



Mapping of Diarrhea among Under-Five Children Based on Household Basic Sanitation in Pagurawan Health Center, Batu Bara Regency

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<p>Track Record Article</p> <p>Accepted: 21 June 2023 Revised: 27 July 2023 Published: 31 July 2023</p> <p>How to cite : Tumanggor, W. R. E., & Chahaya, I. S. (2023). Mapping of Diarrhea among Under-Five Children Based on Basic Sanitation Household in Pagurawan Health Center, Batu Bara Regency. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i>, 5(3), 858–870.</p>	<p style="text-align: center;">Abstract</p> <p><i>Diarrhea in under-five children continued to be the leading cause of morbidity in Batu Bara District. This research investigated the relationship between basic sanitation and diarrhea among under-five children and its spatial distribution in the Pagurawan Health, Batu Bara Regency. The research employed a cross-sectional observational analytical design. The population was all mothers who have under-five children as many as 2310 population then determining the sample size using the Lemeshow formula with a total of 105. The samples were taken by purposive sampling selected by proportional from 9 rural. Data analysis used the is-square test for bivariate analysis and the overlay technique for spatial analysis. The technique performed for spatial is the overlay technique. The research revealed a relationship between the incidence of diarrhea in under-five children and water supply ($p=0.034$), while latrines ($p=0.191$), waste management ($p=1.000$), and wastewater disposal ($p=0.825$) were not. Spatial results found that the highest cases of diarrhea were in Pematang Nibung Village with a vulnerability status. Based on this research, water supply is related to the incidence of diarrhea among under-five children. Meanwhile, the latrines, waste management, and wastewater disposal are not related to the incidence of diarrhea among under-five children in the Pagurawan Community Health Center with a vulnerability status in Pematang Nibung Village.</i></p> <p>Keywords: <i>Diarrhea, Sanitation, Under-five children</i></p>
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INTRODUCTION

Diarrhea in under-five children continued to be the leading cause of death of as many as around 480,000 under-five children globally (UNICEF, 2019a), with Indonesia being among the fifteen countries with the highest number of deaths (International Vaccine Access Center, 2020). According to the Health Profile of Indonesia in 2019, diarrhea is the leading cause of death for children in Indonesia between the ages of 12 and 59 months (Minister of Health Republic of Indonesia, 2020).

The highest cases of diarrhea were found in North Sumatera Province in 2018, based on Basic Health Research. According to diagnosis by health workers, the prevalence of diarrhea in North Sumatera Province reached 14.2% and according to the diagnosis of health workers or symptoms that have been experienced by household members, the prevalence of diarrhea in North Sumatera Province reached 15.4% (Riskesdas, 2018). One of the districts that contribute to the prevalence of diarrhea was Batu Bara Regency, where 1,884 cases (2.68%) were reported (BPS-Statistics North Sumatera Province, 2021). The diarrheal disease was one of the 10 biggest diseases in Batu Bara District. From the available data, there has

been an increase in cases of diarrhea in children every year from 2014, 2015, and 2016, respectively 2,883 cases (14.5%), 3,354 cases (14.8%), and 4,627 cases (16.76%) (BPS-Statistics Batu Bara District Indonesia, 2018).

Diarrhea is often caused by poor sanitation conditions, with many Indonesians lacking basic sanitation needs. According to the United Nations, about 25 million Indonesian do not use toilets and instead feces in fields, bushes, forests, ditches, streets, canals, or other public areas (UNICEF, 2019b). Research shows that 42.5% of Indonesians use unqualified water supply, 47.1% use unqualified sewerage, and 61% use unqualified latrines (Azis et al., 2021). Poor sanitation standards, such as latrines, water supply, and wastewater disposal, contribute to diarrhea in under-five children (Maywati et al., 2023). The frequency of diarrhea is related to latrines and clean water facilities, while the relationship between wastewater disposal amenities and diarrhea cannot be statistically analyzed due to the constant value of waste disposal facilities (Bangun et al., 2020).

