Factors Affecting the Incidence of Leptospirosis in Semarang City

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Article Info	Abstract

Leptospirosis is one of the Emerging Infectious Diseases caused by pathogenic leptospira bacteria, transmitted directly or indirectly through animal urine containing leptospira bacteria. The spread of leptospirosis in Indonesia is broad in most provinces and the mortality rate is quite high. The city of Semarang is an endemic area of leptospirosis with an increasing incidence of leptospirosis every year, this is related to socio-demographic factors, the presence of rats and environmental factors. This study aims to analyze whether the socio-demographic risk factors (age, gender, education, occupation, family income), the presence of rats (contact with rats, and the presence of rat droppings) and the environment (rivers flow, clean water facilities, floods, puddles) affect the incidence of leptospirosis. This research is an analytic observational study with a case -control approach. The population of this study were all leptospirosis sufferers who were recorded in the Semarang City Health Service report in 2019-2021. The samples used were 80 (40 cases, 40 controls) with purposive sampling technique based on the inclusion and exclusion criteria that have been determined. The research instrument used is a questionnaire. The data analysis in this study was univariate analysis (frequency distribution), bivariate analysis (chi-square test) and multivariate analysis (logistic regression test). The results showed that there was a significant relationship between education variables, the presence of rats and the environment with the incidence of leptospirosis in Semarang City. There was no significant relationship between the variables age, gender, occupation and income with the incidence of leptospirosis in Semarang City. The education variable is the factor with the strongest relationship to the incidence of leptospirosis in Semarang City.

INTRODUCTION

Leptospirosis is one of the emerging infectious diseases caused by pathogenic leptospira bacteria, transmitted directly or indirectly through animal urine containing Leptospira bacteria (Ministry of Health RI, 2019). According to WHO (World Health Organization), more than 500,000 severe cases occur every year worldwide (Tubiana et al., 2013), especially in countries with tropical and subtropical climates that have high rainfall (Febrian and Solikhah, 2013). It is known that there are 1,500,000 cases of leptospirosis with 100,000 deaths in the world that occur every year (Equator and Lestari, 2016a).

In recent years numerous reports and reviews from health organizations around the world have highlighted leptospirosis as a growing problem as evidenced by the increased mortality and incidence in humans and animals (Zakharova et al., 2021). SEARO (South-East Asia Regional Office) stated that most countries in Southeast Asia are endemic areas for leptospirosis, including Indonesia, Sri Lanka, Thailand, and India. Leptospirosis cases in Southeast Asia are influenced by the environment, behavior, work, and socio-culture (Equator and Lestari, 2016a).

In Indonesia, leptospirosis is spread on the islands of Java, Sumatra, Bali, Nusa Tenggara, Sulawesi and Kalimantan. There were four provinces that reported cases of leptospirosis in 2015 namely DKI Jakarta, Central Java, Yogyakarta Special Region, and East Java. In Central Java Province, leptospirosis was reported as one of the Extraordinary Events (KLB) that caused death with a Case Fatality Rate (CFR) of 44.44%. The distribution of leptospirosis cases in Central Java Province includes Semarang City, Klaten Regency, Banyumas, Purworejo, Demak, Sukoharjo, Cilacap, Boyolali, Pati, Karanganyar, Jepara, Grobogan, and Surakarta City (Widjajanti, Pujiyanti and Mulyono, 2016).

Leptospirosis cases increased dramatically to as many as 830 cases in 2016, and 894 cases in 2018. The highest cases and deaths due to leptospirosis in 2018 occurred in Central Java with a CFR of 20.84% (Ministry of Health RI, 2019). Based on data from the P2TVZ Section (Control of Zoonotic Vector Infectious Diseases) Semarang City Health Office

(2021) in Semarang City in 2015 there were 56 cases and 8 people died (CFR 14%), in 2016 there were 42 cases and 8 people died (CFR 19%), in 2017 there were 55 cases of leptospirosis (IR 3.47 / 100,000 population) and the number of cases died 14 people (CFR 26%). In 2019 there were 45 cases, and 11 people died (CFR=24%). In 2020, from 47 cases, there are 5 people died (CFR=11%). From January to September 2021, there are 30 cases, and the number of dead cases was 6 people (CFR=20%). (Semarang City Health Office, 2021).

