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SPATIAL CLUSTERS AND DETERMINANTS OF THE HIGH INCIDENCE OF DIARRHEA IN CHILDREN

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Abstract: Diarrhea is a sickness that typically affects toddlers and can cause severe dehydration and death if not treated immediately and effectively. Diarrhea cases in children under five are still highly prevalent in West Java, particularly in regions with poor access to sanitary facilities and clean water. The purpose of this study is to identify the spatial clusters and contributing variables associated with the high rate of diarrhea in children under five in West Java. The method used in this research is Geographically Weighted Poisson Regression (GWPR) which considers geographical location in the analysis. The study revealed that several factors have a significant impact on the number of diarrhea cases among children under five in West Java. These include the percentage of clean and healthy living behaviors, access to adequate sanitation, poverty level, population density, percentage of infants under six months of age exclusively breastfed, percentage of complete basic immunization, ratio of public health center facilities, and the ratio of general practitioners. Detection results using Flexibility Shaped Spatial Scan Statistics show that there are several areas that require special priority treatment, namely Cirebon City, Bogor Regency,

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Cianjur Regency, Bandung Regency, Garut Regency, Subang Regency, Bogor City, Depok City and Cimahi City.

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1. INTRODUCTION

The condition known as diarrhea is characterized by the passing of loose, watery stools three or more times a day. In general, diarrhea can be classified as a mild disease, but it can be dangerous if not treated quickly and appropriately. Untreated diarrhea can lead to severe dehydration. A condition where the body loses a lot of fluids and electrolytes. Severe dehydration is very dangerous because it can lead to organ failure and can cause death [1][2]. In West Java, diarrhea is a common illness that has the potential to be an extraordinary event. Extraordinary Event is a term used to describe the onset or increase of epidemiologically significant morbidity and/or mortality in an area within a certain period of time. This condition has the potential to cause an outbreak [3]. The disease poses a significant risk to toddlers because they can rapidly lose a large amount of fluids, potentially leading to dehydration and even death if not promptly addressed. In addition, diarrhea is contagious. The infection can spread from one individual to another through direct contact or through a contaminated environment [4][5]. Therefore, if there is an outbreak of diarrhea in an area, it is likely to spread to surrounding areas which may worsen the overall health situation in the region.

In Indonesia, diarrhea is still prevalent in toddlers, particularly in communities without access to sanitary facilities and clean water. Diarrhea in toddlers can be caused by viral or bacterial infections, food poisoning, or food allergies [6]. The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) estimate that there are about 2 billion incidents of diarrhea worldwide per year and annually the disease claims the lives of 1.9 million children under five. Seventy-eight percent of these deaths take place in low-income countries, primarily in Africa and Southeast Asia. The 2018 Basic Health Research states that the incidence of diarrhea among children under five was 12.3%, while in infants it was 10.6%. Diarrhea is closely related to stunting. Diarrhea can cause stunting in infants and toddlers. According to information from the 2020 Indonesian Health Profile, the leading cause of death (14.5%) is still diarrhea. The diarrhea fatalities in the toddler group (12 to 59 toddlers) were 4.55% [7].

Diarrhea cases in children under five years old are still a serious problem in West Java. Based on diarrhea cases served at health facilities, West Java Province ranked first in 2019. Even in 2021 diarrhea ranked second as the highest cause of death in toddlers aged 12-59 months [8]. Related to this, efforts are needed to reduce cases of diarrhea in under-five in West Java. Some previous studies examining diarrhea have been conducted by [8][9][10][11][12]. The number of diarrhea cases in under-five is count data that follows the Poisson distribution. Thus the analysis that can be used to determine the influencing factors is poisson regression. In addition, diarrhea is a contagious disease. The Geographically Weighted Poisson Regression approach is applied in situations where each region has distinct geographical circumstances and features by considering the spatial aspect, or region. This results in variations in the amount of diarrhea cases between different regions [13][14].

It is critical to treat toddler diarrhea as soon as possible and precisely. To accomplish this goal, it is imperative to identify the hotspot where occurrences of diarrhea are most common among this age range. Based on this information, it can be known which areas require special attention and top priority in an effort to deal with the problem of diarrhea cases in children under five. One method that can be used to detect hotspots is Flexibly Shaped Spatial Scan Statistic [15][16][17]. The findings of this study should provide insight into the variables influencing diarrhea in children under five as well as the presence of locations that are more likely to cause diarrhea. Thus, efforts to prevent and control diarrhea can be right on target and take place effectively and efficiently. The government can work together with related parties to reduce the number of diarrhea cases in children under five.

2. MATERIALS AND METHODS

2.1. Data

The research involved secondary data from the West Java Provincial Health Service in 2023. The study focused on the 27 districts and cities in West Java Province as the unit of analysis [8]. The data collected included the number of cases of diarrhea in children under five as the response variable, and several independent variables thought to affect this number. The independent variables used include:

1. The percentage of clean and healthy living behaviour (X_1) is the ratio of the number of households implementing 10 percentage of clean and healthy living behaviour indicators in each period to the number of households surveyed in the regency/city in West Java in the same period, multiplied by 100%.
2. Percentage of Access to Appropriate Sanitation (X_2) is the quotient of the number of neighborhoods that have healthy latrines to the number of neighborhoods in each sub-Regency of Surabaya City multiplied by 100%. In this case, a healthy toilet is one that is clean and not used for public use.
3. Poverty Level (X_3) is the ratio of the number of poor households to the total number of households in each Regency/city of West Java multiplied by 100%.
4. Population Density (X_4) is the quotient of the total population to the total area in each Regency/city in West Java in units of (people/km^2). Population density that is not balanced with the size of the area will lead to irregular slum areas that can cause public health problems.
5. The percentage of infants < 6 months receiving exclusive breastfeeding (X_5) is a ratio that shows the number of infants who were given breast milk (ASI) without additional food or drink, for the first six months, compared to the total number of infants under 6 months of age in a population. This percentage is calculated by dividing the number of infants under 6 months who received exclusive breastfeeding during a certain period by the total number of infants under 6 months in the Regency/city of West Java.
6. Percentage of Complete Basic Immunization (X_6) is a ratio that shows the number of infants who have received all vaccinations required in the basic immunization program. Complete

