Vulnerability to ARI and Diarrhea after Disaster

(Huntara Case in Mantikulore and Ulujadi Subdistricts)

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This research was conducted in shelters in two sub-districts, namely Mantikulore and Ulujadi sub-districts, with the aim of describing the level of ARI and diarrhea vulnerability after the disaster (especially shelters in Mantikulore and Ulujadi sub-districts). This research uses weighting scoring method and image interpretation method. The population in this study was 1,138 families from temporary shelters in the two sub-districts, with a sample size of 114 families. Meanwhile, the technique used to obtain samples is quato sampling. The results obtained are (1) In the parameter of ARI sufferers and the parameter of the use of anti-mosquito coils, it can be seen that most respondents fall into the classification of the class not vulnerable. On the parameter of the physical environment of the shelter (number of shelter members and ventilation area), all shelters are classified as highly vulnerable. On the smoking habit parameter, it can be seen that most respondents fall into the highly vulnerable class classification. In the parameter of road area, it can be seen that there are some shelters that are classified as not vulnerable and some are classified as very vulnerable. (2) In the parameter of ARI patients, it can be seen that most respondents are classified as not vulnerable. In the parameter of hand washing before eating and after defecation, it can be seen that all respondents are classified as not vulnerable. For waste management, half of the respondents were classified as vulnerable. In terms of the distance from the shelter to the polling station, it can be seen that all shelters are classified as highly vulnerable.

Keywords: Mapping; Vulnerability; Shelters, ARI, Diarrhea

1. INTRODUCTION

Disasters are events or series of events that threaten and disrupt people's lives and livelihoods caused by both natural and non-natural factors and human factors resulting in human casualties, environmental damage, property losses, and psychological impacts. Based on this definition, there are several important things to note, as follows: (1) disasters are events that result in human casualties, environmental damage, property losses, and psychological impacts; (2) disasters can be caused by natural factors, non-natural factors, and human factors. The various disasters that have occurred in Indonesia show that the Indonesian people still do not have adequate knowledge of the potential disasters that characteristically exist in their region.

Indonesia is a country with a very high and diverse *hazard potential in the* form of natural disasters, man-made disasters or complex emergencies. Some of these potentials are earthquakes, tsunamis, volcanic eruptions, floods, landslides, droughts, land and forest fires, urban and settlement fires, windstorms, disease outbreaks, technological failures, and social conflicts (National Disaster Management Agency, 2008:9).

One example of a natural disaster that has occurred in Indonesia, namely: earthquake, tsunami and liquefaction on September 28, 2018 in Central Sulawesi, covering Palu City, Sigi Regency, Donggala Regency, and Parigi Moutong Regency. This disaster caused casualties and damage, namely as many as 2,685 people lost their lives, 701 people were not found, 1,016 people were mass buried, 272,999 people were displaced, and 100,405 housing units were severely damaged, lightly damaged or lost (Exposure of the Governor of RR, 2019).

The Palu City Government has built temporary shelters for victims whose houses were damaged. A shelter is a place to live after a natural disaster occurs. The function of the temporary

shelters is to provide temporary shelter for the victims whose houses were damaged, while the permanent shelters are being reconstructed.

Based on data from BPBD, the number of shelters built was 7,000 rooms in 7 sub-districts and spread across 26 villages. The shelters are located in Tawaili sub-district, North Palu sub-district, Mantikulore sub-district, South Palu sub-district, Tatanga sub-district, West Palu sub-district, and Ulujadi sub-district (BPBD, Progress of Palu City Shelters as of March 16, 2019).

The number of temporary shelters to be built is due to the number of damaged houses. This causes a large number of people to live in temporary shelters and creates new post-disaster problems, namely the condition of people who are very vulnerable to health problems because the quality of the environment in temporary shelters is different from private homes and the poor sanitation of the shelter living environment.

Health problems or diseases that are prone to occur and are affected by post-disaster communities are ARI, Diarrhea, and others. ARI and diarrhea are diseases that are prone to occur due to poor sanitation of the living environment (home). ARI is a respiratory tract infection that can be caused by germs, viruses, or aspiration (food, fuel oil, dust, etc.) that starts with complaints of mild symptoms until it causes death. Diarrhea is defecation with liquid or semi-liquid (semi-solid) stools, more water content than usual more than 200 g or 200 ml/24 hours.

Based on data from the Ministry of Health, ARI and Diarrhea occupied the number 1 and 2 positions as the most common diseases suffered by the people of Palu City after the disaster, followed by other diseases such as hypertension, skin diseases, and so on. The cases of ARI and Diarrhea in Palu City in November 2018 were 2,194 cases and 1,300 cases for Diarrhea. The post-disaster ARI and Diarrhea cases in each sub-district in Mantikulore and Ulujadi Sub-districts are presented in the table below:

Table 1.1 ARI and Diarrhea Cases, November 2018

District	Village	Case	
		ARI	Diarrhea
Mantikulore	Layana Indah	8	5
	Tondo	25	29
	Talise. V	11	1
Ulujadi	Watusampu	6	16
	Buluri	34	18
	Tipo	38	15
	Silae	10	13
	Kabonena	7	20

Source: Silae Health Center, Tipo Health Center, Kamonji Health Center

Along with the development of technology, remote sensing and geographic information systems are now possible to use in the health sector, especially to identify the level of susceptibility of a disease through environmental aspects that can be obtained through remote sensing images. Remote sensing in the health sector can be used to provide information quickly and accurately, such as the physical condition of the environment that is a factor in causing a disease. In addition, it can also provide spatial information about the spread of a disease and map the vulnerability of a disease based on the analysis of environmental physical condition parameters that match the characteristics of the disease (Riestawati and Barandi, 2016).

