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Community Sanitation Risk Assessment of Tanjung Raja Village: A Rural Slum Study

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ABSTRACT

Background: Areas with high sanitation risks have the potential to transmit infectious diseases. Meanwhile, Tanjung Raja Village is an area with a high level of slums and frequent flooding, so it has the potential to have sanitation risks. This study aimed to assess sanitation risk in Tanjung Raja village. **Method**: This was a quantitative study using the Environmental Sanitation Risk Assessment method. The study sample was all households in Neighborhood III of Tanjung Raja Village as many as 115 respondents using Simple Random Sampling. **Results**: The sanitation risk assessment of Tanjung Raja Village had a scoring category in RT 5 with high-risk results (score 3) and in RT 6 with fewer risk results (score 1) and Environmental health risks obtained related to sanitation included clean water, ownership of latrines, ownership of household waste bins, and wastewater disposal facilities. **Conclusion**: Tanjung Raja village has the potential to have a high sanitation risk with densely populated areas and flooded areas.

Introduction

World Health Organization (WHO) reported that about two billion people in all countries did not have access to proper sanitation [1]. By 2021, an estimated 1.2 billion people worldwide would not have access to adequate drinking water. This can become a pathogen that triggers disease. In 2016, an estimated 829,000 deaths were caused by diarrheal diseases due to inadequate water, hygiene, and sanitation, accounting for 2.8% of all deaths [2]. According to the UN Partnership for Development Framework (UNPDF), 42.8% of Indonesia's population lacks access to proper water sources. While about 55 million people still have open defecation behavior [3,4].

Sanitation risk assessment is a study that focuses on the state of facilities and infrastructure in sanitation and public habits that pose a risk to public health. The Ministry of Health's version of the Sanitation Risk Assessment study includes the availability of drinking water, ownership of defecation sites, ownership of household waste disposal sites, and Waste Water Disposal Facilities. The habits studied, namely hand washing with soap and habits towards waste disposal and selection and open defecation. The Ministry of Health's Sanitation Risk Assessment Study also allocates or maps environmental health risks [5,6].

Tanjung Raja village was included in the category of severe slum with priority 1. Integrated Social Welfare Data (DTKS) in 2020 Tanjung Raja village had several sources of drinking water originating from unprotected wells as many as 1,463 people (25.53%), river, lake, and reservoir water as many as 226 people (3.94%), and unprotected springs as many as 12 (0.21%). This remained a problem because it can cause Water Borne Disease if consumed for a long time [7].

Tanjung Raja village has 3 neighborhoods, namely Neighborhood I, Neighborhood II, and Neighborhood III. Based on observations of areas with river flow where bathing, washing activities were carried out there and garbage disposal was found in Neighborhood III. This area is also often flooded. Based on this data, this study focuses the research area on neighborhood III of Tanjung Raja village, because neighborhood III is an area that has the potential to be more at risk of environmental health problems. This study aimed to assess sanitation risk in Tanjung Raja Villa as a rural slum.

Materials and Method

This study was conducted in neighborhood III of Tanjung Raja village, *ogan ilir* district, south Sumatra, which is a very slum category slum area (based on the decree of the regent of *ogan ilir*). the research was conducted from September - December 2022 or for three months. The type of research used in this study was quantitative research using the EHRA (Environmental Health Risk Assessment) method of the Ministry of Health of the Republic of Indonesia (Figure 1). This method was conducted to understand the condition of hygiene and sanitation facilities that pose a risk to public health on a household scale. Data collection techniques were carried out by observation when the research was related to human behavior. The observation was also conducted in the form of direct observation of existing sanitation. The aim was to obtain information related to data on sanitation and behaviors that pose a risk to public health in Tanjung Raja Village.

The population of this study was all households in Tanjung Raja Village. The sample in this study were all houses in Neighborhood III of Tanjung Raja Village as many as 115 respondents using Simple Random Sampling. The respondents in the study were household members who were found when conducting research allowing interviews. Sample criteria include inclusion criteria. Inclusion criteria, namely where research subjects can represent a qualified research sample. The inclusion criteria in this study are: Housewives or married daughters aged 18 to 60 years and residing in Tanjung Raja Village, if there were two or more people in the household, one of them was taken as a sample. Data analysis was carried out using the available data analysis program, namely the Ms. Excel Template program from the Ministry of Health.

