

## MAPPING OF PROTO VILLAGE COMMUNITY HEALTH CONDITIONS KEDUNGWUNI SUB-DISTRICT, PEKALONGAN DISTRICT

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### Abstract

A person's level of health is influenced by four factors, namely, heredity, environment, behavior and health services, where environmental factors have the greatest role. In Proto Village, based on data from the Village Health Polyclinic, most environmental-based diseases were found, such as ISPA, diarrhea and skin diseases. Information on the distribution of disease in Proto Village can be done using Geographic Information System (GIS) technology in the form of a thematic maps. This research aims to map the distribution of environmental-based diseases in Proto Village with a Geographic Information System (GIS) approach. The type of research is qualitative, case study design with a Geographic Information Systems (GIS) approach. The research location is in Proto Village, Kec. Kedungwuni, Kab. Banjarnegara. The research was conducted in August 2021 - August 2022. The research instruments were GIS software, data on the health conditions of the Proto Village community. Descriptive data analysis methods overlay techniques and scoring techniques. Based on the results of the disease distribution mapping analysis, two RWs in Proto Village are in vulnerable status, namely RW 2 and RW 3, while RW 1 is not in vulnerable status. The distribution pattern of ARI diseases is clustered in RW 3 and random in RW 1 and RW 2. The distribution pattern of diarrhea disease is random, while the distribution pattern of skin diseases is clustered. Based on the condition of well water quality, ARI disease is not caused by water quality, viruses, dust, lack of open ventilation. Diarrhea is caused by water quality and climate change, while skin disease is caused by water quality, personal hygiene, overcrowding and lack of ventilation.

**Keywords:** Environment, ARI, Diarrhea, Skin, GIS

### Introduction

Health is an important factor for human survival. In order to realize an optimal degree of health, health development is needed to foster the level of awareness, willingness and ability of the community to live healthy life.<sup>(1)</sup>

A person's degree of health is influenced by four factors according to Hendrik L. Blum, these factors include heredity, environment, behavior and health services. Environmental factors have the greatest role

in health status, followed by behavioral factors, health services and heredity have the least role in health status.<sup>(2)</sup>

The environment is one of the factors in the transmission and emergence of infectious and non-communicable diseases.<sup>(1)</sup> Environmental-based diseases are still a problem, such as ARI and diarrhea which are among the top 10 environmental-based diseases.<sup>(3)</sup>

Environment-based infectious diseases in Indonesia are dominant such as dengue, tuberculosis, malaria, diarrhea, acute respiratory infections, worms, skin diseases, poisoning and complaints due to poor environment.<sup>(4)</sup> According to research by Nasihah et al.<sup>(5)</sup> states that infectious diseases that occur in dormitory or boarding schools environment are skin diseases (scabies and scabies), ARI, and diarrhea.

Environmental-based diseases in Proto Village are based on data from Kedungwuni 1 Health Center, such as diarrhea and scabies. In 2017, the number of diarrhea cases was 26 cases and decreased to 17 cases in 2018, while scabies increased from 5 cases in 2017 to 19 cases in 2018 spread across Proto Village. Proto Village has 18 small industries (Kec. Kedungwuni in Figures 2020) such as convection batik and jeans. Initial observations in the field showed that people in Proto Village who are close to the industry complained about the quality of their well water, such as cloudy brownish water and odor. The people of Proto Village have held demonstrations related to these problems, but have not yet found a bright spot. Also, some industries do not have Waste Water Treatment Plants (WWTP), where industrial waste is collected in a holding pond and then discharged directly into the river. Clean water has a relationship with public health regarding the occurrence of environmental (water) based diseases, namely typhoid diarrhea, and cholera.<sup>(6)</sup>

The coloring process produces liquid waste that has a strong level of pollutants such as high COD (Chemical Oxygen Demand) and BOD (Biological Oxygen Demand) values, the BBT (Balai Besar Tekstil) laboratory conducted an experiment with the results of textile liquid waste containing COD of 534 mg/l and BOD 99 mg/l.<sup>(7)</sup>