Pagurawan Health Center, located in the Medang Deras Subdistrict, is one of the health centers in the Batu Bara Regency. Its service area includes the rural communities of Aek Nauli, Pangkalan Dodek, Pangkalan Dodek Baru, Durian, Medang, Nenas Siam, Pagurawan, Pematang Nibung, and Sei Buah Keras. Diarrhea cases remained among the top 10 diseases in the Health Center. The Pagurawan Health Center is situated near the coast. The risk factors of diarrhea in this area associated with the incidence of diarrhea are basic sanitation which includes unhealthy latrines, unprotected water supply, improper waste management, and not eligible wastewater disposal. Field observations in Medang Deras sub-district found that the community had unhealthy latrines and poor piping and clean water facilities. Waste management facilities were found in the community not managing waste properly as seen from the absence of trash cans at home and a wastewater disposal system found disposing of household wastewater behind or on the side of the house, namely by flowing it or just letting it stagnate.

Spatial analysis is essential for mapping diarrhea among children under five in Batu Bara Regency, particularly in the Pagurawan Health Center. Area-Based Disease Management (ABDM) can effectively manage diarrhea problems, including spatial analysis, surveillance, and audits. ABDM provides geographic information on under-five diarrhea cases and high-risk villages, making the problem easier to solve (Achmadi, 2020).

Based on the issues mentioned, this study sought to the relationship between household basic sanitation and diarrhea in under-five children, as well as the spatial

distribution of diarrhea and region vulnerability based on household basic sanitation of diarrhea in the Pagurawan Health Center's Working Area, Batu Bara Regency.

METHODS

This study used a cross-sectional observational analytical design. This study was conducted in Pagurawan Health Center Working Area, Batu Bara district on June - September 2021 with an ethical clearance letter from the Research Ethics Committee of Universitas Sumatera Utara No.691/KEP/USU/2021. The population consisted of all mothers with under-five children (0-59 months) which amounted to 2310 population in the Pagurawan Health Center's Working Area in Medang Deras, Batu Bara. The Lemeshow formula was used to determine the sample size, which consisted of 105 mothers of under-five children. The samples were taken by purposive sampling selected by proportional from 9 rural. Information on household sanitary conditions was gathered using a questionnaire and observation checklist. The questionnaire contained the identity of the respondent including the respondent's home address and coordinates, the identity of the under-five children, and several questions regarding the incidence of diarrhea, availability of water supply, healthy latrines, waste management, and wastewater disposal.

The analysis of the data was done using univariate and bivariate methods. The dependent variable, diarrhea, and the independent variable, basic sanitation (latrines, water supply, waste management, and wastewater disposal), were both described using univariate analysis. The relationship between latrines, water supply, waste management, and wastewater disposal was examined using bivariate analysis and the chi-square test. If the p-value is below 0.05, the independent variable will relate to the dependent variable.

Basic sanitation mapping was carried out by mapping the coordinate points of under-five children diarrhea patients recorded using the Kobotoolbox application on an Android phone. The coordinate point data was then processed using Quantum GIS (QGIS) software with QGIS Desktop 3.22.3. The technique performed using QGIS is the overlay technique. Spatial Analysis is made based on a weighting system with the scoring method in the QGIS intersect function where each basic sanitation indicator with a high proportion of unqualified has a high score, 0-25% has a score of 1; 26%-50% has a score of 2; 51%-75% has a score of 3; and 75%-100% has a score of 4. Thus, the vulnerability map can be categorized into four categories, namely not vulnerable with a score of 1-4; Moderately Vulnerable with a score of 5-8; Vulnerable with a score of 9-12; and Very Vulnerable with a score of 12-16.

Furthermore, the data will be processed using maps sourced from the Indonesia Geospatial Portal in the shp format.

RESULTS

Univariate Analysis

Table 1 shows that the study's result revealed that among 105 mothers of under-five children, 21 households (20%) of those in the Pagurawan Health Center's Working Area had under-five children who had diarrhea, compared to 84 households (80%) who did not. Interviews with mothers of under-five children who experienced diarrhea for the previous three (3) months provided information on diarrhea.

