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PUBLIC HEALTH IMPACT OF RAT ON FLOOD-PRONE AREAIN INDONESIAN SETTINGS: *A SYSTEMATIC REVIEW*

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ABSTRACT: Rats can be a reservoir for several disease pathogens in humans, including Leptospira sp, PES, typh salmonellosis, Q-fever and so on. Leptospira is a disease caused by rat vectors which is often found in flood-prone are Floods will spread Leptospira sp. from the urine of infected animals and contaminate water as well as soil, sludge a the environment. The purpose of writing this systematic review is to review articles that discuss the public hea impacts of rat density in flood-prone areas – Indonesian setting, one of which is the impact of Leptospira sp pathoge by rats. The method of writing this systematic review is through a review of journals with the topic of the public hea impact of rat density in flood-prone area settings to identify diseases caused by the presence of rats. Based on this stu there were 9 articles that were relevant to the research question and met the inclusion criteria. From the results of t nine articles, it was found that the density of rats was at risk of causing public health problems in flood-prone are Leptospirosis is the most common disease, especially after the flood disaster. Puddles of water that have be contaminated by Leptospira sp bacteria then settle on the floor of the house, bathroom or surrounding settlements. T bacteria then enter the body through cuts or abrasions on the skin, mucous membranes of the mouth, nose and ey These bacteria can survive for days if not cleaned immediately.

Keyword*:Rats, Floods and Leptospirosis*

I. BACKGROUND

Floods have become one of the natural disasters that are often encountered in various countries, including Indonesia. Flood events cause excessive puddles of water on the ground which generally occurs when the rainy season arrives. The puddles that arise are caused by the increasing amount of water flowing over the land surface, both due to high rainfall and overflowing river water.[1] Flood events have caused various problems and losses for the community, such as causing loss of life and property, then the emergence of epidemics disease/health problems, damage to buildings and residences, damage to infrastructure, and so on. Settlements with flood-prone areas are one of the habitats for rat populations. Puddles of water due to flooding can be a medium for the spread of Leptospira sp. from the urine of infected animals including contaminating clean water as well as soil, sludge and the environment. Polluted environment Leptospira sp. can be a source of transmission of leptospirosis.

Rats can be vectors of diseases that spread several pathogens that cause health problems in humans. These include leptospirosis, typhoid, bubonic plague, salmonellosis, Q-fever, Chagas disease, and also some helminthic diseases such as schistosomiasis and angiostrongyliation, but the disease caused by rat urine is leptospirosis.[2,3] Many mammal species act as reservoirs for leptospirosis, however. Rats are the main reservoir. Types of rats that are widespread in the world and are associated with leptospirosis transmission are Rattus tanezumi, Rattus norvegicus, and Mus musculus.[4]

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 50 of 2017 concerning Environmental Health Quality Standards and Health Requirements for Disease-Carrying Vectors and Animals and their Control, it is stated that vector-borne and zoonotic diseases are infectious diseases through vectors and disease-carrying animals, such as: Leptospirosis.[5] Leptospirosis including certain infectious diseases that can cause outbreaks based on the Decree of the Minister of Health of the Republic of Indonesia No. 1501/Menkes/PerX/2010. Leptospirosis is a health problem in Indonesia, especially in flood-prone areas. Indonesia is located in the tropics, so it has two seasons, namely: the rainy season and the dry season. In general,

the start of the 2018/2019 rainy season can be estimated starting from October - December 2018. The peak of the 2018/2019 rainy season is generally in January - February 2019.[6] This condition is feared to have the potential for an extraordinary event (KLB) of Leptospirosis.[7]

Leptospirosis disease can occur when humans are contaminated with bacteria from the genus Leptospira from the family Leptospiracceae, order Spirochaetales. Leptospirosis can raise well in animal urine contaminated with Leptospirosis.[8] Rat populations in general are often found in the human environment (commensal). However, the existence of rats is often ignored by the community, there are still many people who do not care when there are rats in the house, even humans consciously or do not provide food, shelter, and means of transportation for rats.

