PHRAJ
Public Health Risk Assesment Journal
PHRAJ 3(1): 16–34
ISSN 3025-1109

Institute for Advanced Science, Social and Sustainable Future
MORALITY BEFORE KNOWLEDGE

The relationship between host behavior and environmental sanitation with the incidence of diarrhea in toddlers

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Received Date: June 04, 2025 Revised Date: July 10, 2025 Accepted Date: July 31, 2025

ABSTRACT

Background: Diarrhea is a disease transmitted through water and is a major problem in developing countries, including Indonesia. This study aims to determine the relationship between host behavior and environmental sanitation with the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City. **Methods:** This quantitative research uses a cross-sectional design with a total sample of 68 toddlers. Data analysis was performed univariately, bivariate using chi-square and multivariate multiple logistic regression prediction models. **Findings:** Based on data from the Makrayu Community Health Center, Palembang City, 2022, the prevalence of diarrhea in toddlers is 28.9%. The results of the multivariate analysis showed that the most significant variable on the incidence of diarrhea in children under five was the habit of washing hands (p-value 0.012) after controlling for the variables of processing, provision, and serving of food, quality of latrines, and waste disposal facilities. Host behavior and poor environmental sanitation can cause rapid transmission of diarrhea. Therefore, people are advised to pay attention to small things with big meanings by always practicing a clean and healthy life to avoid germs that cause disease. **Conclusion:** The analysis results show a relationship between the incidence of diarrhea in toddlers and food processing, provision and serving, hand washing habits, and garbage disposal facilities. In contrast, the source of clean water, latrines' quality, and garbage disposal have no significant relationship with the incidence of diarrhea in toddlers in the work area. Makrayu Health Center Palembang City. **Novelty/Originality of this article:** This study uniquely identifies handwashing behavior as the most influential factor in toddler diarrhea incidence after controlling for key environmental sanitation variables.

KEYWORDS: diarrhea; environmental sanitation; host behavior; toddlers.

1. Introduction

Diarrhea is characterized by symptoms such as changes in the shape and consistency of loose to liquid stools and increased frequency of bowel movements of more than (three times a day). The World Health Organization (WHO) states that diarrhea is the second leading cause of death in toddlers (Dukabain et al., 2021). Based on WHO data in 2017, cases of diarrhea in toddlers reached a death rate of around 525,000 each year (Damanik, 2018). In America, the prevalence of diarrhea is more than 3.5 million people with diarrhea each year (Firenza et al., 2022). The 2021 Indonesian Health Profile states that the incidence of diarrhea in toddlers in 2020 was 28.9% based on the set target. The difference in service coverage between provinces in the coverage of diarrhea services in toddlers ranges from

Cite This Article:
Kirana, T. A. (2025). The relationship between host behavior and environmental sanitation with the incidence of diarrhea in toddlers. *Public Health Risk Assesment Journal*, *3*(1), 16-34. https://doi.org/10.61511/phraj.v3i1.2025.1929

4.0% in North Sulawesi to West Nusa Tenggara (61.4%). The results of the Basic Health Research showed that the prevalence of diarrhea in 2018 was 8% in all age groups, 12.3% in toddlers and 10.6% in infants (Republik Indonesia, 2021). The health profile of the province of South Sumatra in 2020 stated that the target number of diarrhea cases in toddlers was 140,46. The prevalence of diarrhea served in toddlers was 21.6% and for all ages was 39.4%. The lowest prevalence of diarrhea in toddlers was in Muratara Regency at 6.6% while the highest prevalence of diarrhea was in Palembang City at 38.6% (Pemerintah Sumatera Selatan, 2020).

The profile of the Palembang City Health Office in 2021 stated that the highest target diarrhea cases in toddlers were in Ilir Barat II District and Dua Puluh Tiga Ilir District. The number of diarrhea cases in toddlers in the Ilir Barat II District area was 1,153 toddlers (Dinkes, 2021). Based on data from the Makrayu Health Center, Ilir Barat II District, Palembang City in 2022, the prevalence of diarrhea in toddlers was 28.9%. John Gordon explains the risk factors for diarrhea using the basic concept of the epidemiological triangle, which concerns the relationship between host factors, agents (causes) and the environment (environment) of the occurrence of disease (Humaira, 2021). Host factors are mothers who have toddlers and host behavior (processing, providing, serving food and hand washing habits). Agent factors (causes) include viruses, bacteria, protozoa and helminths. While environmental factors include clean water sources, ownership of toilets, wastewater drainage channels, and waste disposal facilities. Diarrhea in toddlers can occur from various host behaviors that trigger the growth of enteric germs. Host behavior that can cause germs and bacteria that cause diarrhea is the processing, serving and providing of food and hand washing habits. The better the behavior of the host, the smaller the incidence of diarrhea in toddlers, and vice versa, the worse the behavior of the food host, the higher the risk of diarrhea in toddlers. According to Notoatmodjo, an action or behavior can determine a person's cleanliness and health (Notoatmodjo, 2010).

Limited data on handwashing behavior in Indonesia in 2013 almost half (47%) of the population aged over 10 years said they had washed their hands with soap at the right time (National and Unicef, 2017). Hands contaminated with germs or pathogenic viruses enter the body through food sources. At least washing hands with soap can reduce the incidence of diarrhea by 50% per year (Ginting & Hastia, 2019). The emergence of diarrhea is due to environmental conditions and community behavior that are not mutually beneficial. During the rainy season, the incidence of diarrhea increases compared to the normal season because during the rainy season there can be flooding which causes a virus or bacteria that carries diarrhea to spread (Rimbawati & Surahman, 2019). Poor sanitation has a negative impact on various aspects of life such as decreasing the quality of the community's living environment, contamination of clean water sources and drinking water causes a high number of cases of diarrhea and several other diseases. If clean water is fulfilled, it will have a very good impact on society, such as reducing the impact of disease events caused by unclean water and other factors (Agustiar & Tamam, 2019). Wastewater drainage channels are important because wastewater can endanger human health and pollute the surrounding environment (Sidhi et al., 2016). Human feces disposal facilities or what are often referred to as latrines must be owned by every home and must always be maintained. The presence of latrines in every home aims to prevent pollution of the environment from various types of human waste and as a sign that no one defecates in random places. Household waste disposal facilities if not managed properly will become a breeding ground for disease-carrying animals. The habit of throwing garbage in random places risks causing various germs such as diarrhea.

