DIARRHEA PREDICTION MODEL OF CHILDREN UNDER FIVE BASED ON SANITATION MEANS

Erlani[1] ✉ ⓘD , Sulasmi[1] ⓘD, Fajar Akbar[2] ⓘD, Mulyadi[1] ⓘD , Haderiah[1] ⓘD , Zrimurti Mappau[2] ⓘD
[1]Environmental Health Department, Health Polytechnic of Makassar
[2]Environmental Health Department, Health Polytechnic of Mamuju

ARTICLE INFO

ABSTRACT

The Lamuru Health Center area has the highest number of diarrhea sufferers and is included in the top 10 most common diseases. The sanitation conditions of the house still need to be improved, as well as health requirements, such as clean water facilities, wastewater, family toilets, and waste management. The study aims to determine the prediction model of diarrhea in children under 5 years of age based on sanitation facilities in the village of Massenreng Pulu, Lamuru district, Bone Regency. This type of research is analytical and observational. The population in the study were all housewives who had toddlers in Massenreng Pulu Village, Lamuru District, Bone Regency, totaling 120 people. The study sample was mothers with toddlers as respondents, totaling 120 people, using the selection method selected by total sampling—data analysis with logistic regression test. The results show that there are three insignificant variables: clean water facilities (p-value= 0.500 (OR=0,652), toilet facilities p-value=0.808 (OR=0,895), and waste disposal facilities p-value= 0.922 (OR=0,928), meaning that the three variables do not affect the incidence of diarrhea toddlers. While the variable wastewater disposal facilities are significant, with a p-value=0.004 (OR=3,320), there is an influence on the incidence of diarrhea. This study concludes that clean water, toilets, and waste disposal facilities do not affect the incidence of diarrhea, so they cannot be included in the prediction model. Meanwhile, the variable sewerage facilities can enter predictive models with the incidence of diarrhea. There is a possibility of diarrhea occurring if the recommended wastewater conditions do not meet the requirements. It should make wastewater drainage channels that meet the requirements through government programs and with the help of local communities so that the sewerage is made permanently, waterproof, closed, and not humid.

ABSTRAK

Kata Kunci:

Model prediksi;
Fasilitas sanitasi;
Diare

Wilayah Puskesmas Lamuru merupakan salah satu wilayah dengan jumlah penderita diare terbanyak dan masuk dalam 10 besar penyakit terbanyak. Kondisi sanitasi rumah masih kurang memenuhi syarat kesehatan, misalnya sarana air bersih, air limbah, jamban keluarga, dan pengelolaan sampah. Tujuan penelitian adalah untuk mengetahui model prediksi kejadian diare pada anak dibawah 5 tahun berdasarkan sarana sanitasi di Desa Massenreng Pulu Kecamatan Lamuru Kabupaten Bone. Jenis penelitian ini merupakan observasional analitik. Populasi dalam penelitian adalah seluruh ibu rumah tangga yang memiliki balita di Desa Massenreng Pulu Kecamatan Lamuru Kabupaten Bone yang berjumlah 120 orang. Sampel dalam penelitian adalah ibu yang memiliki balita sebagai responden berjumlah 120 orang dengan metode pemilihan dipilih secara total sampling. Analisis data dengan uji regresi logistik. Hasil penelitian menunjukkan bahwa terdapat tiga variabel yang tidak signifikan yaitu fasilitas air bersih *p-value*=0,500 (OR=0,652), fasilitas toilet *p-value* = 0,808 (OR=0,895) , dan fasilitas pembuangan sampah *p-value*=0,922 (OR=0,928), artinya ketiga variabel tersebut tidak berpengaruh terhadap kejadian diare balita.Sedangkan variabel sarana pembuangan air limbah signifikan dengan *p-value*=0,004 (OR=3,320), sehingga terdapat pengaruh terhadap kejadian diare. Kesimpulan dalam penelitian ini adalah sarana air bersih, sarana MCK, dan sarana pembuangan sampah tidak berpengaruh terhadap kejadian diare, sehingga tidak dapat dimasukkan dalam model prediksi kejadian diare. Sedangkan variabel fasilitas saluran air limbah dapat masuk model prediksi dengan kejadian diare. Peluang dapat terjadinya diare dengan kondisi air limbah yang direkomendasikan tidak memenuhi syarat. Sebaiknya dibuat saluran pembuangan air limbah yang memenuhi persyaratan baik melalui program

✉ *Corresponding Author:*

Erlani
Hp. 081342910052
Email: erlanirappe66@gmail.com

INTRODUCTION

In Indonesia, one of the most common public health problems is diarrhea. Around 75% of the primary health indicators collected in 2007, 2013, and 2018 were re-measured in 2023; from the Indonesian health survey data results, diarrhea in toddlers, both by characteristics and by province, is still relatively high. In total, the prevalence of diarrhea cases was 86,364 cases (Kemenkes, 2023). The leading cause of death due to diarrhea is improper management both in health facilities and in the household. Quick and appropriate management needs to be done to reduce deaths from diarrhea (Zamrudin Hi, Rahim A, Pinontoan R.O, 2016).