Leptospirosis is a health problem in Indonesia, especially in flood-prone areas. Based on the Indonesian Health Profile of the Indonesian Ministry of Health in 2015, compared to 2014, there was a decrease in the number of cases from 550 cases to 366 cases in 2015. A significant decrease in Leptospirosis cases occurred in DKI Jakarta (from 106 cases in 2014 to 37 cases in 2015) and East Java (from 61 cases in 2014 to 3 cases in 2015). However, in Banten, where in 2014 there were no cases, there were 31 cases in 2015. The highest mortality rate due to leptospirosis occurred in DKI Jakarta with a CFR of 16.98%. Although the number of cases in 2015 decreased compared to 2014, the CFR due to leptospirosis increased from 11.27% in 2014 to 17.76% in 2015.[9]

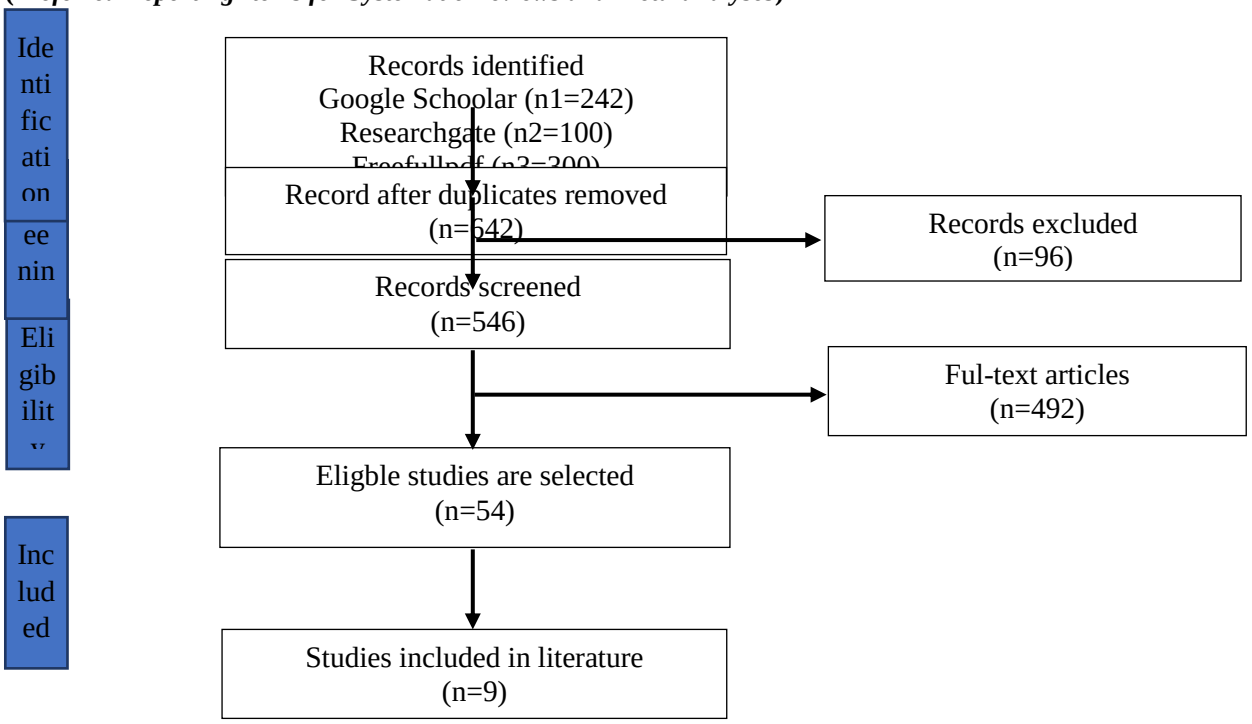
In Indonesia in 2018 there were seven provinces that reported cases of leptospirosis, namely Jakarta, West Java, Central Java, Yogyakarta, East Java, Banten, and Maluku. Leptospirosis cases increased dramatically in 2018 with a total of 895 cases. There are five provinces that experienced an increase in cases of leptospirosis, namely, Jakarta, Central Java, Yogyakarta, and Banten. From 2009 to 2018, the number of leptospirosis cases fluctuated. The number of deaths due to leptospirosis in 2018 was quite high with 148 deaths.[10]

Despite the impact caused by leptospirosis, this disease is still considered a neglected and unreported zoonotic disease.[11,12]In Indonesia, leptospirosis is often associated with diseases that are not clinically visible, are too difficult to diagnose with certainty or are misdiagnosed as dengue fever or other endemic diseases, laboratory facilities to perform confirmatory tests are also lacking and the diagnosis is relatively inaccessible and not fast enough.[13]This prompted the author to conduct this study with the aim of reviewing articles that discuss the public health impact of rat density in flood-prone areas, one of which is the impact of Leptospira sp pathogens by rats.