Lidiawati's research results showed a relationship between the use of clean water, the use of toilets and waste disposal with the incidence of diarrhea in toddlers in the Meuraxa Health Center work area in 2016. Most of the people in Meuraxa sub-district still use well water, do not use toilets when defecating and there are open garbage dumps (Lidiawati, 2016). Dicky Firenza's research found a relationship between maternal knowledge and clean and healthy living behavior (PHBS) with the incidence of diarrhea in toddlers in Pusong Village, Lhokseumawe (Firenza et al., 2022). Makrayu Health Center is a Health

Center located in Ilir Barat II District, Palembang City. Most of the people in the Makrayu Health Center work area live on the banks of the Musi River with poor sanitation conditions and close and narrow distances between houses and alleys. Most people still use Musi River water for daily activities such as; washing, bathing, and people who use plunge toilets for defecation activities as well as waste disposal activities and washing wastewater that is dumped into the surrounding river. Based on this description, the researcher wants to examine the relationship between host behavior and the environment such as; processing, providing and serving food, hand washing habits, clean water sources, toilet quality, waste disposal facilities, SPAL with the incidence of diarrhea in toddlers in the work area of the Makrayu Health Center, Palembang City in 2022. The purpose of this study was to determine the relationship between host behavior and environmental sanitation with the incidence of diarrhea in the work area of the Makrayu Health Center, Palembang City in 2022.

2. Methods

This study is a type of research in the form of an observational analytical survey with a cross-sectional design. The study was conducted with momentary observations in a certain period of time and was conducted once during the study. In this study, the independent variables studied were host behavior (processing, provision, serving food and hand washing habits) and environmental sanitation (source of clean water, quality of toilets, waste disposal facilities and wastewater drainage) and the dependent variable to be studied was the incidence of diarrhea. Population is all subjects to be studied and meet the criteria and characteristics set by the researcher to be studied and then conclusions drawn. The population in this study were toddlers aged (12-59 months) who live in the Makrayu Health Center Working Area, Ilir Barat II District, Palembang City. The sample is the object studied and represented the entire population to be used in the study (Notoatmodjo, 2012). The sample in this study were mothers who had toddlers aged 12-59 months who lived in the Makrayu Health Center working area, Palembang City. The minimum sample size in this study was calculated using the Lameshow formula:

$$\mathrm{N} = \frac{z_{1-\frac{\alpha}{2}}\sqrt{2P(1-p)} \; + \; z_{1-\beta}\sqrt{\mathrm{P_1}(1-\mathrm{P_1}) + \mathrm{P_2}(1-\mathrm{P_2})}}{(\mathrm{P1}-\mathrm{P2})^2}$$

Description: N: Number of samples $z_{1-\frac{\alpha}{2}}$: Standard normal distribution value, the amount depends on the confidence level Ci 95% - 1.96, P: Average proportion ($\frac{P1+P2}{2}$), P1: Proportion of respondents at risk with toilet quality to diarrhea incidence, P2: Proportion of respondents not at risk with toilet quality to diarrhea incidence. In this study, the sample size P1 and P2 were taken from previous studies. The following are the calculation results after being entered into the statistical application:

Table 1. Results of calculations from previous research

Num	Variable	P1	P2	N	n(2)	Source
1.	Food processing, preparation and serving	0.20	0.83	9	18	(Kurniadi et al., 2013)
2.	Clean water source	0.75	0.31	19	38	(Okatini et al., 2007)
3.	Waste disposal facilities	0.01	0.52	14	24	(Prasetya, 2012)
4.	Hand washing habits	0.31	0.68	28	56	(Artika et al., 2017)
5.	Wastewater disposal facilities	0.76	0.23	13	26	(Sidhi et al., 2016)
6.	Toilet quality	0.67	0.32	31	62	(Mukhlasin & Solihudin, 2020)

The results of the sample study in Table 1 obtained the smallest sample calculation value of 9 and the largest sample calculation was clean water 31. The study used a sample size of two proportions with the number of samples multiplied by two from the sample calculation and obtained a sample size of 62. The number of samples to be taken was 62

respondents, to avoid drop out of the study, the sample was increased by 10% (6 respondents) to 68 respondents. The sample determination was carried out randomly based on inclusion criteria and exclusion criteria.

2.1 Inclusion, exclusion criteria, and sampling techniques

Inclusion criteria: Mothers who have toddlers aged (12-59 months) and are willing to be respondents. Residing in the working area of Makrayu Health Center. Exclusion criteria: Mothers who are not willing to be respondents. Mothers and toddlers who do not live in the working area of Makrayu Health Center. Mothers who have disabilities such as muteness and deafness. In this study, sampling was conducted using the calculation of two-way proportion hypothesis test according to Lameshow et al. (1997). The sampling technique in this study was carried out using simple random sampling. According to Sugiyono (2001:57) simple random sampling is a sampling method that is carried out randomly without considering the strata in the population. The sample consisted of 7 sub-districts, namely Kemang Manis, 27, 28, 29, 30, 32, and 35 Ilir, Ilir Barat II District, Palembang City. Sampling in each sub-district is as follows:

$$x = \frac{Population\ x}{Total\ population} \times Total\ sample$$

This study was conducted by selecting a household that has toddlers (12-59 months), then each group was randomly selected. Elwood in Najmah (2015) stated that there are 5 steps in selecting a sample for a study, including: Target population: the population where the research results will be applied. Source population: the population that is the source of research subjects. Eligible population: the population that meets the requirements and inclusion and exclusion criteria to participate in the study. Study entrants: subjects who participate in the study but do not participate until the end of the study. Study participants: subjects who participate until the end of the study.