Table 1 Distribution of Diarrhea Status Under-Five Children's Frequency

Diarrhea	n=105	%
Yes	21	20,0
No	84	80,0

Table 2 shows that 87 households (82.9%) have healthy latrines and 18 (17.1%) have unhealthy ones. The result also showed that as many as 66 households (62.9%) of the respondents already had protected water supplies that complied with health standards. Meanwhile, 100 households (95.2%) and 77 households (73.3%) of the respondents, respectively, did not have household waste management or wastewater disposal that met the health standards.

Table 2 Frequency Distribution of the Latrines, Water Supply, Waste Management, and Wastewater Disposal that Met Requirements

Variables	n=105	%
Healthy Latrines		
No	18	17,1
Yes	87	82,9
Protected Water Supply		
No	39	37,1
Yes	66	62,9
Proper Waste Management		
No	100	95,2
Yes	5	4,8
Qualify Wastewater Disposal		
No	77	73,3
Yes	28	26,7

Bivariate Analysis

Table 3 below shows the relationship between household basic sanitation conditions (unhealthy and healthy latrines; unprotected and protected water supply; improper and proper waste management; and not eligible and qualified wastewater disposal) and the frequency of diarrhea among the under-five children.

Table 3 Relationship of Household Basic Sanitation with Diarrhea in the Under-five Children

Variables	The Incidence of Diarrhea				Total		p-value
	Diarrhea		Not Diarrhea		n	%	
	N	%	n	%			
Healthy Latrines							
No	6	33,3	12	66,7	18	100	0.191
Yes	15	17,2	72	82,8	87	100	
Protected Water Supply							
No	12	30,8	27	69,2	39	100	0.034*
Yes	9	13,6	57	86,4	66	100	
Proper Waste Management							
No	20	20,0	80	80,0	100	100	1.000
Yes	1	20,0	4	80,0	5	100	
Qualify Wastewater Disposal							
No	15	19,5	62	80,5	77	100	0.825
Yes	6	21,4	22	78,6	28	100	

*Significant

The result showed that respondents who have healthy latrines tend not to get diarrhea, 72 households (82.8%) and unhealthy latrines tend to get diarrhea, and 6 households (33.3%) within a p-value of 0.191, meaning that the latrines are not related to the incidence of diarrhea in under-five children.

Basic sanitation related to water supply also shows the proportion of diarrhea under-five children. Respondents who have a protected water supply tend not to get diarrhea, 57 households (86.4%) with an unprotected water supply tend to get diarrhea, and 12 households (30.8%) within a p-value of 0,034, which means that the water supply is related to the incidence of diarrhea in under-five children.

Respondents who have proper waste management tend not to get diarrhea, 4 households (80,0%) and improper waste management tend to get diarrhea, and 20 households (20,0%) within p-value of 1,000, meaning that the waste management is not related to the incidence of diarrhea in under-five children.

In this study, basic sanitation regarding wastewater disposal was also measured in this study. The respondent who has to qualify for wastewater disposal tend not to get diarrhea, 22 households (78,6%) and not eligible tend to get diarrhea, and 15 households (19,5%) within a

p-value of 0,825, meaning that wastewater disposal is not related to the incidence of diarrhea in under-five children.

Spatial Analysis

Pagurawan Health Center working area covers the Rural of Aek Nauli, Pangkalan Dodek, Pangkalan Dodek Baru, Durian, Medang, Nenas Siam, Pagurawan, Pematang Nibung, and Sei Buah Keras. Figure 1 showed the highest proportion of diarrhea incidence was found in Pematang Nibung Village as many as 42.86% having diarrhea among under-five children. Some of the factors causing diarrhea in Pematang Nibung Village were that 85.71% of households had improper waste management and 57.14% of households had not eligible for wastewater disposal. Meanwhile, in the villages of Pagurawan and Pangkalan Dodek Baru, no cases of diarrhea were found. There were respective proportions of diarrhea in Medang Village of 38.46%, Pangkalan Dodek Village of 27.78%, Durian Village of 21.43%, Aek Nauli Village of 16.67%, Sei Buah Keras Village of 15.38 %, and Nenas Siam Village of 14.29%.