II. METHOD

The writing design used in this paper is a systematic review through a review of articles on the topic of the public health impact of rat density in flood-prone areas to identify diseases caused by the presence of rats. The article inclusion criteria used include a) Journals or articles in the last 5 years (2017 to 2022); b) The research subjects were rats as disease vectors; c) The journal used is an original article that focuses on the research location which is a flood-prone area. Meanwhile, the exclusion criteria include a) Journal/article review results; b) Journals/articles displayed are not full text c) Journals or articles with a research focus not on setting flood-prone areas.This research was conducted using the PRISMA chart to describe the process of finding journals that match the research questions. Article searches are limited to health articles based on zoonotic diseases caused by rats which are accessed through several sites, namely: google schoolar, sciencedirect, researchgate, and freefullpdf with the keywords leptospirasp and flood prone areas. Articles that met the inclusion criteria were collected and systematically examined. The process of selecting articles relevant to the research questions and inclusion criteria that have been set is illustrated in the PRISMA chart in figure 1.

Figure 1. PRISMA Chart
(*Preferred Reporting Items for Systematic Reviews and Meta-analyses*)



III. RESULT

The analysis of the 9 articles showed that 1 journal with a mixed method design, 1 journal with a case control study design, 2 journals with a descriptive design, 3 journals with an observational design and 2 journals with a cross sectional study design. After assessing the quality of the study, 9 articles can be categorized as good (high), then data extraction is carried out. This data extraction was carried out by analyzing the data based on the author's name, title, purpose, research method and results, namely the grouping of important data in the article. The results of data extraction can be seen in table 3.

Table 3. Results of Article Data Extraction according to the Criteria

No	Author	Title	Journal	Method	Result
1.	Nur lathifahSyakbanah, et al (2021)	Human Leptospirosis Outbreak: A year After TheCempaka Tropical Cyclone	Journal of Environmental Health, volume 13, no. 4, Pages 211-218	Observation with Spatio-temporal model	There are 99 people in 75 villages in Bantul who are infected with leptospirosis. Villages affected by flooding were 44% and cases of Leptospirosis were spread in 68% of villages. There is a relationship between cases of Leptospirosis in humans and relative humidity with a gap of 1 month (r=0.06849; p<0.05) and a gap of 3 months (r=0.07451; p<0.05) and rainfall with an interval of 1 month (r=0.7451; p<0.05) and a 3-month gap (r=0.6666; p<0.05). Heavy rains cause flooding and increase the transmission of leptospira bacteria into water by contact between humans, animals and the environment.
2.	Muhammad Rifaldi, etal(2020)	Relationship of the Environmental Condition with the Presence of Leptospira in Rats in Flood Prone Areas in Makassar City	Saudi Journal of Nursing and Health Care	Types of analytical research with cross sectional design	The results of this study found that 100% of Mus musculus, 53.3% of Rattus norvegicus, 22.2% of Rattus tanezumi were infected with Leptospira bacteria. The results showed that there were sewers with stagnant water (0.000), puddles other than sewers (0.026), waste disposal (0.005), waste other than ditches (0.007), smell of rat urine (0.049) and optimum stagnant water pH (0.001). with p-value < 0.05.
3.	Dewi, Wahyu Mustika, et al. (2019)	PrevalensiEktoparasit Pada TikusSebagaiUpayaPemetaanRisiko Zoonosis Di Kawasan Rob Kota Semarang (Ectoparasite Prevalence in Rats as an Effort for Mapping Zoonoses Risk in Rob Area, Semarang City)	Journal of Health Ecology. Vol. 18 No. 3, December	Observational area sampling method	The types of ectoparasites found in the rob area of Semarang City were the Xenopsyllacheopis flea, the Hoplopleurapacifica flea and the Laelapsechidninus mite.

