

8. SITI THOMAS_Risk Factors of Leptospirosis In Semarang, Central

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Risk Factors of Leptospirosis In Semarang, Central Java Indonesia: a Case Control Study

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ABSTRACT— Indonesia ranks 3rd in the world among countries with high leptospirosis death rate. The death rate in the country ranges between 16.45% and 56% in individuals of at least 50 years. Central Java had 164 cases with 30 deaths (Case Fatality Rate 18.29%) in 2016. Semarang had total of 56 cases with the death of 8 people recorded in 2015 (Case Fatality Rate: 14.3%). The objective of this study was to analyze the most dominant risk factor related to Leptospirosis in Semarang City. The results of the bivariate analysis showed the significance value (p-value) of knowledge = 0.001; home physical environment = 0.001; behavior = 0.023. Multivariate analysis obtained knowledge (p = 0.04; Odd Ratio = 6.376; 95% Confident Interval = 1.092-37.210), home physical environment (p = 0.012; Odd Ratio = 6.023; 95% Confident Interval = 1.475-24.532) and behavior (p = 0.254; Odd Ratio = 2,553; 95% Confident Interval = 0.509-12,797). The most dominant risk factor related to Leptospirosis is knowledge.

KEYWORDS: Leptospirosis, Knowledge, Home physical environment, Behavior.

1. INTRODUCTION

Leptospirosis is a zoonotic disease caused the genus *Leptospira*. The most affected regions are tropical and subtropical countries with high rainfall as stated by WHO [1]. Leptospirosis worldwide incidences were reported to be 0.1 to 1 per 100, 000 populations and 10 to 100 per 100,000 and could increase during seasonal outbreaks and among high-risk populations [2]. The most affected regions in Indonesia include the islands of Bali, Java, South Sumatra, North Sumatra, West Sumatra, Riau, East Kalimantan, West Kalimantan and West Nusa [3]. In 2016, there were 164 cases with 30 deaths in Central Java (CFR 18.29%) [4], spread across several districts including Jepara, Pati, Demak, Semarang, Boyolali, Klaten, Sukoharjo, Karanganyar, Purworejo, Banyumas and Cilacap. In Semarang, there were 42 cases of Leptospirosis in 2016 [5]. From the concept of the triad epidemiological theory, infectious diseases are influenced by such factors as agent, host and environment [6]. The results showed that unhealthy homes were 3 times more likely to develop the condition compared to healthy ones. Furthermore, houses with rats were 6 times more susceptible to Leptospirosis (p = 0,000; Rp. 6,448; 95% CI = 2,081-19,983) [7]. Other researchers stated that rats, high rainfall, the closeness of houses to the gutter, and the presence of garbage are risk factors related to the incidence of Leptospirosis [8]. Washing and bathing in rivers increases the risk of being infected with *Leptospira* bacteria [9]. For instance, bathing in open space or rivers have a risk rate of 2.4 times (OR = 2.4; 95% CI = 1.3-4.6). In a similar way, washing clothes in the river has a risk of 2.5 Leptospirosis (OR = 2.5; 95% CI = 1.2-4.7) [10]. Fishing in rivers, contact with rats and farm activities in the farm are risk factors for Leptospirosis in Imogiri District [11]. Knowledge is closely related to education. With a high level of education, a person's knowledge will be broader [12]. Environmental and behavior al factors associated with the continuing threat of leptospirosis in St [13]. Study in harmony with Hasanah in 2007 which stated that there is a relationship between knowledge and the incidence of Leptospirosis (p = 0.015) [14]. The purpose of this study was to analyze the most dominant risk factors related to

Leptospirosis in Semarang City.

2. Main Text Methods

2.1 Study design and Setting

This study was observational analytic with case control design. The sampling technique used Proportional Random Sampling and the comparison of cases and controls was 1: 1.

2.2 Data Collection

Data were collection by researches was done by a valid and reliable questionnaire, observation and interviews with respondents. The population included all people suffering from Leptospirosis in Semarang City in 2016. The samples were calculated based on the sample size formula from Dahlan and obtained 24 cases and controls 24 [15]. Confounding variable as age, sex, education and occupation in the case and control groups were matching.

