



Case-Control Study: Risk Factors for Diarrhea in Toddlers in the Doro 1 Community Health Center Work Area

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ABSTRACT

The significant rise in diarrhea cases in the highland area of Puskesmas Doro 1, reaching 339 cases in 2025. This study employed a mixed-methods design with a sequential explanatory model. The quantitative phase used a case-control study on 34 toddlers (17 cases and 17 controls) selected through consecutive and simple random sampling. Data analysis utilized the Chi-Square test. The qualitative phase involved in-depth interviews with policymakers. The results showed a significant relationship between diarrhea incidence and clean water facilities ($p=0.001$; $OR=35.00$), family latrines ($p=0.002$; $OR=10.56$), and waste disposal facilities ($p=0.016$; $OR=5.76$). On the other hand, parenting style and handwashing with soap (CTPS) showed no significant relationship. Qualitative findings confirmed that water source contamination due to substandard septic tank distances was the primary cause, even though community hygiene behavior was adequate. Poor physical environmental quality is the major determinant of diarrhea incidence compared to behavioral factors. Interventions focusing on improving basic sanitation infrastructure and protecting water sources are required to break the chain of transmission.

Keywords: Case-Control, Toddler Diarrhea, Environment, Mixed Methods, Risk Factors

ABSTRAK

Terjadi peningkatan signifikan kasus diare di wilayah pegunungan Pusat Kesehatan Masyarakat Doro 1, mencapai 339 kasus pada tahun 2025. Penelitian ini bertujuan untuk menganalisis faktor risiko utama diare pada balita melalui pendekatan kuantitatif dan kualitatif. Penelitian ini menggunakan desain campuran (mixed methods) dengan model urutan eksplanatori. Tahap kuantitatif menggunakan studi kasus-kontrol pada 34 balita (17 kasus dan 17 kontrol) yang dipilih melalui sampling berurutan dan acak sederhana. Analisis data menggunakan uji Chi-Square. Tahap kualitatif dilakukan melalui wawancara mendalam dengan pembuat kebijakan. Hasil menunjukkan hubungan yang signifikan antara kejadian diare dan fasilitas air bersih ($p=0.001$; $OR=35.00$), fasilitas toilet keluarga ($p=0.002$; $OR=10.56$), dan fasilitas pembuangan limbah ($p=0.016$; $OR=5.76$). Sebaliknya, pola pengasuhan dan kebiasaan mencuci tangan dengan sabun (CTPS) tidak menunjukkan hubungan yang signifikan. Temuan kualitatif mengonfirmasi bahwa pencemaran sumber air akibat jarak septitank yang tidak memadai merupakan penyebab utama, meski pun perilaku higiene komunitas baik. Kesimpulan: Kualitas lingkungan fisik yang buruk merupakan

faktor penentu utama insiden penyakit diare, dibandingkan dengan faktor perilaku. Intervensi untuk meningkatkan infrastruktur sanitasi dasar dan melindungi sumber air diperlukan untuk memutus rantai penularan

Kata Kunci: Studi Kasus-Kontrol, Diare Balita, Lingkungan, Mix Method, Faktor Risiko

INTRODUCTION

Diarrheal disease remains a significant public health problem in developing countries, including Indonesia. This disease is closely related to environmental conditions, clean and healthy living behaviors, and the availability of clean water. Globally and nationally, diarrhea is a leading cause of morbidity and mortality, especially in areas with inadequate sanitation. Diarrhea is the second leading cause of death in children under five, and was responsible for the deaths of 370,000 children in 2019 (World Health Organization, 2022). Data from the 2020 Indonesian Health Profile shows that diarrhea is the second leading cause of death after pneumonia (lung infection) in infants aged 29 days to 11 months, accounting for 9.8% of all deaths, and in toddlers aged 12 to 59 months, accounting for 4.5% of total deaths (Kementerian Kesehatan RI, 2023).