No	Author	Title	Journal	Method	Result
			2019: 171-182		
4.	Hajar Camelia Dewi, RirihYudhastuti (2019)	FaktorRisikoKejadian Leptospirosis Di Wilayah Kabupaten Gresik (Tahun 2017-2018) (Risk Factors for Leptospirosis Incidence in Gresik Regency (2017-2018))	Muhammadiyah Nursing Journal 4 (1) 2019	The research is an observational type	The resultsshowedthat 54.5% ofleptspirosispatientsaged 46-55 years, 50% were male, and 66.7% had riskyoccupations. Therewas a relationshipbetweenthepresenceofwaterstagnation (p = 0.0001 and OR = 22), ditchconditions (p = 0.053 and OR = 0.205), useof PPE (p = 0.000), andwashinghandsandfeetwithsoap (p = 0.000 and OR = 0.031) withtheincidenceof leptospirosis
5.	Ratna Dian Kurniawati, et al (2018)	The Correlation Between Physical Environmental Factors And The Occurence Of Leptospirosis	Journal of Public Health, Volume 14, No. 2, Pages 223-230	Analytical survey with cross sectional approach	Based on the results of the study, the frequency distribution of the incidence of leptospirosis was categorized as not sick (32.0%) and sick (68.0%). Frequency distribution of physical environmental factors; rivers or water bodies are categorized as not at risk (38.0%) and at risk (62.0%). Frequency distribution of physical environmental factors; sewer categories are not at risk (35.0%) and at risk (65.0%). Frequency distribution of physical environmental factors; puddles are categorized as not at risk (28.0%) and at risk (72.0%). Frequency distribution of physical environmental factors; the distance from the settlement to the waste disposal site is not at risk (33.0%) and at risk (67.0%).
6.	Purbaningsih, Vita Catelya, et al (2018)	DeskripsiJumlah Dan SpesiesTikus Di DesaBanjarpanepenKecamatanSumpiuhKabupatenBanyumas (Description of the Number and Species of Rats in Banjarpanepen Village, Sumpiuh District, Banyumas Regency)	Public Health Journal. Vol. 38 No. 4 Pg. 305-364	Descriptive research	There were 4 cases of Leptospirosis in Banjarpanepen Village with 2 deaths. The number of rats caught in Banjarpanepen Village was 16.5% of the 200 traps that were set for 4 days. The success of the trap in catching rats was included in the high category, because more than 7%, namely 16.5% and the species of rats caught in the RT 1 RW 4 area were Rattus tanezumi 13

No	Author	Title	Journal	Method	Result
					(76.47%), Juvenile 4 (0, 24%). The rat species caught in the RT 1 RW 8 area were 10 Rattus tanezumi (62.5%), Juvenile (young rat) 5 (31.25%), and Subadult (juvenile rat) 1 (6, 25%).
7.	Kusumajaya, Ari, et al. (2018)	Tikus Pada Daerah Kasus*Leptospirosis* (StudiTentangTikus Dan Lingkungan Pada Daerah Kasus Leptospirosis Di KabupatenBanyumas) (Rats in Leptospirosis Case Areas (Study on Rats and the Environment in Leptospirosis Case Areas in Banyumas Regency))	Public Health Bulletin. Vol. 39 No. October 3, 2018	Descriptive research	The rats caught using grilled coconut bait were 29 rats and 27 rats using grilled salted fish bait. The types of rats caught were Rattus Tanezumi and Mus Muscullus rats with a rat density of 28%.
8.	Sholichah, Zumrotus, et al. (2017)	SebaranInfeksi Leptospira Patogenik pada Tikus dan Cecurut di Daerah PascaBanjirKabupaten Pati dan EndemisBoyolali (Distribution of Pathogenic Leptospira Infection in Mice and Shrubs in Post-Flood Areas in Pati and Endemic Districts of Boyolali)	Balaba Journal Vol. 13 No. 2, December 2017: 173-182	Observational research with cross sectional design	It was found that mice and shrews were infected with Leptospira sp. which are pathogenic spread in a random pattern with case points in the home range of positive mice. This will increase the risk of leptospirosis transmission
9.	DefryanaRakebsa, Citra Indriani, Widagdo Sri Nugroho (2017)	Epidemiologi leptospirosis di Yogyakarta dan Bantul (Epidemiology of leptospirosis in Yogyakarta and Bantul)	BKM Journal of Community Medicine and Public Health Volume 34 Number 4	Case control research	Knowledge (OR: 1.95% CI: 0.58-1.71) and attitude (OR: 0.8,95% CI: 0.47-1.40) did not have a significant relationship with the incidence of leptospirosis. The presence of mice in the house did not have a significant relationship with (OR: 0.7, 95% CI: 0.15-3.78). Multivariate analysis found that the variables were the distance of the house to the open drain (OR: 2.96, 95% CI:1.22-7.14) and the presence of garbage in the house (OR: 2.03, 95%CI: 1.14-3.62) has a significant relationship with the incidence of leptospirosis.