Remote sensing is the science and technology of obtaining information on the earth's surface (land and oceans) and atmosphere using sensors on vehicles operating in the air/aerospace (aircraft and hot air balloons) or on vehicles operating in outer space/space (satellites and spacecraft). Based on its scope, remote sensing can be divided into (1) satellite system remote sensing, (2) photography and photogrammetry system, (3) thermal system remote sensing, (4) Radar system (radio detection and ranging), (5) LiDAR system (*light detection and ranging)*. Currently, remote sensing has been integrated with other modern geospatial technologies such as Geographic Information Systems (GIS), *Global Positioning System (*GPS), and mobile-based mapping (Arifin and Prima, 2019).

Geographic information system (GIS) is a tool with a computer system used to enter, store, check, integrate, manipulate, analyze, and display data related to positions on the earth's surface. GIS has been used in various fields, including the health sector. In the health sector, GIS applications are used to describe health conditions, epidemiological analysis and public health management (De Mers (1997) in Arifin and Prima, 2019).

Remote sensing and GIS in the health sector can describe the spatial distribution of related phenomena. There have been many studies on health from individual to environmental aspects, but spatial modeling for geographical health studies is expected to explain (where), (why), and (what are the implications) of health problems in an area. Thus, it can identify infectious diseases, determine the causes of the emergence of infectious disease problems spatially, and provide recommendations for action including prevention, monitoring, and control based on facts in the field (Latifah et al., 2013).

The purpose of this study is to describe the level of ARI and diarrhea vulnerability after the disaster, especially in temporary shelter locations in Mantikulore and Ulujadi sub-districts.

Remote sensing techniques in relation to health research can be used to perform visual interpretation of locations that may have a risk for disease. In addition to remote sensing, GIS techniques also have their own advantages in health-related research. Through GIS, it can be used to perform data processing, *scoring*, and summation, and then the results can be displayed in the form of maps (Dewantari and Prima, 2016).

2. RESEARCH METHODS

The type of research used in this study is descriptive quantitative, with a spatial approach to assess respondents from each shelter in the Mantikulore and Ulujadi sub-districts who are vulnerable to post-disaster ARI and diarrhea.

This research was conducted in temporary shelters in Mantikulore and Ulujadi Sub-districts, Palu City. The total number of shelters from both areas is 12, in Mantikulore Sub-district there are 4 shelters and in Ulujadi Sub-district there are 8 shelters.
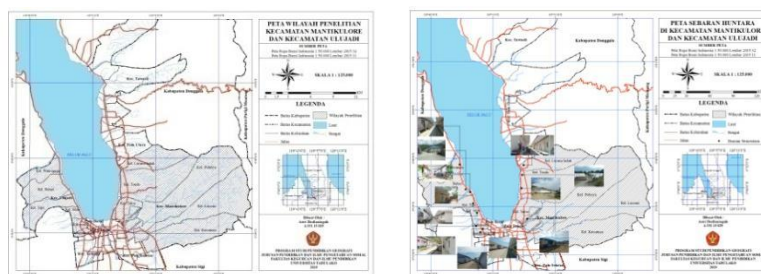

Figure 2: Distribution of shelters *Figure 1*: Research area

The population in this study were all families living in temporary shelters in Mantikulore and Ulujadi sub-districts. Mantikulore sub-district amounted to 370 families and Ulujadi sub-district amounted to 768 families, so the total population of this study was 1,138 families. The sample used in this research is part of the population, the number of samples is set at 10% of the population in Mantikulore Sub-district and 10% of the population in Ulujadi Sub-district. Meanwhile, the technique used in sampling is the *quota sampling* method, which is a way of determining the number of sample members that have been determined.

The techniques used for data collection in this study are observation techniques, questionnaire techniques, interview techniques, and documentation techniques.

Data analysis in this study was weighted scoring and interpretation of cintra. Scoring is done to provide a value for the effect of a property of a parameter on an estimated event. After all parameters are given a scoring value, the next step is to give a weighting value. The purpose of parameter weighting is to express how much influence a parameter has on an event. The events in question here are ARI and diarrhea. Giving the weight value per parameter is done directly, namely by giving a high weight value to parameters that have an influence on the susceptibility of

ARI and Diarrhea, and vice versa, namely giving a small weight value to parameters that do not really affect the susceptibility of ARI and Diarrhea. The total value of all weights is 100. This data analysis was carried out using Landsat images and images from Google Earth manually. This is done after the field data is given a score and weighting. The intended data analysis of this research is to mark the temporary shelters of respondents who fall into the non-vulnerable, vulnerable and highly vulnerable classes. After the shelter has been marked, the next thing is to make a map with the help of one of the GIS *software*, namely between ArcGIS, QGIS or ArcView.