Table 2. Sampling

Num	Ward	Number of Toddlers 12-59 Months	Sample Calculation	Number of Samples
1.	27 Ilir	240	240/5,655 × 68	3
2.	28 Ilir	208	208/5,655 × 68	2
3.	29 Ilir	716	716/5,655 × 68	9
4.	30 Ilir	1,722	1,722/5,655 × 68	21
5.	32 Ilir	1,150	1,150/5,655 × 68	14
6.	35 Ilir	1,021	1,021/5,655 × 68	12
7.	Sweet Mangosteen	598	598/4,595 × 68	7
8.	Total	5,655	-	68

2.2 Data types

Primary data is defined as data taken directly from the research object by the researcher himself or the organization (Riwidikdo, 2012). Primary data is obtained from the results of interviews with mothers who have toddlers using questionnaires and observation sheets. Secondary data is defined as data obtained indirectly from the research object. Researchers can take data from those that have been collected by other parties in various ways or methods, both commercially and non-commercially (Riwidikdo, 2012). Secondary data taken by researchers were obtained from the Makrayu Health Center, journals, library books, the Palembang City Health Office profile book, the South Sumatra Provincial Health Office, disease incidence data from the Health Center and internet media related to the research taken.

Primary data regarding respondent characteristic variable data were obtained based on interview results using data in the form of questionnaires. While for primary data

regarding environmental sanitation using observation sheets. Secondary data were obtained by taking data on diarrheal disease incidence at the Makrayu Health Center level, Ilir Barat II District, Palembang City along with other supporting data related to the research sourced from various books, journals, internet media, and health profile books from the Palembang City Health Office and the South Sumatra Provincial Health Office. Primary data collected using questionnaires include observations and questions regarding host behavior (food processing, provision, serving and hand washing habits) and environmental sanitation (clean water facilities, family toilets, waste water drainage, garbage disposal facilities).

2.3 Data processing, analysis, and presentation

According to Toasu & Azizah (2013), the method of data processing in research is divided into four steps, namely: Editing (Data Editing), activities are carried out to check and ensure that questions on the questionnaire have been answered completely, relevantly and consistently. Coding (Data Coding), activities are carried out to change data from letter or sentence form into numeric data (code). The purpose of providing codes is to make it easier to analyze closed data. Entry (Data Entry), the next stage after coding is to enter the data obtained into a computer program. Cleaning (Data Cleaning), if data from each data source or respondent has been entered, the data that has been input is rechecked to avoid the possibility of code errors, then corrections or corrections are made (Notoatmodjo, 2003).

Univariate analysis is conducted to describe the characteristics of each variable studied (Notoatmodjo, 2010). The form of data summary depends on the type of data. The numeric data size used is the average, maximum and minimum values. While the categorical data used is the frequency distribution or proportion of each variable studied, both independent and dependent variables. After conducting univariate analysis, the results will be known as the frequency distribution for each variable and can be continued to bivariate analysis. Bivariate analysis is conducted to determine the significant relationship between two variables, independent and dependent (Notoatmodjo, 2010). In this study, the dependent variable is the incidence of diarrhea and the independent variables are host behavior (processing, provision, serving food and hand washing habits) and environmental sanitation (clean water facilities, family toilets, wastewater drainage, garbage disposal facilities). So the test used to determine the relationship with this study is the chi-square test.

After conducting univariate analysis, the results will be known as the frequency distribution for each variable and can be continued to bivariate analysis. Bivariate analysis was conducted to determine the significant relationship between two variables, independent and dependent (Notoatmodjo, 2010). In this study, the dependent variable was the incidence of diarrhea and the independent variables were host behavior (food processing, provision, presentation and hand washing habits) and environmental sanitation (clean water facilities, family toilets, wastewater drainage, garbage disposal facilities). So the test used to determine the relationship with this study was the chi-square test.

The modeling steps are as follows: Conduct bivariate analysis on each independent variable with the dependent variable. If the bivariate test results have a p-value<0.25, then the variable is included in the multivariate model. Next, select variables that are considered significant to be included in the multivariate modeling, by maintaining variables with a p-value<0.05 and variables with a p-value>0.05 are removed. The variables that are removed are not simultaneously, but are carried out gradually starting from the variable with the largest p-value. Then look at the change in PR value before and after the variable is removed. If one of the variables has a change in PR value>10%, then the variable remains in the modeling. After obtaining a model consisting of important variables, the last step is to examine the possibility of interaction between variables in the model. If the interaction variable has a significant value (p-value<0.05), it means that the variables interact and remain in the modeling. The research data is presented in the form of univariate tables,

bivariate tables and multivariate tables with narratives containing explanations or interpretations of the data obtained descriptively.

3. Result and Discussion

3.1 Univariate analysis results

3.1.1 Distribution of diarrhea incidence in toddlers

The study was conducted in the Makrayu Health Center Working Area, Ilir Barat II District, Palembang, there were several limitations, namely because the research location tended to be criminal, so health workers from the health center and local cadres were needed to accompany them and observations were only carried out during the study. Therefore, the results obtained cannot describe the host's behavioral habits as a whole. The dependent variable in this study is the incidence of diarrhea in toddlers. The study was conducted using the following questionnaire:

Table 3. Distribution of the frequency of diarrhea incidents in toddlers in the Makrayu Health Center work area

Variable	n	%
Diarrhea Occurrence (Diarrhea)	21	30.9
Diarrhea Occurrence (No Diarrhea)	47	69.1

Based on Table 3, the results of the study in Kemang Manis, 27,28,29,30,32,35 Ilir sub-districts showed that 21 toddlers (30.9%) were exposed to diarrhea, while 47 (69.1%) toddlers were not exposed to diarrhea and the difference between them was 30.9%.