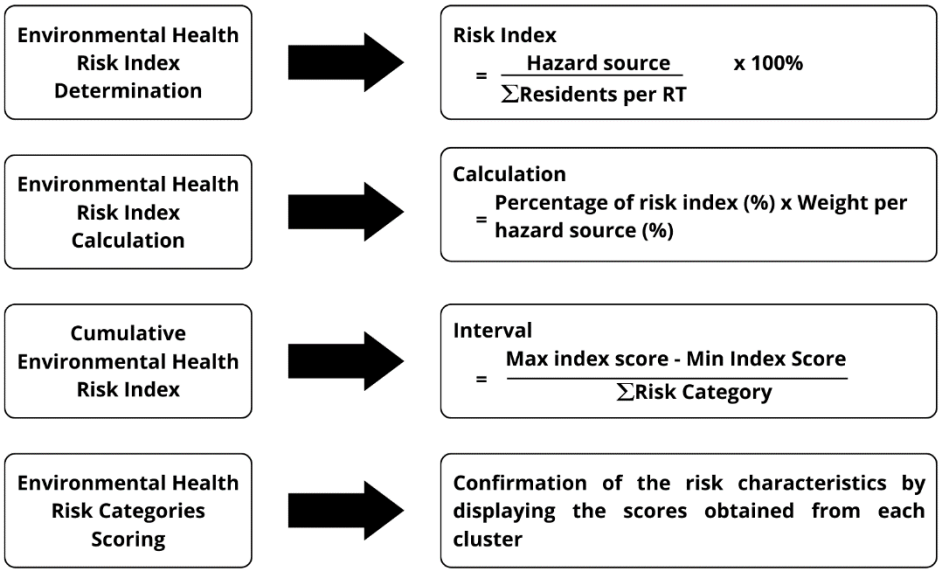

Figure 1. Steps for Environmental Health Risk Assessment (Ministry of Health EHRA Study)

This study assessed several variables consisting of environmental sanitation risk measured using the Ministry of Health's EHRA Questionnaire. This variable was the result of observations and measurements of the water availability variable measured by observation of the condition of the availability of clean water that has physical quality such as colorless, odorless, and tasteless as well as quantity (scarcity of clean water). Furthermore, the variable of garbage bin availability was assessed by observing the presence of garbage bins used to dispose of and collect garbage. The

variable of latrine ownership was assessed by observing the feasibility of the latrine and its construction such as whether the septic tank was closed and watertight, gooseneck, and had a floor), protected from the sight of others, contained sufficient water, did not contaminate the soil and surface water, and the distance from the water source was at least 10 meters. Another variable was the means of wastewater disposal which was assessed by observing the means of disposal from bathroom and kitchen activities and by observing the presence or absence of stagnant water around the house. The variable of hand washing behavior with soap was assessed by conducting interviews at five important times, namely: 1) After defecation; 2) After washing children; 3) Before eating food; 4) Before feeding infants/toddlers; 5) Before preparing food for the family. The household waste management variable is measured by observing household waste management such as hoarding or burning. The open defecation variable was assessed by interview to assess the behavior. This study received ethical approval from the ethics committee of the Faculty of Public Health, Sriwijaya University with number 325/UN9.FKM/TU.KKE/2022.

Results and Discussion

Results

In Table 1, the characteristics of respondents include the age of the respondent, the status of the house, and the last education of the respondent. The characteristics of the most age was above 45 years by 30% where the distribution of RT 5 was more than RT 6. The status of home ownership was more living in their parent's house by 20.8%. and most respondents only finished elementary school, namely 46.1%.

The population density indicator has a population density of 665 people per km2, equivalent to 7 people per ha. For the population density indicator, the population is said to be dense if there are 25 people per ha. In the poverty indicator, there are 63 recipients of the Certificate of Disadvantage. Area III of Tanjung Raja village is watershed and has a history of flooding so this area meets category 3 of the 4 criteria for determining strata.