IV. DISCUSSION

Research by Syakbanah, N L et al (2021) shows the number of villages affected by leptospirosis during the year was 51 (68%). The spatial distribution map shows six villages with a high incidence of 28.0 - 42.1 per 100,000 population (dark maroon), namely Gadingsari, Gadingharjo, Gilangharjo, Guwosari, Ringinharjo, and Srihardono. Meanwhile, 22 villages had a moderate incidence rate of 14.0 - 28.0 per 100,000 population in the Districts of Kasihan, Pajangan, Pandak, Jetis, Bambanglipuro, Kretek, Dlingo, Imogiri. Furthermore, 23 villages were categorized as having a low incidence rate, followed by 24 villages without case finding in a year. 1 month relative humidity (r = 0.6849) and 3 months interval of rainfall (r = 0.6666) had a strong positive correlation with human leptospirosis cases. That is, the increase in leptospirosis cases in humans followed the increase in relative humidity 1 and 3 months earlier. A 1-month lag in rainfall (r = 0.7451) and a 3-month lag in relative humidity (r = 0.8561) also had a strong positive correlation with human leptospirosis cases, which means that an increase in human leptospirosis cases followed an increase in rainfall.[14]

Anwar, M R et al (2020) This study shows that the most common rats caught in flood-prone areas of Makassar City are 18 male rats (72%) and 10 positive Leptospira (40%). Meanwhile, there were 7 female rats (28%) and only 1 positive for Leptospira (4%). The rats caught according to trap locations in flood-prone areas of Makassar City were sewer rats (*Rattus norvegicus*), house mice (*Rattus tanezumi*), and house mice (*Mus musculus*), which included; *Rattus norvegicus* were caught outside the house as many as 9 (60%), inside the house as many as 6 (40%) and positive for containing Leptospira bacteria as many as 8 (53.3%) with 6 (75%) each caught outside and 2 tails. (25), *Rattus tanezumi* were caught outside the house as many as 6 (66.7%), inside the house as many as 3 (33.3%) and positive for Leptospira as many as 2 (22.2%) were caught in the house while *Mus musculus* 1 (100%) and positive caught at home. The rats caught in flood-prone areas in Makassar City were obtained as many as 25 mice during 4 days of catching. The number of rats caught was 5-7 tails per day using 100 single live traps that only had one side of the entrance. The working principle of this trap is that the trap door will close when the bait is pulled by the mouse, and the mouse will be trapped. The bait used when setting up the mousetrap is roasted coconut. Every day the traps are controlled so that the bait can be replaced if it is deemed inappropriate to use.

During the rainy season, people often come into contact with a flood-polluted environment that carries wastewater into the streets and settlements. Slum dwellers are more susceptible to exposure to leptospira pathogens. Most of the clinical cases occur in the rainy season due to the lack of drainage system in the slum areas. The presence of rats is also caused by the presence of garbage in the house that is not managed properly and lighting is not good, rats will be preferred. Open waste conditions have a 16,3 times greater risk of spreading leptospirosis. The presence of garbage, especially food scraps that are disposed of in the trash that does not meet the requirements will invite rats.[15]