3.1.2 Frequency distribution of host behavior (food processing, preparation and serving and hand washing habits) and environmental sanitation (source of clean water, quality of toilets, waste water drainage and waste disposal facilities).

This study was conducted on 68 respondents who were mothers who had toddlers aged 12-59 months living in the working area of Makrayu Health Center, Palembang City. The results of the research data conducted on the variables of food processing, provision and presentation, habits of washing stairs, sources of clean water, quality of toilets, SPAL, and waste disposal facilities are as follows:

Table 4. Frequency distribution of host behavior and environmental sanitation

Variable	n	%
Food Processing, Preparation and Serving (Poor)	45	66.2
Food Processing, Preparation and Serving (Poor)	23	33.8
Bad Hand Washing Habits	46	67.6
Hand Washing Habits (Good)	22	32.4
Clean Water Source (Unprotected)	8	11.8
Clean Water Source (Protected)	60	88.2
Toilet Quality (Not Qualified)	20	29.4
Kualitas Jamban (Memenuhi Syarat)	48	70.6
Wastewater Drainage Channel (Not Qualified)	30	44.1
Wastewater Drainage Channel (Qualified)	38	55.9
Waste Disposal Facilities (Not Qualified)	49	72.1
Waste Disposal Facilities (Meet Requirements)	19	27.9

The results of the analysis conducted based on Table 4 show that the proportion of poor and good food processing, provision and serving has a difference of 32.4%, the proportion of poor and good hand washing habits has a difference of 35.2%, the proportion of qualified and unqualified clean water sources has a difference of 50%, the proportion of qualified and

unqualified toilet quality variables has a difference of 29.4%, the proportion of qualified and unqualified wastewater drainage variables has a difference of 11.8%, and the proportion of unqualified and qualified waste disposal facilities has a difference of 44.2%.

3.2 Bivariate analysis results

3.2.1 The relationship between food processing, preparation and presentation and the incidence of diarrhea in toddlers

Based on the objectives of the study to determine the relationship between food processing, provision and presentation, hand washing habits, clean water facilities, toilet quality, wastewater drainage channels, and garbage disposal facilities with the incidence of diarrhea in toddlers in the Makrayu Health Center Working Area of Palembang City. The results of the study were conducted using the chi-square statistical test. The results of the analysis of food processing, provision and serving with the incidence of diarrhea in toddlers in the Makrayu Health Center work area are as follows:

Table 5. Relationship between food processing, provision and presentation with the incidence of diarrhea in toddlers in the Makrayu Health Center work area.

Food Processing, Preparation and Serving	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Good	18	40.0	27	60.0	45	100	0.046	3.06
Good	3	13.0	20	87.0	23	100		1.00-9.34

The results of the analysis in Table 5 show that respondents with good food processing, provision and presentation and experienced diarrhea complaints were 13.0% while respondents with poor food processing, provision and presentation and experienced diarrhea complaints were 40%. Based on the Chi-Square test, the p-value is 0.046 ($p<0.05$), meaning that there is a relationship between food processing, provision and presentation with the incidence of diarrhea in toddlers. The results of the analysis show a PR value=3.067 (95% CI; 1.00-9.34) or PR>1 with an estimate ranging from 1.006 to 9.345, which means that poor food processing, provision and presentation increases the risk 3 times greater exposure to diarrhea compared to good food processing, provision and presentation.

3.2.2 The relationship between hand washing habits and the incidence of diarrhea in toddlers

The results of the analysis between the relationship between hand washing habits and the incidence of diarrhea in toddlers in the Makrayu Health Center work area are as follows:

Table 6. Relationship between hand washing habits and diarrhea incidence in toddlers

Hand Washing Habits	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Good	19	41.3	27	58.7	46	100	0.016	4.54
Good	2	9.1	20	90.9	22	100		1.16-17.80

The results of the analysis in Table 6 show that respondents with good hand washing habits and experiencing diarrhea complaints were 9.1% while respondents with poor hand washing habits and experiencing diarrhea complaints were 41.3%. Based on the Chi-Square test, the p-value is 0.016 ($p<0.05$), meaning that there is a relationship between hand washing habits and the incidence of diarrhea in toddlers. The results of the analysis show a PR value=4.543; 95% CI (1.160-17.801) or PR>1 with an estimated CI value ranging from 1.160 to 17.801, which means that poor hand washing habits are 4.5 times more at risk of being exposed to diarrhea compared to good hand washing habits.

3.2.3 The relationship between clean water sources and the incidence of diarrhea in toddlers

The results of the analysis of the relationship between clean water sources and the incidence of diarrhea in toddlers in the Makrayu Health Center Work Area of Palembang City are as follows:

Table 7. Relationship between clean water sources and diarrhea incidence in toddlers

Clean Water Source	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Protected	3	37.5	5	62.5	8	100	0.695	1.25
Good	18	30.0	42	70.0	60	100		0.47-3.31

The results of the analysis in Table 7 show that respondents who have unprotected clean water sources and experience diarrhea complaints are 37.5% while respondents who have protected clean water sources and experience diarrhea complaints are 30%. The results of the bivariate analysis with the Chi-Square test p-value 0.695 (p>0.05) means that there is no relationship between clean water sources and the incidence of diarrhea in toddlers.