According to Syina Research<sup>(8)</sup> states that the people of Dukuh Klambon who use groundwater are starting to feel about groundwater that has decreased water quality caused by hazardous waste from metal industry activities. Metal industry activities also produce solid waste and particles that cause air pollution in the form of solid waste and particles, where the Pesarean Village community began to get ARI.<sup>(8)</sup> ARI is divided into 2 parts, namely the upper part including cough, runny nose, sore throat, earache and the part including bronchitis, bronchiolitis and pneumonia.<sup>(9)</sup>

According to Citrapancayudha and Soetarto<sup>(10)</sup> explained that the wax contained in batik waste contains chemical compounds that cause itching of the skin, disruption of breathing, digestion and cancer.<sup>(10)</sup> According to Wahistina et al<sup>(11)</sup> stated that the distance between the well and the waste storage of the tofu factory in Kraton Village, Kencong District, Jember Regency is less than 10 m ( $\pm$  7 m), the close distance between the well and the waste storage has a risk of skin disease, stomach disease from the use of well water.<sup>(11)</sup>

Information on the distribution of diseases in Proto Village can be done using Geographic Information System (GIS) technology. GIS has a role in disease prevention such as spatial clustering analysis, which can be used to determine the spatial distribution pattern of a disease that can be analyzed for its relationship with environmental factors.<sup>(12)</sup> Dwi et al research<sup>(13)</sup> related to mapping the distribution of diseases in Tanggamus Regency, Lampung Province, that using Geographic Information Systems (GIS) produces maps of each disease such as maps of the distribution of HIV/AIDS, DHF, diarrhea, malaria and leprosy.

In determining priority areas in efforts to prevent and control a disease can use the distribution of information on vulnerable areas based on place and time.<sup>(14)</sup> This study aims to map the distribution of environmental-based diseases in Proto Village with a GIS approach.

**Method**

The research method used is descriptive qualitative. The research location is Proto Village, Kedungwuni Subdistrict, Pekalongan Regency. The research was conducted in August 2021 - August 2022. The population in this study is the Proto Village community related to public health conditions. The data taken are environment-based diseases such as ARI, diarrhea and skin diseases. The data source uses secondary data in the form of data on the number and type of diseases from the Village Health Clinic (PKD). Attribute data includes population data, the number of cases of each disease, and the Incidence Rate (IR) value for each disease. Data on the number of disease cases is processed with a formula to obtain the IR value. The number of classes used is three classes. The formula for obtaining the IR value, disease incidence data is processed as follows:<sup>(1)</sup>

$$IR = \frac{\text{Jumlah Kasus}}{\text{Jumlah Penduduk}} \times K$$

Information :

K = Constant (100, 1,000, 10,000,100,000)

**Table 1. Incident Rate (IR) Scoring**

Class	IR	Score
Class I: 0.00 - 50.00	Low	1
Class II: 50.01 - 107.65	Currently	2
Class III: 107.66 – 500.00	Tall	3

Source: Hilda et al, 2016

**Table 2. Disease Susceptibility Level Scoring**

Number of Parameter Scores	Level of Vulnerability
1 – 3	Not vulnerable
4 – 6	Prone
7 – 9	Very vulnerable

Source: Hilda et al, 2016

Data collection used secondary data and observation. Data analysis was carried out using descriptive analysis techniques. The distribution pattern uses visual colors, namely not vulnerable in green, vulnerable in yellow and very vulnerable in red as well as IR classes where class I is green, class II is yellow and red for class III. Data were analyzed spatially using overlay techniques and scoring techniques.

**Results**

Scoring Incidence Rate (IR) ISPA, diarrhea and skin diseases.