Environmental factors are significant in the interaction between host and agent factors. The residential environment (home) is a basic need, a place to shelter from other living things, and also a place to shelter from climate disturbances (Departemen Kesehatan RI, 2000). The environment and construction of houses that do not meet health requirements can be a risk factor for disease transmission, especially in environmental-based diseases (Departemen Kesehatan RI, 2000).

The high incidence of diarrhea is strongly supported by the state of the environment in which they live (home). Environmental sanitation is an effort to maintain environmental cleanliness in poor conditions by properly handling waste disposal, maintaining housing cleanliness, providing clean water, and so on. Environmental sanitation aims to create a healthy and comfortable environment. Efforts in basic sanitation include human waste disposal facilities, waste disposal facilities, wastewater disposal systems, and clean water provision (Azwar, 1996). A toilet disposes of human waste that every family needs and is always maintained to be clean and healthy (Soeparman, 2002). This is done so that human waste does not pollute the environment, as a form of the family's effort not to defecate carelessly. Every human being produces waste; essential sanitation efforts are needed to provide waste disposal facilities. Basic sanitation and bacteriological quality of clean water that meets the requirements are essential to maintain a good and safe quality of life for every family. If clean water quality in terms of sanitation and bacteriology is poor, it will cause people in the environment to easily contract diseases. One thing that can happen is diarrhea (Chandra, 2007).

Lamuru Health Center is a health center with many sufferers whose diarrhea has consistently increased. Based on a preliminary survey in the Lamuru Health Center area conducted by the researchers as the target area of the study, it was found that the sanitation conditions of houses were still inadequate; many still used wells as a source of drinking water that did not meet the requirements. The condition of the family toilets did not meet the requirements. Most residents had open wastewater disposal sites that could cause pollution of water sources, odors, and stagnant water. Wastewater just flowed so that it could invite vectors that could cause diarrhea.

METHOD

Type of Research

This research is an analytical observational study with a cross-sectional approach. The epidemiological study design studies the condition of environmental sanitation facilities about the incidence of diarrhea.

Place and Time of Research

This research was conducted in Massenreng Pulu Village, Lamuru District, Bone Regency. The implementation of research activities took place in May – November 2018.

Population and Sample

The study's population consisted of 120 housewives with children under 5 years of age in Massenreng Pulu Village, Lamuru District, Bone Regency. The sample consisted of mothers of children under 5 years of age, with 120 respondents selected by total sampling.

Data collection

Data collection was carried out using questionnaires, interviews, and observations. The type of questionnaire used was a closed questionnaire so that respondents could choose the answers provided by the researcher. Observations were conducted using observation sheets, which were conducted directly by the research team assisted by students.

Data Analysis and Processing

The data has been presented as tables of manual data processing results using computerization, distribution tables, and relationship analysis tables accompanied by explanations. Data analysis was carried out using logistic regression tests of the Statistical Package for the Social Sciences (SPSS) software program. The independent variables analyzed in the prediction model are Clean water, Toilet facilities, wastewater disposal, and Waste disposal, while the dependent variable is diarrhea in toddlers.

RESULT

The research was conducted in Massenreng Pulu village, Lamuru district, Bone regency, South Sulawesi Province, Indonesia, using questionnaires and observations of sanitation facilities on 120 respondents who had children under 5 years of age. Research data has been presented in several tables as follows.

Table 1. Distribution of Respondents Based on the Occurrence of Diarrhea in Children Under 5 Years in Massenreng Pulu Village, Lamuru district, Bone Regency (n= 120)

Incidence of Diarrhea	f	%
Diarrhea	83	69,17
No diarrhea	37	30,84
Total	120	100,01

Source: Primary data

Table 1 shows that of the 120 respondents, 83 (69.17%) have children under 5 years of age who suffer from diarrhea, and 37 (69.0%) have toddlers who do not.

Table 2. Distribution of Respondents Based on Ownership of Clean Water Facilities, Family Toilet Facilities, Wastewater Disposal Facilities, Waste Disposal Facilities (n= 120)

Variables	Sanitary conditions	f	%
Clean water	Eligible	106	88,3
	Not eligible	14	11,7
Toilet facilities	Eligible	84	70
	Not eligible	36	30
Wastewater disposal	Eligible	57	47,5
	Not eligible	63	52,5
Waste disposal	Eligible	9	7,5
	Not eligible	111	92,5

Source: Primary data

Based on the presentation in Table 2, it can be seen that as many as 14 people, or 11.7% of the total respondents, use clean water facilities that do not meet health requirements. Respondents with family toilet facilities that do not meet the criteria are 30% of the total respondents, and respondents who have wastewater disposal facilities that do not meet the requirements are 52.5% of the total respondents and 92.5% of respondents who have waste disposal facilities that do not meet the criteria from a total of 120 respondents.

Table 3. Multivariate test results for variables clean water facilities, family toilet facilities, wastewater disposal facilities, and waste disposal facilities (n= 120)

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Clean water facilities	-,427	,634	,454	1	,500	,652	,188	2,261
Toilet facilities	-,111	,427	,059	1	,808	,895	,366	2,191
Wastewater disposal facilities	1,247	,446	8,525	1	,004	3,481	1,507	8,040
Waste disposal facilities	-,075	,770	,010	1	,922	,928	,205	4,195

Variable(s) entered on step 1: Clean Water Facilities, Family Toilet Facilities,
Wastewater disposal facilities, Waste disposal facilities.