Table 1. Distribution Frequency of Respondent's Characteristics (N=115)

Variables	Frequencies				N	
	RT 5 (N=70)		RT 6 (N=45)			
	N	%	N	%	N	%
Age (year)						
<=20	0	0	5	4.3	5	4.3
21 - 25	4	3.5	0	0	4	3.5
26 - 30	11	9.7	4	3.5	15	13.
31 – 35	12	10.4	6	5.2	18	15.6
36 – 40	9	7.8	9	7.8	18	15.6
41 – 45	11	9.6	9	7.8	20	17.4
>45	23	20	12	10.4	35	30.4
House Ownership						
Self-owned	52	45.2	35	30.4	87	75.6
Official Residence	0	0	0	0	0	0
Rent	2	1.7	1	0.9	3	2.6
Contract	1	0.9	0	0	1	0.9
Parentss House	15	13	9	7.8	24	20.9
Last Education						
Not Graduated	1	0.9	3	2.6	4	3.5
Elementary	35	30.4	18	15.7	53	46.1
Junior	17	14.8	13	11.3	30	26.1
Senior	16	14	9	7.8	25	21.8
Vocational	1	0.9	2	1.7	3	2.6
Bachelor	0	0	0	0	0	0

This study describes household sanitation facilities in area III of Tanjung Raja Village. The distribution of these sanitation facilities can be explained in Figures 2a, 2b, 2c, and 2d. Almost all communities did not have proper trash bins, with only 3% of communities having them in RT 05, while in RT 6, all communities did not have proper trash bins. Ownership of latrines in community homes was no longer a major problem in this area. However, this study still found that 21% of the community members in RT 05 and 4.4% of the community members in RT 06 do not have a toilet at home. Sewerage facilities are still a problem in this area, the study found that almost half of the community did not have a sewer, 46% in RT 05 and 53.3% in RT 06. Household waste management measures in this community were also very low, with only 19% of the community conducting household waste management. Figures 2e and 2f describe the community's open defecation behavior and drinking water management measures. The study found that 23% of the community in RT 05 still practiced open defecation and 4% of the community in RT 06 also practiced open defecation.