Doro District is geographically located between 110°12'20" and 110°14'10" East Longitude and between 7°27'39" and 7°29'34" South Latitude with an altitude of 370 meters above sea level, presenting its own health challenges. The geographical conditions of an area, such as coastal areas, urban areas, and highlands, have different environmental risk factors that can influence the incidence of this disease (Aini et al., 2025). In contrast to coastal areas that may be hampered by seawater intrusion or urban areas with high population density, highland areas often face problems related to clean water sources originating from mountain springs that are not necessarily free from bacteriological contamination, as well as local community sanitation patterns. Ideally, areas with abundant natural resources such as highlands should have a good level of health, but data shows a significant gap in cases of environmentally-

based diseases in this region. Environmental factors such as physical water quality and poor sanitation facilities have been shown to have a strong correlation with the high incidence of diarrhea in various regions in Indonesia (Pellondou et al., 2025).

Based on Doro Community Health Center profile data, the trend in diarrhea cases shows an alarming increase and consistently ranks first among the top ten most common diseases. In 2023, 254 cases of diarrhea were recorded, out of an estimated 867 cases, significantly higher than Tuberculosis (49 cases) and Dengue Fever (21 cases). Cases increased again in 2024, with diarrhea cases rising to 299. This situation worsened in 2025, with data through the end of November showing a significant spike in cases, reaching 339 (Puskesmas Doro 1, 2024). This drastic increase indicates that existing risk factor control efforts are not yet optimal and require an in-depth evaluation of the underlying causes.

Previous research has highlighted risk factors for diarrhea, including clean water supply, waste management, and ownership of healthy latrines (Septiani et al., 2025). Recent studies have also found that preventive behavior and basic household sanitation are crucial for successfully reducing diarrhea incidence in vulnerable groups (Rahmah et al., 2025). However, most of these studies were conducted in areas with common geographic characteristics. The gap in information regarding the dominant risk factors specific to highland areas like Doro requires further exploration, to determine whether they are influenced by physical environmental factors, community behavior, or other socio-demographic factors. Accurate identification of risk factors is essential for formulating effective

intervention strategies to break the chain of transmission.

Based on the high incidence of diarrhea that continues to increase year after year in the Doro 1 Community Health Center (Puskesmas Doro 1) area, this study aims to analyze risk factors for diarrhea using a case-control study approach. This research is expected to provide a comprehensive overview of the determinants of diarrhea incidence in highland areas, thus providing a basis for policymakers in developing more targeted prevention programs.

RESEARCH METHODS

Research Design or Plan

This study employed a mixed methods design with a sequential explanatory model. Quantitative data collection and analysis were conducted first, followed by qualitative data collection to further explore the findings. The quantitative part employed a case-control approach to analyze the factors triggering diarrhea in toddlers. Meanwhile, the qualitative part aimed to explore information regarding the implementation of the diarrhea management program in the Doro 1 Community Health Center (Puskesmas Doro 1) working area. This study was conducted from November 2025 to January 2026.

Quantitative Population and Sample

The case population was all registered toddlers with diarrhea who received services at the Doro Community Health Center from 2024 to 2025. The control population was toddlers who did not experience diarrhea during the same period. The sample size was determined using the Lemeshow formula for case-control studies with a 95% confidence level and 80% power, resulting in a total of 17 case samples and 17 control samples with a 1:1 ratio.

Quantitative Sampling Techniques

Case samples were selected using consecutive sampling based on medical record data. Control samples were drawn using simple random sampling from a list of

healthy toddlers. The sample criteria included toddlers aged 1 to 5 years living in the Doro 1 Community Health Center area and having complete health records. Exclusion criteria included those who refused to be interviewed.

Quantitative Data Collection

Data were collected through structured interviews using questionnaires and observations of environmental conditions. Independent variables included clean water facilities, waste disposal facilities, family toilet facilities, handwashing with soap (CTPS), and maternal parenting practices. The dependent variable was the incidence of diarrhea in toddlers. During the data collection process, all respondents provided informed consent and agreed to participate in the interviews.