In Dewi's research, W M et al (2019), it was carried out through 5 stages, namely the preparation stage, catching mice, identifying mice, collecting ectoparasites and identifying ectoparasites. The prevalence rate of ectoparasite infestation in all types of rats caught in Bandaharjo and BangetayuKulon villages was 100% ectoparasite infested, while in Tugurejo all types of rats caught had an infestation prevalence rate of <100% because *Bandicotas* indica only infested 50%, *Rattus norvegicus* 80% and *Rattus tenezumi* 72.2%. The types of ectoparasites found in the rob area of Semarang City were the *Xenopsyllacheopis flea*, the *Hoplopleurapacifica flea* and *the Lealapsechidninustungau*. Mapping based on the number of rats caught in the rob area of Semarang City has a very stable evenness index, meaning that the types of rats found are evenly distributed in each kelurahan, namely Tugorejo Village 31 (high category), BangetayuKulon Village 28 (medium category) and Bandaharjo Village 25 individuals (low category), mapping the number of ectoparasites based on the type of rats caught and the potential for zoonotic diseases to appear in BangetayuKulon Village including the high category, Bandaharjo Village medium category and Tugorejo Village low category.[16]

In a study conducted by Dewi, H C et al (2019) regarding risk factors that influence the incidence of leptospirosis in the Gresik Regency area, it can be concluded that there is a relationship between the presence of standing water and the incidence of leptospirosis in Gresik Regency with p = 0.001 and OR = 22. There is a relationship between sewer conditions and the incidence of leptospirosis in Gresik Regency with p value = 0.053 and OR = 0.205. There is a relationship between the use of PPE when doing risky work with the incidence of leptospirosis in Gresik Regency with a p value = 0.000 and there is a relationship between the habit of washing hands and feet with soap and the incidence of leptospirosis in Gresik Regency with p = 0.000 and OR = 0.031.Of the 28 rat traps distributed, 9 rats were trapped. The types of rats caught included three bush rats (Rattus tiomanicus), two house mice (Rattus diardii), two sewer mice (Rattus norvegicus) and two field mice (Rattus exulans). Where the 9 rats were found in Cerme, Kedamean District, Sidayu District, and ManyarDistrict.[17]

Based on the results of research by Kurniawati, R D et al (2018), the existence of rivers around settlements is one of the risk factors for leptospirosis. Based on the results of the study, there were about 95.2% of leptospirosis sufferers who lived in houses near rivers. The existence of rivers near settlements, statistically

shows the relationship between the distance of the house to the river and the incidence of leptospirosis (p = 0.000). The existence of sewers around settlements is one of the risk factors for leptospirosis. Based on the results of the study, there were about 86.2% of leptospirosis patients who had a house with a sewer. The existence of culverts near settlements, statistically showed a relationship between culverts and the incidence of leptospirosis (p = 0.000). The presence of standing water around settlements is one of the risk factors for leptospirosis. Based on the results of the study, there were about 88.9% of leptospirosis patients who had a puddle of water in their house. The presence of inundation near settlements, statistically showed a relationship between inundation and the incidence of leptospirosis (p = 0.000). The presence of garbage is an indicator of the presence of rats in the house. The presence of respondents with homes close to the landfill accounted for 83.6% of leptospirosis. Statistics show the relationship between the distance from the house to the landfill and the incidence of leptospirosis (p = 0.000). The condition of settlements in the Sukahaji area is prone to flooding, densely populated, high slum areas and many inundated ditches and garbage disposal. This condition can be a breeding ground for rats, so it is very possible to be one of the causes of the spread of leptospirosis.[18]

In a study conducted by Purbaningsih, V C et al (2017) showed cases of leptospirosis in Banjarpanepen Village recorded 4 cases with 2 deaths in RT 1 RW 8 and RT 1 RW 4 affected by cases of Leptospirosis 2 out of 4 patients worked as grinders for brown sugar and sugar cane, because people who do not use footwear during work and are infected with leptospira bacteria through contact with water or food. The results of the installation of mouse traps in RT 1 RW 4 Banjarpanepen Village showed that of the 120 mouse traps installed with 14.16% success traps and in RT 1 RW 8 with 20% success traps from 80 traps. The number of rats caught in Banjarpanepen Village was 16.5% of the 200 traps that were installed for 4 days. The success of the trap in catching rats was included in the high category, because more than 7%, namely 16.5% and the species of rats caught in the RT 1 RW 4 area were *Rattus tanezumi* 13 (76.47%), *Juvenile* 4 (0, 24%). The rat species caught in the RT 1 RW 8 area were 10 *Rattus tanezumi* (62.5%), *Juvenile* (young rat) 5 (31.25%), and *Subadult* (juvenile rat) 1 (6, 25%).[19]

