JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Spatial Analysis of Drinking Water Quality and Environmental Sanitation on the Incidence of Diarrhea in Toddlers

Nickolas Fernando P.[1], Mursid Raharjo[1], Nurjazuli[1]

[1] Faculty of Public Health, Diponegoro University, Semarang, Indonesia.

Received: August 20, 2024
Revised: October 30, 2024
Accepted: November 25, 2024
Published: November 30, 2024

Corresponding Author:
Nickolas Fernando P.
nickolasfernando@yahoo.co.id

DOI: 10.29303/jppipa.v10i11.8894

Abstract: Diarrhea is a common symptom of gastrointestinal infection caused by various bacterial, viral, and parasitic organisms and is characterized by loose stools and increased frequency when infected. Sanitation factors are closely related to environmental health and can affect the level of public health. The absence of a spatial picture of areas that are vulnerable to an increase in cases of children under five years old diarrhea complicates important case finding efforts to prevent outbreaks. The purpose of the study was to spatially analyze the effect of drinking water quality and sanitation on the incidence of diarrhea in children under five years old in the Administrative City of West Jakarta in 2023. This study used a quantitative method with a Cross Sectional research design and an ecological study with a spatial approach to determine the correlation of risk factors with cases of diarrhea in children under five years old geographically. The results of the study showed that the quality of environmental sanitation between the diarrhea group in the last 3 months and the no diarrhea group in the last 3 months had a value (p value = 0.373), water quality (p value = 0.036) with PR 1.840, CTPS habits (p value = 0.100) with PR 1.509, and type of drinking water source (p value = 1.151) with PR 1.442. And the water quality variable is the most dominant factor related to the incidence of diarrhea in children under five years old in the West Jakarta Administrative City in 2024. The results of the multivariate analysis of logistic regression with the ward conditional backward method p value = 0.32 with PR = 4.110 CI = Low 1.129 and upper 14.96 which shows that children under five years old with drinking water quality that does not meet the requirements have a 4.110 greater chance than toddlers whose drinking water quality meets the requirements in the ODF sub-district in the West Jakarta Administrative City

Keywords: Children under five years old diarrhea; Environmental sanitation quality; Spatial analysis.

Introduction

Health development is an effort to enhance awareness, willingness, and the ability to live healthily for everyone, in order to achieve the highest degree of public health. Health is a crucial aspect of human life, as every individual requires health to carry out their activities. The Minister of Health Regulation Number 36 of 2009 regarding health states that health is a state of physical, mental, and social well-being that allows every person to lead a daily life with social and economic participation. One of the government's efforts to improve health is through the Community-Based Total Sanitation (STBM) program (Kementerian Kesehatan RI, 2014) .

Community-Based Total Sanitation (STBM), also known as Community-Led Total Sanitation (CLTS), is a government program aimed at strengthening efforts to promote clean and healthy living, prevent the spread of environmentally-based diseases, enhance community

How to Cite:
Fernando P, N., Raharjo, M., & Nurjazuli, N. (2024). Spatial Analysis of Drinking Water Quality and Environmental Sanitation on the Incidence of Diarrhea in Toddlers. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 9033–9043. https://doi.org/10.29303/jppipa.v10i11.8894

capabilities, and implement the government's commitment to improving access to drinking water and sustainable basic sanitation. Water and sanitation are among the goals in the Sustainable Development Goals (SDGs), specifically point 6, which aims to ensure availability and sustainable management of water and sanitation for all (Kementerian PPN, 2020)

The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) estimate that there are around 2 billion cases of diarrhea and 1.9 million young children die from diarrhea worldwide each year. Of all these deaths, approximately 78% occur in developing countries, particularly in Africa and Southeast Asia. According to the 2020 Indonesian Health Profile data, infectious diseases, particularly diarrhea, contributed to deaths in the age group of 29 days to 11 months in 2019. Similar to the previous year, in 2020, diarrhea remained a major issue, causing 4.55% of deaths among toddlers (12-59 months) and increased to 10.3% in 2021 (Kemenkes RI, 2022). Environmental factors are risk factors for environmentally-based diseases, including diarrhea. Diarrhea remains a significant health problem worldwide, especially in developing countries. An unhealthy environment, combined with unhealthy behaviors and pathogens that cause diarrhea, can lead to diarrhea incidents (Kemenkes RI, 2010). The incidence of diarrhea in toddlers in Indonesia was 12.3% in 2020, and in 2021, the number of diarrhea cases reached 23.8%. According to the National STBM report, the percentage of villages/kelurahan achieving Open Defecation Free (ODF) status nationally in 2022 was only 57.01% of all areas implementing STBM. A village/kelurahan is considered ODF if all its residents have access to sanitation facilities. Healthy sanitation facilities effectively serve as sanitation systems. The number of diarrhea cases in DKI Jakarta from 2018 to 2022 fluctuated across all age groups, with a total of 123,904 cases in 2021. However, there was a notable increase in diarrhea cases among toddlers, rising from 39,136 cases in 2021 to 51,177 cases in 2022, with deaths increasing from 5 to 10 due to diarrhea. The age group with the highest prevalence of diarrhea was among those aged 1-4 years at 11.5%, followed by infants at 9%. Generally, diarrhea is more prevalent in children under 5 years old due to their weaker immune systems, making them more susceptible to the spread of diarrhea-causing organisms (Maidartati & Rima, 2017).