**Table 3. IR scoring of ARI disease**

No	RW	Score	Status
1	RW 1	1	Low
2	RW 2	2	Currently
3	RW 3	2	Currently

Source: Primary Data, 2022

**Table 4. IR Scoring for Diarrhea Disease**

No	RW	Score	Status
1	RW 1	1	Low
2	RW 2	1	Low
3	RW 3	1	Low

Source: Primary Data, 2022

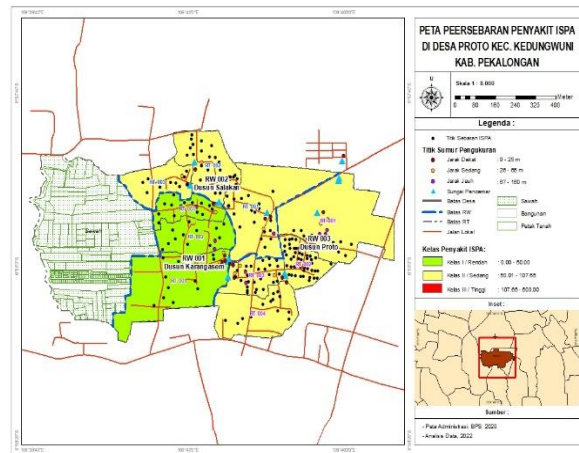
**Table 5. IR Scoring for Skin Diseases**

No	RW	Score	Status
1	RW 1	1	Low
2	RW 2	1	Low
3	RW 3	1	Low

Source: Primary Data, 2022

**a. Acute Respiratory Infection (ARI)**

Acute Respiratory Tract Infection (ARI) is a disease of the upper or lower respiratory tract caused by infectious agents.<sup>(15)</sup>



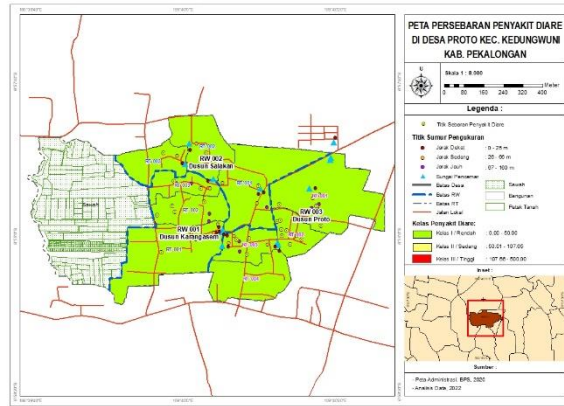
**Figure 1. ARI Disease Distribution Map**

The results of the ARI disease data mapping in Proto Village in 2019 can be seen in Figure 1, showing that the Proto Village area marked with green areas is included in class I or low, namely RW 1 and yellow areas are included in class II or medium, namely RW 2 and 3, with the Incident Rate (IR) value of ARI disease, namely RW 1 of 45.45, then RW 2 and 3 of 81.86 and 93.24. The ARI cases in Proto Village fall into the low class of RW 1, which means that the number of people suffering from ARI is not high, and

RW 2 and RW 3 fall into the medium class, which means that the number of people suffering from ARI is quite high.

**b. Diarrhea**

Diarrhea is a condition in which the stool is not normal, which is known by increasing the volume and dilution of the stool and the number of bowel movements more than four times a day.<sup>(16)</sup>