In Kusumajaya's research, A et al (2018) obtained an overview of the distribution of Leptospirosis until October 2018 by village in all health centers in Banyumas Regency with the highest cases being Ajibarang Health Center I and Sumpiuh III Health Center, for moderate cases Gumelar, Wangon II and Cilongok Health Centers II, then the lowest case or 1 case was in several villages, including: Pekuncen Health Center, Cilongok I, Cilongok II Kedungbanteng, Sokaraja II, Baturaden II, Ajibarang II, Wangon II, Jatilawang and Purwojati. The risk factors for leptospirosis can be seen from 2 male respondents, it is known that the patient's habits before being exposed to Leptospirosis are often taking water in the river, washing in the river, not using footwear when leaving the house, not washing hands after handling animals and there are wounds on the body. In the patient's home/workplace there are rats and pets in the form of cats. For the condition of houses with open water reservoirs, open trash cans/directly dumped into the yard and there are puddles of water during the rainy season. In addition, there are gaps or holes that have the potential for rats to enter and open sewers or sewers. The rats caught in the Leptospirosis case area in Banyumas Regency are residential/house mice. This is evidenced by the identification of rats with bait that are often found in residential areas, specifically grilled coconut and grilled salted fish which are distributed according to their habitat, i.e. indoor and outdoor habitats. The density of rats in the case area according to the Regulation of the Minister of Health of the Republic of Indonesia No: 50 of 2017 is high because it exceeds the quality standard (<1).[20]

Research of Sholichah, Z et al (2017) shows that rats and shrews caught in BakaranKulon Village, Pati Regency and Jeron Village and Sindon Village, Boyolali Regency. Rats were caught by setting traps placed around cases of leptospirosis with a total of 185 traps in JeronBoyolali Village, 200 traps in Sindon Boyolali Village for 2 days and 130 traps in BakaranKulon Pati Village for 3 days. Infection status of *Leptospira sp.* examined by PCR method on kidney organs. The kidneys were cut into small pieces weighing ±30 mg and DNA was isolated according to the Genomic DNA Mini Kit (Tissue) procedure from Geneaid (Cat. No. GT100). In this study, it was concluded that in the post-flood area of BakaranKulon Village and leptospirosis endemic areas, Sindon Village and Jeron Village, Boyolali Regency, mice and shrews infected with *Leptospira sp.* which are pathogenic spread in a random pattern with case points in the home range of positive mice. This will increase the risk of transmission of leptospirosis. The leptospirosis case in Sindon Village is outside the daily home range of rats but close to rice fields which allows contact with rats from rice fields.[21]

In a study conducted by Rakebsa, D et al (2017), the presence of rats in the house did not have a significant relationship with the incidence of leptospirosis. The type of house walls, floor of the house, the presence of a ceiling did not have a significant relationship with the incidence of leptospirosis. The variable distance from house to open canal has a significant relationship to the incidence of leptospirosis. The results of the calculation of the OR between the distance from the house to the open canal and the incidence of leptospirosis is 2.7. The results of this OR indicate that the probability of finding respondents who have a distance from the ditch. Furthermore, the variable used goods outside and inside the house does not have a significant relationship with the incidence of leptospirosis. The presence of garbage in the house is associated

with the incidence of leptospirosis. The presence of farm animals around the house has a significant relationship with the incidence of leptospirosis with an OR value of 1.9. The probability of finding respondents who have livestock around the house is 1.9 times in the case group compared to the probability of finding respondents who have livestock around the house in the control group. Ownership of a pet is not related to the incidence of leptospirosis.[22,23, 24]

V. CONCLUSIONS AND RECOMMENDATION

This systematic review provides an understanding that the density of rats is at risk of causing public health problems in flood-prone areas. Leptospirosis is the most common disease, especially after the flood disaster. Puddles of water that have been contaminated by Leptospira sp bacteria then settle on the floor of the house, bathroom or surrounding settlements. The bacteria then enter the body through cuts or abrasions on the skin, mucous membranes of the mouth, nose and eyes. These bacteria can survive for days if not cleaned immediately. It is recommended for the community to always pay attention to personal hygiene sanitation, especially environmental cleanliness before and after the flood.

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