In subtropical countries, leptospira infection is rare, the climate suitable for the development of leptospires is warm air, wet soil and alkaline pH. Such conditions can be found in tropical countries throughout the year. In tropical countries, the incidence of leptospirosis is 1000 times more than in subtropical countries with a higher risk of disease. Leptospira can survive in moist and hot soil for up to 43 days (Equator and Lestari, 2016a).

Leptospirosis is a disease associated with the environment. Environmental factors that play a role in the incidence of leptospirosis are home sanitation. Home sanitation is said to be good if it meets the criteria for a healthy home, namely fulfilling the requirements for preventing transmission between residents of the house by providing clean water, managing feces and household waste, being free of disease vectors and rats, not excessive occupancy density, sufficient morning sunlight, protected food and drink. from pollution, adequate lighting and ventilation (Auliya, 2014). Work or carrying out activities that pose a risk of contact with sources of infection, such as doctors, veterinarians, nurses, rescue or SAR teams, soldiers, hunters, and workers in abattoirs, pet shops, plantations, agriculture, mines, and mountaineers, and others are risk factors for leptospirosis (Ministry of Health of the Republic of Indonesia, 2017).

Maniah et al. (2016) have conducted research concerning to environmental factors related to the incidence of leptospirosis in the city of Semarang, stating that in 2015 there were 56 cases in the city of Semarang with a mortality rate of 8 cases (CFR 14.29%) spread over 26 health centers. The number of leptospirosis cases that died was in 8 health centers, namely Pegandan, Tlogosari Wetan, Bangetayu, Pandanaran, Karangayu, Mijen, Karanganyar, and Tlogosari Kulon health centers.

Environmental factors related to the incidence of leptospirosis include the presence of standing water, ditch conditions, the presence of rats and a history of injuries. The factors of ownership of pets, activities in water and a history of contact with dead rats are not associated with the incidence of Leptospirosis in Semarang City. Dominant cases of leptospirosis occur in the productive age of 35-39 years. In terms of gender, males are more dominant, Setyorini et al. (2017) mention that leptospirosis cases are mostly found in areas with medium rainfall of 101-300 mm/month. Meanwhile, most of the garbage dumps are less than 500 meters away. The analysis of the distribution pattern of Leptospirosis showed that the results of the nearest neighbor analysis ratio of 0.60 meant that the distribution pattern of Leptospirosis cases was in a grouped position following the pattern of river flow. Meanwhile, most of the garbage dumps are less than 500 meters away. The analysis of the distribution pattern of Leptospirosis showed that the results of the nearest neighbor analysis ratio of 0.60 meant that the distribution pattern of Leptospirosis cases was in a grouped position following the pattern of river flow. Meanwhile, most of the garbage dumps are less than 500 meters away. The analysis of the distribution pattern of Leptospirosis showed that the results of the nearest neighbor analysis ratio of 0.60 meant that the distribution pattern of Leptospirosis cases was in a grouped position following the pattern of river flow.

Leptospirosis is an acute infection caused by leptospira bacteria. One of the factors that influence the incidence of Leptospirosis in the Gajahmungkur District, Semarang City in 2014-2018 is the environmental risk factor, Nurhandoko and Siwiendrayanti (2018) in their research mention the vulnerability zone of the environmental risk factor for the incidence of Leptospirosis in Gajahmungkur District shows that the research variables studied mostly occur in The 3 sub-districts are Sampangan Village, Bendan Ngisor Village, and Bendan Duwur Village. The 3 sub-districts are very susceptible to the spread of Leptospira bacteria in the environment. The vulnerability zone points are evenly distributed throughout Gajahmungkur District. The presence of signs in mice is an environmental risk factor that is very susceptible to other variables.