3.2.4 The relationship between toilet quality and the incidence of diarrhea in toddlers

The results of the analysis of the relationship between toilet quality and the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City are as follows:

Table 8. Relationship between toilet quality and diarrhea incidence in toddlers

Clean Water Source	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Eligible	10	50	10	50	20	100	0.056	2.18
Qualify	11	22.9	37	77.1	48	100		1.10-4.33

The results of the analysis in Table 8 show that out of 20 respondents with inadequate toilet ownership, 10 toddlers (50%) experienced diarrhea. Meanwhile, out of 48 respondents with adequate toilet ownership, 11 toddlers (22.9%) experienced diarrhea. The results of the bivariate analysis conducted using the Chi-Square test showed a p-value of 0.056 (p>0.05), concluding that there was no relationship between toilet ownership and the incidence of diarrhea in toddlers.

3.2.5 The relationship between wastewater drainage channels (SPAL) and the incidence of diarrhea in toddlers

The results of the analysis of the relationship between wastewater drainage channels and the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City are as follows:

Table 9. Relationship between wastewater drainage and diarrhea incidence in toddlers

Clean Water Source	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Eligible	9	30.0	21	70.0	30	100	1.00	0.95
Qualify	12	31.6	26	68.4	38	100		0.46-1.95

The results of the analysis in Table 9 show that out of 30 respondents with wastewater drainage (SPAL) that does not meet the requirements, 9 toddlers (30%) experienced

diarrhea. Meanwhile, out of 38 respondents with wastewater drainage (SPAL) that meets the requirements, 12 toddlers (31.6%) experienced diarrhea. Based on the Chi-Square test, the p-value is 1.00 (p>0.05), meaning that there is no relationship between wastewater drainage and the incidence of diarrhea in toddlers.

3.2.6 The relationship between waste disposal facilities and the incidence of diarrhea in toddlers

The results of the analysis of the relationship between waste disposal facilities and the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City are as follows:

Table 10. Relationship between waste disposal facilities and diarrhea incidence in toddlers

Clean Water Source	Diarrhea Incident						*P Value*	PR 95% CI
	Diarrhea		No Diarrhea		Total			
	n	%	n	%	n	%		
Not Eligible	19	38.8	30	61.2	49	100	0.049	3.68
Qualify	2	10.5	17	89.5	19	100		0.94-14.31

The results of the analysis in Table 10 show that respondents who have waste disposal facilities that do not meet the requirements and experience diarrhea complaints are 38.8%, while respondents who have waste disposal facilities that meet the requirements and experience diarrhea complaints are 10.5%. Based on the Chi-Square test, the p-value is 0.049 (p<0.05), meaning that there is a relationship between waste disposal facilities and the incidence of diarrhea in toddlers. The results of the analysis show a PR value=3.684; 95% CI (0.94-14.31) or PR>1 with an estimated CI value of 0.948 to 14.314, which means that processing, waste disposal facilities that do not meet the requirements are at 3.7 times greater risk of being exposed to diarrhea compared to waste disposal facilities that meet the requirements.

3.3 Multivariate analysis results

3.3.1 Bivariate selection

The multivariate analysis conducted by the researcher aims to determine the independent variables that have the most influence on the dependent variable. The following are the stages of multivariate analysis of the multiple logistic regression test of the predictive factor model, namely: before conducting multivariate analysis, bivariate analysis is first conducted on each independent variable and dependent variable in order to determine the variables that will be used as candidates in multivariate analysis. If the bivariate test results with a probability value (p value)<0.25 then it cannot be included in the multivariate. However, if the p value>0.25 but is considered significant in substance and the variables can be included in multivariate modeling.

Table 11. Bivariate selection results

Variable	P-Value	Information
Processing, Serving, Providing Food	0.046	Enter Modeling
Hand Washing Habits	0.016	Enter Modeling
Clean Water Source	0.695	Not Into Modeling
Toilet Quality	0.056	Enter Modeling
Wastewater Drainage Channel (SPAL)	1.00	Not Into Modeling
Waste Disposal Facilities	0.049	Enter Modeling

Bivariate selection based on Table 11 that variables with p-value<0.25 are processing, serving, providing food, hand washing habits, toilet ownership, and waste disposal facilities. While clean water sources and wastewater drainage channels (SPAL) have p-values>0.25. It

can be concluded that the multivariate independent variables on diarrhea incidence are processing, serving, providing food, hand washing habits, toilet ownership and waste disposal facilities.

3.3.2 Multivariate modeling

The multivariate modeling stage carried out starts from the analysis of all independent variables, then variables with a p-value<0.05 are maintained by removing variables with a p-value>0.05. After the clean water source and wastewater drainage (SPAL) variables are removed, the following statistical calculation results are obtained:

Table 12. Multivariate modeling

Variable	P-Value	PR	(95%-CI)
Hand Washing Habits	0.012	8.53	1.61-45.20
Processing, Serving, Providing Food	0.131	3.15	0.71-13.98
Toilet Quality	0.158	2.55	0.69-9.41
Waste Disposal Facilities	0.080	4.50	0.83-24.24

The results of the analysis included in the multivariate selection based on Table 13, namely the variables of processing, serving, food provision, ownership of toilets and waste disposal facilities have a p-value>0.05, then these variables are removed from the multivariate modeling gradually starting from the variable with the highest p-value. The variable with the highest p-value is the quality of the toilet.

3.3.3 Removing the latrine quality variable

After the latrine quality variable is removed, the next step is to look at the change in PR value before and after the latrine quality variable is removed. If the change in PR value is>10%, then the variable is considered a confounding variable and remains in the multivariate modeling.

Table 13. Multivariate modeling without toilet quality variables

Variable	P-Value	PR (Initial)	PR (Final)	PR Changes
Hand Washing Habits	0.012	8.53	7.99	22.8%
Processing, Serving, Providing Food	0.068	3.15	3.87	6.25%
Waste Disposal Facilities	0.055	4.50	5.10	13%

Based on the calculation results in Table 13, the PR change value is obtained>10%, so the toilet quality variable is a confounding variable so that the variable is re-entered into the multivariate model. Furthermore, the variable with the second highest p-value is removed, namely food processing, provision and serving.