A.   ARI

Table 2.1 Members of the house with a history of ARI

ARI	Score	Weight
None	1	
Healed	2	10
There is	3	

Source: *Utami, 2013*

Table 2.2 Density classification of shelters

Residential density	Score	Weight
8 m /person^2	1	
8 m^2 /two people	2	10
8 m^2 /three people	3	

Source: *Primary Data, 2019*

Table 2.3 Classification of smoking habits

Smoking habit	Score	Weight
No smoking	1	
Rarely smoke	2	9
Smoking	3	

Source: *Utami, 2013*

Table 2.4 Classification of the use of mosquito coils

Use of mosquito repellent	Score	Weight
Not using	1	
Yes, but rarely	2	9
Using	3	

Source: *Utami, 2013*

Table 2.5 Classification of ventilation area

Ventilation area	Score	Weight
Qualified (>10% floor area)	1	
Not eligible (<10% floor area)	3	10

Source: *Utami, 2013*

Table 2.6 Classification of the width of temporary shelter entrances

Driveway width	Score	Weight
<4 m	1	
4-6 m; can be passed by 1 car	2	8
4-6 m; can be passed by 2-3 cars	3	

Source: *Riestawati and Barandi, 2016*

B. Diarrhea

Table 2.7 Household members with history of diarrhea

Diarrhea	Score	Weight

None	1	
Healed	2	10
There is	3	

Source: *Fakhriadi and Laily, 2017*

Table 2.8 Classification of hand washing habits after defecation

Hand washing habits	Score	Weight
Often	1	
Rare	2	7
Never	3	

Source: *Fakhriadi and Laily, 2017*

Table 2.9 Classification of hand washing habits before eating

Hand washing habits	Score	Weight
Often	1	
Rare	2	7
Never	3	

Source: *Fakhriadi and Laily, 2017*

Table 2.10 Classification of waste treatment

Waste processing	Score	Weight
Transported by officers	1	
Burned	2	10
Discarded carelessly	3	

Source: *Ayuningrum and Mutiah, 2015*

Table 2.11 Classification of distance to temporary TPS

Distance to TPS	Score	Weight
>1000 m	1	
100-1000 m	2	10
<100 m	3	

Source: *DG PPM and LPP, Dipkes 1998 (Jati, 2014)*

3. RESULTS AND DISCUSSION

A. ARI

The ARI variable has 6 parameters, namely the parameter of people with ARI, the parameter of the number of dwelling members, the parameter of smoking habits, the parameter of the use of mosquito coils, the parameter of the width of the driveway, and the parameter of the ventilation area.

1) Parameter of ARI Patients

Based on the data from the parameter of ARI sufferers, most of the people who became respondents in this study chose the first answer choice (no occupancy members suffer from ARI), while the next most answer choice chosen by respondents was the third answer choice (there are occupancy members who suffer from ARI), and the least answer choice chosen by the people who became respondents was the second answer choice (has recovered from ARI).

2) Parameter Number of Residential Members

This parameter aims to determine whether the area/size of the respondent's dwelling meets the size requirements for 1 person. The occupancy area/room size that meets the requirements for 1 person is 8 m^2 , while the occupancy area of each shelter in Mantikulore Sub-district and Ulujadi Sub-district is as follows:

Table 3.1 Residential Area

Village	Long	Width	P*L (m)^2
Watusampu	4,5 m	3,5 m	15,75
Buluri 11	4 m	3,5 m	14
Buluri 8	5 m	4 m	20
Tipo	4,5 m	3,5 m	15,75
Silae	4,5 m	3,6 m	16,2
Kabonena 10	4,8 m	3,5 m	16,8
Kabonena 16	4,5 m	3,5 m	15,75
DonggalaKodi	4,7 m	3,5 m	16,45
Talise Valangguni	4,8 m	3,6 m	17,28
Tondo 12	4,7 m	3,6 m	16,92
Tondo 3	6 m	4 m	24
Layana Indah	4,8 m	3,5 m	16,8

Source: Primary Data, 2019

Based on the occupancy area table above, it can be seen that with such an area with the condition that in a room size of 8 m^2 for 1 person, the better number of family members is 1-2 people, it can also be 3-4 people but it is already in the category of space / occupancy area that does not meet the requirements, especially if more than 4 people in one dwelling whose size is as shown in table 4.24.

The results obtained from this study, namely the answer choices of the community who were the respondents who mostly chose the third answer choice (> 4 people), while the next most answer choices chosen by respondents were the second answer choices (3-4 people), and the least answer choice chosen by the community who were respondents was the first answer choice (1-2 people).