Qualitative Data

Qualitative data was obtained through in-depth interviews with the Head of the Community Health Center, the Head of the Environmental Health Program, and the local Village Head. The goal was to understand policies, programs, and challenges in addressing diarrhea in the area. Informants were selected using a purposive sampling method based on their role and involvement in the diarrhea management program. Interviews were recorded and then transcribed.

Data Analysis Techniques

Data analysis in this study was carried out in stages based on a sequential explanatory mixed methods model design, where quantitative data were first analyzed to determine the relationship between risk factors and the incidence of diarrhea in toddlers, then the results were further developed through qualitative analysis.

1. Quantitative Data Analysis

Data collected through questionnaires and observations are first processed:

- a. Editing, to ensure completeness and consistency of answers.

- b. Coding, by providing a numeric code for each answer category to facilitate data processing.
- c. Data entry, using SPSS software version 25.
- d. Cleaning, to ensure there are no input errors, duplicate data, or missing data.

Analysis is carried out in three stages:

a. Bivariate Analysis

This analysis aims to explain the characteristics of respondents and the frequency distribution of each variable studied, both independent and dependent. The results are presented in the form of frequency and percentage tables to provide an initial overview of the respondents' condition.

b. Bivariate Analysis

This analysis aims to determine the relationship between independent variables and the occurrence of diarrhea in toddlers (dependent variable). The Chi-Square (χ^2) test was used to analyze the relationship between the two variables with a significance level of $\alpha = 0.05$. The results of the analysis are presented in the form of p-values, Odds Ratio (OR), and 95% Confidence Interval (95%) to assess the relative risk posed by certain factors.

2. Qualitative Data Analysis

Data from in-depth interviews with the Head of the Community Health Center, the Head of the Environmental Health Program, and the Village Head were analyzed using thematic analysis. The analysis steps include:

- a. Verbatim transcription of interview recordings.
- b. Data reduction, namely selecting data that is relevant to the research focus.
- c. Coding, by grouping respondents' statements into certain meaning categories.
- d. Theme formation, to find patterns of thinking related to the implementation of diarrhea control programs.

Narrative conclusions regarding program policies, barriers, and recommendations.

RESULTS AND DISCUSSION

1. Quantitative Data Analysis

Univariate Analysis

Univariate analysis was used to describe the characteristics of respondents in this study based on their diarrheal condition, both in the group experiencing diarrhea and the group without. Respondent characteristics analyzed included toddler age, gender, maternal education level, and maternal occupation. The results of this analysis are presented in frequency and percentage tables to provide an overview of the characteristics of respondents in both groups (Table 1).

Table 1. Distribution of Toddler Age Based on Diarrhea Status

Age	Control n (%)	Case n (%)
Infants (0–1 years)	4 (23.5)	3 (17.6)
Toddlers (1–3 years)	10 (58.8)	11 (64.7)
Preschool (3–5 years)	3 (17.6)	3 (17.6)
Total	17 (100)	17 (100)

Based on Table 1, the majority of respondents from both groups, namely the case group and the control group, were in the toddler age group (1–3 years). In the case group, approximately 64.7% of respondents were in the toddler age group, while in the control group it reached 58.8%. For the infant group (0–1 years), the percentage in

the case group was 17.6% and in the control group 23.5%. Meanwhile, in the preschool group (3–5 years), the proportion of respondents in both groups was the same, namely 17.6% each. These results indicate that the majority of respondents in this study were toddlers, which is an age group with a high risk of experiencing digestive health problems, such as diarrhea.