Table 3, which is the first multivariate modeling, shows that the obtained odd ratio (OR) value in the ownership of clean water facilities is 0.652 CI 95% = 0.188 <OR <2.261 Children using facilities that do not meet clean water standards have an OR of 0.652, indicating a reduced likelihood of diarrhea compared to those using facilities that do meet the standards. The OR value in ownership of family toilet facilities is 0.895 CI 95% = 0.366 <OR <2.191, meaning the risk of diarrhea in children under 5 years of age with unqualified family toilet ownership is 0.895 times greater than those with qualified family toilets, and OR value in the waste disposal facility is 0.928 CI 95% = 0, 205 <OR <4.195, meaning the risk of diarrhea in children under 5 years of age with ownership of waste disposal facilities that do not meet the requirements 0.928 times greater than the waste disposal facilities that meet the requirements.

Table 4. Results of modeling of wastewater disposal facilities with the occurrence of diarrhea in children under 5 years of age in Massenreng Pulu village

variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Waste water disposal facilities	1,200	,417	8,268	1	,004*	3,320	1,465	7,524

*Sig : 0,004

Table 4 above shows the results of the second multivariate modeling, variable wastewater disposal facilities Wald value (8.268) with Sig = 0.004. Thus, the variable wastewater disposal is the most dominant factor influencing the incidence of diarrhea in toddlers in the village of Massenreng Pulu,

Lamuru Subdistrict, Bone Regency. The analysis results also obtain the value of the odds ratio (OR) on the ownership of wastewater facilities is 3,320 CI 95% = 1,465 <OR <7,524, meaning the risk of diarrhea in children under 5 years of age with ownership of wastewater facilities that do not meet the requirements of 3,320 times greater than the wastewater facilities that meet the requirements.

According to the results of the regression analysis, the correlation between the variables of ownership of clean water facilities, family toilet facilities, wastewater disposal facilities, and garbage disposal facilities to the incidence of diarrhea (compound correlation) with the Chi-Square technique obtained a Chi-Square value of 9.318 with a Sig value of 0.054> 0.05, meaning that together the variables of ownership of clean water facilities, family toilet facilities, wastewater disposal facilities, and garbage disposal facilities are not related to the incidence of diarrhea. Furthermore, the logistic regression determinant coefficient is 0.105, so the contribution of the variables of ownership of clean water facilities, family toilet facilities, wastewater disposal facilities, and garbage disposal facilities to the incidence of diarrhea is only 10.5%. However, the test results also show that the prediction accuracy in this study is 68.3% of these variables affecting the incidence of diarrhea.

Mathematical prediction model for the incidence of diarrhea in children under 5 years of age

From the results of the multivariate analysis in Table 3, a mathematical prediction model for the incidence of diarrhea in children under 5 years of age can be prepared using the derivative formula from the general logistic regression formula as follows;

$$\ln (P/(1-P)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ...$$

Where;
P = Probability of event
X1,X2,X3 = Value of independent variables
β = Estimate coefficient

Probability of diarrhea incidents in children under 5 years of age in MassenrengPulu village

The probability of diarrhea in children under 5 years old using a prediction model from the derivative of the general logistic regression formula with predictor variables whose conditions do not meet the standard requirements. The coefficient values and regression weights from the logistic analysis results are substituted into the derivative formula with the prediction calculation for each independent variable as follows ;

$$P = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ...)}}$$

The probability of diarrhea occurring is caused by the condition of wastewater disposal facilities

$$\ln \frac{p}{1-p} = -1,447 + 1,200 * (\text{Waste water disposal facilities})$$

$$P = \frac{1}{1 + e^{-(-1,447 + 1,200)}}$$

$$P = \frac{1}{2,2801791}$$

P = 0,438

Thus, if a child under 5 years of age interacts with wastewater disposal facilities that do not meet the requirements, the probability of contracting diarrhea is 43.8%.

The probability of diarrhea occurring is due to the condition of clean water facilities

The probability of diarrhea occurring in children under 5 years of age from the prediction model with clean water facilities that do not meet standard requirements is;

$$ln \frac{p}{1-p} = -1,013 + (-0,427) \text{ (clean water facilities)}$$

$$P = \frac{1}{1 + e^{-(-1,013 - 0,427)}}$$

$$P = \frac{1}{5,2206958}$$

$$P = 0,191$$

If a child under five interacts with clean water facilities that do not meet the requirements, the probability of contracting diarrhea is 19.1%.

The probability of diarrhea occurring is caused by the condition of the family's toilet facilities

The probability of diarrhea occurring in children under 5 years of age after constructing a prediction model with toilet facilities that do not meet the requirements is;

$$ln \frac{p}{1-p} = -1,013 + (-0,111) \text{ (family toilet facilities)}$$

$$P = \frac{1}{1 + e^{-(-1,013 - 0,111)}}$$

$$P = \frac{1}{4,077138}$$

$$P = 0,245$$

If a child under 5 years of age interacts with toilet facilities that do not meet the requirements, the probability of contracting diarrhea is 24.5%.

The probability of diarrhea occurring is caused by the condition of waste disposal facilities.