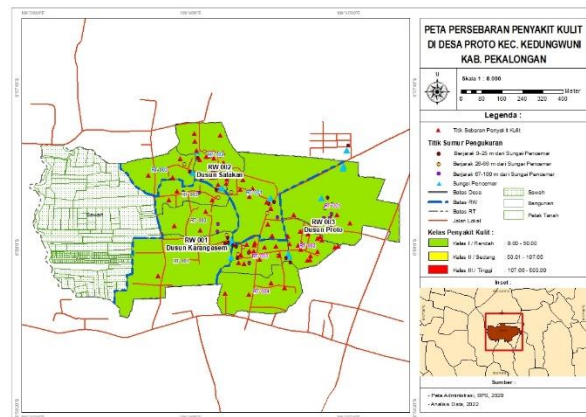


**Figure 2. Diarrhea Disease Distribution Map**

The results of diarrheal disease mapping in Proto Village in 2019 can be seen in Figure 2. shows that diarrheal disease in the Proto Village area is marked with green areas in class I or low, with the Incident Rate (IR) value of diarrheal disease in RW 1, RW 2 and RW 3 amounting to 9.51, 4.09 and 12.80, respectively. In 2019, there were 26 cases of diarrhea in Proto Village spread across three RWs, namely nine cases in RW 1, three cases in RW 2, and 14 cases in RW 3. The number of diarrhea cases in Proto Village is low, which means that the number of diarrhea disease patients is not high

**c. Skin**

Skin diseases are diseases that have symptoms such as itching, reddish rashes located on the outside of the body, which can be caused by viruses, personal hygiene, chemicals and so on.<sup>(17)</sup>



**Figure 3. Skin Disease Distribution Map**

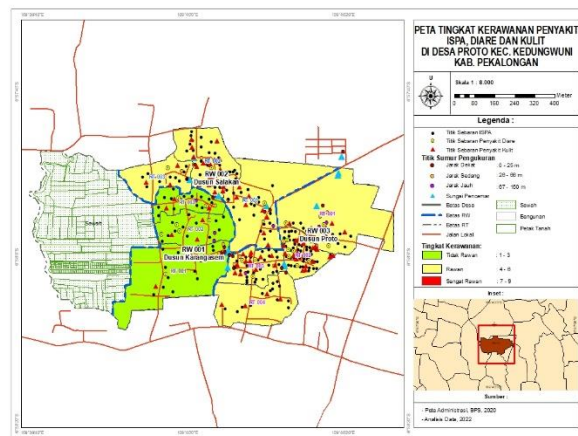
The results of skin disease mapping in Proto Village in 2019 can be seen in Figure 3. shows that skin diseases in the Proto Village area marked with green areas are included in class I or low, with the Incident

Rate (IR) value of skin diseases in RW 1, RW 2 and RW 3 amounting to 8.46, 45.02 and 36.65, respectively. The breakdown of skin diseases in Proto Village 2019 amounted to 80 cases in three RWs, namely in RW 1 totaling eight cases, RW 2 totaling 33 cases and in RW 3 totaling 39 cases. The number of skin disease cases in Proto Village is in the low class, which means that the number of people with skin disease is not high.

**Table 6. Total Score of ARI, Diarrhea, Skin Disease Vulnerability Level in Proto Village**

No	Village	Score			Total Score	Level of Vulnerability
		ISPA	Diarrhea	Skin		
1	RW 1	1	1	1	3	Not vulnerable
2	RW 2	2	1	1	4	Prone
3	RW 3	2	1	1	4	Prone

Source: Primary Data, 2022



**Figure 4. Map of Disease Susceptibility Levels In Proro Village**

The disease vulnerability map in Figure 4 shows that there are 2 RWs classified as vulnerable, namely RW 2 and RW 3 with a score of 4, while RW 1 is not vulnerable with a score of 3. The causes of ARI, diarrhea, and skin diseases include poor water quality, climate change, personal hygiene, lack of ventilation opened in the house.

## Discussion

### a. Acute Respiratory Infection (ARI)

ARI is a disease that affects the throat, nose and lungs that occurs for approximately 14 days. ATI affects the part of the channel above the larynx, but this disease many also affects the upper and lower channels in a sequential manner.<sup>(18)</sup> ARI is divided into two parts, namely upper and lower.<sup>(19)</sup>

Figure 1. shows that ARI disease is concentrated in certain locations and some are not, where ARI disease is clustered in RW 3 and spreads randomly in RW 1 and RW 2. According to research by Wulandari & Widayani<sup>(20)</sup> showed that the distribution pattern of ARI disease in Lemahwungkuk District, Cirebon City was clustered, where the physical quality of the environment (residential density, vegetation cover, distance to pollution sources, road surface conditions, and type of roof of house) is related to the level of ARI

incidence,<sup>(20)</sup> Based on the Decree of the Minister of Health of the Republic of Indonesia number 829/Menkes/SK/VII/1999, the permanent natural ventilation area is at least 10% of the floor area, as well as lighting that can illuminate all parts of the room and is not dazzling.