Several epidemiological-based studies of leptospirosis in the Semarang City area have shown various risk factors for the incidence of leptospirosis. Risk factors, especially in the individual and his physical environment. Individual risk factors are behavioral factors of individuals who are at risk of contracting leptospirosis. While the risk factors for the physical environment are factors in the physical environment that support the transmission of leptospirosis. The majority of individual risk factors and the physical environment from several studies show individual risk factors in the form of a history of open wounds on the feet or hands that touch rat urine, while the risk factors for the physical environment include the presence of rats around the house, the presence of puddles, bathing/washing habits in rivers, and bad gutters.

Based on the problems that have been described in the background, namely the incidence of leptospirosis in the city of Semarang which has increased and the number of risk factors that affect the incidence of leptospirosis, a further study is needed in relation to the risk factors for the incidence of leptospirosis so that further it is known what factors influence the incidence of leptospirosis. in the city of Semarang. This study aims to analyze more deeply whether socio-demographic risk factors, the presence of rats, and the environment affect the incidence of leptospirosis in Semarang City, and how much influence they have on leptospirosis so that leptospirosis risk factors can be controlled appropriately.

METHOD

This research is an analytic observational study with a case-control. The population used is all leptospirosis sufferers recorded in the Semarang City Health Office report in 2019 - 2021.The sample in this study for 2019 - 2021 to 80 people where 40 were in the case group and the other half were in the control group with the purposive sampling technique.

The independent variable in this study is socio-demography, which includes age, gender, education, occupation, and family income. Presence of rats, which includes contact with rats and presence of rat droppings. Environment, which includes river flow, clean water facilities, floods, and puddles. While the dependent variable used is the incidence of leptospirosis in the city of Semarang. The research

instrument used is a questionnaire. Data analysis in this study were univariate analysis (frequency distribution), bivariate analysis (chi-square test) and multivariate analysis (logistic regression test).

RESULTS AND DISCUSSION

The study was conducted on all leptospirosis sufferers who were recorded in the Semarang City Health Service report in 2019–2021. The total sample that was obtained was 80 respondents (40 cases and 40 controls).

Table 1. Distribution of Comparative Socio-Demographic Factors, Rat Presence Factors and Respondent Environmental Factors between Case and Control Groups.

Variable	Case (n=40)	Control (n=40)
Age		
Adult (26-45 years)	15 (37.5%)	15 (37.5%)
Elderly (46-65 years)	25 (62.5%)	25 (62.5%)
Gender		
Man	33 (82.5%)	33 (82.5%)
Woman	7 (17.5%)	7 (17.5%)
Education		
Low education	20 (50.0%)	6 (15.0%)
higher education	20 (50.0%)	34 (85.0%)
Work		
at risk	4 (10.0%)	2 (5.0%)
No Risk	36 (90.0%)	38 (95.0%)
Income		
< MSE	20 (50.0%)	14 (35.0%)
MSE	20 (50.0%)	26 (65.0%)
Rat Presence		
No risk	31 (77.5%)	40 (100.0%)
at risk	9 (22.5%)	0 (0.0%)
Environment		
No risk	28 (70.0%)	38 (95.0%)
at risk	12 (30.0%)	2 (5.0%)

Table 1 shows a comparison of the socio-demographic distribution of respondents which shows that judging from the age in this study, both the case and control groups were mostly from the elderly age group (46-65 years), namely 25 (62.5%) respondents. Judging from gender, the male is dominating by 33 (82.5%) respondents. In terms of education, the case group of respondents with low education was 20 (50.0%) and respondents with higher education were 20 (50.0%) respondents, while in the control group the majority of respondents with higher education were 34 (85.0%) respondents. In terms of occupation, both the case group and control group were mostly with no-risk work status, in the case group there were 36 (90.0%) and 38 (95.0%) respondents in the control group. In terms of income, most of the control group > MSE, namely 26