The probability of diarrhea occurring in children under 5 years of age after preparing the prediction model with the condition of waste disposal facilities that do not meet the requirements is;

$$ln \frac{p}{1-p} = -1,013 + (-0,075) \text{ (waste disposal facilities)}$$

$$P = \frac{1}{1 + e^{-(-1,013 - 0,075)}}$$

$$P = \frac{1}{3,96833146}$$

P = 0,252

Thus, if children under 5 years of age interact with waste disposal facilities that do not meet the requirements, the probability of contracting diarrhea is 25.2%.

DISCUSSION

The incidence of diarrhea in a community is an indicator of the state of health status in a community related to the implementation of the health system at the community level, which certainly does not meet health requirements. Diarrhea can affect anyone; therefore, it is hoped that the community will pay attention to health problems by controlling risk factors that are not only for themselves but also pay attention to the condition of the family and the surrounding environment. Diarrhea is indeed an old disease, but from year to year, diarrhea sufferers are always there, and amounts that are not small, even if this is left alone, can result in death.

Below, we have interpreted the diarrhea prediction model based on respondents' ownership of sanitation facilities;

The influence of ownership factors of clean water facilities on the incidence of diarrhea

One sanitation facility that is not less important in the incidence of diarrhea is the primary source of drinking water. Some infectious germs are transmitted through the oral-fecal pathway, which causes diarrhea. Liquids or objects contaminated with feces and mouths can be transmitted, such as from fingers, drinking water, and food prepared in pots that have been washed with polluted water (Departemen Kesehatan RI, 2000).

The results show that the availability of clean water facilities that do not meet the requirements impacts diarrhea in infants because in the well-water dug wells, some wells experience cracking around the well, the lip of the well does not meet construction standards, and around the well, there is a pool of water to allow water to seep into the well. Thus, the well water is then used by respondents for their daily water needs.

Based on the data obtained that respondents have a means of providing clean water does not meet the requirements but not diarrhea; this happens because although the supply of clean water consumed does not meet the requirements for drinking purposes, respondents first boil the water to boil and most of the respondents always cook in the container and storage of water for drinking purposes is closed so that it is less likely to be contaminated with bacteria that cause diarrhea. Besides that, some respondents have clean water supply facilities that meet the standards but experience diarrhea. It can happen because there are respondents still cooking in a container and storing water for open drinking purposes. There is also a toilet with a clean water source of fewer than 10 meters, so it is likely to be contaminated with bacteria that cause diarrhea. The results of different studies obtain a ρ value between the condition of clean water facilities and the incidence of diarrhea of 0.001, which indicates that the condition of clean water facilities is related to the incidence of diarrhea (Yantu et al., 2021) (Hafizah, 2024).

According to the logistic regression analysis results, Sig = 0.493> 0.05 means no influence between clean water facilities and the incidence of diarrhea in infants. The results are in line with the research (Irwan Amar, 2022); the p-value of 0.374 is more significant than α 0.05, which means there is no relationship between the use of clean water and the occurrence of diarrhea disease. Likewise, the results of the study (Rau & Novita, 2021) show that there is no influence between the type of clean water facilities (sig value = 0.367) and the incidence of diarrhea in toddlers.

Most of the respondents whose toddlers have experienced diarrhea are not only because they do not use clean water that does not meet standard requirements, but other factors are also triggers. As for

the clean water used by the toddler's parents, which has come from dug wells that do not meet construction requirements and are not protected or maintained for cleanliness, this could be a potential for contamination by pathogenic bacteria that cause diarrhea. Water whose quality does not meet physical, chemical, and bacteriological requirements without treatment can have adverse effects and impacts in the form of diseases for people who use or drink it.

It is known that water is a basic need that must be met for drinking, bathing, and washing. A healthy home must be supported by clean water in sufficient quantities. The human need for water every day is at least 1.5-2 liters because if humans lack water, it will cause death (Soemirat, 2018). Unclean water can cause various diseases because it can be a place for bacteria to grow. Getting good water, according to certain standards, is currently an expensive commodity because water has been polluted by various kinds of waste from human activities, both waste from household activities, waste from industrial activities, and other activities (Wardhana, 2004).

The influence of facility factors for wastewater disposal on the incidence of diarrhea

The condition of wastewater disposal that do not meet the requirements can have impacts such as becoming a breeding ground for disease vectors, causing unpleasant odors from an aesthetic perspective, creating an unfavorable view for the family or other communities, and causing diseases such as diarrhea (Junias, M., & Balelay, 2008) Communities that dispose of wastewater directly from their households without going through sewers that meet health requirements so that the wastewater can pollute the soil and can be a medium for disease transmission. Risk factors that significantly influence the incidence of diarrhea are environmental factors, exposure to information, and family income level (Hafizah, 2024)(Getachew et al., 2018).