3) Smoking Habit Parameters

Based on data from the smoking habit parameter, most of the people who were respondents in this study chose the third answer choice (there are members of the dwelling who smoke), while the next largest answer choice chosen by respondents was the first answer choice (there are no members of the dwelling who consume cigarettes), and the least answer choice chosen by the people who were respondents was the second answer choice (there are members of the dwelling who smoke, but rarely/smoking outside the dwelling).

4) Parameter of Usage of Anti Mosquito Burn

Based on the data from the ARI patient parameters, most of the respondents in this study chose the first answer choice (not using mosquito repellent), while the next largest answer choice chosen by respondents was the third answer choice (using mosquito repellent), and the least answer choice chosen by the respondents was the second answer choice (using mosquito repellent, but occasionally).

5) Driveway Width Parameters

Based on the data from the parameter of the width of the entrance road to the shelters, almost all shelters in Mantikulore and Ulujadi Sub-districts, except for five shelters, are included in the second answer option (the number of cars that can enter, only 1 car), while the five shelters are included in the third answer option (the number of cars that can enter, there are 2-3 cars).

6) Ventilation Area Parameters

This parameter aims to determine whether the ventilation area of the respondent's shelter meets the size requirements for a residence. The ventilation area that meets the requirements for residential houses is 10% of the floor area of the dwelling, while the dwelling area and ventilation area of each shelter in Mantikulore Sub-district and Ulujadi Sub-district are as follows:

Table 3.2 Comparison of 10% Occupancy Area and Ventilation Area

| Village | Residential | | Ventilation | | |
	Residential Area	10% Residential Area	P (m)	L (m)	P*L (m)²
Watusampu	15,75 m²	1,5 m²	0,25	3,5	0,8
Buluri 11	14 m²	1,4 m²	0,25	3,5	0,8
Buluri 8	20 m²	2 m²	-	-	-
Tipo	15,75 m²	1,5 m²	0,25	3,5	0,8
Silae	16,2 m²	1,62 m²	0,25	3,6	0,9
Kabonena 10	16,8 m²	1,68 m²	0,25	3,5	0,8
Kabonena 16	15,75 m²	1,5 m²	0,25	3,5	0,8
Donggala. K	16,45 m²	1,6 m²	0,25	3,5	0,8
Talise. V	17,28 m²	1,7 m²	0,25	3,6	0,9
Tondo 12	16,92 m²	1,69 m²	0,25	3,6	0,9
Tondo 3	24 m²	2,4 m²	-	-	-

	16,8 m^2	1,68 m^2	0,25	3,5	0,8
Layana. I					

Source: Primary Data, 2019

The ventilation area that meets the requirements is 10% of the floor area of the shelter, so from the comparison table of shelter area and ventilation area above, it can be seen that the ventilation area in all shelters in Mantikulore Subdistrict and Ulujadi Subdistrict is categorized as unqualified, because the ventilation area in all shelters is less than 10% of the total floor area. Therefore, the shelters in Mantikulore and Ulujadi sub-districts are included in the second answer option (unqualified if <10% of the floor area).

B. DIARRHEA

The Diarrhea variable has 5 parameters, namely the parameter of diarrhea sufferers, the parameter of the habit of washing hands after defecation, the parameter of the habit of washing hands before eating, the parameter of household waste processing, and the parameter of residential distance to the TPS.

1) Diarrhea Patient Parameters

Based on data from the parameters of diarrhea sufferers, most of the people who became respondents in this study chose the first answer choice (no dwelling members suffer from diarrhea), while the next most answer choice chosen by respondents was the second answer choice (has recovered from diarrhea), and the least answer choice chosen by the people who became respondents was the third answer choice (there are dwelling members who suffer from diarrhea).

2) Parameters of Handwashing after Defecation and Handwashing before Eating

Based on data from two parameters, namely the habit of washing hands after defecation and the habit of washing hands before eating, the results showed that all people who became respondents in this study chose the first answer choice (always wash hands after defecation and before eating).

3) Household Waste Treatment Parameters

Based on the data from the respondents' household waste management parameters, most of the respondents in this study chose the second answer choice (household waste is burned), while the next largest answer choice chosen by the respondents was the third answer choice (household waste is disposed of carelessly), and the least answer choice chosen by the respondents was the first answer choice (household waste is disposed of at the TPS).

4) Parameter Distance of Shelter to TPS

Based on the data from the distance parameter of the shelter to the TPS, all shelters in Mantikulore and Ulujadi Sub-districts that were the research sites and had temporary waste disposal sites were included in the third answer choice (distance from the shelter to the TPS is less than 100 meters), and some shelters in the research sites did not have temporary waste disposal sites.

Based on the results that have been obtained from the research and have been described above, the data (respondents' answer choices) are given the appropriate score. After scoring, the next step is to multiply each score by the weight of the parameter that has been determined.