basic immunization usually includes vaccinations against diseases such as tuberculosis (BCG), diphtheria, pertussis, tetanus (DPT), polio, measles, hepatitis B, and includes pneumococcal vaccine (PCV) and rotavirus, depending on each country's national health policy. This percentage is determined by dividing the total number of infants in West Javan districts and cities under the age of six months by the number of infants who are exclusively breastfed during a given period.

7. Health facility ratio of Health Center (X_7) is the quotient of the number of health center to the total population in each Regency/city in West Java.
8. The ratio of general doctor (X_8)is the quotient of the number of general practitioners in health centers in each Regency/city in West Java to the total population.

2.2. Poisson Regression

A discrete probability distribution that is often used is the Poisson distribution. The Poisson distribution describes the probability of the number of events in a certain time interval. Poisson distribution can also describe an event that rarely occurs so it has a small chance. An approach that models the relationship between predictor variables and response variables that follow the Poisson distribution is Poisson regression. Poisson regression is a nonlinear regression. The poisson regression model is as follows [19][20][21][22]:

$$log(\lambda_i) = \boldsymbol{x}_i^T \boldsymbol{\beta} \quad (1)$$

Where is the average number of events in the i-th observation, $\mathbf{x}_i = \begin{bmatrix} 1 & x_{1i} & x_{2i} & \dots & x_{ki} \end{bmatrix}^T$ and $\boldsymbol{\beta} = \begin{bmatrix} \beta_0 & \beta_1 & \beta_2 & \dots & \beta_k \end{bmatrix}^T$. The approach used to estimate Poisson regression parameters is Maximum Likelihood Estimation (MLE). The principle of MLE is to maximize the likelihood function. MLE is used when the distribution of the variables is known. The results obtained cannot be solved analytically, so an iterative procedure is needed, using Newton-Raphson.

2.3. Geographically Weighted Poisson Regression (GWPR)

Geographically Weighted Poisson Regression (GWPR) is a modification of the global regression model, specifically Poisson regression. In GWPR, each parameter is calculated at each location point. Thus, each geographic location has a different regression parameter value. The Geographically Weighted Poisson Regression model is as follows [23][24][25][26]

$$log(\lambda_i) = \beta_0(u_i, v_i) + \beta_1(u_i, v_i)x_1 + \beta_2(u_i, v_i)x_2 + \cdots + \beta_k(u_i, v_i)x_k \quad (2)$$

Where (u_i, v_i) represent the longitude and latitude coordinates of the i-th point at a certain geographic location. Parameter estimation of the GWPR model can be performed using Maximum Likelihood Estimation (MLE) by maximizing the likelihood function [23][24].

2.4. Flexibly Shaped Spatial Scan Statictic

The Flexibly Shaped Spatial Scan Statistic is a statistical method used to detect clusters in a location, whether point-based or aggregate data. This approach is more flexible in detecting clusters that are not circular, unlike the Circular Spatial Scan Statistic method. This method was first introduced by Toshiro Tango and Kunihiko Takahashi in 2005 [16]. The Flexibly Shaped Spatial Scan Statistic has the advantage of detecting irregularly shaped clusters, which are more consistent with real-world disease distribution patterns. Essentially, this method divides an area into several small regions (n) and cases per region (Y_i)assumed to follow a Poisson distribution. The geographic location of each region is determined using the central coordinates. The Flexibly Shaped Scan Statistic is applied to irregular hotspot in each area. These hotspot consist of a collection of regions that border the central region. To detect hotspots, this method uses a flexible scanning window. The window used to detect clusters is a set of regions arranged to form a shape Z with a maximum length L predetermined [16][17]. The algorithm then examines all different sets of Z to detect significant clusters. This window is then examined to identify areas with higher risks compared to surrounding areas. The method also involves a likelihood ratio test and Monte Carlo hypothesis testing to determine the existence of statistically significant clusters [17][18].

3. RESULTS

West Java is one of Indonesia's provinces located on the western part of Java Island. West Java consists of 27 Regencies/cities. It is surrounded by the Java Sea to the north, Central Java to the east, the Indian Ocean to the south, and the province of Banten and the DKI Jakarta to the west. The province has an area of approximately 35,377.76 km² and consists of various types of topography ranging from mountains, highlands, to coastal lowlands [27]. Mapping of the number of diarrhea cases in children under five and its determinants in West Java Regency/City is presented in the form of thematic maps.