Based on the results of the logistic regression test, the prediction of variable wastewater disposal facilities for diarrhea in this study is 68.3%, and a significant 0.004 <0.05 means that there is an influence on the occurrence of diarrhea in the family members (children under 5 years of age) of respondents. These results are in line with research conducted by (Soeparman, 2002), which shows that sewerage has a relationship with the incidence of diarrhea in infants in the Work Area of Banggai Health Center, Banggai Laut Regency. Furthermore, the analysis results have also obtained the odds ratio (OR) value in the ownership of wastewater facilities is 3,320 CI 95% = 1,465 <OR <7,524, meaning the risk of diarrhea in children under 5 years of age with ownership of wastewater facilities that do not meet the requirements 3,320 times greater compared to wastewater facilities that meet the requirements. This study is also in line with the results of research (Azizah, 2013), which show that the means of disposal of wastewater significantly affects the incidence of diarrhea in children under 5 years of age. Likewise, the research (Muh.Saleh, 2014) shows a relationship between sewerage and diarrhea. Furthermore, the study's results (Taosu & Azizah, 2013) show a relationship between the availability of a wastewater disposal system and the incidence of diarrhea in toddlers. Even the research results found by (Puspitasari et al., 2015) also show a relationship between wastewater disposal facilities and diarrhea incidents.

Obtained data of ownership of the respondent's wastewater disposal facility, indicating that the wastewater is disposed of carelessly, the channel is open and smelly, and the distance from the source of clean water or well is less than 10 m. It can be a risk for contact with germ-mediating insects that cause diarrhea, and in general, the means of disposal of respondents' wastewater in the village of Massenreng Pulu are included in the criteria that do not meet the requirements. From the results of observations on the respondents' sewage drains, it has been found that many respondents still use unburdened earth excavation for their wastewater disposal, and many sewage drains are not smooth, open, and smelly. The condition of open wastewater drainage facilities is that wastewater does not flow smoothly or has stagnant water and smells, so it invites disease vectors. Thus, it significantly contributes to health problems such as diarrhea experienced by children under 5. In other words, the condition of wastewater disposal facilities that do not meet the requirements is at great risk of influencing the incidence of diarrhea in children under 5 years compared to wastewater disposal facilities that meet sanitation requirements. Improper wastewater disposal is a health problem, so it needs to be addressed as early as possible. Wastewater from bathrooms, kitchens, and toilets contains substances harmful to humans and living things around them (Taosu & Azizah, 2013).

The environment around the house becomes unhealthy, which can be caused by a house discharging its wastewater on open ground without any sewage disposal. It results in muddy, dirty conditions, which can become a breeding ground for insects and spread unpleasant odors. The presence of wastewater comes out, stagnates, and goes into the ground because the sewage is leaking or broken. If the distance is too close to the well, the wastewater can contaminate the well, so drink and rinse your mouth. Eventually, diarrhea can be risky for people who use it (Azwar, 1996).

Based on the condition of wastewater facilities that do not meet standard requirements, it is necessary to improve and increase environmental sanitation by using wastewater canals that meet health requirements to reduce the incidence of diarrhea. In addition to the actions that need to be implemented to prevent the transmission of diarrheal disease, it is best to create a tightly closed wastewater disposal system and always maintain the sanitation of wastewater drainage channels so that there is no possibility of stagnant water as a medium for the transmission of diarrheal disease.

Factors of influence of family toilet facilities on the incidence of diarrhea

There are 84 (70%) toilet facilities of respondent families in Massenreng Pulu village that fulfill health requirements but are not clean. Some people still throw their feces directly into rivers, gardens, and other places. According to (Wardhana, 2004), the low use of healthy toilets will affect the high diarrhea morbidity. The bacteriological spread of germs around the latrine is because the latrine does not meet health requirements. Hence, the possibility of a chain of disease transmission from feces is easy to breed to a new host and can contaminate water sources.

The most important health need is the proper disposal of feces. The most dominant variables affecting the incidence of under 5 years old are toilet facilities (Leni, 2019). As for the contamination of soil and water can be caused by the disposal of feces carelessly and not well. It can also be a source of infection and dangerous for health because diseases classified as waterborne diseases will quickly occur, such as diarrhea, typhoid, cholera, paratyphoid, hepatitis, dysentery, worm disease, and so on.

(Wulandari, 2009) explained that removing feces in an ineligible place would double the incidence of diarrhea in infants compared to families who dispose of feces according to sanitation requirements. The data obtained shows that there are respondents who do not use the type of latrine that meets the requirements, but they dispose of manure in rivers, gardens, and other places so that animals or insects that normally could spread E.coli could reach the droppings. In contrast, 84 respondents (70%) whose family latrines are eligible but cause diarrhea. This is because even though the type of toilet fulfills the requirements, there are some respondents whose building does not have a roof and is not cleaned so that it can be reached by animals or insects that can spread the bacteria that cause diarrhea. Apart from that, there are still many respondents who do not have cleaning equipment in their toilets and only clean the toilet once a week, and there are even respondents who do not use clean water after defecating, so they are at high risk of contamination by bacteria that cause diarrhea.