Based on the Healthy Toilet Access Data for DKI Jakarta in 2020, out of 2,975,536 family cards (KK) in DKI Jakarta, 134,526 KK (4.5%) still practiced open defecation (BABS). In 2022, the percentage of KK still practicing open defecation increased to 5.6%, which amounts to 149,079 KK from a total of 2,684,069 KK in that year. This indicates an increase in the number of KK practicing open defecation from 2020 to 2022, which aligns with the increase in diarrhea incidents among toddlers from 2021 to 2022·(Dinkes Prov.DKI Jakarta, 2022) Sanitation is closely related to environmental health and can affect the health status of the community. The low coverage of sanitation can degrade the quality of the community's living environment, contaminate drinking water sources, and increase the likelihood of disease transmission related to the environment, such as diarrhea (Kementerian PPN, 2020).

Another factor mentioned by Diyanti et all Diyanti et al., (2021), indicates that respondents who did not dispose of children's feces in healthy toilets were 7.286 times more likely to suffer from diarrhea compared to those who did. Furthermore, respondents whose food and drink storage did not meet health standards were 14.095 times more likely to contract diarrhea than those whose storage was adequate.

The Ministry of Health has developed a behavioral approach through the Community-Based Total Sanitation (STBM) program, which aims to change the habit of open defecation to being Open Defecation Free (ODF). ODF stands for Open Defecation Free, meaning an area or community is free from the practice of open defecation. The relationship between ODF and diarrhea cases is that the adoption of good ODF practices can help reduce the risk of diarrhea disease transmission. The ODF concept ensures that everyone or every household has access to adequate sanitation facilities and avoids open defecation, which can lower the risk of water contamination and the spread of diarrhea diseases. By improving access to hygienic toilets and promoting clean and healthy living behaviors, ODF aims to prevent disease transmission (Kemenkes, 2023). The ODF status indicates that the community has achieved the goal of no longer practicing open defecation. This can reduce the risk of environmental contamination and the transmission of diarrhea diseases through contaminated drinking water. Therefore, ODF helps prevent and control diarrhea in the community. The percentage of ODF villages from 2018 to 2022 has continued to increase, with 45 ODF villages (17%) recorded in 2022 out of a total of 267 villages in DKI Jakarta. This indicates that the achievement of ODF status in DKI Jakarta is still relatively small (Dinkes Prov.DKI Jakarta, 2022). Based on preliminary study data, environmental factors causing diarrhea can include sanitation, specifically the disposal of feces and the quality of drinking water. These two factors are interconnected; poor sanitation, due to a significant number of people practicing open defecation, can lead to the contamination of drinking water sources and increase the transmission of environmentally-based diseases, especially diarrhea.

Method

This research is a quantitative study using a cross-sectional approach and a spatial approach. The cross-sectional study in this research involves sampling at a single point in time to describe the distribution patterns of diarrhea and disease determinants based on drinking water quality and environmental sanitation. The population for this study consists of toddlers in ODF villages, totaling 711 toddlers over the last three months in West Jakarta Administrative City, with a research sample of 50 using the Lameshow formula.

Univariate analysis was performed by processing data analytically. For variables with ratio scale data, the univariate analysis presented includes mean, maximum, minimum, and standard deviation values. The univariate analysis is presented in tables and narratives. The purpose of univariate analysis is to describe or explain the characteristics of each research variable.

Bivariate analysis was conducted by creating categorical variables, both nominal and ordinal. This analysis used SPSS version 20 with the chi-square test (χ^2), with $\alpha = 0.05$ and a 95% Confidence Interval (CI), and calculated the risk estimates of each independent variable on the dependent variable using the Prevalence Ratio.

The multivariate analysis in this study used multiple logistic regression testing with the backward method. This analysis was conducted to determine the dominant factors affecting the dependent variable.

Spatial analysis was conducted using ArcGIS version 10.3. After processing all data, it was analyzed in the ArcMap 10.3 spatial data processing software to create maps and combine tabular data with its geographical references. The distribution of diarrhea incidents in toddlers was mapped by placing points in each area based on the number of cases, resulting in a spatial distribution map of diarrhea in toddlers. The spatial data processing stage involved organizing the data by grouping it, such as data on households with toddlers suffering from diarrhea, the quality of clean water, and toilet facility data (KK BABS).

Results and Discussion

Table 1. Frequency Distribution of Diarrhea Incidence Variables in Toddlers in West Jakarta Administrative City in 2024

Diarrhea Incidence in Toddlers	Number	Precentage %
No diarrhea in the last 3 months	18	36.0
Diarrhea in the last 3 months	32	64.0
Total	50	100.0

Based on Table 1 regarding the distribution of independent variables, it is known that the incidence of diarrhea in toddlers in the last 3 months includes 32 respondents (64.0%) who had diarrhea, while 18 respondents (36.0%) did not experience diarrhea. The distribution of data based on diarrhea case incidents in West Jakarta Administrative City in 2024 was then processed through mapping using GIS to serve as an effective and efficient source of information. The mapping of diarrhea cases for affected individuals is as follows (Figure 1).