2.3 Data analysis

The collected data was labeled and coded. It was entered and analyzed using SPSS. Data analysis was carried out in univariate, bivariate with Chi Square test and multivariate. Multiple logistic regression was performed to determine the associated factors for knowledge, home physical environment and behavior toward leptospirosis among the respondents. Categorical data was presented as Frequency Table and Percentage. A p-value of less than 0.05 was judged to be statistically significant [16].

3. Results

3.1 Overview of the study location

The study was conducted in the city of Semarang with an area of 373.70 km². Semarang City has 16 districts and 177 sub-districts. In addition, it has 4 regional boundaries, the western one with Kendal Regency, the eastern with Demak Regency, the southern with Semarang Regency and the northern one bounded by the Java Sea with a coastline length of 13.6 kilometers. In 2016 the incidence of Leptospirosis was spread in several areas of Semarang as illustrated in Figure 1.

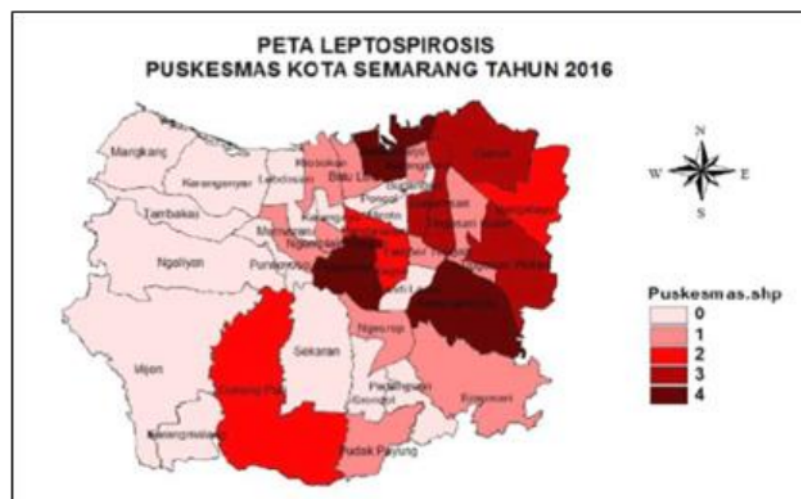


Fig 1. Spread Map incidence of leptospirosis in the city of Semarang

The study was conducted in the city of Semarang, sampling at 19 health centers, i.e.:

No.	Health Centers' name in Semarang	Number of Patients	Number of Leptospirosis	Number of Samples
1.	Bandar Harjo	2		1
2.	Kedungmundu	2		1
3.	Pegandan	4		3
4.	Tlogosari Wetan	3		2
5.	Bangetayu	2		1
6.	Kagok	2		1
7.	Gayamsari	1		1
8.	Halmahera	3		2
9.	Pandanaran	2		1
10.	Tlogosari Kulon	1		1
11.	Genuk	3		2
12.	Karang Doro	1		1
13.	Krobokan	1		1
14.	Ngesrep	1		1
15.	Pudak Payung	1		1
16.	Rowosari	1		1
17.	Bulu Lor	1		1
18.	Ng. Simongan	1		1
19.	Gunung Pati	2		1
	Total	34		24

3.2 Univariate Analysis (Characteristics of Respondents)

Univariate analysis was carried out through frequency distribution to describe the characteristics of respondents including age, sex, education, occupation between case groups and controls as presented in table 1.

Table 1. Description of Characteristics of Respondents

Characteristics	cases	controls	P
Age			0,824
- 20-30 year	1 (4,2%)	1 (4,2%)	
- 31-40 year	5 (20,8%)	4 (16,7%)	
- 41-50 year	4 (16,7%)	5 (20,8%)	
- 51-60 year	6 (25%)	9 (37,5%)	
- > 60 year	8 (33,3%)	5 (20,8%)	
Sex			1,000
- Man	19 (79,2%)	19 (79,2%)	
- Woman	5 (20,8%)	5 (20,8%)	
Education			0,948
- Elementary school	12 (50%)	10 (41,7%)	
- Junior high school	5 (20,8%)	6 (25%)	
- Senior high school	5 (20,8%)	6 (25%)	