(65.0%) respondents, while in the balanced control group 20 (50.0%) respondents < MSE and 20 (50.0%) respondents > MSE. The factor of the presence of mice in the case group was 9 (22.5%) respondents with risk status, and 31 (77.5%) respondents not at risk. In the control group, all 40 (100.0%) respondents were not at risk. In terms of the environment, in the case group there were 12 (30.0%) respondents with risk status, while 28 (70.0%) respondents were not at risk. In the control group the most with no risk status, namely 38 (95.0%) respondents. The factor of the presence of mice in the case group was 9 (22.5%) respondents with risk status, and 31 (77.5%) respondents not at risk. In the control group all 40 (100.0%) respondents were not at risk. In terms of the environment, in the case group there were 12 (30.0%) respondents with

risk status, while 28 (70.0%) respondents were not at risk. In the control group, the most with no risk status, namely 38 (95.0%) respondents. The factor of the presence of mice in the case group was 9 (22.5%) respondents with risk status, and 31 (77.5%) respondents not at risk. In the control group, all 40 (100.0%) respondents were not at risk. In terms of the environment, in the case group, there were 12 (30.0%) respondents with risk status, while 28 (70.0%) respondents were not at risk. In the control group the most with no risk status, namely 38 (95.0%) respondents.

Table 2. Results Bivariate Analysis of Socio-Demographic Risk Factors, Mice Presence Factors and Environmental Factors on Leptospirosis Incidence in Semarang City.

Variable	Case (n=40)	Control (n=40)	p
Age			
Adult (26-45 years)	15 (37.5%)	15 (37.5%)	1.000
Elderly (46-65 years)	25 (62.5%)	25 (62.5%)	
Gender			
Man-man	33 (82.5%)	33 (82.5%)	1.000
Woman	7 (17.5%)	7 (17.5%)	
Education			
Low education	20 (50.0%)	6 (15.0%)	0.001
higher education	20 (50.0%)	34 (85.0%)	
Work			
at risk	4 (10.0%)	2 (5.0%)	0.396
No Risk	36 (90.0%)	38 (95.0%)	
Income			
< MSE	20 (50.0%)	14 (35.0%)	0.175
MSE	20 (50.0%)	26 (65.0%)	
Rat Presence			
No risk	31 (77.5%)	40 (100.0%)	0.001
at risk	9 (22.5%)	0 (0.0%)	
Environment			
No risk	28 (70.0%)	38 (95.0%)	0.003
at risk	12 (30.0%)	2 (5.0%)	

Based on Table 2 shows that the variables of age, gender, occupation and income obtained a p-value > 0.05, it can be interpreted that these variables are not related to the incidence of leptospirosis, while the education variable, the presence of rats and the environment obtained p-value <0.05, it can be interpreted that these variables are significantly related to the incidence of leptospirosis in Semarang City.

Table 4.3 Logistics Regression Test Results

	Sig.	Exp (B)	95% CI for EXP (B)	
			Lower	Upper
Age	0.673	0.776	0.239	2.521
Gender	0.422	0.666	0.148	3,005
Education	0.006	6.133	1.013	37.114
Work	0.408	0.307	0.019	5.037
Income	0.707	0.279	0.355	4,607
The presence of mice	0.999	1,235	0.130	11.764
Environment	0.063	5.488	0.910	33,078
Constant	0.999	0.000		

All variables in the study were included in the multivariate analysis, both with p <0.05 or more than 0.05 in the bivariate chi-square or fisher's exact test. The results of the multivariate model analysis showed that there was 1 variable that greatly influenced leptospirosis, namely education (p = 0.006, OR = 6.133, 95% CI = 1.013-37.114).