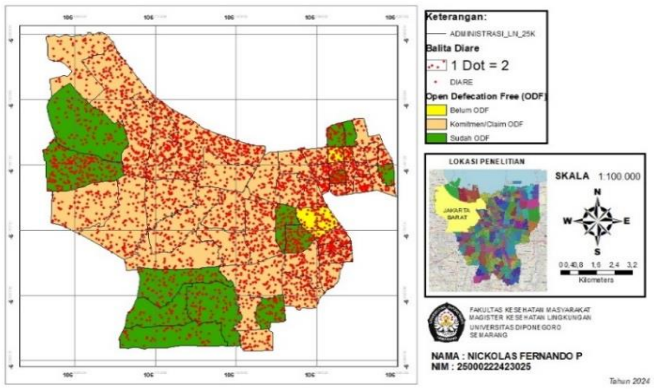

Figure 1. Map of Distribution of Diarrhea Cases in West Jakarta Administrative City

The distribution of data based on the toddler samples in West Jakarta Administrative City in 2024 has been processed through mapping using GIS to serve as an effective and efficient source of information. The mapping of diarrhea cases for affected individuals is as follows (Figure 2).

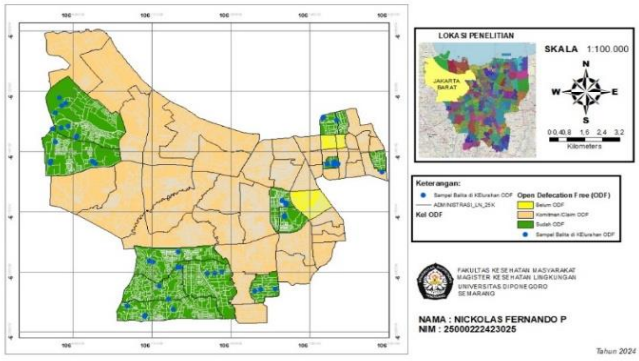

Figure 2. Distribution Map of Toddler Sample Points in West Jakarta Administrative City

The distribution of data based on the incidence of diarrhea and the number of toddler samples in West Jakarta Administrative City in 2024 has also been processed through mapping using GIS to provide an effective and efficient source of information. The mapping of diarrhea cases for affected individuals is as follows (Figure 3).

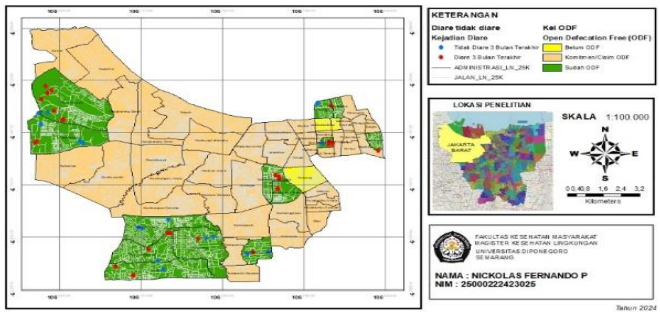

Figure 3. Distribution Map of Diarrhea Incidence in ODF Villages in West Jakarta Administrative City

Figure 3 above shows the distribution of toddler samples taken in this study, represented by blue and red dots. The red dots indicate toddlers with diarrhea, while the blue dots represent toddlers without diarrhea located in villages that are Open Defecation Free (ODF) in West Jakarta Administrative City. The research sample consists of 50 samples, spread across 13 ODF villages in West Jakarta Administrative City, including Kalideres, Kembangan, Kebon Jeruk, Taman Sari, Tambora, and Grogol Petamburan.

The incidence of diarrhea in toddlers in West Jakarta Administrative City, as processed from the data, shows that among the respondents, 32 (64.0%) experienced diarrhea in the last 3 months, while 18 respondents (36.0%) did not. The total number of respondents was 50. The incidence of diarrhea can be influenced by several factors, including sanitation practices, drinking water quality according to microbiological parameters, handwashing with soap and running water, and the type of water source used.

Diarrhea more commonly affects toddlers due to their still-weak immune systems, making them highly vulnerable to the spread of diarrhea-causing bacteria. If diarrhea is accompanied by persistent vomiting, it can lead to dehydration (fluid deficiency). Diarrhea can occur due to both direct and indirect factors, including agents, hosts, behaviors, and environmental factors. Direct causes include bacterial, viral, and parasitic infections, malabsorption, allergies, chemical poisoning, and toxins produced by microorganisms, fish, fruits, and vegetables. Indirect factors that can accelerate the occurrence of diarrhea include nutritional status, exclusive breastfeeding, environment, clean and healthy living behaviors (PHBS), handwashing habits, eating behaviors, immunization, and socioeconomic factors (Oktavianisya et al., 2023).

Other environmental factors influencing the incidence of diarrhea include waste management and wastewater treatment. Waste in a community is produced by one or more families residing in buildings in a village or city. Waste should be placed in temporary storage that is sturdy, covered, and easy to transport before being taken to the final disposal site to prevent contamination of food and drink (*Agus Iryanto, Joko*, & Raharjo, 2021; Oktavianisya et al., 2023).

According to the findings of this study, consistent with Munawarah, (2022) research, among 26 cases analyzed, the spatial analysis related to the presence of E. coli showed a correlation between diarrhea cases and the presence of E. coli.

The researchers believe that since most areas of West Jakarta have conditions that could potentially be endemic for toddler diarrhea, the Health Office through the West Jakarta Health Sub-Department needs to enhance preventive and promotional efforts in controlling diarrhea among toddlers. Furthermore, given the vast and densely populated areas of West Jakarta, the researchers recommend prioritizing regions for these efforts by utilizing geographic information systems.