From the results of data analysis using the scoring and weighting method, it can be seen that the highest value is 30 and the lowest value is 7, then the next step is to classify these values in a way:

Vulnerable Value $= \dfrac{Xmax - Xmin}{n}$

Xmax : highest value
Xmin : lowest value
n : number of desired classes
Value Range $= \dfrac{30-7}{3}$

$= \dfrac{23}{3}$

$= 7.67$ or 7

From these calculations, table 3.3 below is the classification of the vulnerability level of ARI and Diarrhea.

Table 3.3 Classification of ARI and Diarrhea Susceptibility Levels

Class Interval	Classification
7-14	Not vulnerable
15-22	Vulnerable
23-30	Highly Vulnerable

Source: Primary Data, 2019

In table 3.3 above, it is known that the classification of the level of vulnerability of ARI and Diarrhea is divided into 3, namely the value of 7-14 is included in the classification of classes not vulnerable, vulnerable values 15-22 are included in the classification of vulnerable classes, values 23-30 are included in the classification of very vulnerable classes.

C. ARI Vulnerability Level Compensation
1) Parameter of ARI Patients

Based on the data analysis above, it can be seen that in this parameter most respondents fall into the non-vulnerable class classification, which indicates that most respondents do not have families suffering from ARI. However, there were some respondents who were classified as highly vulnerable and susceptible to ARI, although not as many as those who did not suffer from ARI. The existence of some respondents who fall into the highly vulnerable class classification needs to be watched out for too, because it can be known that viruses, germs, bacteria from ARI diseases are transmitted from sufferers to other people through respiratory air or saliva splashes of sufferers. The principle is that ARI germs in the air are sucked in by new guests and enter the entire respiratory tract, from the respiratory tract germs spread throughout the body if the infected person has low immunity, then he will get ARI (Depkes RI (1996) in Noviyanti, 2012: 12).
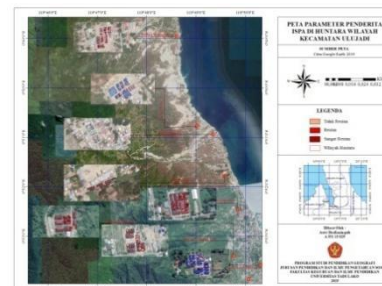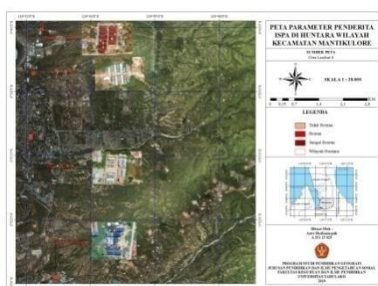

Figure 3. people with ARI in Mantikulore sub-district *Figure 4*. people with ARI in Ulujadi sub-district

2) Residential Density Parameters

This parameter compares the number of dwelling members with the area of the temporary dwelling. The eligible space for 1 person is 8 m2. The area of the temporary shelters in the research locations is almost all the same, which is around 15.75-16.45 m2. So, if the shelter area is that large, it can only accommodate 1-2 people to be considered a qualified shelter area.

Based on the data analysis conducted above, it can be seen that in this parameter all shelters in the Mantikulore and Ulujadi sub-districts have respondents with a very vulnerable class classification, because these respondents have more than 4 members with a shelter area of only around 15.75-16.45 m2.

The condition of many or few family members in one dwelling can affect the susceptibility of ARI. The narrow living area with a large number of family members causes bacteria and viruses to be transmitted through breathing from one family member to another. The more family members in one dwelling, the transfer of disease, especially airborne diseases, will be easier and faster. Meanwhile, for more details about respondents who fall into the non-vulnerable, vulnerable and highly vulnerable classes can be seen in the map below.
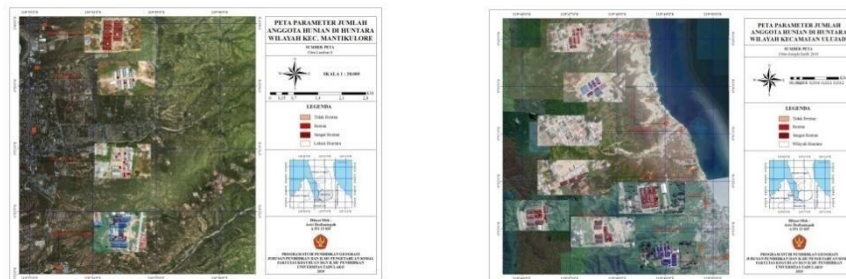
Figure 5: Number of members of the Mantikulore shelter *Figure 6*: Number of members of the Ulujadi shelter

3) Smoking Habit Parameters

This parameter has the intention of knowing whether or not there are respondents' family members who consume cigarettes in the shelter, so from the results obtained in the field and data analysis has been carried out on these results, it can be seen that in this parameter all shelters in the Mantikulore and Ulujadi sub-districts are classified as very vulnerable, this is because most respondents have family members who are active smokers. The presence of family members who consume cigarettes in one dwelling, then other family members will be vulnerable to ARI. This is because ARI can be caused not only by viruses, bacteria and fungi, but also by inhaling cigarette smoke, motor vehicle fumes, and other pollutants.