Based on the results of the logistic regression analysis, the results obtained $\text{Sig} = 0.807 > 0.05$, meaning that there is no influence of family toilet facilities on the incidence of diarrhea in toddlers. The results of the analysis also obtain the odds ratio (OR) value of family toilet ownership of 0.846 CI 95% $= 0.222 < \text{OR} < 3.227$, meaning that the risk of diarrhea in toddlers with family toilet ownership that does not meet the requirements is 0.846 times greater than toilet facilities that meet standard requirements. These results align with research conducted by (Yantu et al., 2021) that the condition of family toilets is not related to the incidence of diarrhea in toddlers in Waleure village. Furthermore, the study's results (Rau & Novita, 2021) show that the condition of the toilet (sig value = 0.133) does not affect the incidence of diarrhea in toddlers. Different from the research results by (Zamrudin Hi, Rahim A, Pinontoan R.O, 2016), that the means of the existence of latrines has a relationship with the incidence of diarrhea. Furthermore, the results of the study are also not in line with the results of the analysis obtained by (Wijaya, 2012), who explains that the type of family latrines has a relationship with the incidence of diarrhea experienced by children under 5 years of age who live around the Banaran TPS of the UNNES Campus. With an OR value of 17, it is known that the risk of diarrhea in infants with an unhealthy category family toilet is 17 times greater than that of a healthy category family toilet, 95% CI: 3.46-83.45. Although the odds ratio value obtained is smaller than similar studies, it has already

shown that the risk of diarrheal disease in children under five in Massenreng Pulu village, Bone Regency, is greater than the condition of latrines that do not meet the requirements compared to those that meet the requirements. The factor of ownership or not having toilet facilities for parents of toddlers is not the leading cause of diarrhea, yet it can be due to other factors such as socio-economic status, parental education, nutrition, food, or drinks. The factor of eating or drinking, whether in the form of milk or other drinks whose sanitation is not well maintained, then the potential for contamination and exposure to disease-causing vectors that enter the host's body.

The condition of toilets for toddlers in the Massenreng Pulu village area that do not meet the requirements occurs due to the lack of awareness and knowledge of respondents so that respondents rarely clean their toilets, which results in the toilet facilities emitting an unpleasant odor, which, of course, can invite insects, especially flies. The availability of family toilets has a big impact on reducing the risk of diarrhea, and families who do not have toilets and who have toddlers are at greater risk of getting diarrhea (Sengkey et al., 2020).

The influence of ownership of waste disposal facilities on the incidence of diarrhea

According to (Undang-Undang RI, 2008), waste management is carried out with a comprehensive approach from upstream, before a product is produced that has the potential to become waste, to downstream, namely at the product phase that has been used so that it becomes waste, which is then returned to the environmental media safely. Waste management with the new paradigm involves waste reduction and handling activities. Waste reduction includes limitation, reuse, and recycling, while waste handling activities include sorting, collection, transportation, processing, and final processing. Data obtained from waste disposal facilities that do not meet the requirements are as many as 111 respondents (92.5%) with open trash bin ownership, some respondents throw waste directly into rivers, gardens, and other places such as throwing it in the front yard of the house so that the activity of littering can become a breeding ground for flies that transmit diseases. Based on the study's results (Junias & Balelay, 2008), the density of flies is an indicator of the place's cleanliness. Besides, the high density of flies can be a medium for the spread of germs (Junias, M., & Balelay, 2008). Furthermore, (Prasetia, 2011) research results also explain that waste is one of the factors that has quite an influence on the occurrence of diarrhea where garbage when mixed with water, will rot and can pollute the surrounding clean water sources and also can become a breeding place for flies carrying E. coli.

This research shows that disposing of garbage that does not meet the requirements can cause diarrhea in children under 5 years of age because most of the waste disposal facilities that are used by the community are still not providing garbage bins in the house, there are also garbage bins that do not have a lid and thrown away so that it can cause odor, this, of course, could have caused the emergence of diarrhea trigger vectors such as flies.

Based on the logistic regression test results obtained $p = 0.922$ ($p > 0.05$), there is no influence between the means of garbage disposal and the incidence of diarrhea. However, based on the value of the odds ratio (OR) = 0.928 and 95% CI = 0.205 <OR <4.195, it means that the risk of diarrhea in children under 5 years of age with ownership of waste disposal facilities that do not meet the requirements 0.928 times greater than the waste disposal facilities that meet the condition. The results of this study are different from those conducted by (Zamrudin Hi, Rahim A, Pinontoan R.O, 2016) in the working area of the Banggai Public Health Center in Banggai Laut Regency, where it was found that the waste disposal facility has a relationship with the incidence of diarrhea in children under 5 years of age. Furthermore, the results of the study conducted by (Langit, 2016) stated that there was no relationship between the condition of the waste disposal site and the incidence of diarrhea in toddlers in the Rembang Health Center Work Area.

Uncontrolled waste disposal has a negative impact on health because it is a suitable medium for organisms or pests, such as flies, that can cause disease. Health problems that can arise, such as diarrhea, cholera, and typhus, can spread quickly to waste management sites that do not meet standard requirements. Waste disposal facilities must meet standard requirements so that they do not become breeding grounds for insects or disease transmission vectors.

The recommended requirements for trash bins are that they are made of waterproof, strong, and leak-proof materials, have a cover, and are easy to open, empty, and clean. Therefore, efforts that need to be made by the community or mothers who always interact with waste are to provide a place to dispose of waste, close it tightly, and if buried in the ground, make it tight so that vectors do not come to land.

In addition to the variables that have been described above, a mother who acts as a caregiver for toddlers can contribute to preventing her child from having diarrhea, for example, by washing her hands before feeding her child. Mothers as caregivers and caring for toddlers are some of the factors that cause diarrhea due to poor maternal behavior. The level of education influences maternal behavior the mother obtains; usually, the higher the mother's education, the higher the level of knowledge and understanding of the mother (Hartati & Nurazila, 2018).