Frequency Distribution of Environmental Sanitation Quality

Table 2. Frequency Distribution of Environmental Sanitation Quality Variables in West Jakarta Administrative City in 2024

Environmental Sanitation Quality	Number	Precentage %
Safe	24	48.0
Adequate	25	50.0
Sharing	1	2.0
Total	50	100.0

Based on Table 2 regarding the distribution of independent variables, it is known that the quality of environmental sanitation related to diarrhea incidence in this study mostly falls into the adequate sanitation category, with 25 respondents (50.0%) categorized as safe, 24 respondents (48.0%) in the adequate category, and 1 respondent (2.0%) in the sharing category.

The distribution of data based on environmental sanitation quality related to diarrhea incidence and the number of toddler samples in West Jakarta Administrative City in 2024 has been processed through mapping using GIS to provide an effective and efficient source of information. The mapping of diarrhea cases for affected individuals is as follows (Figure 4).

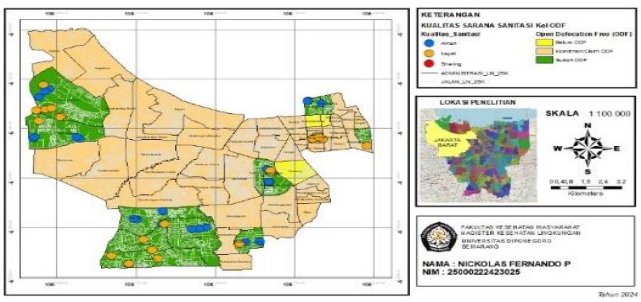

Figure 4. Map of Diarrhea Incidence Cases with Environmental Sanitation Quality in West Jakarta Administrative City

The following is the result of the analysis of the spatial distribution pattern of environmental sanitation quality based on the Average Nearest Neighbor analysis, which shows that the distribution pattern is random:

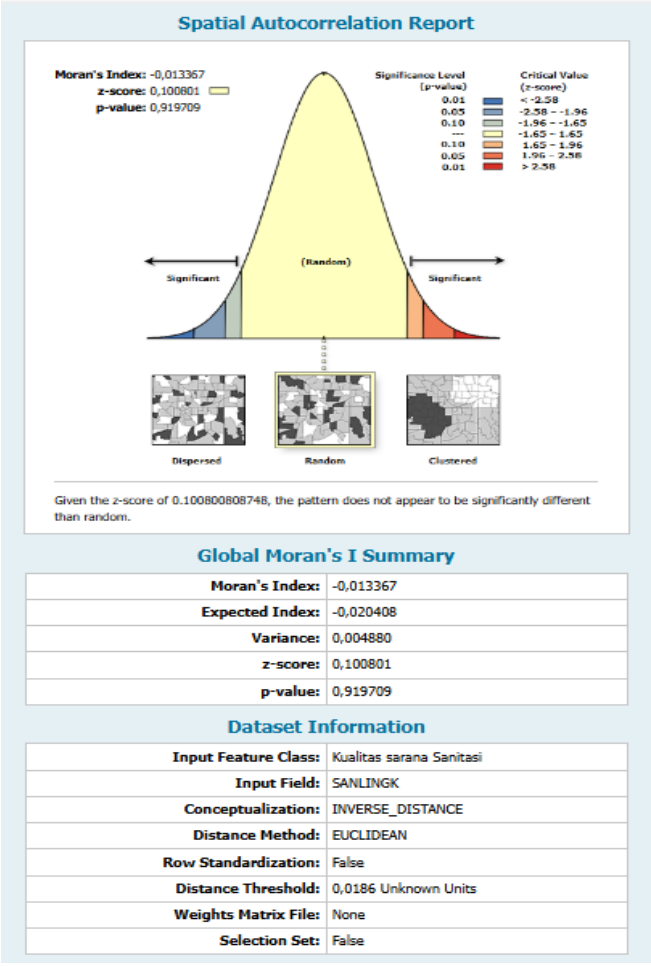

Figure 5. Results of the Analysis of Environmental Sanitation Quality Distribution Pattern

Frequency Distribution of Water Quality

Table 3. Frequency Distribution of Water Quality Variables in West Jakarta Administrative City in 2024

Water Quality	Number	Percentage%
Not Qualifying	33	66.0
Qualified	17	34.0
Total	50	100.0

Based on Table 1.6 regarding the distribution of independent variables, it is known that the quality of water concerning diarrhea incidents in this study largely falls into the category of unsuitable, with 33 respondents (66.0%), while the quality of water that meets standards concerning diarrhea incidents accounts for 17 respondents (34.0%).