Kusnoputranto (2000) in Rudianto (2013:93) states that cigarette smoke is one of the indoor pollutants. In addition to increasing the occurrence of a disease, the presence of cigarette smoke will increase the presence of pollutants in the room, as well as increase the risk of illness from other toxic materials. If you inhale air mixed with particulate matter from cigarette smoke too often, it is possible to irritate the respiratory tract, then it will be easily infected. Meanwhile, for more details about respondents who fall into the classes of not vulnerable, vulnerable, and very vulnerable can be seen in the map below.
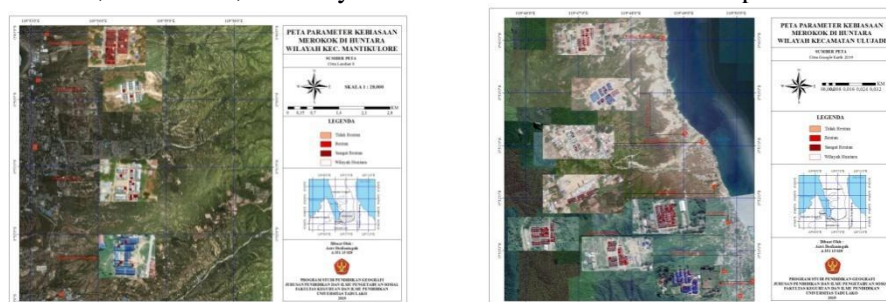

Mantikulore shelter cigarette smoke *Picture 8*. Ulujadi shelter cigarette smoke

4) Parameter of Usage of Anti Mosquito Burn

This parameter aims to determine whether or not respondents use anti-mosquito coils in their shelters, so from the results obtained in the field and data analysis on these results,

it can be seen that all shelters in the Mantikulore and Ulujadi sub-districts are classified as not vulnerable, because most of the people who are respondents do not use anti-mosquito coils, they prefer to use fans to repel mosquitoes and other types of diptera order insects, but there are some respondents who only occasionally use anti-mosquito coils.

The use of mosquito coils in the family is at risk of causing ARI compared to those who do not use mosquito coils. The use of mosquito repellents has been shown to cause respiratory problems. The active ingredients contained in mosquito repellents are very dangerous and can interfere with human health. There are various insecticides contained in mosquito repellents currently in circulation, including propoxur, dichlorvos, chlorpyrifos, and pyrethroids derivatives such as pyrethrine, d-allethrine, and transfluthrine (propoxur, dichlorvos, and chlorpyrifos have higher toxicity than pyrethroid derivatives), if these mosquito repellents are exposed in large quantities, they can reduce cholinesterase activity (the enzyme that releases excessive sweating, dizziness, nausea, vomiting, diarrhea, and shortness of breath (Medan Bisnis (2011) in Saleh et al., 2017:174). Thus, it would be better if a family does not use mosquito repellent or change to a safer electric mosquito repellent. Meanwhile, for more details about respondents who fall into the classes of not vulnerable, vulnerable, and very vulnerable can be seen in the map below.
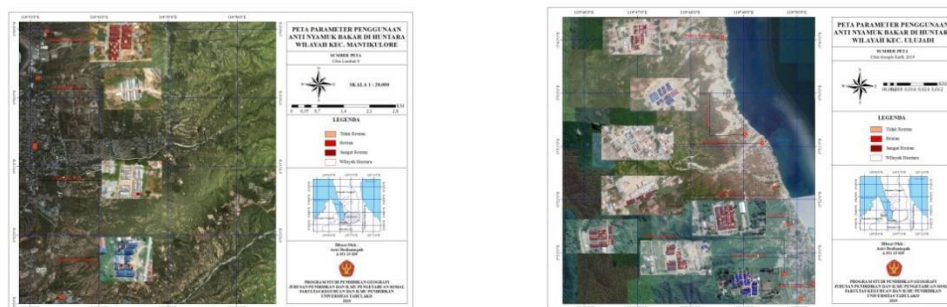
Mosquito repellent for Mantikulore shelter Mosquito repellent for Ulujadi shelter *Picture 9.*

5) Driveway width parameter

In this parameter, the width of the entrance road in each shelter is measured by how many cars can enter the shelter. In Watusampu, Buluri, Kabonena, Donggala Kodi, Tondo with 12 respondents, and Layana Indah the number of cars that can enter the shelter is only 1 car, because the location of the shelter is located in the hallway. Meanwhile, in Tipo, Silae, Tondo with 3 respondents, and Talise Valangguni the number of cars that can enter the shelter is 2-3 cars, because the location of the shelter is right on the edge of the highway.

This parameter is included in one of the causes of ARI, because based on the explanation of the smoking habit parameter above, ARI can occur not only due to viruses, bacteria, and fungi but can also occur from pollutants such as vehicle fumes.

6) Ventilation area parameter

Based on the data analysis conducted above, it can be seen that in this parameter, all temporary shelters in the Mantikulore and Ulujadi sub-districts have only one class classification, namely the highly vulnerable class classification. Temporary shelters that fall into the very vulnerable class indicate that the ventilation area of the shelter does not meet the requirements (<10% of the floor area), as explained above, that a qualified shelter has a ventilation area >10% of the floor area, while an unqualified shelter has a ventilation area <10% of the floor area.