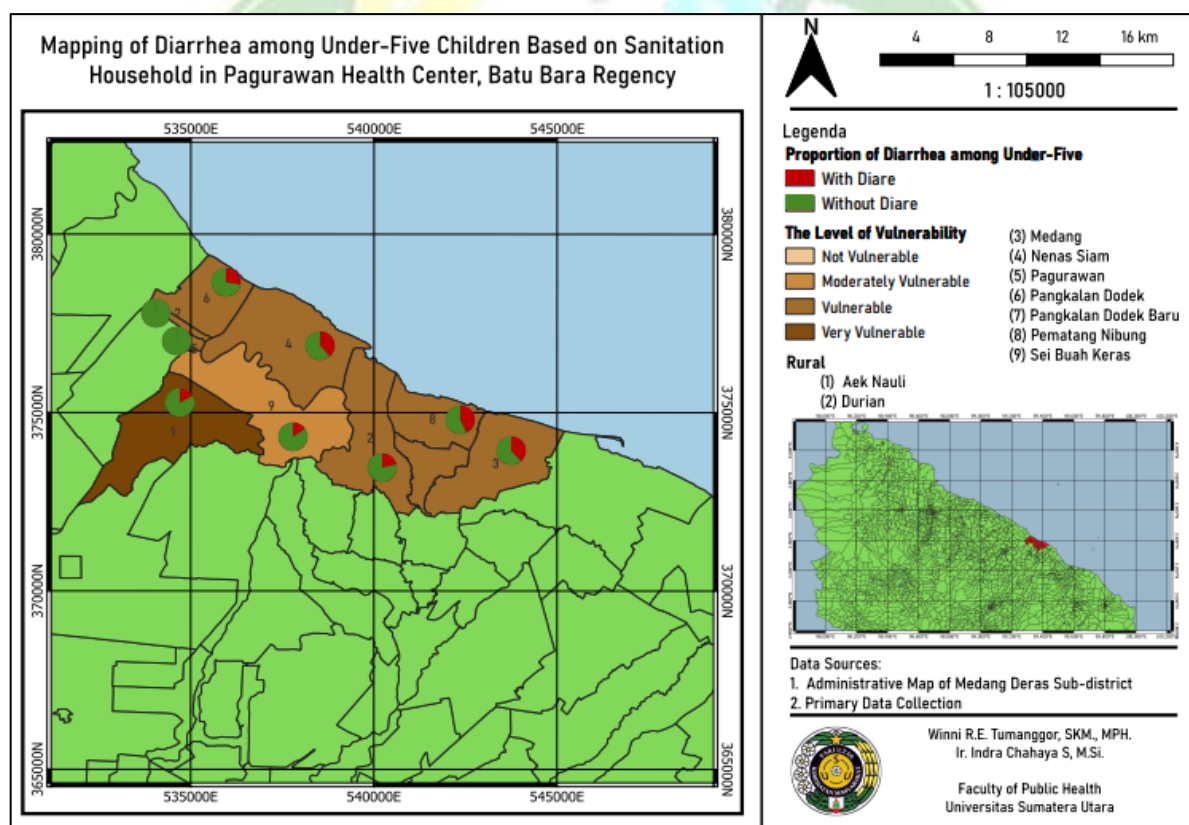


Figure 1. Mapping of Diarrhea among Under-Five Children Based on Sanitation Household in Pagurawan Health Center, Batu Bara Regency

Aek Nauli Village was an area with very vulnerable based on poor sanitation. Aek Nauli Village has as many as 3 households (50.0%) have unhealthy latrines, as many as 5 households (83.33%) have unprotected water supply, as many as 6 households (100.0%) have improper waste management, and as many as 6 households (100.0%) have not eligible wastewater disposal. Meanwhile, other villages were classified as vulnerable areas, except for Sei Buah Keras Village, which are moderately vulnerable areas.