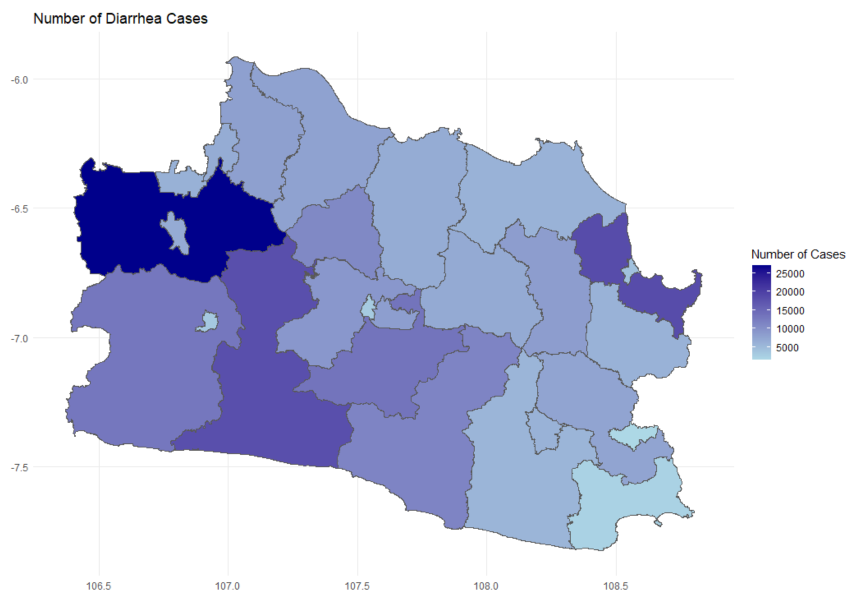

Figure 1. Mapping of Regencies/Cities based on Number of Diarrhea in West Java.

Data on cases of diarrhea in children under five in West Java regency/city are counts. West Java is one of the provinces in Indonesia with a high number of diarrhea cases in children under five. The number of diarrhea cases in children under five in West Java is 671,835 cases. The mapping of cases of diarrhea in children under the age of five in West Java is shown in Figure 1. Bogor Regency has the most diarrhea cases in West Java with 91,471. Bekasi Regency and Bandung Regency also have a high number of diarrhea cases in children under five. The high number of cases is due to the density conditions in the Regency/city, where a large population will encourage an increase in the number of large toddler populations. Population density that is not balanced with the area gives rise to areas that are irregular slums, resulting in the emergence of health problems, especially for toddlers [28][29].

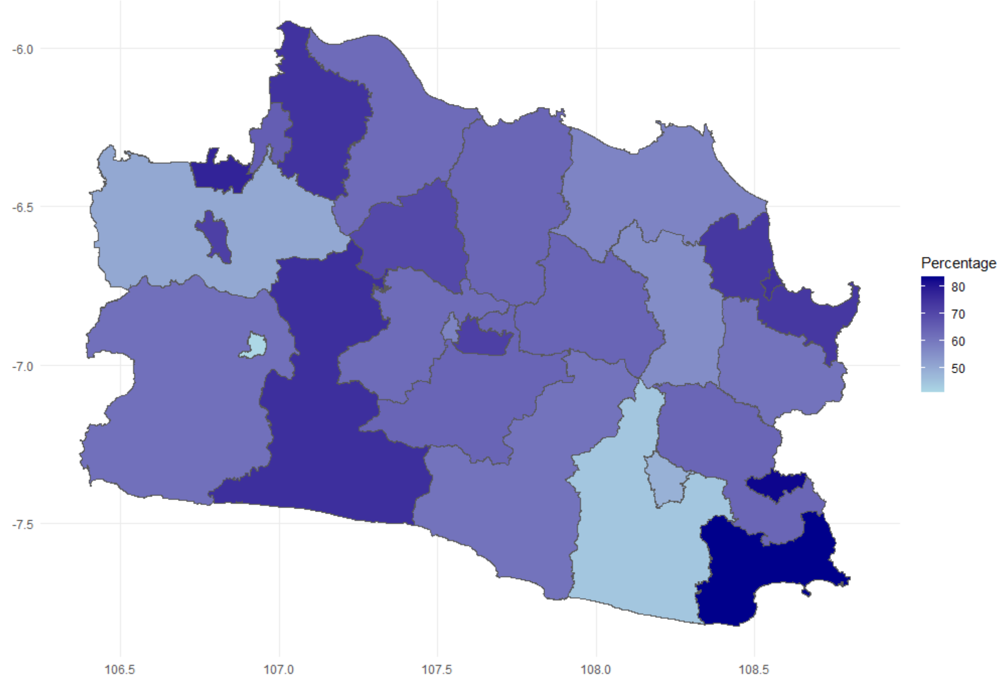

Figure 2. Mapping of Regencies/Cities based on the percentage of clean and healthy living behaviors in West Java.

The percentage of clean and healthy living behaviors is a health behaviors that is carried out with the awareness of all family and community members. PHBS is very necessary because it can prevent and overcome diseases and other health problems [30]. An overview of PHBS conditions in West Java is shown in Figure 2. There are 3 Regencies/cities in West Java that have PHBS below 50%, namely Tasikmalaya City, Tasikmalaya Regency, and Sukabumi City. This shows that in these areas there are still many households that are less aware of implementing the 10 indicators of PHBS, so that it can have an impact on the development of disease seeds, especially diseases that attack toddlers.