Based on observation of water quality in Proto Village, some of it is murky brownish and smelly, ARI can be caused by viruses, climate change and dust (information from the village midwives), many people work as tailors for clothes, jeans, etc. with a total of 158 (5.70%), where some workers when they doing activities indoors do not open the ventilation of the house, so that the air circulation does not run well, so dust or pollution will be trapped in the room and there will be a lack of lighting.

According to research by Rahman & Nurjannatul<sup>(21)</sup> stated that patients with Acute Respiratory Infections (ARI) on Saugi Island were caused by the sanitation of the home environment such as water sources and waste disposal that did not meet standards.<sup>(21)</sup> According to Guantari et al<sup>(22)</sup> states that viruses are the most common cause of ARI. Aspects of air quality, such as poor ventilation, can result in air exchange mechanisms that make a room stuffy, making a room stuffy and humid which can cause bacteria, viruses and fungi to multiply, potentially causing ARI disease.<sup>(23)</sup>

According to Maulana's research,<sup>(24)</sup> found that there was an influence between lighting and an increase in the risk of ARI transmission of 1,907 times in the working area of the Bantarkawung Community Health Center, Brebes Regency, with a category of lack of lighting as much as 76.9% of homes with ARI disease.<sup>(24)</sup>

According to research by Manan et al.<sup>(25)</sup> stated that extreme climate change could result in the prevalence of diseases such as ARI increasing,<sup>(25)</sup> as well as dust and transportation (burning exhaust gas) are factors that cause ARI disease.<sup>(26)</sup>

## **b. Diarrhea**

In Indonesia, the incidence of diarrhea is driven by multifactors, both directly and indirectly, such as nutritional conditions, population, environment, behavior and the source of drinking water consumed by the community.<sup>(27)</sup>

Based on figure 2. shows that diarrhea disease patients spread in Proto Village, where the pattern of diarrheal disease is possible because of environmental conditions that support the development of bacteria or viruses that cause diarrheal disease. According to research by Hanum et al<sup>(28)</sup> stated that the distribution pattern of infectious diseases, namely dengue fever, diarrhea, pneumonia and pulmonary TB+ in Semarang City, spread randomly.

Diarrhea cases in Proto Village are in the low class, which means the number of people suffering from diarrhea is not high. The distribution of diarrheal disease based on the condition of well water quality could be one factor because the water quality in Proto Village is cloudy, brownish and smelly, as well as another factor, namely climate change. According to research by Suhartono et al<sup>(29)</sup> stated that the small jeans industry in Surabayan Village, Wonopringo District, Pekalongan Regency, jeans waste water has the potential for environmental pollution if it is disposed of directly without any treatment with waste water characteristics, namely COD 150 mg/L, BOD 60 mg/L and SS 50 mg/L as adjusted with the quality standards of Central Java Province Regional Regulation No. 5 of 2012 concerning Quality Standards for Liquid Waste from the Textile Industry.<sup>(29)</sup>

This research is in line with Langit's research<sup>(30)</sup> that there is a relationship between clean water supply and the incidence of environmental-based diseases, namely diarrhea, in the Rembang 2 Community Health Center working area with a p value < 0.05, namely 0.001.<sup>(30)</sup>

High BOD content can cause digestive disorders and skin irritation, in line with the research of Rachmawati et al<sup>(31)</sup> states that high BOD levels in water usually have the characteristics of a high content of microorganisms, and have an almost 15 times greater risk of developing digestive diseases and skin irritation.<sup>(31)</sup>