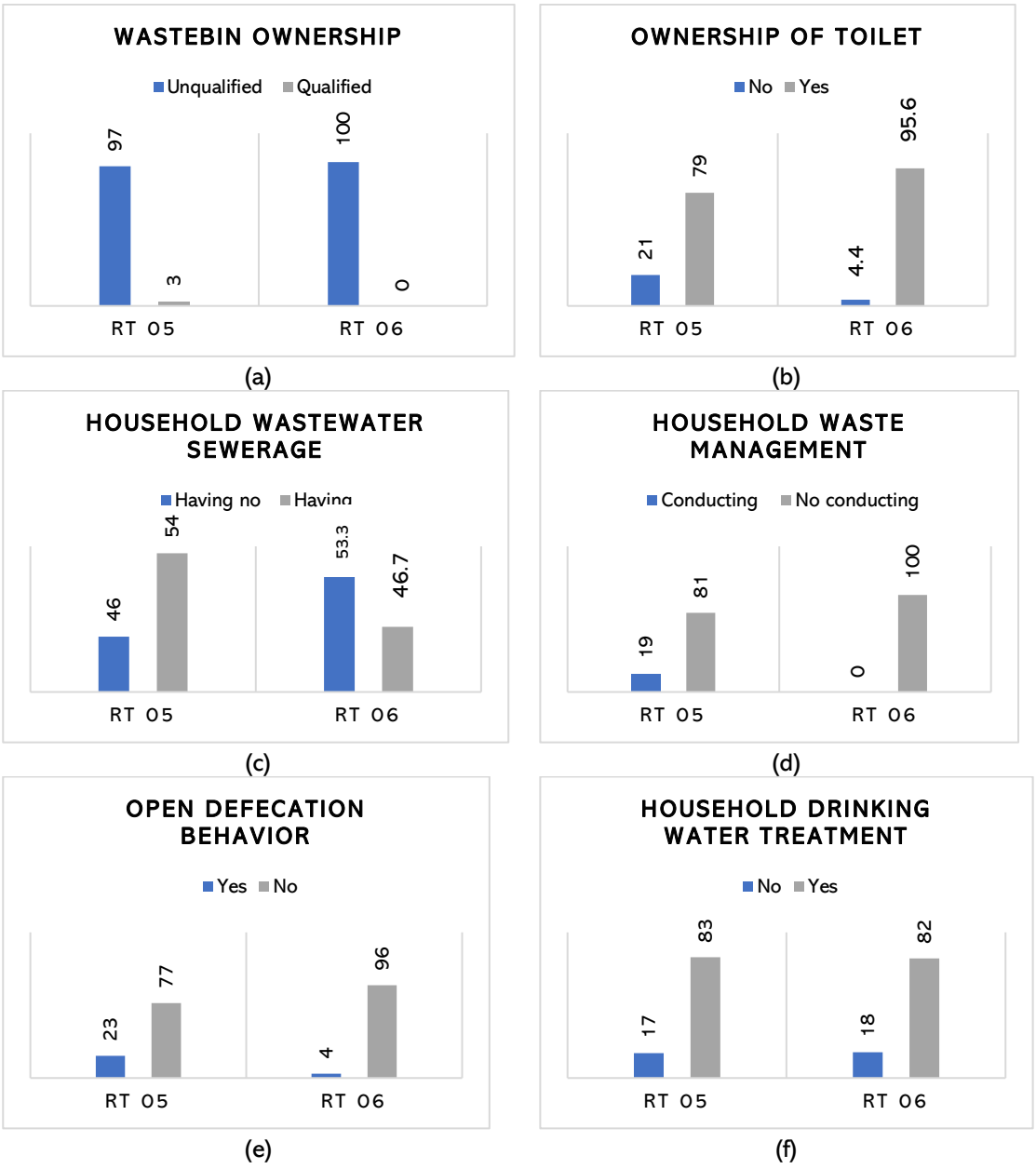

Figure 2. Household Sanitation Facilities in Area II of Tanjung Raya Village; a) Wastebin Ownership; b) Ownership of Toilet; c) Household Wastewater Sewerage; d) Household Waste Management; e) Open Defecation Behavior; f) Household Drinking Water Treatment

The study also explored the source of water for the community's daily life (Figure 3). The study found that less than half of the villagers in RT 05 use piped water (about 43%) as their source of clean water for drinking, cooking, washing dishes, clothes, and bathing. Some still use gallon water, river water, borehole water, and dug wells. The river water was still used by around 7% of the community for daily activities including cooking and drinking. After piped water, the other most common source used by the community was borehole water at around 16-24%. The people of Tanjung Raja Village who live in RT 06 use piped water less for their needs. Only 9% of the community use piped water as a source of drinking water, while the community in this area mostly uses boreholes (around 36-49%) for their daily activities. Neighborhood 05 was no different, with about 7% of the community using river water for all their needs including drinking and cooking.