The distribution of data based on water quality related to diarrhea incidents and the number of toddlers in the West Jakarta Administrative City in 2024 was processed through mapping with GIS/SIG to serve as an effective and efficient source of information. The mapping of diarrhea case distribution for patients is as follows:

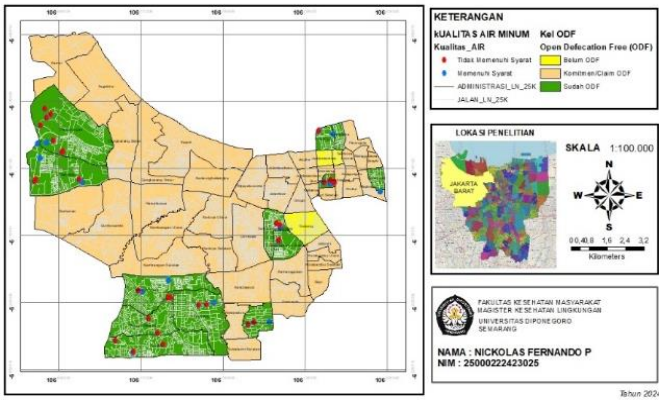

Figure 6. Map of Diarrhea Incident Cases Related to Drinking Water Quality in West Jakarta Administrative City

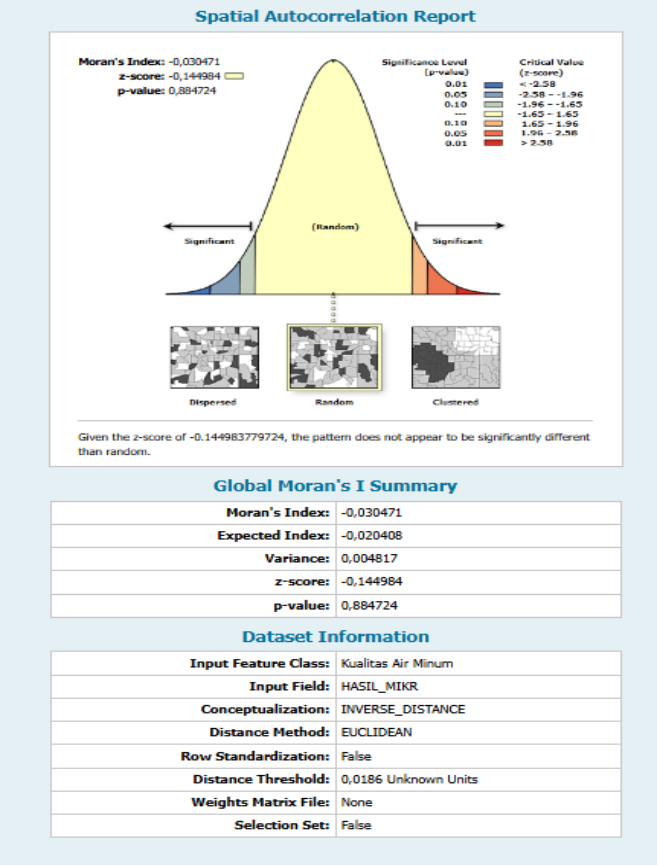

Figure 7. Analysis Results of Water Quality Distribution Patterns

From Figure 7, the distribution pattern of water quality based on the analysis using Spatial Autocorrelation (Moran's I) indicates that the distribution is random, meaning the water quality analysis is random and unpatterned, with a p-value of 0.0751 and Moran's index of -0.1452.

Frequency Distribution of CTPS Habits

Table 4. Frequency Distribution of CTPS Habit Variables in West Jakarta Administrative City in 2024

CTPS Habit	Number	Percentage%
Not Used to CTPS	23	46.0
Used to CTPS	27	54.0
Total	50	100.0

Based on Table 4 regarding the distribution of independent variables, it is noted that the CTPS habit concerning diarrhea incidents in this study mostly falls into the category of "used to CTPS," with 27 respondents (54.0%), while those not used to CTPS concerning diarrhea incidents amount to 23 respondents (46.0%). The mapping of diarrhea case distribution for patients is as follows:

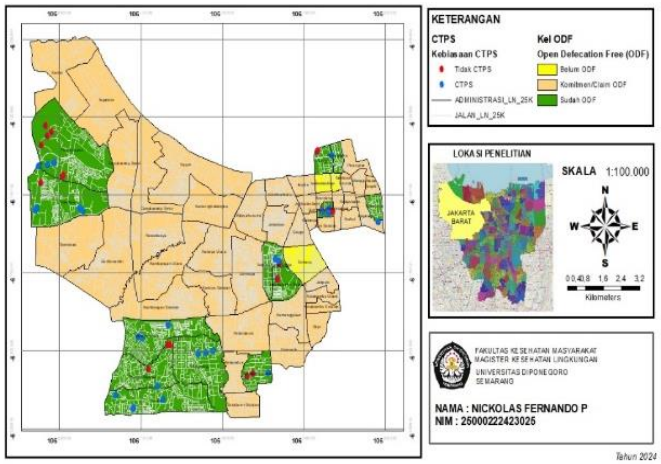

Figure 8. Map of Diarrhea Incident Cases Related to Handwashing with Soap in West Jakarta Administrative City

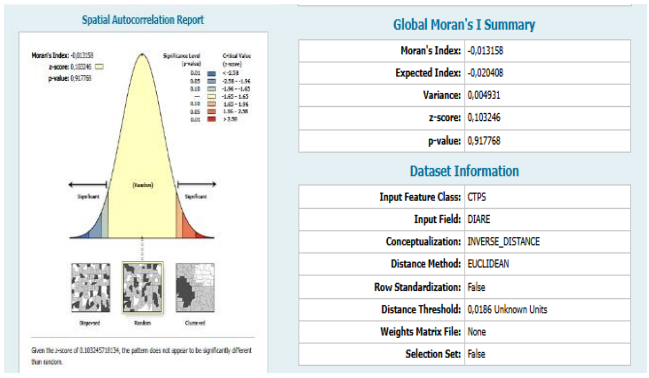

Figure 9. Results of Handwashing with Soap Analysis

Based on Figure 9, the analysis of the distribution pattern using Spatial Autocorrelation (Moran's I) shows that the pattern of handwashing with soap distribution is random, unpatterned, with a p-value of 0.9177 and Moran's index of -0.0131.