DISCUSSION

There is no relationship between latrine conditions and the frequency of diarrhea in under-five children at Pagurawan Health Center ($p=0.191$). According to the Regulation of the Minister of Health of the Republic of Indonesia, healthy latrines must meet criteria such as walls, roofs, watertight floors, drained wastewater, gooseneck type, clean conditions, soap and clean running water, and septic tanks at least 10 meters away from water sources.

The findings of this research are in line with prior studies that discovered that latrine conditions are not related to the incidence of diarrhea (Langit, 2016; Sari et al., 2020). Additional research has demonstrated that the latrines with significantly are not related to diarrhea (Kurniawati & Abiyah, 2021). This study is consistent with Rizkiah (2020) who states that the healthy latrines used by the family are not related to diarrhea in toddlers in the Sungailiat Health, Bangka Regency. Research conducted at Tipo Health Center also shows that there is no influence on latrine diarrhea in under-five children (Rau & Novita, 2021). However, this study's results differ from those of several earlier research that stool disposal is related to diarrhea (Utama et al., 2019). Another study also mentioned that there was an influence between healthy latrines and diarrhea in Banjarmasin (Kasman & Ishak, 2020).

In daily activities, humans certainly need healthy family latrines, because through healthy latrines, families can avoid various diseases. One of them is diarrhea. Diarrhea in under-five children is not only caused by the availability of healthy latrines but is also influenced by other factors, such as the mother's habit of washing her hands before feeding the child (Prawati & Haqi, 2019). However, several respondents did not have latrines and dumped their feces behind their homes, which served as a garbage dump. Because flies will be attracted to feces if they are dumped outside, this condition has the potential to induce diarrhea. Flies will spread harmful bacteria to food, which humans will eventually consume (Slamet, 2009).

This study proves that water supply that does not meet the requirements is a risk factor for diarrhea in under-five children ($p\text{-value}=0.034$). According to the findings of field

research, a lot of mothers use public water sources or tap water as a source of clean water. Some mothers boil water to be used as drinking water, while others utilize refillable bottles of water. The use of public water with a piped system can be contaminated with *E-coli* due to leaks in the pipes. In addition, contaminated and incompletely boiled water can be a risk factor for diarrhea. Research conducted by Freya et al. (2022) showed that the incidence of diarrhea has a relationship to the water used as a source of drinking water by the Regional Drinking Water Company. The study found that this occurred due to a leak in the Regional Drinking Water Company pipe network which caused dirty water to enter the piping and cause recontamination.

In addition, it was found that the under-five children's mothers used depot drinking water. The use of drinking water from drinking water depots that are not maintained can also cause the incidence of diarrhea. This is supported by research conducted by Darmawan et al. (2022) showing that there is a relationship between actions that do not practice hygiene and sanitation in drinking water depots with the incidence of diarrhea in under-five children. By utilizing clean water that is shielded from contamination at the source, the community can decrease the prevalence of diarrhea (Nur et al., 2022). Sinaga (2020) states that there is a relationship between the availability of facilities and the incidence of diarrhea in under-five children in Sei Kepayang Tengah Village, Asahan Regency. Several previous studies have the same results (Misriyanto et al., 2020; Romeo et al., 2021; Workie et al., 2019).

According to Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017, states that water for sanitary hygiene must be protected from pollution, disease-carrying animals, and vector breeding sites. The source of clean water is crucial for daily use, as unqualified, unprotected sources can contaminate water, increasing diarrhea risk in under-five children. Unprotected water sources are a risk factor for diarrhea in children under five, according to research done in Jamma City, Northeastern Ethiopia (Workie et al., 2019).

Waste management involves three stages: collection, storage, transportation, and destruction. Storage should be in closed bins, transportation should be daily, and disposal should be environmentally friendly (Sumantri, 2017). However, waste management is not a risk factor for diarrhea. (p -value=1,000). The condition in the field shows that most respondents disposed of garbage in open land far from their homes. The distance of the trash can from the house is a possible reason why diarrhea transmission does not occur. The results of this study are in line with research conducted by Aolina et al. (2020) which states that waste management is not related to diarrhea in the community of Cintaraja Village.