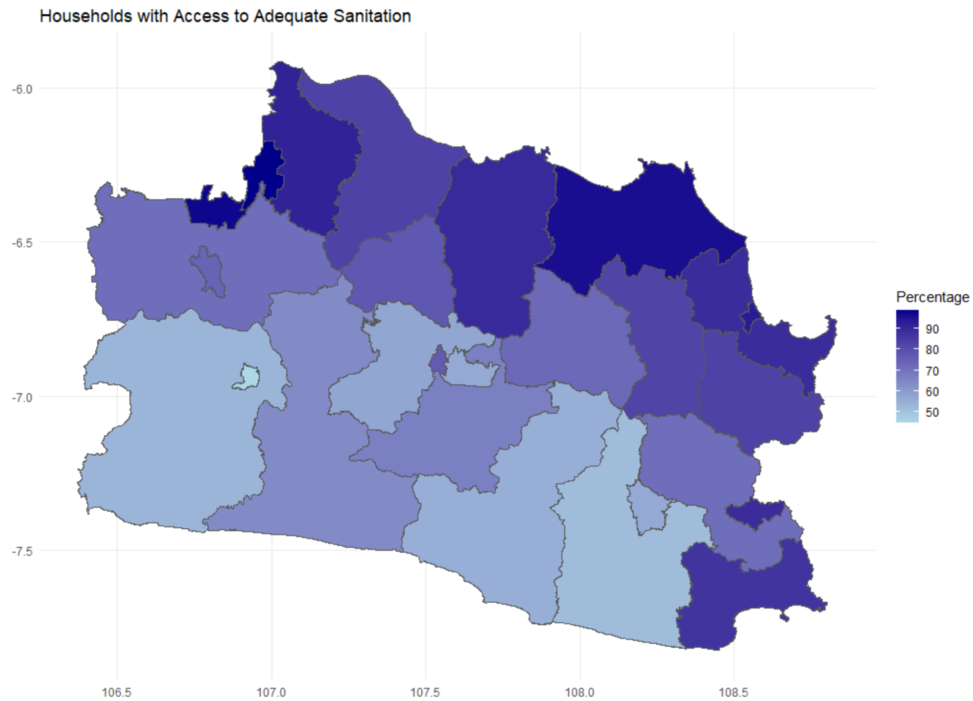

Figure 3. Mapping of Regencies/Cities based on percentage of access to adequate sanitation facilities in West Java.

The percentage of access to adequate sanitation facilities has a correlation with a decrease in the incidence of diarrhea. Proper sanitation includes facilities such as adequate toilets and effective waste treatment systems. Proper sanitation facilities help prevent the spread of disease. The use of clean toilets and proper waste disposal systems can reduce the risk of spreading diarrhea [31]. The distribution of the percentage of access to adequate sanitation facilities is presented in Figure 3. In most Regencies/cities in West Java, the percentage of access to adequate sanitation facilities is above 70%. Bekasi City has the highest percentage of access to adequate sanitation facilities at 98.52% while Sukabumi City has a percentage below 50% at 44.76%.

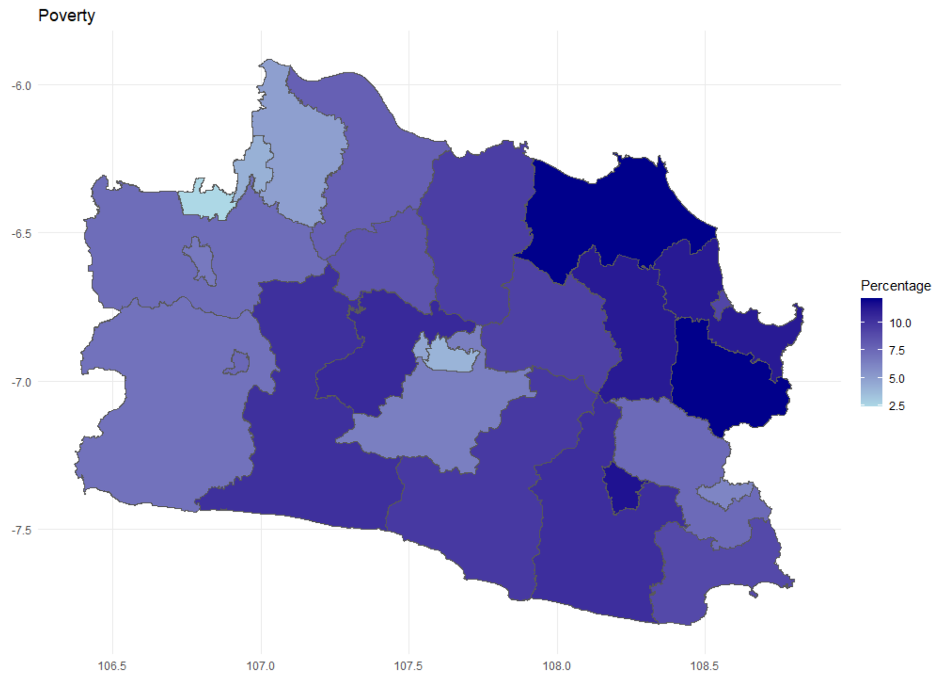

Figure 4. Mapping of Regencies/Cities based on Poverty Level in West Java.

The number of people in poverty decreased in 2023 compared to 2022. This decline is the result of various government efforts in poverty reduction. Poverty levels significantly associated with number of diarrhea cases in children under the age of five. Poor families often do not have adequate access to clean water. They use polluted water sources for their daily needs. This can increase the risk of diarrheal disease [32]. In addition, inadequate sanitation is often found in poor areas. This makes them vulnerable to the spread of diarrhea. The distribution of poverty levels is presented in Figure 4. Most Regencies/cities in West Java have poverty rates below 13%. However, the Regencies of Cianjur, Tasikmalaya, West Bandung, Cirebon, Majalengka, Tasikmalaya City, Kuningan, and Indramayu have poverty rates above 10%.