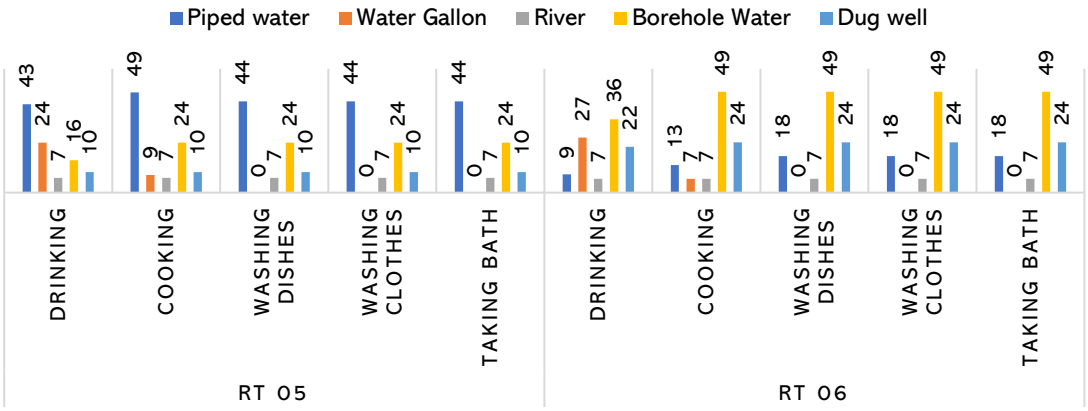

Figure 3. Water Source for Daily Activities

The environmental health risk is the value of hazard sources and opportunities for hazard exposure (unhealthy behavior) found in Tanjung Raja Village. To determine the magnitude of risk, the first step was to create an environmental health risk index table per RT based on the sources of hazard and the components in it. Then, the environmental health risk index value was weighted based on the severity of the hazard source component and the chance of hazard occurrence. After that, the risk index was calculated through the cumulative index table and the last step was to categorize the environmental health risk for each RT. This environmental health risk index is the initial stage for determining environmental health risks, where for each hazard source and its components, it is calculated based on each neighborhood, divided by the number of residents or respondents per neighborhood, and multiplied by 100%. The Environmental Health Risk Index values can be seen in Table 2.

After that, the Environmental Health Risk Index Calculation is the second stage or step in determining environmental health risks, by weighting the components of hazard sources and hazard exposure opportunities. This means calculating the environmental health risk index based on the risk index table. How calculate the environmental health risk index by giving 100% weight to each hazard source and hazard exposure opportunity, where 100% weight will be divided based on the number of components in the hazard variable and hazard exposure opportunities. The weight distribution is based on the severity of each component, so each component may have the same weight or even very different weights. The calculation results can be seen in Table 3.

The next stage is to determine the cumulative environmental sanitation risk index. At this stage, the calculation or summation of the environmental health risk index is carried out based on the calculation of the value obtained from the weighting results in Table 3. The summed risk index is the overall value of the source of danger and the chance of the source of danger occurring. The value is obtained based on the summation of each variable component that is a source of danger. The result of the summation is called the Environmental Health Risk Assessment (EHRA) value which is used for categorizing or scoring environmental health risks. The results of the cumulative risk index can be seen in Table 4.

This EHRA value will be used to categorize environmental health risks by using the interval calculation of the total maximum risk index and the total minimum risk index. To get the interval value, the highest value minus the lowest value and divided by the number of risk categories (Table 5). The number of risk categories in question is the number of risk categories used in this study, namely 4 (less risky, medium risk, high, and very high). Based on this, the environmental health risks in Neighborhood III of Tanjung Raja Village are described in Table 6.

Then, to score environmental health risks, it is adjusted to the number code that indicates the category. For Code number 1 indicates the less risky category, number 2 indicates the medium risk category, number 3 indicates high risk and number 4 indicates the very risky category. This was done only as a form of confirmation of the risk characterization by displaying the score obtained by each RT based on the Environmental Health Risk Score ("EHS Score") in Area 3 of Tanjung Raja Village. This study found that Area 3 of Tanjung Raja Village, which consists of two RTs, RT 05 and RT 06, has different sanitation risks. The community of RT 05 has high sanitation risk while the community of RT 06 has low sanitation risk.

Table 2. Environmental Health Risk Index

Variables	Answers	RT 5		RT 6	
		N	%	N	%
Hazards related to sanitation					
Clean water Source	Polluted water source	40	7.1	6	1.6
Toilet ownership	None	15	5.4	2	1.1
Wastewater of Sewerage	None	32	11.4	24	13.3
Waste bin ownership	None	2	0.4	0	0
	Inadequate	68	12.6	45	13
Hazards related to Behaviour					
Waste management	No treatment	57	20.4	45	25
Drinking water source management	No treatment	12	4.3	8	4.4
Handwashing with soap	Not conducted	70	25	45	25
Open defecation	Yes	16	5.7	2	1.1

Table 3. Environmental Health Risk Calculation

Parameters	Answers	Weight (%)	RT 5 (N=92)	RT 6 (N=85)
Hazards related to sanitation				
Protected water source	Polluted water source	13	6	1
Use of unprotected water sources	Unprotected	13	1	1
Toilet Ownership	None	25	5	1
Wastewater Sewerage	None	25	11	13
Waste bin Ownership	None	13	0	0
	Inadequate	13	13	13
Hazards related to behavior				
Household waste management	No treatment	25	20	25
Drinking water source management	No treatment	25	4	4
Hand washing with soap	Not conducted	25	25	25
Open Defecation Behaviour	Yes	25	6	1