- Bachelor (S1)	2 (8, 3%)	2 (8, 3%)	0,950
Occupation			
- labor	2 (8, 3%)	4 (16, 7%)	
- Traders	1 (4, 2%)	1 (4, 2%)	
- teacher	4 (16, 7%)	1 (4, 2%)	
- IRT	2 (8, 3%)	4 (16, 7%)	
- Parking officers	2 (8, 3%)	2 (8, 3%)	
- security	1 (4, 2%)	1 (4, 2%)	
- Private	3 (12, 5%)	4 (16, 7%)	
- Does not work	1 (4, 2%)	1 (4, 2%)	
- Entrepreneur	4 (16, %)	4 (16, 7%)	
- Retired	2 (8, 3%)	1 (4, 2%)	
- Civil servants	2 (8, 3%)	1 (4, 2%)	

Table 1 shows age, sex, education and occupation in the case and control groups were homogeneous (all characteristics $p > 0.05$).

Table 2. Description of Respondents' Physical Environment in Semarang in Case and Control Groups.

Physical Environment of the House		Percentage			
		Case		Control	
		No	Yes	No	Yes
1.	Have you found rats inside or outside your house?	0	100	33,3	66,7
2.	Can gutters at home or in your home environment flow smoothly?	50	50	16,7	83,3
3.	Are there gutters at home or in your neighborhood?	37,5	62,5	54,2	45,8
4.	Does the house / around your house have garbage scattered about?	54,2	45,8	62,5	37,5
5.	Has your home environment ever been flooded?	37,5	62,5	79,2	20,8
6.	Are there puddles at home or in your environment?	62,5	37,5	87,5	12,5
7.	Does the gutter at home or in your environment often overflow?	54,2	45,8	66,7	33,3
8.	Is the distance of your house to a landfill less than 1 km?	25	75	41,7	58,3
9.	Is your garbage collection place closed?	45,8	54,2	45,8	54,2
10.	Is your garbage collection place often cleaned by officers?	29,2	70,8	37,5	62,5

The condition of the respondent's physical environment was measured on the basis of 10 questions with "yes" and "no" answer choices. The description of the respondent's physical environment can be seen in table 2.

Table 3. Description of Respondent's Knowledge of Leptospirosis in Case and Control groups.

Knowledge	Percentage			
	Case		Control	
	No	Yes	No	Yes
1. Know about leptospirosis	87,5	12,5	54,2	45,8

Knowledge	Percentage			
	Case		Control	
	No	Yes	No	Yes
2. Rat as carriers of leptospirosis	83,3	16,7	54,2	45,8
3. Cows, sheep, goats, pigs, and dogs as carriers of leptospirosis	95,8	4,2	91,7	8,3
4. General symptoms of leptospirosis include fever, headache, and pain in the muscles	95,8	4,2	79,2	20,8
5. Severe leptospirosis can cause leptospirosis pneumonitis in the form of coughing up blood with yellow eyes	87,5	12,5	75,0	25,0
6. Flooded and humid environmental conditions can increase the occurrence of leptospirosis	75,0	25,0	41,7	53,8
7. Leptospirosis can be prevented	87,5	12,5	54,2	45,8
8. Using gloves or boots while cleaning the house or inundation water or mud is a way to prevent leptospirosis	83,3	16,7	45,8	54,2
9. Weather or climate can affect leptospirosis	70,8	29,2	45,8	54,2
10. The type of information provided by the community health office or health office about the dangers of leptospirosis can already make people know about the disease leptospirosis	87,5	12,5	62,5	37,5
11. Know the danger level of leptospirosis	83,3	16,7	54,2	45,8
12. A person's nutritional status and immune level can reduce the risk of transmitting leptospirosis	58,3	41,7	37,5	62,5

Community's knowledge on leptospirosis was measured by 12 questions using "yes" or "no" answer choices. The description of the knowledge of leptospirosis in the Semarang sub-district area is shown in Table 3.

Table 4. Descriptions of respondents' behavior towards Leptospirosis in the Case and Control Groups.