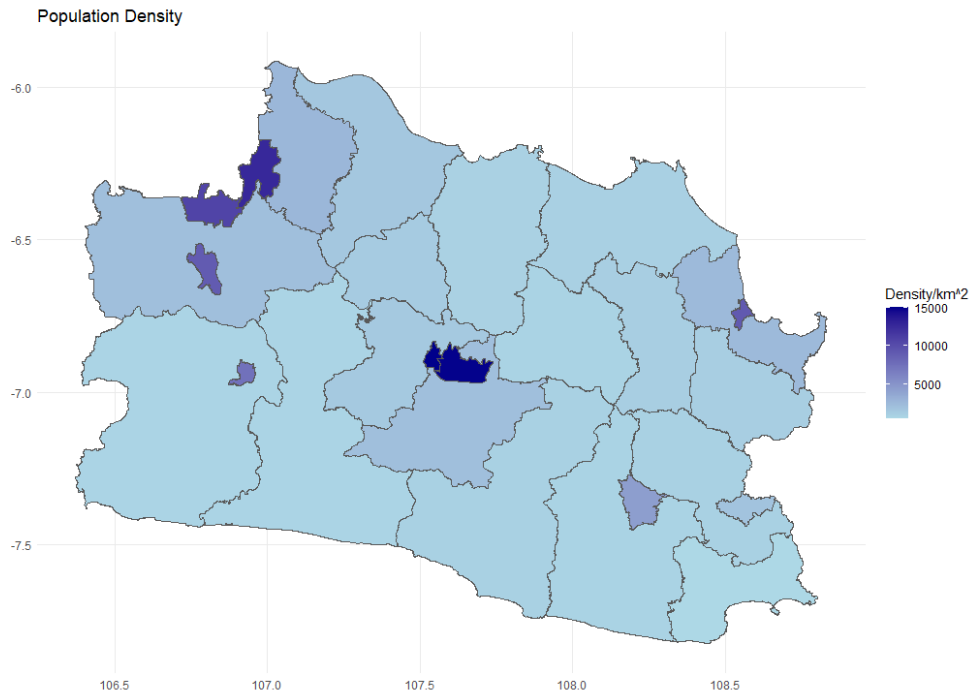

Figure 5. Mapping of Regencies/Cities based on Population Density in West Java.

Diarrheal diseases can be transmitted through environmental conditions, for example with slum conditions [33][34]. The slum environment is the impact of population density. Population density is a condition in which the number of people in an area increases rapidly. The increase in population causes the need for land, especially for housing, to increase. This can result in a shortage of land. In addition, it produces more waste, both household waste and industrial waste. This can pollute the environment and cause health problems [35]. Population density can cause the environment to become slum conditions, such as garbage piling up and stagnant water which results in increased transmission of diarrheal diseases. The distribution of population density in West Java is presented in figure 5. Cimahi City is the most populous area in West Java with a population density of 15044.1 per-hectare, while Pangandaran is the area with the lowest population density of 427.2 per-hectare.

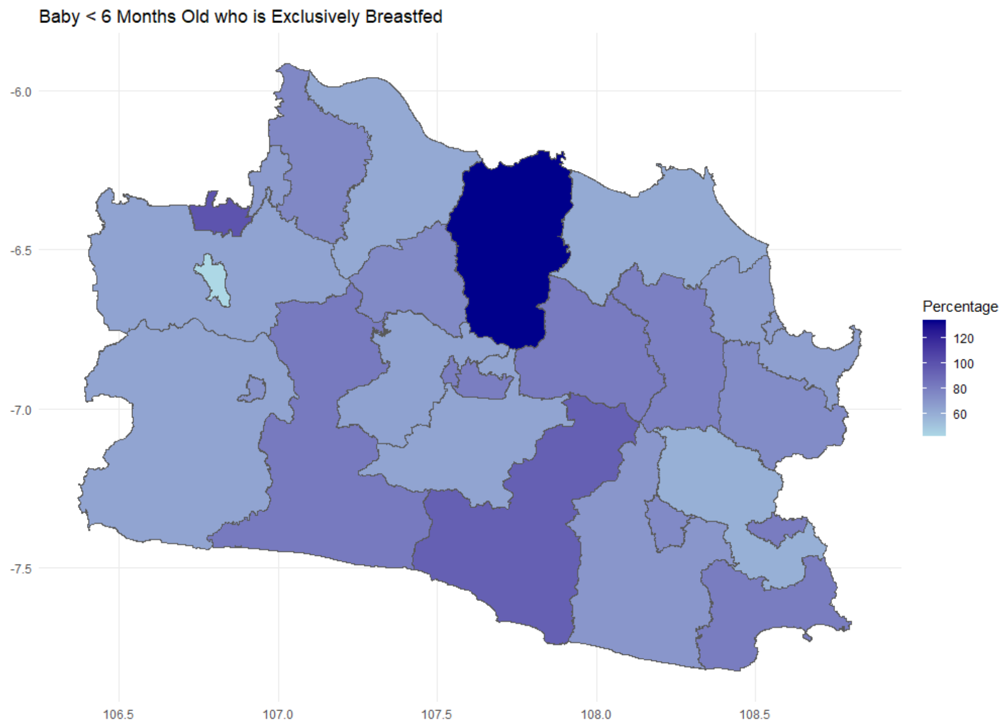

Figure 6. Mapping of regencies/cities based on number of exclusively breastfed babies under 6 months old in West Java.

Exclusive breastfeeding contains antibodies and immune substances that help protect infants from infections, including gastrointestinal infections that cause diarrhea. Infants who are exclusively breastfed for the first six months of life tend to have stronger immune systems and are better protected against pathogens that cause diarrhea [36]. Subang Regency has the highest exclusive breastfeeding rate while Bogor city has the lowest at 41.6%.