The factor that most influence the risk of diarrhea in children under 5 years old in Massenreng Pulu Village, Lamuru District, Bone Regency, is ownership of wastewater disposal facilities. Thus, ownership of wastewater disposal facilities that do not meet the requirements is the most dominant influencing variable.

Mathematical prediction model of diarrhea in children under 5 years of age

Based on the results of the multivariable analysis with a logistic regression test, a prediction model of diarrhea incidence has been prepared: ownership of clean water facilities, toilet facilities, wastewater disposal facilities, and garbage disposal facilities. All the independent variables included in the mathematical prediction model, including clean water facilities, toilet facilities, wastewater disposal facilities, and garbage disposal facilities, wastewater facilities are the most dominant factor influencing the incidence of diarrhea and the chance of children under 5 years of age getting diarrhea if the wastewater disposal facilities do not meet the requirements is 43.8%. While the other three variables are not so dominant or insignificant, the probability value and prediction value of diarrhea occurrence, if children under 5 years of age interact with the condition of clean water facilities that do not meet the requirements probability of diarrhea occurrence, is 19.1%, if children under 5 years of age interact with the condition of toilet facilities that do not meet the requirements, the probability of diarrhea occurrence is 24.5%, and if children under 5 years of age interact with the condition of garbage disposal facilities that do not meet the requirements, the probability of diarrhea occurrence is 25.2%.

Based on the predicted values or numbers of these variables, it is estimated that the respondent's activities in the Lamuru Health Center area are related to the ownership and use of sanitation facilities that do not meet health requirements. Of course, if efforts are not made to improve sanitation sustainably in the future, the probability of diarrheal disease will increase.

Several limitations existed during the implementation of this study, such as the possibility of bias in sample measurement so that it is not representative of the population as a whole, uncontrolled environmental factors such as time, location, and weather conditions during the study, and other factors such as the hygiene or personal cleanliness of each mother of toddlers. These things affect the study's results, although not as the core of the study.

Furthermore, the potential limitation of prediction accuracy of 68.3% of the main variables affecting diarrhea incidence is due to the inclusion of other unmeasured variables that can affect the results of this study. Other variables or external factors limit the accuracy of the core variable prediction model as a predictor of diarrhea incidence in children under 5 years of age.

CONCLUSION AND SUGGESTION

Clean water facilities, toilet facilities, and waste disposal facilities are not dominant predictors of the incidence of diarrhea in children under five. Ownership of inadequate wastewater disposal facilities is the dominant predictor of diarrhea in children under five, with a p-value = 0.004, OR = 3.481, and a probability of 43.8%. Some efforts are needed from the regional government and the community to work together to build and improve sanitation facilities that do not meet the requirements. Sewage water that fulfills the criteria should be made based on government programs and with local community self-help so that the sewerage is made permanent, waterproof, closed, and not moist.

REFERENCES

Azizah, S. L. & R. (2013). Hubungan Sarana Sanitasi Dasar Rumah Dengan Kejadian Diare Pada Balita Di Desa Ngunut Kabupaten Tulungagung. *Jurnal Kesehatan Lingkungan*, *7*(1), 32–37. https://journal.unair.ac.id/download-fullpapers-kesling490ad6e01ffull.pdf

Azwar, A. (1996). *Pengantar Ilmu Kesehatan Lingkungan*. Mutiara Sumber Widya.

Chandra, B. (2007). *Pengantar Kesehatan Lingkungan* (1st ed.). Buku Kedokteran EGC.

Departemen Kesehatan RI. (2000). *Buku Pedoman Pelaksanaan Program P2 Diare*. Ditjen PPM.

Getachew, A., Tadie, A., Hiwot, M. G., Guadu, T., Haile, D., Cherkos, T. G., Gizaw, Z., & Alemayehu, M. (2018). *Environmental factors of diarrhea prevalence among under five children in rural area of North Gondar zone , Ethiopia*. 5–11. https://doi.org/10.1186/s13052-018-0540-7

Hafizah, A. (2024). Studi Literatur Review: Pengaruh Sarana Penyediaan Air Bersih terhadap Kejadian Diare pada Balita. *Zahra: Journal of Health and Medical Research*, *4*(1), 92–97. https://adisampublisher.org/index.php/aisha/article/view/646

Hartati, S., & Nurazila, N. (2018). Faktor Yang Mempengaruhi Kejadian Diare Pada Balita Di Wilayah Kerja Puskesmas Rejosari Pekanbaru. *Jurnal Endurance*, *3*(2), 400. https://doi.org/10.22216/jen.v3i2.2962

Irwan Amar, D. S. (2022). The Relationship Of Environmental Sanitation With The Event Of Diarrhea On Children In The Working Area Of The Sihepeng Health Center. *Jese*, *1*(3), 49–56. https://journal.tritunas.ac.id/index.php/jese/article/view/99

Junias, M., & Balelay, E. (2008). Hubungan Antara Pembuangan Sampah dengan Kejadian Diare pada Penduduk di Kelurahan Oesapa Kecamatan Kelapa Lima Kota Kupang. *Mkm*, *03*(02), 92–104. https://mediakesehatanmasyarakat.wordpress.com/wp-content/uploads/2012/06/artikel-5.pdf

Kemenkes. (2023). Survei Kesehatan Indonesia 2023 (SKI). *Kemenkes*, 235.