Frequency Distribution of Types of Drinking Water Sources

Table 5. Frequency Distribution of Drinking Water Source Type Variables in West Jakarta Administrative City in 2024

Type of Drinking Water Source	Number	Percentage %
Unprotected	22	44.0
Protected	28	56.0
Total	50	100.0

Based on Table 5 regarding the distribution of independent variables, it is noted that the type of drinking water source related to diarrhea incidents in this study predominantly falls into the protected category, with 28 respondents (56.0%), while the unprotected category accounts for 22 respondents (44.0%). The mapping of diarrhea case distribution for patients is as follows.

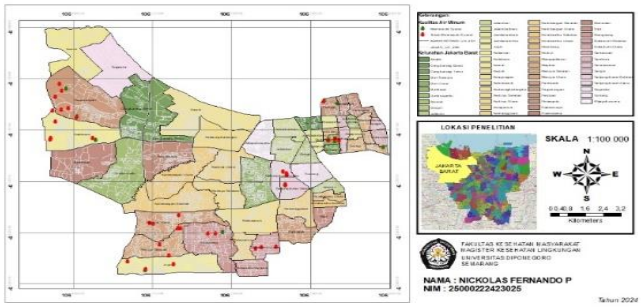

Figure 10. Map of Diarrhea Incident Cases Related to Types of Drinking Water Sources in West Jakarta Administrative City

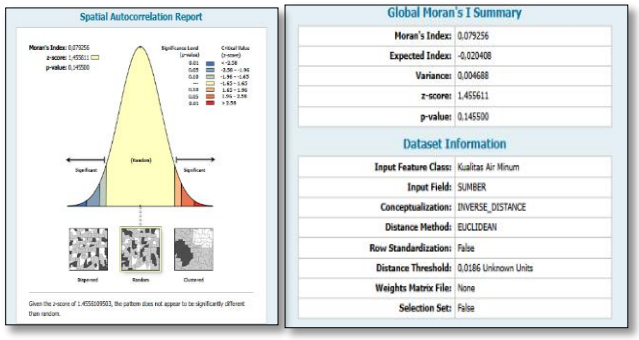

Figure 11. Results of Water Quality Distribution Pattern Analysis

The table below presents the results of the Chi-Square correlation analysis between independent variables (environmental sanitation quality, water quality, CTPS habits, and types of drinking water sources) and diarrhea incidents in West Jakarta Administrative City in 2024. The table consists of cross-tabulation and the significance value of the statistical test.

Relationship between Environmental Sanitation Quality and Diarrhea Incidents in Toddlers

Table 6. Relationship between Environmental Sanitation Quality and Diarrhea Incidents in Toddlers in West Jakarta Administrative City in 2024

Environmental Sanitation Quality	Diarrhe Incident		Total	P *Value*
	No Diarrhea in the Last 3 Months	Diarrhea in the Last 3 Months		
Safe	9	15	24	0.326
	37.5%	62.5%	100.0%	
Adequate	8	17	25	
	32.0%	68.0%	100.0%	
Sharing	1	0	1	
	100.0%	0.0%	100.0%	
Total	18	32	50	
	36.0%	64.0%	100.0%	

Based on Table 6, it is found that the relationship between environmental sanitation quality and diarrhea incidents in the last 3 months shows that in the adequate category there are 17 respondents (68.0%), in the safe category there are 15 respondents (62.5%), and in the sharing category, there are 0 respondents.

For the data on environmental sanitation quality between the diarrhea group in the last 3 months and the non-diarrhea group in the last 3 months, the p-value is 0.326 (p>0.05), indicating that the data is not homogeneous or that there is no significant relationship between environmental sanitation quality and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024.

Based on the Chi-Square test results, there is no relationship between sanitation ladder and diarrhea incidents, as evidenced by the significance value (p value = 0.0373). The data processing results show that the sanitation ladder concerning diarrhea incidents in this study predominantly falls into the adequate sanitation category, with 25 respondents (50.0%), followed by the safe category with 24 respondents (48.0%), and the sharing category with 1 respondent (2.0%).

The analysis of the relationship between the sanitation ladder and diarrhea incidents in the last 3 months shows that in the safe category there were 15 respondents (62.5%), in the adequate category there were 17 respondents (68.0%), and in the sharing category, there were 0 respondents. This indicates a lack of significant correlation between the sanitation ladder and the occurrence of diarrhea in toddlers.

Factors that can directly or indirectly influence the occurrence of diarrhea are important to consider. Environmental factors are the most critical, which is why improving environmental sanitation is necessary for diarrhea prevention (Zubir, 2016). (Elsi Evayanti et al., 2014) Individuals with weakened immune systems are more susceptible to diseases, including diarrhea, cholera, measles, typhus, malaria, dengue fever, and influenza. Environmental health issues include sanitation (toilets), drinking water supply, housing, waste disposal, and wastewater management (Notoatmodjo, 2016).(Soekidjo Notoatmodjo, 1997)

According to the researcher, the quality of environmental sanitation is not solely based on access to sanitation ladders; other factors, such as liquid waste and slum conditions, serve as media for the spread of various diseases, especially cholera and diarrhea. These factors also provide breeding grounds for pathogenic microorganisms and mosquitoes. Poorly managed wastewater can lead to the pollution of surface or groundwater, which may be used for daily activities such as bathing, drinking, and cleaning kitchen utensils.