3.3.4 Removing the variables of processing, serving and providing food

After the variables of food processing, provision and serving are removed, the next step is to see the change in PR value before and after the variables of food processing, provision and serving are removed. If the change in PR value is>10% then the variable is considered a confounding variable and remains in the multivariate modeling.

Table 14. Multivariate modeling without food processing, serving and provision variables

Variable	P-Value	PR (Initial)	PR (Final)	PR Changes
Hand Washing Habits	0.010	8.531	8.680	1.75%
Processing, Serving, Providing Food	0.074	2.556	3.149	23%
Waste Disposal Facilities	0.046	4.501	5.426	20%

It is known based on Table 14 that the change in PR value is>10%, so the variables of food processing, provision and serving are confounding variables so that these variables are re-entered into the final multivariate model.

3.3.5 Final model

The results of the multivariate analysis after the modeling was completed were then used in the final model using multiple logistic regression tests as follows. The results of the multivariate analysis based on Table 4.13 show that there is one variable with a p-value of 0.012 (P<0.05), namely hand washing habits. The results of the analysis show that the hand washing habit variable is the most influential variable on the incidence of diarrhea in toddlers after being controlled by the variables of food processing, provision and presentation, toilet quality and waste disposal facilities.

Table 15. Final multivariate model

Variable	P-Value	PR	95%-CI (Lower)	95%-CI (Upper)
Hand Washing Habits	0.012	8.53	1.61	45.20
Processing, Serving, Providing Food	0.131	3.15	0.71	13.98
Toilet Quality Facilities	0.158	2.55	0.69	9.41
Waste Disposal	0.080	4.50	0.83	24.24

The prevalence ratio (PR) value of the hand washing habit variable is 8.531, which means that respondents with poor hand washing habits are at 8.5 times greater risk when compared to respondents with good hand washing habits. The interval in the belief in poor hand washing habits (95% CI; 1.610-45.204) which means that the general population is believed that 95% of toddlers experience diarrhea ranges from 1.6 to 45.2 when compared to good hand washing habits.

3.4 The relationship between food processing, preparation and presentation and the incidence of diarrhea in toddlers

Based on the results of the chi square test statistically shows a p-value=0.046 (p<0.05) H_o is rejected, meaning that there is a significant relationship between food processing, provision and presentation with the incidence of diarrhea in the working area of the Makrayu Health Center, Palembang City. The value of the test results shows a significant relationship between food processing, provision and presentation with the incidence of diarrhea in the working area of the Makrayu Health Center, Palembang City. These findings agree with Dewi & Patmawati (2019) who showed a p-value of 0.001<0.05, which means there is a relationship between food processing, provision and presentation with the incidence of diarrhea in toddlers in Anreapi District, Polewali Mandar Regency (Ratnasari et al., 2019) and research conducted by Vera et al., (2021) showed a p-value of 0.004<0.05, meaning there is a relationship between food presentation behavior and the incidence of diarrhea in the Pante Ceureumen Health Center Work Area, West Aceh Regency (Yunita et al., 2021). However, this study does not agree with Mitha Erlisya's research (2019) which showed no relationship between food processing and the incidence of diarrhea in toddlers in the Klangenan Health Center work area, Cirebon Regency (p-value 0.733>0.05) (Puspandhani, 2019).

Food is one of the most important things in life. The food consumed is not only nutritious, but also safe, meaning it does not contain microorganisms and disease-causing chemicals such as (radioactive substances, toxins, preservatives and dyes), worms and amoeba such as Salmonella and Shigella. Food processing, provision and serving are one of the factors that influence the incidence of diarrhea in toddlers in the work area of the Makrayu Health Center, Palembang City, because the processing time until the food is consumed by the community is more than four hours and the food served is not covered which can cause food to be contaminated by disease-carrying stars such as flies. Food

processing, provision and serving are very important to pay attention to in order to avoid contamination that causes health problems. Bacteria contaminated by dirt or dust and pathogenic microbes can cause food to be contaminated. According to the 2014 Minister of Health Regulation, food that has been served is no more than 4 (four) hours. If food is served more than 2 hours before consumption, it should be placed in a heater or refrigerator (cooler) (Hidayanti, 2012). Therefore, the presentation of food that is fit for consumption needs to pay attention to the method, place and principles when serving. Efforts that can be made by both the government and health workers are outreach to the community to increase public insight regarding the processing, provision and presentation of good food.

3.5 The relationship between hand washing habits and the incidence of diarrhea in toddlers

Based on the results of the chi square test statistically obtained a p value=0.016 ($p<0.05$) H_o is rejected, meaning that there is a significant relationship between poor hand washing habits and the incidence of diarrhea in the Makrayu Health Center work area of Palembang City. The results of the study agree with Okta with a p-value of 0.000<0.05 indicating a significant relationship between hand washing behavior and the incidence of diarrhea in toddlers (Pratiwi, 2019) and research conducted by Ali and Erma with a p-value of 0.000<0.05 meaning that there is a relationship between hand washing habits and the incidence of diarrhea in children (Rosidi et al., 2020). This study disagrees with the study conducted by Rahmi Hidayanti (2012) which showed a p value of 0.168>0.05, meaning there is no significant relationship between hand washing behavior and diarrhea in Cisarua, Cigudeg and Megamendung Districts, Bogor Regency (Hidayanti, 2012). A study based on Bradley, American researchers and the Infectious Disease Society of America said that long nails measuring more than three millimeters beyond the fingertips store bacteria that can harm the body. Clean nails must always be maintained so as not to become a nest for diseases transmitted by disease-causing germs (Bradley et al., 2011).