Langit, L. S. (2016). Hubungan Kondisi Sanitasi Dasar Rumah Dengan Kejadian Diare Pada Balita Di Wilayah Kerja Puskesmas Rembang 2. *Jurnal Kesehatan Masyarakat (JKM e-Journal)*, *4*(2), 160–165. http://ejournal-s1.undip.ac.id/index.php/jkm

Leni, P. (2019). Household Risk Factors On The Event Of Diarrhea Disease. *Jurnal Ilmu Kesehatan Masyarakat*, *10*(1), 50–58. https://doi.org/10.26553/jikm.2019.10.1.50-58

Muh.Saleh, L. H. R. (2014). *Hubungan Kondisi Sanitasi Lingkungan dengan Kejadian Diare pada Anak Balita di Wilayah Kerja Puskesmas Baranti Kabupaten Sidrap Tahun 2013*. *Jurnal Kesehatan, 7 (1), 221-233*. https://doi.org/10.24252/kesehatan.v7i1.940

Prasetia, E. (2011). *Gambaran Sarana Sanitasi Kesehatan Lingkungan di Wilayah Kerja Puskesmas Limboto Tahun 2009*. *3*(1), 255–265. https://ejurnal.ung.ac.id/index.php/JHS/article/view/28

Puspitasari, A. D., Nuryani, D. D., & Sary, L. (2015). Hubungan Kondisi Saluran Pembuangan Air Limbah, Sarana Air Bersih Dan Jamban Dengan Kejadian Diare Pada Balita Di Wilayah Kerja Puskesmas Simpang Agung Kecamatan Seputih Agung Lampung Tengah. *Jurnal Dunia Kesmas*, *4*(3), 157–162. https://doi.org/https://doi.org/10.33024/jdk.v4i3.437

Rau, M. J., & Novita, S. (2021). Pengaruh Sarana Air Bersih Dan Kondisi Jamban Terhadap Kejadian Diare Pada Balita Di Wilayah Kerja Puskesmas Tipo. *Preventif : Jurnal Kesehatan Masyarakat*, *12*(1), 110–126. https://doi.org/10.22487/preventif.v12i1.298

Sengkey, A., Joseph, W. B. S., & Warouw, F. (2020). Hubungan Antara Ketersediaan Jamban Keluarga Dan Sistem Pembuangan Air Limbah Rumah Tangga Dengan Kejadian Diare Pada Balita Usia 24-59 Bulan Di Desa Raanan Baru Kecamatan Motoling Barat Kabupaten Minahasa Selatan. *Jurnal Kesmas*, *9*(1), 182–188. https://ejournal.unsrat.ac.id/index.php/kesmas/issue/view/2592

Soemirat, J. (2018). *Kesehatan Lingkungan* (Kesepuluh). Gadjah Mada University Press.

Soeparman, S. (2002). *Pembuangan Tinja dan Limbah Cair*. Penerbit Buku Kedokteran EGC.

Taosu, S. A., & Azizah, R. (2013). Hubungan Sanitasi Dasar Rumah dan Perilaku Ibu Rumah Tangga dengan Kejadian Diare pada Balita di Desa Benu Nusa Tenggara Timur. *Jurnal Kesehatan Lingkungan*, *7*(1), 1–6. https://journal.unair.ac.id/download-fullpapers-kesling5a4956b1a1full.pdf

Undang-Undang RI. (2008). Undang-Undang Republik Indonesia Nomor 18 Tahun 2008 Tentang Pengelolaan Sampah.

Wardhana, W. A. (2004). *Dampak Pencemaran Lingkungan*. Andi.

Wijaya, Y. (2012). Faktor Risiko Kejadian Diare Balita Di Sekitar Tps Banaran Kampus Unnes. *Unnes Journal of Public Health.*, *1*(2). https://doi.org/10.15294/ujph.v1i2.3050

Wulandari, A. P. (2009). Hubungan Antara Faktor Lingkungan Dan Faktor Sosiodemografi Dengan Kejadian Diare Pada Balita Di Desa Blimbing Kecamatan Sambirejo Kabupaten Sragen Tahun 2009. *Universitas Muhammadiyah Surakarta*, i–97. https://eprints.ums.ac.id/5960/1/J410050008.PDF

Yantu, S. S., Warouw, F., & Umboh, J. M. L. (2021). Hubungan antara Sarana Air Bersih dan Jamban Keluarga dengan Kejadian Diare pada Balita di Desa Waleure. *Jurnal KESMAS*, *10*(6), 24–30. https://ejournal.unsrat.ac.id/v3/index.php/kesmas/article/view/35445

Zamrudin Hi, Rahim A, Pinontoan R.O, & W. R. (2016). *Hubungan antara Fasilitas Sanitasi Dasar dan Personal Hygiene dengan Kejadian Diare pada Balita di Wilayah Kerja Puskesmas banggai Kabupaten Banggai Laut. Universitas Samratulangi, Manado. https://www.semanticscholar.org/paper/HUBUNGAN-ANTARA-FASILITAS-SANITASI-DASAR-DAN-DENGAN-Rahim-Pinontoan/4e37ecc2ba236103a1e75cb0c8c568771a3a766f#citing-papers*