Behavior	Percentage			
	case		Control	
	no	yes	No	yes
1. Do you often contact/ touch rats?	54,16	45,8	58,3	41,7
2. Do you use personal protective equipment (gloves, masks, shoes, protective clothing) when in direct contact with rat, livestock, pets or dead animals?	79,16	20,83	58,3	41,7
3. Do you bathe in the river / other types of open baths?	79,16	20,83	83,34	16,67
4. Do you use soap during bathing?	4,16	95,83	16,67	83,34
5. Do you often have direct contact with dirty water such as puddles of rainwater, gutters and so on?	29,16	70,08	58,3	41,7
6. Do you use personal protective equipment (gloves, masks, shoes, protective clothing) when in direct contact with dirty water?	62,5	37,5	20,8	79,16
7. Do you immediately clean your body after direct contact with dirty water?	33,34	66,6	25	75
8. Do you hoard garbage around the house (home yard)?	66,67	33,3	54,16	45,8

Behavior	Percentage			
	case		Control	
	no	yes	No	yes
9. When working, do you use footwear?	12,5	87,5	4,16	95,83

Public health behavior was measured by 9 questions with "yes" and "no" answer choices. The description of public health behavior in the city of Semarang was as shown in table 4.

3.3 Bivariate Analysis

The relationship of knowledge, behavior and physical environment of the houses with the incidence of Leptospirosis can be seen in table 5.

Table 5. Relationship between Knowledge, behavior and Physical environment of the House with the incidence of Leptospirosis

Variable	case		control		P	OR	CI 95%
	F	%	F	%			
Knowledge					0,001	11,00	2,1-57,5
- Low	21	87,5	12	50			
- High	3	12,5	12	50			
Behavior					0,023	5	1,2-21,5
- Bad	10	41,7	3	12,5			
- Good	14	58,5	21	87,5			
Physical Environment of the House					0,001	9,23	2,5-34,6
- Bad	17	70,8	5	20,8			
- Good	7	29,2	19	79,2			

The result of bivariate analysis with Chi square test is shown in Table 5, the analysis results established that knowledge is related to the incidence of Leptospirosis. The respondents with low knowledge were up to 11 times more likely to develop the condition than those with more understanding of the condition ($p = 0.001$; $OR = 11,0$; $95\% CI = 2,1-57,5$). In addition, behavior variables are also related to the incidence of Leptospirosis. The respondents with bad behaviors were 5 times more likely to develop it compared to those with good conduct ($p = 0.023$; $OR = 5,0$; $95\% CI = 1,2 - 21,5$). The physical environment of the house plays a significant role as well. The individuals living in the physical compromised home were 9.23 times more likely to be infected compared to those living in a better seating ($p = 0.001$; $OR = 9.23$; $95\% CI = 2.5-34.6$).

3.4 Multivariate Analysis

The variables entered in the multivariate test are those which in the bivariate test have a p -value <0.25 . From the results of the three bivariate examinations, multivariate tests with multiple regressions were conducted. The results of the analysis were as presented in table 6.

Table 6. Results of analysis of Multivariate tests with multiple regression

Variable	B	p-value	OR	95% CI
Knowledge	1,852	0,040	6,376	1,09-37,21
Physical Environment of the House	1,792	0,012	6,023	1,48-24,53
Behavior	0,937	0,254	2,553	0,51-12,78

Table 6 shows that after the three variables were analyzed together with the multivariate test, knowledge and behavior were risk factors for the incidence of Leptospirosis. In fact, the most dominant variable related to the incidence of Leptospirosis was knowledge (OR: 6.367; 95% CI: 1.09 - 37.21) and then the physical environment of the house (OR: 6.023; 95% CI: 1.48 –24.53)