Judging from the age in this study, both case and control groups were mostly from the elderly age group (46-65 years), namely 25 (62.5%) respondents. The results of statistical tests stated that age was not associated with the incidence of leptospirosis in Semarang City with a p-value > 0.05. Wirata and Saputro (2016) mention cases of leptospirosis can strike starting from the age of 6-70 years. Ulfah et al., (2018) in their research stated that adults (18-40 years) had a 42.22 times greater risk of developing leptospirosis than old age. However, in this study, age was not associated with the incidence of leptospirosis in the city of Semarang. Several studies say the incidence of leptospirosis is often influenced by various socio-cultural, occupational, behavioral and environmental factors. The risk of leptospirosis increases in areas where there are large numbers of animals and individuals with jobs as farmers or ranchers (Nursitasari, 2019). In addition to this, environmental factors and individual behavioral factors also play a role in the incidence of leptospirosis, leptospirosis is a risk for people working outdoors with animals and also risk for individuals exposed to contaminated water (Dewi and Yudhastuti, 2019). The results of this study are in line with the research conducted by Wirata and Saputro (2016) which states that age is not associated with the incidence of leptospirosis.

The results of the study showboth the control group and the case group were dominated by male sex, namely 33 (82.5%) respondents. The results of statistical tests stated that gender was not associated with the incidence of leptospirosis in Semarang City with p-value > 0.05. Prihantoro and Siwiendrayanti (2017) in his research said 80% of leptospirosis patients are male. Men and women have the same risk of contracting leptospirosis. However, men tend to be less concerned if there is a wound that can be a place for leptospirosis bacteria to enter. However, in this study gender is not a factor associated with the incidence of leptospirosis in Semarang City, the results of the study are in line with research

conducted by Wirata and Saputro (2016) which mentions gender is not associated with the incidence of leptospirosis. Men and women will always carry out activities, both indoors and outdoors, so they are both at risk of leptospira bacteria that can infect the body.

In terms of education, the case group of respondents with low education was 20 (50.0%) and respondents with higher education were 20 (50.0%) respondents, while in the control group the majority of respondents with higher education were 34 (85.0%) respondents. The results of statistical tests stated that education was significantly related to the incidence of leptospirosis in Semarang City with a p-value <0.05. The results of the study are in line with research that has been carried out by Widjajanti (2020) who mentions in endemic areas, the level of education also affects the incidence of leptospirosis, people who are highly educated always behave in a clean and healthy life in their daily life, hence that they can avoid leptospirosis transmission. On the other hand, people with low education do not know the importance of clean and healthy living behavior, environmental sanitation and personal hygiene are very poor as a result they are infected with leptospires. Education is one of the factors that are quite important in the transmission of diseases, especially leptospirosis. Low public education will bring awareness to the various risks of exposure to diseases that are around them. The higher the level of public education, the more significant the impact on the process of cutting the transmission line for leptospirosis (Martini et al., 2019).

In terms of occupation, both the case group and the control group were mostly with no-risk work status, in the case group there were 36 (90.0%) and 38 (95.0%) respondents in the control group. The results of statistical tests stated that work was not related to the incidence of leptospirosis in Semarang City with p-value > 0.05. Leptospirosis can occur as an occupational hazard (occupational hazard) attacking rice and sugarcane farmers, mining workers, veterinarians, breeders, dairy farmers, workers working in abattoirs, fishermen and soldiers. Outbreaks can occur in people who are exposed to rivers, canals and lakes whose water is contaminated with urine from domestic and wild animals or contaminated with urine and infected animal tissues. This disease is also a recreational risk (recreational

hazard). For swimmers, mountaineers, athletes, and those who camp in infected areas (Febrian, 2013).

Occupations that are at risk of infection with leptospirosis bacteria work as boatmen, and bamboo assemblers who often work in water for long periods (more than 6 hours). Work as a scavenger, because of frequent contact with garbage and a dirty environment. Work as animal breeders and veterinarians who are exposed to handling livestock/animals, especially when milking, touching dead animals, helping animals give birth, or finally contact with other materials such as placenta and amniotic fluid. Farmers in the fields are always in contact with moist soil and water that may be contaminated with Leptospira bacteria. Slaughterhouse workers. Gardeners/workers in plantations who are often in contact with moist soil contaminated with Leptospira bacteria. Sewer cleaners who always work in wet places, when working without personal protective equipment. Mining workers. Fish anglers, shrimp/ freshwater fish pond workers. Soldiers, hunters, and mountaineers, when wading through water or swamps. Laboratory workers who frequently examine Leptospira specimens. Hospital cleaners and paramedics. In this study, most of the respondents with non-risk jobs are private employees, civil servants and housewives/not working (Isnaini and Dyah, 2020). The results showed that work was not associated with the incidence of leptospirosis in the city of Semarang.