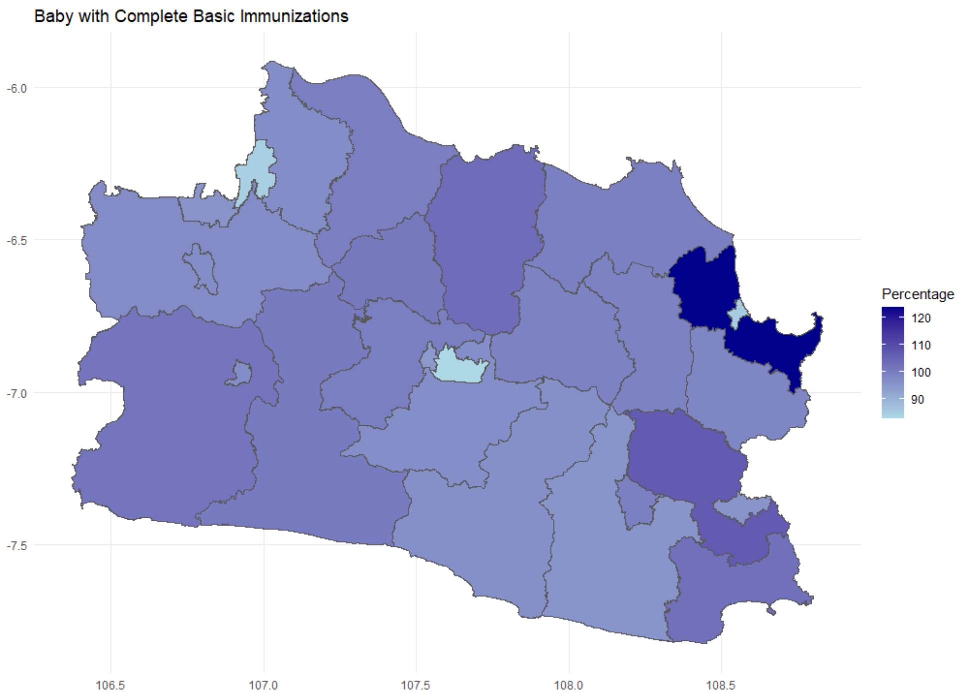

Figure 7. Mapping of Regencies/Cities based on Percentage of Baby with Complete Basic Immunizations in West Java.

Complete basic immunization includes vaccinations against several major diseases that can have a serious impact on a child's health. Complete basic immunization helps strengthen a toddler's overall immune system. A child with a strong immune system is better able to fight off infections, including those that cause diarrhea [37][38]. Vaccinated toddlers are less likely to suffer from secondary infections that can worsen their health conditions, including conditions that can cause or worsen diarrhea. Figure 7 shows that all Regencies/cities in West Java have a high percentage of infants with basic immunization above 80%.

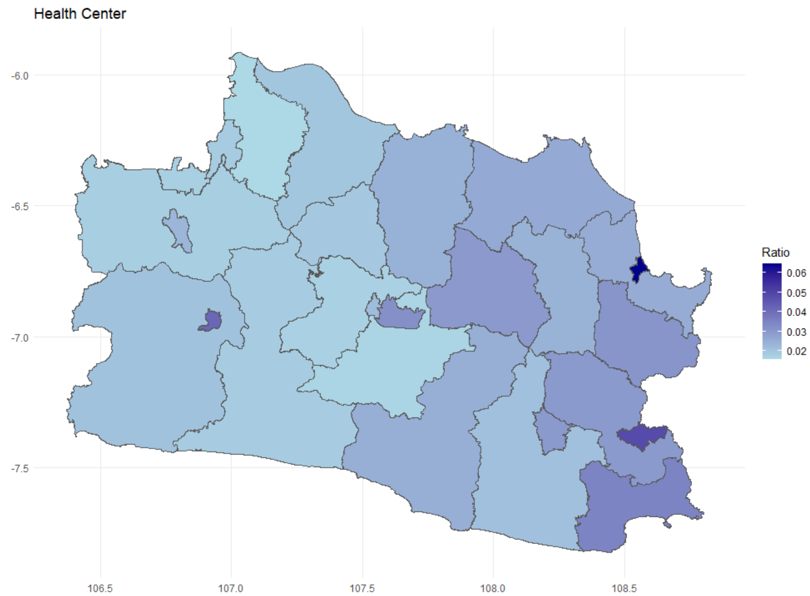

Figure 8. Mapping of Regencies/Cities based on Ratio of Public Health Center in West Java.

The public health center facility ratio is calculated to determine whether or not an area needs an additional public health center. According to the Health Office, one public health center serves 30,000 people. Cirebon City is the area with the highest public health center ratio of 0.06433, while Bekasi Regency with a ratio of 0.01575 is the area with the lowest public health center ratio. Public health center is one of the health facilities built by the government with the aim of assisting public health services. In addition, it is expected to provide counseling on disease prevention [39].

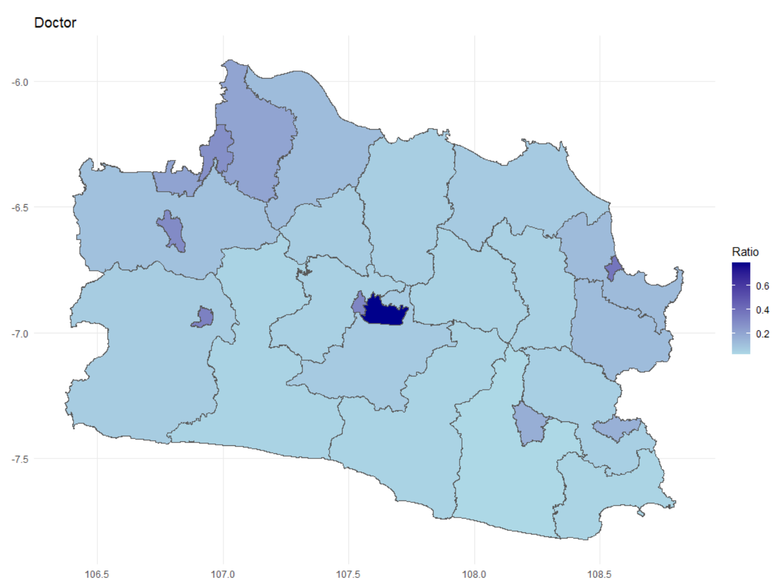

Figure 9. Mapping of Regencies/Cities based on Ratio of General Doctor in West Java.