4. Discussion

The results showed that there was a relationship between knowledge and the incidence of Leptospirosis in the Semarang. This finding was in line with the study of Okatini et al. in the Jakarta area in 2003-2005 which started that at a low level of knowledge, people suffered more from Leptospirosis (68.4%) [17]. The Ikawati et al., studied in the Klaten Regency area [18], Supraptono et al. was conducted in the Semarang region in 2009 [19], and Sofiyani et al. in Klaten Regency stated [20] that there is a relationship between knowledge and the incidence of Leptospirosis. Knowledge and attitude into forming an acceptable practice to reduce transmission of Leptospira among urban population in Malaysia [21]. Humans may be exposed to leptospirosis through occupational, recreational, or environmental factors [22]. zoonotic disease prevention practices show varying relationships between knowledge, attitude, and prevention practices [23]. Knowledge or cognition is a very important domain in shaping one's actions (over behavior). Behavior based on knowledge will be better than behavior that is not based on knowledge, there is a relationship between knowledge and leptospirosis prevention efforts [24]. People with lower education levels might have sufficient knowledge, but this does not mean that they have the proper understanding to translate it into proper attitudes and beliefs [25]. A large majority of the participants had never heard about the disease leptospirosis. Thus, they were considered to have poor knowledge (81.1%) for a total of 24 questions about leptospirosis [26]. Poor knowledge of Leptospirosis implied the need for repeated health education for people especially for those with low education, as control efforts [27]. Good knowledge of leptospirosis will lead to better attitude and practice. If their knowledge, attitude and practice are good, the risk of getting infection might possibly decrease [28]. Knowledge and attitudes about leptospirosis into practices that reduce the transmission of Leptospira among an urban slum population at high risk for exposure to the bacteria [16].

The physical environment of houses related to the incidence of Leptospirosis. Physical and biological environmental factors are proven to be related with the incident of the condition. Physical environmental factors included the presence of water bodies, gutters, stagnant water, and the distance between houses and garbage collection points. Similarly, biological environmental factors related to the incidence of Leptospirosis, including rat populations inside or outside the house as well the presence of pets [29]. Research showed that the presence of stagnant water proved to be a risk factor related to the incidence of Leptospirosis. These results were relevant to this study [30]. Research stated that respondents who saw rat in their house had a risk of 4.5 times [31]. Leptospira species that is transmitted through rats is the most dangerous to human compared to all Leptospira in other domestic animals³². In addition, a history of

flooding and the distance between houses and landfills are also risk factors for Leptospirosis [33]. This study proved that health conduct is related to the incidence of Leptospirosis. Leptospirosis is an infectious disease that occur in intact skin conditions, such as where someone is in contact with water, soil, and plants contaminated with urine from rats or other animals with Leptospirosis for quite long. Leptospira contamination in the human body, it is obligatory to wear masks, gloves, work clothes and boots [34]. This study supports several previous works, such as the research showing that poor puddle conditions are risk factors for Leptospirosis incidence ($p = 0.014$ Rp. = 5.71; 95% CI = 1.42-223.01) [32]. The water around the house is at risk for Leptospirosis 2.23 times compared to homes in dry settings.

Poor environmental conditions are statistically related to the incidence of Leptospirosis, while sanitation in homes and residences are not related. The existence of rats is the dominant factor. Research Azwar et al, show the workers' level of knowledge and practice were relatively poor despite an overall good practice on leptospirosis [35]. Risk factors for exposure to leptospirae include occupational exposure, recreational activities and household environmental factors [36]. Poor house hygiene and environmental sanitation were also responsible for the increased risk of leptospirosis due to the close proximity to uncollected trash and rodent infestations [37]. Knowledge of these practices that are lacking in the assessed community is important to better plan effective intervention strategies [38].

5. Conclusion

From the results of the study, it can be concluded that knowledge and physical environment of houses are directly related to the incidence of Leptospirosis in the Semarang. The most dominant variable is knowledge, where it is low, the risk of developing Leptospirosis is increased up to 6.376 times compared to a scenario where it is high. Besides, poor physical environment increases the risk of Leptospirosis up to 6.023 times compared to a good setting.

6. Limitation

The principal limitation of the method is the maximum number of cases which can be recruited and analyze.

7. Ethics approval and consent to participate

This study received ethical clearance from the Bioethics Committee of Medical Research / Medical Faculty of Sultan Agung Islamic University, Semarang (41 / I / 2018/ Bioethics Commission).

8. Consent for publication

Not applicable.

9. Availability of data and materials

The datasets analyzed and the software commands during the current study are available from the corresponding author on reasonable request.

10. Competing interests

The authors declare that there is no conflict of interest in the present study.

11. Funding

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12. Authors' contributions

STZ and R conceived, designed, coordinated and supervised the research project including data collection. AK, MJ and FM performed the data quality control, performed the statistical analyses and evaluated the results. All authors involved in the writing and revising the manuscript, gave their contribution to improve the paper and approved the final manuscript.

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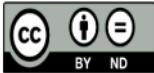
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