According to research by Rachmawati et al<sup>(31)</sup> stated that people who have dug wells with unqualified well walls have a 7,650 times greater risk of developing digestive disorders and skin irritation compared to people who have dug wells with well wall conditions that meet the requirements. And people who have dug wells with unqualified well floors have a 5.926 times greater risk of developing digestive disorders and skin irritations.<sup>(31)</sup>

According to research by Pertiwi et al<sup>(32)</sup> stated that climate change could trigger an impact on public health, where air temperature, rainfall and humidity could cause diarrhea in Bandar Lampung City in 2018-2019.<sup>(32)</sup>

According to Ernyasih's research<sup>(33)</sup> stated that climate change greatly influences poor environmental conditions and lack of understanding of food hygiene, so that when climate change occurs, parasites, viruses and disease vectors can develop very quickly.<sup>(33)</sup>

### **c. Skin disease**

Skin diseases are dominant on the skin surface and are often found in developing countries and are related to social conditions such as low economic conditions, because people still do not prioritize personal and environmental hygiene.<sup>(34)</sup>

Figure 3. shows that skin diseases spread in a cluster pattern, where in 1 house there is more than one person suffering from skin diseases such as itching, redness and watery skin and there is a close distance between neighbors suffering from skin diseases. According to research by Idayani et al<sup>(35)</sup> stated that the closer the house is to a leprosy patient, the more likely it is that contact will occur both inside the home, outside the home and at work and the distribution pattern of leprosy in Kragan District and Sarang District is clustered, with the closest distance being 0 km , and the average distance between lepers is 1.3 km.

Cases of skin diseases in Proto Village mostly affect boarding school students, such as itching, runny nose and some people also complain of itching after bathing using well water, personal hygiene, overcrowding and lack of open ventilation. Skin diseases can be classified as diseases caused by polluted water or insufficient clean water for sanitary hygiene purposes.<sup>(36)</sup>

According to Sugiester et al<sup>(37)</sup> related to the quality of dug wells and personal hygiene related to skin health problems in Indonesia, stating that risk factors for skin diseases can occur due to environmental sanitation conditions, availability of clean water sources, body hygiene, clothing, and so on. Agents of skin disease transmission include water, air, food, disease-transmitting animals and insects as well as humans themselves.

According to research by Sajida et al<sup>(38)</sup> stated that in Denai Village, related to the relationship between personal hygiene and environmental sanitation and complaints of skin diseases, there was a relationship between skin hygiene  $p = 0.009$ , hands and nail hygiene  $p = 0.001$ , clothes hygiene  $p = 0.011$ , towel hygiene  $p = 0.001$ , bed and bed linen hygiene  $p = 0.025$  and environmental sanitation  $p = 0.014$  with skin diseases.<sup>(38)</sup>

High levels of manganese (Mn) also cause iron levels in the body to decrease, raising the risk of developing skin disorders.<sup>(39)</sup> Apart from manganese content, occupant density and ventilation can also cause skin diseases.



Occupant density affects the process of disease transmission from one person to another and one's personal hygiene determines health status in order to maintain and prevent skin diseases.<sup>(37)</sup> Lack of ventilation causes the air exchange process to be reduced with makes the humidity high, which is a favored by microorganisms such as fungi to reproduce, thus helping the transmission of skin diseases.<sup>(40)</sup>

## Conclusion

Based on the results of the disease distribution analysis, two RWs in Proto Village are vulnerable, namely RW 2 and RW 3, while RW 1 is not vulnerable. The distribution pattern of ARI diseases is clustered in RW 3 and random in RW 1 and RW 2. The distribution pattern of diarrheal diseases is random, while the pattern of any skin disease is clustered. Based on the condition of well water quality, ARI disease is not directly caused by water quality, the main factors are viruses, dust, lack of open house ventilation. Diarrhea diseases are caused by poor water quality and climate change, while skin diseases are caused by water quality, personal hygiene, overcrowding and lack of open house ventilation.

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