Relationship between Water Quality and Diarrhea Incidents in Toddlers

Table 7. Relationship between Water Quality and Diarrhea Incidents in Toddlers in West Jakarta Administrative City in 2024

Water Quality	Diarrhe Incident		Total n (%)	p- value	PR (95% CI)
	Diarrhe a in the last 3 months (%)	No Diarrhe a in the last 3 months (%)			
Doesn't meet the requirements	25 (75,8%)	8 (24,2%)	33 (100,0)	0,036	0,224 (0,064-0,783)
Meets the requirements	7 (41,2%)	10 (58,8%)	17 (100,0)		
Total	32 (64,0%)	18 (36,0%)	50 (100,0)		

Based on Table 7, the analysis results show the relationship between water quality and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024. It was found that the water quality that does not meet standards corresponds to 25 respondents (75.8%) who experienced diarrhea in the last 3 months, while the water quality that meets standards corresponds to 7 respondents (41.2%) who experienced diarrhea in the same period. The statistical test yielded a significant p-value of 0.036, indicating that p-value < 0.05, which allows us to conclude that there is a significant relationship between water quality and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024.

The odds ratio (OR) calculated was 0.224 (0.064 - 0.783), meaning that respondents with substandard water quality have a 1 time greater chance of experiencing diarrhea compared to those with acceptable water quality.

The analysis using the Chi-Square test indicates a relationship between drinking water quality (Microbiological Parameters) and diarrhea incidents in toddlers, as demonstrated by the significant value (p-value = 0.036). This is because the majority of respondents (66.0%) experienced diarrhea associated with water quality that does not meet standards, while 34.0% of respondents who experienced diarrhea were associated with water quality that met standards.

In summary, the relationship between water quality and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024 shows that 25 respondents (75.8%) with substandard water quality experienced diarrhea in the last 3 months, while 7 respondents (41.2%) with acceptable water quality did so. The statistical test yielded a significant p-value of 0.036, indicating that p-value < 0.05, which allows us to conclude that there is a significant relationship between water quality and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024.

The results also showed a prevalence ratio (PR) of 1.840, meaning that toddlers with substandard water quality are 1.840 times more likely to experience diarrhea compared to those with acceptable water quality.

According to the research by Kadir F. et al. (2021), the factors related to drinking water sources, the physical quality of clean water, bacteriological quality, the types of clean water facilities, the risk of contamination of clean water facilities, the condition of toilets, and diarrhea incidents in toddlers are significant. The findings of the second and third articles indicate that the overall quality of clean water and its bacteriological content (p=0.014) are specifically related to diarrhea incidents in toddlers.(Khairunnisa et al., 2023)

The researcher emphasizes the importance of water for humans; using water that does not meet quality standards for its intended purpose can lead to health issues. This can result in various diseases, including diarrhea, typhoid, cholera, and serve as a breeding ground for pathogenic microorganisms and mosquitoes.

Relationship between CTPS Habits and Diarrhea Incidents

Table 8. Relationship between CTPS Habits and Diarrhea Incidents in Toddlers in West Jakarta Administrative City in 2024

CTPS Habit	Diarrhe Incident		Total n (%)	p-value
	Diarrhe a in the last 3 months (%)	No Diarrhe a in the last 3 months (%)		
Not used to	18 (78.3%)	5 (21.7%)	23 (100.0)	0.100
Used to	14 (51.9%)	13 (48.1%)	27 (100.0)	
Total	32 (64.0%)	18 (36.0%)	50 (100.0)	

Based on Table 8, the analysis of the relationship between CTPS habits and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024 indicates that among those not accustomed to CTPS, there were 18 respondents (78.3%) who experienced diarrhea in the last 3 months. In contrast, among those who are accustomed to CTPS, 14 respondents (51.9%) experienced diarrhea in the same period.

The statistical test yielded a significant p-value of 0.100, indicating that p-value > 0.05, allowing us to conclude that there is no significant relationship between CTPS habits and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024.

Data processing shows that the majority of respondents (54.0%) are accustomed to CTPS, while 46.0% are not accustomed to it in relation to diarrhea incidents.

The analysis reveals that among those not accustomed to CTPS, 18 respondents (78.3%) experienced diarrhea in the last 3 months, while among those accustomed to CTPS, 14 respondents (51.9%) experienced diarrhea. The statistical test results indicate

a p-value of 0.100, leading to the conclusion that there is no significant relationship between CTPS habits and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024. Establishing handwashing habits does not happen spontaneously; it must be cultivated from a young age, involving education for oneself and the community while promoting a clean and healthy lifestyle. Children can also be effective role models for adults, particularly in emphasizing the importance of handwashing, which is often underestimated·(Windyastuti, Rohana, N, Santo, 2017)

According to the research by Proverawati and Rahmawati (2011),(Bintara Birawida et al., 2020) the largest group of respondents practiced handwashing with soap at a good standard, totaling 57 individuals (77%). In contrast, there were 17 individuals (23%) whose handwashing behavior was deemed poor. This indicates that while there are more respondents practicing good handwashing, there are still individuals who do not understand how to wash their hands properly with soap, as evidenced by the 17 (23%) respondents exhibiting poor handwashing practices. Based on the questionnaires filled out by the respondents, on average, they washed their hands without soap, using only water.