Hand washing behavior is said to be successful if it has become a habit and adequate facilities and infrastructure such as the availability of clean water and soap are very necessary. Based on the Indonesian Ministry of Health, proper hand washing is done with soap and running water. The running water in question can be water from a container such as a bottle, can, large bucket, barrel, jerry can. Hand washing can be done by applying soap to the palms of the hands and then rubbing it until it reaches the fingers and back of the hands for at least 20 seconds. Then rinse with running water and dry. The habit of washing hands is the most influential factor in the occurrence of diarrhea in toddlers in the work area of the Makrayu Health Center in Palembang City, because there are still many people who do not wash their hands properly, some only use water without using soap. Washing hands with soap and clean running water is more effective in cleaning dirt that sticks to nails, finger joints and skin. By washing hands with soap we can avoid various bacteria and viruses that can interfere with the health of the body. Washing hands has become a basic action in clean and healthy living behavior, therefore, the habit of washing hands with soap and clean water must be practiced from an early age in order to avoid various diseases. Efforts that can be made by health workers can be in the form of socialization to the community regarding the correct way to wash hands using soap.

3.6 The relationship between clean water sources and the incidence of diarrhea in toddlers

Based on the results of the chi square test statistically obtained a p-value=0695 ($p<0.05$) H_o is accepted, meaning there is no relationship between clean water sources and the incidence of diarrhea in the work area of the Makrayu Health Center, Palembang City in 2022. The results of this study agree with the findings of Samiyati et al., (2019) showing a p-value of 0.060, meaning there is no relationship between water sources and the incidence of diarrhea in toddlers in the work area of the Karanganyar Health Center, Pekalongan Regency (Samiyati et al., 2019) and research conducted by Fatmawati & Indrawati (2017) showed a p-value of 0.907, meaning there is no significant relationship between the use of

clean water and the incidence of diarrhea in toddlers (Fatmawati & Indrawati, 2017). The results of this study do not agree with the findings of Nurwinda and Yuni (2019) which showed a p value of 0.019, meaning that there is a relationship between the main source of water and the incidence of diarrhea in toddlers in the Bernung Health Center area, Gedong Tataan District, Pesawaran Regency (Saputri, 2019).

Based on the description above, in this study, the source of clean water is not a risk factor for causing diarrhea. Most people use clean water from PDAM, but there are still people who use river water for bathing and washing (clothes and cutlery). The Indonesian Ministry of Health (2016) stated that access and use of a clean water comes from PDAM, pump wells, dug wells and protected springs (Aolina et al., 2020). Poor physical quality of water causes germs that cause diseases such as salmonella shigella, E. coli. As with diseases that can be transmitted through water are cholera, diarrhea, skin diseases and other diseases. Unprotected clean water sources can cause a high risk of diarrhea. Therefore, the community is expected to be able to a maintain the quality and quantity of protected clean water sources for daily needs.

3.7 The relationship between toilet quality and the incidence of diarrhea in toddlers

Based on the chi square test, statistically the p-value=0.56 ($p<0.05$) H_o is accepted, meaning that there is no relationship between the quality of toilets and the incidence of diarrhea in the work area of the Makrayu Health Center, Palembang City in 2022. These findings agree with research conducted by Yantu et al., (2021) showing that the p-value is 0.606>0.05, meaning that there is no significant relationship between the condition of family toilets and the incidence of diarrhea in toddlers in Waleure Village (Yantu et al., 2021) and research conducted by Luthfi showed a p-value of 0.417, meaning that there is no relationship between healthy toilets and diarrhea complaints in toddlers (Rofiana, 2017). The results of the study did not agree with the findings of Azmi, et al. (2018) who had a p value of 0.000<0.05 that there was a relationship between toilet ownership and the incidence of diarrhea in toddlers in the Bambaira Health Center work area, Pasangkayu Regency (Azmi et al., 2018).

In this study, toilet quality was not a risk factor for diarrhea. Based on field observations, most people already have private toilets and only a small number of people use shared toilets. The results of interview data that have been carried out are the habits of parents who still dispose of toddler feces in places that do not meet the requirements, such as diapers that are thrown in the trash and sometimes only cleaned on the toilet floor. The cleanliness of toilets in the Makrayu Health Center work area community is mostly clean and free from vectors such as flies and cockroaches. However, some of them still have toilet walls with bricks that allow the transmission of microorganisms to easily enter through holes in the walls. Feces or feces that are disposed of in random places can cause diseases caused by viruses or bacteria. Feces or stools that are swarmed by flies and land on food or drinks, therefore the food and drinks are contaminated by viruses or bacteria that can transmit diseases. Therefore, it is expected that the surrounding community can always maintain the cleanliness of the toilet at all times, so that it does not become a breeding ground for disease-causing animals and reduce the incidence of diarrhea.

3.8 The relationship between wastewater drainage and the incidence of diarrhea in toddlers

Based on the chi square test statistically obtained a p-value=1.00 ($p<0.05$) H_o is accepted, meaning there is no relationship between SPAL and the incidence of diarrhea in the work area of the Makrayu Health Center, Palembang City in 2022. The results of this study are in line with the research conducted by Miswan et al. (2018) with a p-value of 0.637>0.05 indicating that there is no significant relationship between SPAL and the incidence of diarrhea (Miswan et al., 2018) and research conducted by Menik et al. (2019) has a p-value of 1.00 meaning there is no relationship between wastewater drainage channels and the incidence of diarrhea in toddlers in the work area of the Karanganyar

Health Center, Pekalongan Regency (Samiyati et al., 2019). While this study is not in line with the study conducted by Henny & Nababan, (2020) showed a p value of 0.015<0.05 that there is a relationship between wastewater drainage channels and diarrhea (Bangun & Nababan, 2020).

In this study, SPAL is not a risk factor for diarrhea. The results of an observation that has been carried out are that most people have closed wastewater drainage channels so that they do not cause odors and vectors such as flies so that they can minimize the incidence of diarrhea, but a small number of people still have open wastewater drainage channels that cause odors and become a breeding ground for disease-carrying animals. Therefore, when building wastewater drainage channels, it is expected to comply with health standards, namely remaining in a closed condition but the cover is not permanent so that it can be routinely cleaned and monitored. The government can work with all stakeholders starting from planning to evaluation to the community and provide support and guidance (Ikhwan, 2016).