The World Health Organization (WHO) sets the ideal ratio of general practitioners to population at 1 doctor per 1,000 population. This means that in an ideal scenario, one general practitioner should serve the health needs of 1,000 people [40][41]. The Indonesian government targets the ratio of general practitioners to population to be lower than the WHO standard, which is 1 general practitioner per 2,500 population. This means that 1 general practitioner in Indonesia should serve the health needs of 2,500 people. Bandung City has the highest ratio of GPs at 0.7911, while Tasikmalaya Regency has the lowest at 0.0199. More general practitioners in each Regency/city can treat diarrhea patients quickly. As a result, fewer cases of diarrhea are anticipated in West Java. In addition, general practitioners can also conduct counseling on the prevention of diarrheal diseases with coordination from related parties such as health centers. Therefore, the ratio of general practitioners is expected to increase so that health conditions can be improved and minimize the incidence of diarrhea.

3.1. Poisson Regression

The Poisson regression model is a global regression, so each location is assumed to be homogeneous. Modelling of diarrhea cases in children under five in West Java starts with determining the model parameter estimates. The parameters of the Poisson regression model are estimated using the MLE method. The results of the parameter estimation are shown in Table 1.

Table 1. Results of Poisson Regression Parameter Estimation

Variables	Coefficient	p-value
Intercept	14.07	0.00
The percentage of clean and healthy living behaviors (X_1)	-0.02	0.00
Access to adequate sanitation (X_2)	0.003974	0.00
Percentage of poverty (X_3)	-0.09926	0.00
Population density (X_4)	-0.000118	0.00
The number of exclusively breastfed babies under 6 months (X_5)	0.000469	0.00
Percentage of Complete Basic Immunization (X_6)	-0.002434	0.00
Ratio of Public Healthy Center (X_7)	-84.42	0.00
Ratio of General Doctor (X_8)	2.981	0.00

*Tests are based on the use of a significance level of 0.05

The model shows that all variables have a significant effect on the number of diarrhea cases among children under five in West Java, according to the results of the partial significance test. Therefore, the model is as follows.

$$Log(\mu_i) = 14.07 - 0.02X_1 + 0.003974X_2 - 0.09926X_3 - 0.000118X_4 + 0.0004686X_5 - 0.002434X_6 - 84.42X_7 + 2.981X_8 \quad (3)$$

$$\mu_i = \exp\,(14.07 - 0.02X_1 + 0.003974X_2 - 0.09926X_3 - 0.000118X_4 + 0.0004686X_5 - 0.002434X_6 - 84.42X_7 + 2.981X_8) \quad (4)$$

With μ_i is the expected value of the number of diarrhea cases among children in i-th regency/city. The Poisson regression model, with a pseudo-R^2 value of 0.7287806, effectively explains approximately 72.87806% of the variation in the incidence of diarrhea cases among children under the age of five in West Java. This value is able to provide a fairly good explanation of the spatial pattern in the number of diarrhea cases in children under five based on the independent variables used.

3.2. Geographically Weighted Poisson Regression

In this research, the Geographically Weighted Poisson Regression (GWPR) method is used to analyze the number of diarrhea cases in children under five years old in West Java by taking into account the geographical location of a region. The use of GWPR allows researchers to consider the spatial structure in the data, which may not be fully covered by the Poisson regression model. One important aspect in the application of GWPR is the determination of the optimal bandwidth.

In this study, the kernel used was bisquare with an adaptive bandwidth of 21 with an AIC value of 29740.64. GWPR modeling resulted in several significant variables presented in Table 2.

Table 2. Results of Geographically Weighted Poisson Regression Parameter Estimation

Variables	Coefficient	
	Minimum	Maximum
Intercept	10.883	29.897
The percentage of clean and healthy living behaviors (X_1)	-0.037	0.014
Access to Adequate Sanitation (X_2)	-0.018	0.005
Percentage of Poverty (X_3)	-0.170	0.008
Population density (X_4)	-0.0002	0.000
The number of exclusively breastfed babies under 6 months (X_5)	-0.005	0.015
Percentage of Complete Basic Immunization (X_6)	-0.169	0.011
Ratio of Public Healthy Center (X_7)	-118.090	-74.055
Ratio of General Doctor (X_8)	-0.074	3.180

The minimum and maximum ranges of coefficients were used to evaluate the variation or difference in the relative impact of each predictor variable on the number of diarrhea cases among children under five in West Java. GWPR modeling resulted in 27 model variations based on each city/Regency. In general, the GWPR model is as follows.

$$Y_i = \beta_{0i} + \beta_{1i}X_1 + \beta_{2i}X_2 + \beta_{3i}X_3 + \beta_{4i}X_4 + \beta_{5i}X_5 + \beta_{6i}X_6 + \beta_{7i}X_7 + \beta_{8i}X_8 \quad (5)$$

With Y_i is the expected value of the number of diarrhea cases among under-fives in i-th Regency/City.

The pseudo-R^2 value in the GWPR model of 0.9227407 indicates that the GWPR model successfully explains about 92.27% of the variation in cases of diarrhea in children under five in West Java. This value can provide a satisfactory explanation of the spatial pattern in cases of diarrhea in children under five based on the independent variables used. However, it is important to remember that the pseudo-R^2 value only gives a relative idea of the quality of the model and cannot be compared directly with the R^2 in conventional linear regression models.

Table 3. Comparison of AIC Values

Model	AIC
Poisson Regression	104316.5
Geographically Weighted Poisson Regression	29740.6

To find out which model is more suitable in describing diarrhea cases under five years old in West Java, a comparison between Poisson regression and GWPR models based on AIC Criteria was conducted. The best model is to produce the smallest AIC value. Table 3 shows that the appropriate model for modelling the number of under-five diarrhea cases in West Java is the GWPR model. This is because the resulting AIC value is lower than that of the Poisson regression model. Thus, for the Flexibly Shaped Spatial Scan Statistic analysis used is the result of GWPR modeling.