Table 4. Cumulative Environmental Health Risk

Parameter	RT 5	RT 6
Hazards related to sanitation	37	29
Hazards related to behaviour	55	56

Table 5. Category of Environmental Health Risk

Category of Risk Area	Lower limit	Upper limit	Score
Low Risk	85	87	1
Middle Risk	88	90	2
High Risk	91	93	3
Very High Risk	94	96	4

Table 6. Environmental Health Risk Assessment Scoring

Tanjung Raja	IRS Cumulative	Score	Category
RT 5	92	3	High Risk
RT 6	85	1	Low Risk
Total Risk Index Min-Max (Interval)	85-92 (1.75)		

Discussion

The results of the study found that most respondents had trash bins but did not meet the requirements because most people used open waste baskets and open plastic bags found in the kitchen. Most open plastic waste baskets contain wet waste that easily decomposes and will be disturbed due to unpleasant odors. According to the regulation of the Minister of Public Works No. 03/PRT/M/2013 on the implementation of waste infrastructure and facilities in the treatment of household waste and waste like household waste, a trash can that meets health requirements is a trash can made of a base that is strong enough, lightweight, waterproof, and airtight with a smooth inner surface. The lid is easy to open and close, which is hygienic and very convenient for garbage cans containing rotten garbage. Easy to fill, empty, and easy to clean containers [8, 9, 10].

Toilet ownership is basic hygiene that everyone should have. If the ownership of toilets in the community is still relatively low, then people who carry out defecation activities outdoors will be higher, and this behavior will interfere with health and cause environmental pollution, causing the spread of disease. [11, 12, 13]. The community has begun to implement good sanitation facilities, but there are still some people who practice open defecation due to not having a toilet. This is in line with previous research which stated that the variable of latrine ownership had a significant relationship between latrine ownership and open defecation [2, 14, 15].

The study found that most villagers did not have sewerage. Indiscriminate disposal of wastewater will cause damage to the surface soil, cause puddles that will become breeding grounds for mosquitoes, flies, and other vectors, and cause unpleasant odors. In the community of Neighborhood III, especially in RT 5 and RT 6, the majority have a low level of elementary school education. This is in line with research conducted by previous studies which state that there is a significant relationship between education and ownership of household waste disposal channels, respondents who do not have these drains were categorized as having low education [16].

Clean water sources are very important to be considered for the community. Clean water becomes a medium for disease transmission if the quality and quantity are not considered. Previous studies have found that infectious diseases occur in communities with poor sanitation and water quality. [17]. The community in Neighborhood III has implemented quite well in the use of clean water for sanitation needs, it can be observed from the number of households that use piped water as a source of clean water such as for bathing, washing, and others. However, access to piped water needs to reach more people because there are still people who use river water as a source of their daily activities. The quality of piped water can be seen through physical, chemical, and biological parameters. According to respondents, water from tap water often has a cloudy smell and color, therefore, to maintain water quality, it needs to be checked continuously by the relevant agencies.

Besides the use of clean water, in the use of water sources for drinking, respondents also have a fairly high frequency of using refilled water/gallons. While this is still below the use of boreholes for drinking water, it still needs to be watched out for because every brand or drinking water depot has qualified water quality. Previous research conducted showed that the highest incidence of

diarrhea was experienced by consumers who consumed water from brands or drinking water depots that did not meet the requirements. [18].

Improper waste management results in environmental pollution from disease vectors, including insects and other rodents. Vectors can multiply rapidly and cause disease. Improper waste management also disturbs the aesthetics and freshness of the surrounding air due to certain gases produced during the decomposition of waste by microorganisms. [12] Previous research stated that operational aspects have a close relationship with the health status of community infectious diseases. This operational aspect found that community participation is a crucial factor in overcoming waste problems because success in waste management lies in the contribution of the local community. As in the sorting of waste composition by separating organic and inorganic waste [19].