Relationship between Drinking Water Sources and Diarrhea Incidents

Table 9. Relationship between Drinking Water Sources and Diarrhea Incidents in Toddlers in West Jakarta Administrative City in 2024

Dringking Water Sources	Diarrhe Incident		Total n (%)	p- value
	Diarrhe a in the last 3 months (%)	No Diarrhe a in the last 3 months (%)		
Unprotected	17 (77.3%)	5 (22.7%)	22 (100.0)	0.151
Protected	15 (53.6%)	13 (46.4%)	28 (100.0)	
Total	32 (64.0%)	18 (36.0%)	50 (100.0)	

Based on Table 9, the analysis of the relationship between the type of drinking water source and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024 reveals that among those using unprotected drinking water sources, 17 respondents (77.3%) experienced diarrhea in the last 3 months. Conversely, among those using protected drinking water sources, 15 respondents (53.6%) experienced diarrhea during the same period.

The statistical test yielded a significant p-value of 0.151, indicating that p-value > 0.05, which allows us to conclude that there is no significant relationship between the type of drinking water source and diarrhea incidents in toddlers in West Jakarta Administrative City in 2024.

The analysis using the Chi-Square test shows that there is no relationship between the type of drinking water source and diarrhea incidents, as evidenced by the significant value (p-value = 1.151). This is because, in this study, the majority of drinking water sources were categorized as protected, with 28 respondents (56.0%), while unprotected sources accounted for 22 respondents (44.0%).

The analysis indicates that among those using unprotected drinking water sources, 17 respondents (77.3%) experienced diarrhea in the last 3 months, whereas among those using protected sources, 15 respondents (53.6%) experienced diarrhea. The prevalence rate obtained was 1.442, meaning that toddlers using protected drinking water sources have a 1.442 times greater chance of being affected compared to those using unprotected sources.

According to Wandansari (2013), the availability of drinking water sources influences the transmission of diarrhea. The correlation analysis indicates that the presence of unprotected drinking water sources increases the risk of diarrhea in toddlers within a given area. This is due to the body's requirement for drinking water, as water constitutes 90% of the human body. Water serves various essential functions, including acting as a transport medium within the body. When drinking water sources do not meet physical, chemical, and bacteriological standards, they can become breeding grounds for disease transmission.

The researcher notes that although the significance value indicates no direct relationship, the risk of diarrhea in toddlers still exists. Therefore, drinking water sources must originate from protected sources that meet health requirements.

Results and Discussion of Multivariate Analysis

Table 10. Dominant Variables Influencing Diarrhea in Toddlers in West Jakarta Administrative City, 2024

Variabel	Sig.	Exp(B)	95% C.I.for EXP(B)	
			Lower	Upper
Water Quality(1)	0.032	4.110	1.129	14.960
CTPS Habit(1)	0.097	3.023	0.817	11.177
Constant	0.179	0.465	0.465	

Multivariate modeling using the backward conditional method was employed to identify significant variables affecting the dependent variable. The significant variables identified were water quality and handwashing habits (CTPS). The water quality variable had a significant value (p-value = 0.032) and a prevalence ratio (PR) of 4.110 with a 95% confidence interval (CI) of 1.129 – 14.960, indicating a significant relationship between water quality and diarrhea incidents in toddlers. Toddlers with water quality that does not meet standards are 4.110 times more likely to experience diarrhea than those with acceptable water quality.

Although the CTPS variable had a significance value (p-value = 0.097) and a PR of 3.032 with a 95% CI of 0.817 – 11.177, indicating no significant relationship, it shows that toddlers with poor handwashing habits still have increased risk. From the significant variables, logistic regression analysis using the backward method revealed that two variables, drinking water quality and handwashing habits (CTPS), are associated with diarrhea incidents. The water quality variable showed a significant value (p-value = 0.032), with a PR of 4.110 and a 95% CI of 1.129 - 14.960, confirming a significant relationship. The likelihood of diarrhea in toddlers is greater (4.110 times) when the drinking water quality is inadequate. The CTPS variable, while not significant with a p-value of 0.097, indicates that respondents who do not practice proper handwashing are 3.023 times more likely to experience diarrhea compared to those who do.

Conclusion

Among the 50 respondents, 18 (36%) reported no diarrhea in the last three months, while 32 (64%) experienced diarrhea. There is no significant relationship between sanitation facilities and diarrhea incidents among toddlers in the ODF area of West Jakarta Administrative City, as indicated by the p-value of 0.373. However, a significant relationship was found between drinking water quality (microbiological parameters) and diarrhea incidents in toddlers in the same area, with a p-value of 0.036. No significant relationship was found between handwashing habits (CTPS) and diarrhea incidents in toddlers (p-value = 0.100), nor was there a significant relationship between the type of drinking water source and diarrhea incidents (p-value = 0.151). The multivariate logistic regression analysis, using the backward method, indicates that water quality is a dominant variable with a significant relationship (p-value = 0.032), while handwashing habits (CTPS) do not show a significant relationship (p-value = 0.097).

Author Contributions
All authors had significant contributions in completing this manuscript.

Funding
This research was funded personally by the researcher.

Conflicts of Interest
The authors declare no conflict of interest.

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