Meanwhile, the results of this study are not in line with Jamaluddin & Zarnila (2020) who state that waste management is related to diarrhea in under-five children in Suka Mulia Village and Alur Manis Village, Aceh Tamiang Regency. Therefore, waste management is important to prevent transmission transmitted by these vectors because there is a relationship between the density of flies (vectors) and the incidence of diarrhea in under-five children in the Gondosari Health Center Working Area (Maulidah & Siwiendrayanti, 2022). Other studies have also suggested that fly density is a factor in the incidence of diarrhea in the community (Hutagalung et al., 2023).

The condition of the wastewater disposal who do not meet the requirements is more 70,%. According to Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2014 shows that water waste disposal that meets the requirements is wastewater disposal that is not clogged and flowed into a closed ditch because an open water waste disposal will be a source of breeding for disease vectors, one of which is diarrhea. According to this study, under-five children do not have an increased risk of diarrhea due to wastewater disposal ($p\text{-value}=0.825$). The results as the same as with previous studies which stated that there was no connection between wastewater disposal and diarrhea in Karanganyar Health Center's Working Area, Pekalongan Regency (Samiyati et al., 2019). This study disagrees with Maywati et al. (2023) who that wastewater disposal is related to diarrhea in toddlers. Another study also stated that the wastewater disposal system significantly is related to diarrhea in under-five children aged 3-5 years in Penyasawan Village (Wulandari et al., 2021).

Unqualified wastewater disposal conditions can develop disease vectors and reduce the environment's aesthetic value. In the Pagurawan Health Center working area, unqualified sewerage conditions can cause diarrhea in under-five children. However, clean living behavior through washing hands with soap can prevent diarrhea in many families. Although, many respondents' unqualified wastewater disposal systems prevent diarrhea in under-five children due to clean living behavior (Ruhardi & Yuliansari, 2021).

Aek Nauli village is a village that has a very vulnerable level of diarrhea incidence in under-five children, but the incidence of diarrhea in Aek Nauli village is relatively low with the proportion of diarrhea incidence in under-five children s only 1 household (16.67%). Aek Nauli Village is one of the villages with poor sanitation, but it is not the only factor that causes an under-five child to get diarrhea. Environmental, sociodemographic, and behavioral factors can be the factor of diarrhea. The research by Yunita et al. (2021) states that maternal behavior (washing milk bottles, washing hands, serving food, and providing clean water) is

related to diarrhea in toddlers in the Pante Ceureumen Health Center. Low cases of diarrhea are also due to breastfeeding in under-five children which makes under-five children's immunity strong. This is supported by research conducted by Hendrastuti (2019), it states that there is a relationship between exclusive breastfeeding and the incidence of diarrhea in under-five children.

Spatial analysis showed that the highest proportion of diarrhea cases was in Pematang Nibung Village with 3 households (42.86%). Based on observations, it was found that most of the diarrhea conditions that occurred among under-five children were caused by poor basic sanitation households. Communities tend to have improper waste management systems and unqualified wastewater disposal. This is in line with a study conducted by Maywati et al. (2023), it claims that the frequency of diarrhea is related to waste management and wastewater disposal in under-five children at the Bantar Health Center in Tasikmalaya City with a risk of poor sanitation conditions more than 5 times compared to sanitation conditions that comply health requirements.

CONCLUSIONS

According to the statistical analysis, the water supply is related to the incidence of diarrhea among under-five children. Meanwhile, the latrines, waste management, and wastewater disposal are not related to the incidence of diarrhea among under-five children in the Pagurawan Community Health Center. In addition, Spatial results found that the highest cases of diarrhea were in Pematang Nibung Village with a vulnerability status. According to the study's findings, it was identified that it would be feasible to create and put into use a model that would adequately identify the sanitation intervention priorities for the Pagurawan Health Center's Working Area in Batu Bara. Environmental health professionals can frequently check the quality of the community's clean water supply and offer advice on how to properly boil water as a way to reduce the prevalence of diarrhea. This study can be expanded by looking at the several clean water sources the community uses, their quality, and their sources of contamination. In addition, more research can look at other factors, like exclusive breastfeeding status and mother hygiene practices, that contribute to diarrhea in under-five children.

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