3.9 The relationship between waste disposal facilities and the incidence of diarrhea in toddlers

Based on the results of the chi square test, statistically the p-value=0.049 (p<0.05) H_o is rejected, meaning that there is a significant relationship between waste disposal facilities that do not meet the requirements and the incidence of diarrhea in the work area of the Makrayu Health Center, Palembang City in 2022. The results of the study agree with the findings of Nurhaedah (2019) showing a significant relationship between waste processing and the incidence of diarrhea (p-value 0.049<0.05) (Nurhaedah, 2019) and the findings of Luthfi (2017) there is a relationship between waste disposal facilities and complaints of diarrhea in toddlers (p-value 0.038) (Rofiana, 2017) based on the results of observations carried out, uncovered trash cans can be a breeding ground for vectors. The results of the study did not agree with the findings of Fenita et al., (2021) that there was no relationship between waste management and the incidence of diarrhea in toddlers in Keranggan Village, Setu District, South Tangerang City (p-value 1.00>0.05) (Indah et al., 2021).

From the results of observations conducted by researchers, household trash cans are usually located in the kitchen to dispose of unused items. Some respondents have trash cans with lids and some do not have lids. Waste disposal facilities must meet requirements such as: closed, not leaking, not becoming a nest for insects and not becoming a breeding ground for disease-causing vectors. When disease-causing animals (flies) land on open trash cans and then land on food and drinks, the food and drinks have been contaminated and can potentially cause diarrhea. In order to avoid contamination by disease-causing animals, efforts to provide closed and waterproof trash cans and socialization increase general knowledge about good waste disposal facilities.

3.10 Multivariate analysis of variables influencing diarrhea

Washing hands with soap (CPTS) is an important way and habit to clean hands from dirt such as bacteria that cause dangerous diseases. Washing hands using antiseptic soap, clean water, a clean cloth or towel is a good way to wash hands (Italia et al., 2016). Washing hands using water alone without soap is not enough to remove germs, oil/dirt/fat on the skin but also provides fragrance. The results of the final multivariate model analysis with multiple logistic regression tests showed that the most dominant variable influencing the incidence of diarrhea in toddlers was the habit of washing hands after being controlled by the clean water variable. The hand washing habit variable has a p-value=0.015 (<0.05) and a PR value=7.037, meaning that poor hand washing habits are 7 times more at risk of suffering from diarrhea compared to good hand washing habits after being controlled with clean water. Hand washing habit interval (95% CI; 1.468-33.742), meaning the general population is believed to have 95% poor hand washing habits and diarrhea incidence ranges from 1.5 to 33.8 times when compared to good hand washing habits.

Hand washing activities are activities aimed at cleaning the palms, backs of the hands and fingers from germs and bacteria that cause diseases that can be detrimental to health. The habit of washing hands using soap is the most effective health action to reduce the risk of transmission of various diseases such as diarrhea and other diseases. Most people who live in the Makrayu Health Center work area have a habit of washing their hands using only water without using soap. Public knowledge about CTPS is quite high but the implementation carried out by the community is still lacking. The lack of implementation and practice is the cause of diarrhea because hands contain germs and are not clean. The implementation of CPTS has been going on for a long time, but the community that practices it is still low, therefore CPTS promotion efforts must continue to be carried out to increase public awareness of the importance of washing hands using soap. Therefore, it is important for mothers to increase their knowledge by reading through mass media and internet media about how important it is to wash hands using soap in order to minimize the incidence of diarrhea by washing hands using soap properly and correctly which can trigger diarrhea in toddlers.

4. Conclusion

The conclusion of the research results conducted on 68 respondents in the working area of the Makrayu Health Center in Palembang City in 2022 is as follows: The frequency of toddlers exposed to a diarrhea and those without diarrhea in the Makrayu Health Center working area has a percentage difference of 30.9%. The frequency of host behavior (processing, providing and serving food that is not good and good has a difference of 32.4% and bad and good hand washing habits have a difference of 35.2%) and environmental sanitation (protected and unprotected clean water sources have a difference of 50%, the quality of toilets that meet requirements and do not meet requirements has a difference of 29.4%, SPAL that meets requirements and does not meet requirements has a difference of 11.8%, waste disposal facilities that do not meet requirements and do meet a requirements have a difference of 44.2%). There is a relationship between food processing, provision and serving with the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center in Palembang City (p-value=0.046).

There is a relationship between hand washing habits and the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City (p-value=0.016). There is no relationship between clean water sources and the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City (p-value=0.695). There is no relationship between toilet quality and the incidence of diarrhea in toddlers in the Working Area of the Makrayu Health Center (p-value=0.056). There is no relationship between wastewater drainage channels (SPAL) and the incidence of diarrhea in toddlers in the Working Area of the Makrayu Health Center, Palembang City (p-value=1.000). There is a relationship between waste disposal facilities and the incidence of diarrhea in the Working Area of the Makrayu Health Center, Palembang City (p-value=0.049). The factor that most influences the incidence of diarrhea in toddlers in the working area of the Makrayu Health Center, Palembang City is the habit of washing hands with a p-value=0.012 (<0.05) and PR=8.531.

Acknowledgement

The author express their gratitude to the reviewers for their valuable and constructive feedback on this article.

Author Contribution

The author contributed equalily to the conceptualization, methodology, analysis, and writing of this review. The authors collaboratively reviewed and approved the final manuscript for submission.

Funding
This research did not use external funding.

Ethical Review Board Statement
Not available.

Informed Consent Statement
Not available.

Data Availability Statement
Not available.

Conflicts of Interest
The author declare no conflict of interest.

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