The unqualified ventilation area is due to the small size of the shelters. The ventilation area of the shelters in each kelurahan is similar, with the width following the width of the shelter and the height not exceeding 0.25m. Shelters that have ventilation that does not meet health requirements will affect the health of the occupants of the house. This is because the airflow exchange process from outside to inside the house is not smooth. Tulus (2008) in Rudianto (2013: 98), explains that the effect of poor ventilation is the lack of O2 levels and the increase in CO2 levels, the presence of stuffy, room air temperature rises and room air humidity increases. The effect of air pollution can cause breathing difficulties, so that foreign objects including viruses, bacteria and other microorganisms cannot be removed from the respiratory tract.

D.   Diarrhea Susceptibility Level Comparison

1)   Parameters for people with diarrhea

Based on the data analysis above, it can be seen that in this parameter most respondents fall into the non-vulnerable class classification, which indicates that most respondents do not have family members who suffer from diarrhea. However, there were some respondents who were classified as highly vulnerable and susceptible to diarrhea, although not as many as those who did not suffer from diarrhea. The existence of some respondents who are included in the highly vulnerable class classification needs to be watched out too, because it can be known that diarrhea is caused by several factors, one of which is the living environment, which indicates that with several respondents who have suffered or are still suffering from diarrhea there is a possibility that if the living environment remains unclean it can cause diarrhea to be vulnerable to other respondents.
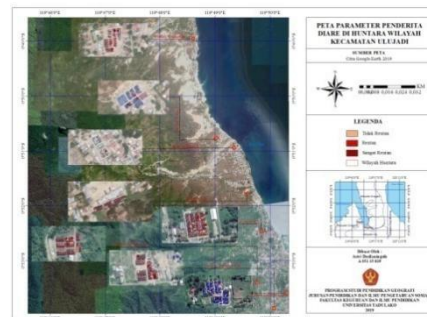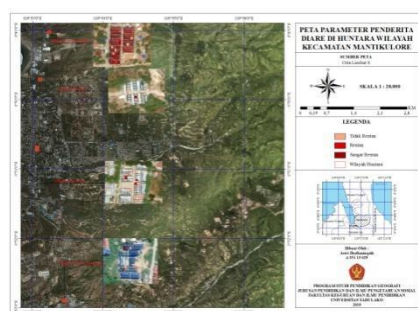

Figure 11 Diarrhea patients in Mantikulore shelter *Figure 12* Diarrhea patients in Ulujadi shelter

2)   Parameters of hand washing habit

The handwashing habit parameter includes two parameters, namely the habit of washing hands after defecation and the habit of washing hands before eating. Handwashing habits are one of the factors that can cause diarrhea.

Based on WHO (2009) in Risyida (2014: 75), washing hands with soap has been shown to reduce the incidence of diarrheal disease by approximately 40%. Hand washing here is emphasized before eating and after defecation. Hand washing is one of the most cost effective interventions to reduce the incidence of diarrhea. In addition, the Indonesian Ministry of Health (2009) concluded that about 30 related studies found that hand washing with soap can cut the number of diarrhea patients by half. As for the results obtained in the field and data analysis has been carried out on these results, it can be seen that in the parameter of the habit of washing hands after defecation and the parameter of the habit of washing hands before eating there is only one class classification, namely the classification of the class is not vulnerable. So, all respondents in temporary shelters in Mantikulore and Ulujadi sub-districts always wash their hands after defecation and before eating.
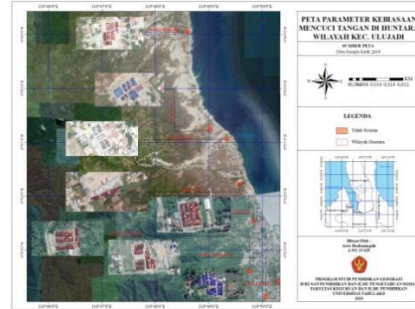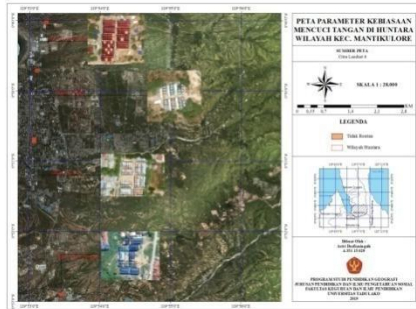
Figure 13. Handwashing in Mantikulore shelter *Figure 14*. Handwashing in Ulujadi shelter

3) Waste Management Parameters

This parameter aims to determine the respondents' habits in waste management, so from the results obtained in the field and data analysis on these results, it can be seen that all shelters in Mantikulore and Ulujadi sub-districts have respondents who are classified as vulnerable. This is because most of the shelters do not provide public waste bins. The only shelters with trash bins are Watusampu shelter, Silae shelter, Kabonena shelter with 16 respondents, and Talise Valangguni shelter. According to respondents whose shelters did not have public waste bins, they chose to burn or litter the waste.