In terms of income, most of the control group > MSE, namely 26 (65.0%) respondents, while in the balanced control group 20 (50.0%) respondents < MSE and 20 (50.0%) respondents > MSE. The results of statistical tests showed that income was not related to the incidence of leptospirosis in Semarang City with a p-value >0.05. The results of the study are in line with research conducted by Samekto et al., (2019) that proves several variables that have been shown to have no effect on the incidence of leptospirosis are the presence of standing water around the house, the presence of garbage in the house, poor gutter conditions, risky work, low income, bathing and washing habits in rivers and no socialization of leptospirosis. This can be caused by other variables that have a stronger influence, in this study the education factor.

The factor of the presence of mice in the case group was 9 (22.5%) respondents with risk status, and 31 (77.5%) respondents not at risk. In the control group, all 40 (100.0%) respondents were not at risk. The results of statistical tests stated that the presence of rats was significantly associated with the incidence of leptospirosis in Semarang City with a p-value <0.05. One of the animals that are the source of transmission of Leptospirosis is rodents (rats). Unclean environmental conditions such as the presence of rats in the house is one of the risk factors for leptospirosis. Rats in the house increase the risk of 7.4 times the incidence of leptospirosis (Equator and Lestari, 2016b). In this study, some respondents were still in bad environmental conditions, there were many rats, thus increasing the risk of leptospirosis. Like other living things, living mice interact with their environment such as temperature, humidity, light, and soil texture. In this study, there were rats around the house and rat droppings were found in the house, even rats wandering around the house were very at risk of being infected with leptospira bacteria. Humans will always carry out activities in their environments therefore when humans carry out activities and come into contact with an environment contaminated with leptospira bacteria (eg garbage, sewer water, soil or plants) they can infect humans (Maniiah, Raharjo and Dewanti, 2016).

In terms of the environment, there were 12 (30.0%) respondents in the case group with risk status, while 28 (70.0%) respondents were not at risk. In the control group the most with no risk status, namely 38 (95.0%) respondents. The results of statistical tests stated that the environment was significantly related to the incidence of leptospirosis in Semarang City with a p-value <0.05. Leptospirosis is a zoonotic disease caused by a spiral-shaped bacterial infection of the genus Leptospira which is pathogenic and can be transmitted from animals to humans. Leptospirosis is the most widespread zoonosis in the world, especially in countries with tropical and subtropical climates that have high rainfall (Pertiwi, Setiani and Nurjazuli, 2014).

The results of the study are in line with the research conducted by Maniiah, Raharjo and Dewanti (2016) who mentions that there is a relationship between the presence of puddles with the incidence of leptospirosis and respondents who

live around their homes have puddles of water that have a 3.385 times greater risk of developing leptospirosis compared to respondents whose homes do not have puddles of water. The incidence of leptospirosis is increasing in developing countries, most of which are in the Southeast Asian region, where leptospirosis is endemic. The incidence of leptospirosis is often influenced by various factors, one of which is the environment (Nursitasari, 2019). In general, leptospirosis is a disease that often occurs in flood-prone areas because the incidence of this disease is highest after the flood recedes (Maniiah, Raharjo and Dewanti, 2016).

CONCLUSION

The conclusions of this study are: There is a significant relationship between education variables, the presence of rats and the environment with the incidence of leptospirosis in Semarang City. There is no significant relationship variableage, gender, occupation and incomewith the incidence of leptospirosis in Semarang City. Education variable is the factor with the strongest relationship to the incidence of leptospirosis in Semarang City

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