Feces is a medium that can spread E. coli bacteria, which can cause disease, Open Defecation Behavior (ODB) will give a dangerous warning to the health of the general public. The number one disease is a waterborne disease. Waterborne diseases can be transmitted to humans through microorganisms or substances in the water in the environment. Bacteria or microorganisms can contaminate through daily activities such as drinking, bathing, washing, food preparation processes, or eating food that has been contaminated with bacteria [20]. Based on previous research, the physical environment variable found that the relationship between the physical environment and open defecation behavior showed negative results, which means that the correlation is not unidirectional, meaning that the worse the physical environment is, the more it will affect open defecation behavior [21, 22].

Drinking water treatment, namely respondents were good enough in treating drinking water sources, but there were still some respondents who did not have full awareness to maintain the quality of drinking water by carrying out treatment. Most respondents do not treat drinking water because the water comes from refilled water/gallons purchased at drinking water depots. This is not appropriate, because in Indonesia there are still several depots that do not comply with the requirements. As in previous research on the identification of *E. coli* bacteria in refilled drinking water produced by refilled drinking water depots in the Padang Selatan sub-district, the results showed that 10 out of 13 samples examined did not meet the bacteriological requirements [15].

The Clean and Healthy Lifestyle Program is implemented as an effort to empower household members to have the awareness, willingness, and ability to live a clean and healthy lifestyle. By implementing a healthy lifestyle, the community plays an active role in maintaining and improving public health, preventing the risk of disease, and protecting themselves from the threat of disease. Wash hands with soap five times, namely before eating, before breastfeeding or feeding babies/children, after going to the toilet, or defecating. after splashing babies/children, and before cooking or preparing food [23]. Hand washing is one way to prevent the occurrence of diseases that come from vectors in food, one of which is diarrhea disease. This phenomenon has been studied by previous research which states that there is a significant relationship between the habit of washing hands with soap before feeding with the incidence of diarrhea disease [6, 24, 25].

The first action taken in conducting a risk assessment is to identify hazards and opportunities for hazard exposure. In the study, the variables that are the source of hazards are sanitation-related hazards including clean water sources, ownership of trash bins, ownership of latrines, sewerage, and for behavior-related hazards including hand washing with soap, household waste management, open defecation, and drinking water treatment. Based on the existing data, the value of the data is then calculated to become the value of the environmental health risk index, then weighting is carried out in each variable. The first variable is clean water sources, its components are polluted protected water sources and unsafe unprotected water sources. Each component is given the same weight value of 13% with the consideration that both have the same level of danger and will generally be a source of pollution to clean water.

The second variable is ownership of latrines with a weight value of 25%, then the third variable is ownership of trash bins which has two components, namely unqualified and absent, each component also has the same weight of 13%. For the fourth variable, the sewer has a weight of 25%. For behavioral forms, there are four variables, such as handwashing with soap, household waste management, open defecation, and drinking water source treatment with the same weight

value of 25%. This is carried out with the same consideration as the previous variables that these variables have the same level of danger and will generally be a source of pollution.

Based on the calculation results in the previous steps, the environmental health risk index value for each RT in Neighborhood III was obtained, with the lowest value of 85 and the highest value of 92. Based on the results obtained, RT 5 has category three, which is a high risk, and RT 6 has category 1, which means it is less risky. RT 5 has the highest Index value because many houses are still lacking in implementing Clean and Healthy Living Behaviors, such as disposing of garbage in the river, not having a sewer, defecation behavior, etc. Based on the interview results, because the houses in RT 5 are closest to the riverbank or watershed, they use the river for toilet activities and as a source of clean water or drinking water.

Conclusion

As a whole, the sanitation risk assessment in Tanjung Raja Village was scored as less risky, with each RT having a scoring category in RT 5 with a high-risk result (score 3) and RT 6 with a less risky result (score 1). It is because the houses in RT 5 are closest to the riverbank that they use the river for daily activities (bathing, washing, brushing teeth) and as a source of clean water or drinking water that potentially has hazards related to sanitation and behavior. Environmental health hazards related to sanitation in the study were many respondents who did not have sewerage (49%). Environmental health hazards related to behavior in the study were dominated by respondents who did not wash their hands with soap at five important times (100%). Tanjung Raja Village is included in stratification level three (3) which fulfills three (3) criteria or indicators in the risk assessment stratification, namely poverty rate, watershed area, and flood-affected area.

Declaration

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Conflicts of Interest: The authors declare no conflict of interest.

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