Waste is a source of disease and a breeding ground for disease vectors such as flies, mosquitoes, rats, cockroaches, and so on. Waste can cause comfort and aesthetic disturbances such as unpleasant odors and unsightly views. Therefore, waste management is very important to prevent disease transmission. Garbage bins should be provided, garbage should be collected daily and disposed of in a dumpster. If it is not covered by the waste disposal service to the landfill, waste can be destroyed by burning. For more details on respondents who fall into the non-vulnerable, vulnerable and highly vulnerable classes, see the map below.
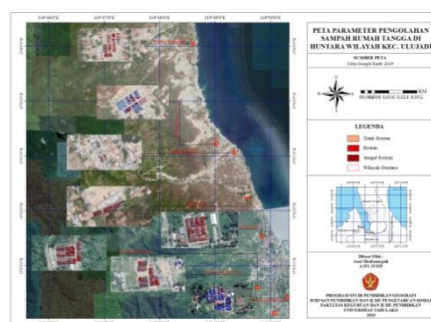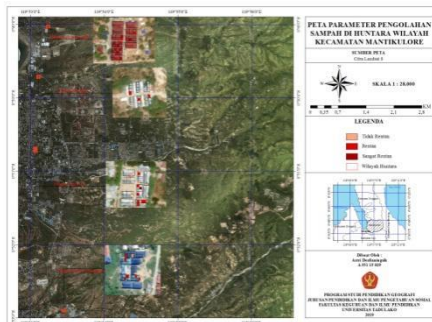

Figure 15. Trash from Mantikulore shelter *Figure 16*. Trash from Ulujadi shelter

4) Shelter to polling station distance parameter

This parameter is carried out by observing all shelters that are the research sites. As for the results obtained in the field and data analysis has been carried out on these results, it can be seen that in the Watusampu, Silae, Kabonena areas with 16 respondents, Talise Valangguni, and Tondo with 12 respondents are classified as very vulnerable. Meanwhile, shelters in the Buluri, Tipo, Kabonena areas with 10 respondents, Donggala Kodi, Tondo with 3 respondents did not have a TPS (waste disposal site) so that respondents in this shelter area disposed of garbage arbitrarily or just burned it. Some shelters that are included in the vulnerable class classification have a fairly close distance to the TPS, which is less than 100 m, the close distance between the TPS and the shelter makes it close to the source of disease and the breeding ground for disease vectors such as flies, mosquitoes, rats, cockroaches, and so on.

E. ARI and Diarrhea

Based on the table, map and explanation above, it can be seen that from a total of 114 respondents from two regions, namely 38 respondents from Mantikulore sub-district and 77 respondents from Ulujadi sub-district, the most dominant parameters that will be prone to ARI and Diarrhea from the two regions are the smoking habit parameter for ARI and the waste management parameter for Diarrhea.

The smoking habit parameter is included in the most dominant thing that will be prone to ARI because cigarette smoke is one of the pollutants in the room. So, with the size of the residential ventilation area that does not meet the requirements (> 10% of the floor area), the air circulation between cigarette smoke and air from outside the dwelling does not run smoothly, resulting in if members of the dwelling too often inhale air mixed with particulates from cigarette smoke, it is possible to irritate the respiratory tract which will then be easily infected.

The parameter of household waste management is included in the most dominant thing that will be prone to diarrhea because, waste is a source of disease and a breeding ground for disease vectors such as flies, mosquitoes, rats, cockroaches, and so on. So, if flies, rats, cockroaches that have come into contact with garbage and then come into contact with food and others, they will easily get diarrhea. Meanwhile, the most dominant parameters from respondents are as follows.

4. CONCLUSIONS

Based on the results of the research conducted on the temporary shelters in each kelurahan in Mantikulore and Ulujadi Sub-districts, the following conclusions were drawn:

1. ARI Variable
   a. In the parameter of ARI sufferers, it can be seen that most respondents fall into the classification of the non-vulnerable class.
   b. In the parameter of the physical environment of the shelter, it can be seen that all shelters have respondents who are classified as very vulnerable, as well as in the area of residential ventilation, all shelters are classified as very vulnerable.
   c. In the smoking habit parameter, it can be seen that most respondents fall into the highly vulnerable class classification.
   d. In the parameter of mosquito repellent use, it can be seen that most respondents are classified as not vulnerable.
   e. In the road area parameter, it can be seen that some shelters are classified as not vulnerable and some are classified as highly vulnerable.

2. Diarrhea Variable
   a. In the parameter of ARI sufferers, it can be seen that most respondents fall into the classification of the non-vulnerable class.
   b. In the parameter of hand washing before eating and after defecation, it can be seen that all respondents fall into the non-vulnerable class classification.
   c. In the waste management parameter, it can be seen that half of the respondents fall into the vulnerable class classification.
   d. In the parameter of the distance of shelters to TPS, it can be seen that all shelters are classified as very vulnerable.

5. LITERATURE

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