and Leptospirosis

There is a significant relationship between the temperature of leptospirosis cases in this area of research which may be due to that average temperature per month ranged between 29.35 °C-30.62 °C is the optimal temperature for growth of bacteria leptospira. The urine of mice carrying the bacteria lacker although temperatures in the optimal temperature for the proliferation of rats, but rats breed not all carry the bacteria leptospira. So that, cases of leptospirosis erupted in February-March (because seasonal patterns including rainy season) are supported by the presence of water logging and flooding. These conditions resulted in environmental sanitation and residential housing decline, so, cases of leptospirosis soared and caused an outbreak of leptospirosis [5, 9, 10].

3.2 Association between Humidity and Leptospirosis

The results of this study showed no association between moisture with cases of leptospirosis in Sampang Rat (Rattus tanezumi) and (Rattus novergicus) captured in the study area, even though the carrier leptospira bacteria was not affected by the average kelembaban. Kelembaban in Sampang district is between 63.4%-80%. Humidity is included in the upper limit of the optimum moisture rodents to breed, so, the lack of a significant association between humidity and leptospirosis cases in Sampang may occur. Rats require optimum humidity around 70%-80% for the breed. In addition, because data on suspected cases of leptospirosis and humidity factor season is only for 1 year in 2013, it leads to a detailed analysis of the relationship less. Humidity can affect the activity of mice in both the day and night to transmit diseases including leptospirosis [5, 9, 10].

3.3 Association between Rainfall and Leptospirosis

The average of rainfall per month ranged between 183-190 mm in Sampang. Climate can affect the pattern of infectious diseases due to that both disease agents viruses, bacteria or parasites, vectors are sensitive to temperature, humidity and other ambient environmental conditions. In addition, the WHO also states the rodent-borne diseases such as leptospirosis associated with warm weather conditions. From the observation of the WHO south-east Asia region, it concluded that leptospirosis is a re-emergence of infectious diseases in southeast Asia. Climates and environmental conditions, environmental sanitation residential housing, population density and the factors of unhealthy behavior support high transmission of disease in the region. Leptospirosis has a seasonal distribution (the change from summer to rainy season), and precipitation can be used to predict the occurrence of leptospirosis. Leptospirosis can affect public health as well as animal and its prevalence may increase, which can be prevented by vaccination for animal disease. While the human society improve the quality of hygiene and sanitation and rainfall affects adnya puddles and flooding. Flooding causes environmental sanitation is poor residential housing, while at the time of the flood, many breeding places for rats switched houses [5, 9, 11].

3.4 Association between Solar Radiation and Leptospirosis

Intensity or duration of solar lighting is very influential with the temperature and humidity around it. Rodent or rats are animals active at night, so, the sun shines longer affect the activity of the rodent. Lighting sun’s effect on rodent habit rests until sunset. Rodent rest in a dark place and protected from the sun for reproductive activities, as well as in the habit of putting up food for the group [4, 5, 9].
4. Conclusion

Among seasonal factors (temperature, humidity, rainfall and solar radiation length), rainfall factor had a significant association with cases of leptospirosis in Sampang 2013. There are a few things that might make this happen. Some of them are that less duration data is retrieved, the complete climate data obtained, and the lack of frequency data take leptospirosis cases. Moreover, it may try personal hygiene and environmental sanitation in Sampang poorly implemented community.

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