3.3. Results of Detection of Diarrhea Hotspot Using the Flexibly Shaped Spatial Scan Statistic Method

Information on hotspots of diarrhea incidence in children under five is needed to identify areas that need special priority. With the availability of this information, the government can prioritize efforts to deal with diarrhea cases in children under five in these areas. Flexibly Shaped Spatial Scan Statistic is one of the methods used to detect focal points or clusters, where in this study the areas detected as focal points or clusters are referred to as under-five diarrhea enclaves.

Table 4. Detection Results of Diarrhea Hotspot in West Java

Hotspot	Number of Regency/City	Number of under-five Diarrhea Cases	Expected Number of under-five Diarrhea Cases	Relative Risk
1	1	3904	1263.755	3.089
2	8	291645	246431.17	1.183
3	2	47447	41193.745	1.152
4	1	33736	36043.266	0.936

The level of vulnerability of an area to under-five diarrhea is obtained based on the proportion of cases to the population in the area. Table 4 shows the process of detecting diarrhea in children under five. Four hotspots of diarrhea in children under five were identified.

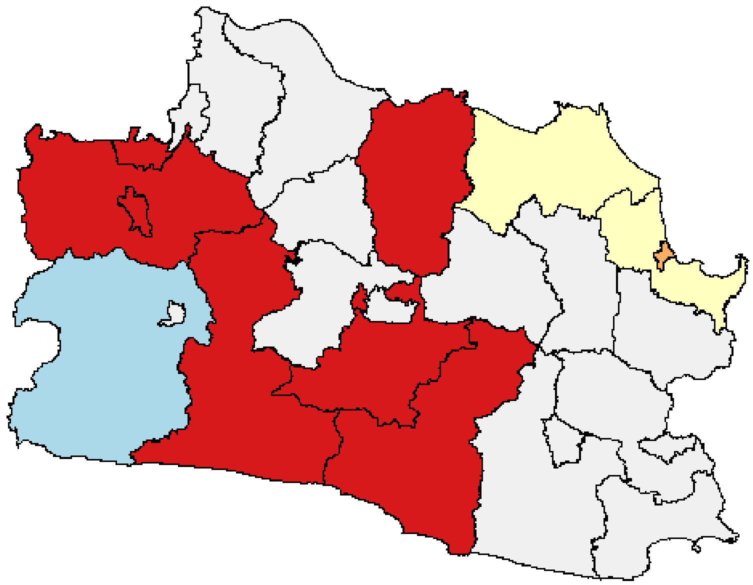

Figure 10. Mapping of Diarrhea Hotspot in West Java.

Figure 10 shows the differences in diarrhea prevalence levels for each region as indicated by the color differences. Dark colored areas indicate that the prevalence level of diarrhea in that area is quite high. Based on Figure 10, there are four hotspots of diarrhea among children under the age of five in West Java, with the following information for each hotspot:

1. Hotspot 1 consists of 1 Regency, namely Cirebon City. In Figure 10, Cirebon City is marked with orange color. Cirebon City is the most vulnerable area for diarrhea cases in children under five. Judging from the relative risk value, Cirebon City has a risk of finding the number of under-five diarrhea cases 3.09 times greater than the Regencies/cities outside hotspot 1.
2. The second hotspot is characterized by a red colored area consisting of 8 Regencies/cities namely Bogor Regency, Cianjur Regency, Bandung Regency, Garut Regency, Subang

Regency, Bogor City, Depok City and Cimahi City. These Regencies/cities are classified as sub-Regencies prone to diarrhea in children under five. Judging from the relative risk value, these Regencies/cities have a risk of finding the number of under-five diarrhea cases 1.18 times greater than the Regencies/cities outside hotspot 2.

3. The third hostpot is marked with yellow areas consisting of 2 Regencies, namely Cirebon Regency and Indramayu Regency. These Regencies are classified as sub-Regencies prone to diarrhea in children under five. According to the relative risk value, the Regency / city has a risk of finding the number of under-five diarrhea cases 1.15 times greater than the Regency / city outside hotspot 3.
4. The fourth hotspot is marked with blue areas, namely Sukabumi Regency. Judging from the relative risk value, Sukabumi Regency has a risk of finding the number of under-five diarrhea cases 0.936 times greater than the Regencies outside hotspot 4.
5. Grey areas are Regencies/cities that are not included in the zone prone to diarrhea in children under five. Regencies/cities that are included in the non-vulnerable zone include Bekasi City, Bekasi Regency, Karawang Regency, Purwakarta Regency, West Bandung Regency, Bandung City, Sumedang Regency, Majalengka Regency, Kuningan Regency, Tasikmalaya Regency, Tasikmalaya City, Ciamis Regency, Banjar Regency and Pangandaran Regency.

4. CONCLUSION

Based on the results obtained, the factors that have a significant impact on the high number of diarrhea cases among children under five in West Java are include the percentage of clean and healthy living behaviors, percentage of access to adequate sanitation, poverty level, population density, the percentage of exclusively breastfed babies under 6 months, the percentage of complete basic immunization, ratio of public health center and the ratio of general practitioners. Modeling using GWPR showed that the model was able to explain approximately 92.27% of the variation in the number of diarrhea cases among under-fives in West Java. In addition, the results of spatial cluster detection showed that there are hotspot of diarrhea that require special handling priorities from the government. Efforts to improve access to clean water, sanitation, and complete basic immunization coverage in these areas are expected to decrease the incidence of diarrhea in children under five. Thus, appropriate policies and interventions based on the results of this study are needed to decrease the incidence of diarrhea among children under five in West Java, especially in areas identified as high incidence clusters.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests.

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