Table 2. Distribution of Toddler Gender Based on Diarrhea Status

Gender	Control (%)	n	Case n (%)
Man	10 (58.8)	10	(58.8)
Woman	7 (41.2)	7	(41.2)
Total	17 (100)	17	(100)

From the univariate analysis, the distribution of respondents by gender showed similar results between the case and control groups. In both groups, 58.8% of respondents were male (Table 2), while 41.2% were female. The univariate analysis results indicate that descriptively, diarrhea was more common in boys in this study, although the difference in proportion was not significant compared to girls.

Table 3. Distribution of Maternal Education Level Based on Diarrhea Status

Level of education	Control (%)	n	Case n (%)
Elementary School/Equivalent	7 (41.2)	6	(35.3)
Junior High School/Equivalent	4 (23.5)	7	(41.2)
High School/Equivalent	5 (29.4)	3	(17.6)
College	1 (5.9)	1	(5.9)
Total	17 (100)	17	(100)

Based on the results of univariate analysis, the distribution of maternal education levels in the case and control groups showed that most respondents had primary to secondary

education (Table 3). In the control group, the largest number of mothers were those with elementary school/equivalent education, namely 7 people (41.2%), followed by high school/equivalent as many as 5 people (29.4%), junior high school/equivalent as many as 4 people (23.5%), and college 1 person (5.9%). Meanwhile, in the case group, the majority of respondents had junior high school/equivalent education, as many as 7 people (41.2%), followed by elementary school/equivalent as many as 6 people (35.3%), high school/equivalent as many as 3 people (17.6%), and college 1 person (5.9%). From these results it can be seen that in both groups, most mothers had a relatively low to secondary education level.

Table 4. Distribution of Maternal Occupation Based on Diarrhea Status

Mother's Job	Control (%)	n	Case n (%)
Housewife	16 (94.1)	17	(100)
Caregiver	1 (5.9)	0	(0.0)
Total	17 (100)	17	(100)

Based on the results of the univariate analysis, the distribution of mothers' occupations in the case and control groups showed that almost all respondents were housewives (Table 4). In the control group, 16 (94.1%) were housewives, while 1 (5.9%) worked as a caregiver. Meanwhile, in the case group, all 17 (100%) respondents were housewives, and none had other occupations. These results indicate that most mothers in this study did not work in the formal sector and played a larger role in household affairs.

Bivariate Analysis

Table 5. Analysis of the Relationship between Environmental and Behavioral Risk Factors and the Incidence of Diarrhea in Toddlers

Variables	Risk Category	Case n (%)	Control n (%)	p-value	OR (95% CI)	Information
Parenting	Not good	1 (5.9)	2 (11.8)	0.545	0.469 (0.038 – 5.720)	Not significant
	Good	16 (94.1)	15 (88.2)			
Family Toilet Facilities	Not eligible	13 (76.5)	4 (23.5)	0.002	10,563 (2,165 – 51,529)	significant
	Qualify	4 (23.5)	13 (76.5)			
Waste Disposal Facilities	Not good	12 (70.6)	5 (29.4)	0.016	5,760 (1,317– 25,187)	Significant
	Good	5 (29.4)	12 (70.6)			
Wash hands your with soap	Not good	3 (17.6)	3 (17.6)	1,000	1,000 (0.171– 5.833)	Not significant
	Good	14 (82.4)	14 (82.4)			
Clean Water Facilities	Not eligible	15 (88.2)	3 (17.6)	0.001	35.00 (5,071- 241,558)	significant
	Qualify	2 (11.8)	14 (82.4)			

Source: Primary Data

This study involved 34 respondents who were divided into a case group (toddlers with diarrhea) and a control group (healthy toddlers) in Doro District.

The Relationship Between Parenting Patterns and the Incidence of Diarrhea

Based on the results of the bivariate analysis (Table 5), the p-value obtained was 0.545 ($p > 0.05$), indicating no significant relationship between parenting patterns and the occurrence of diarrhea. The Odds Ratio (OR) value was 0.469 with a 95% confidence interval of 0.038 to 5.720. This indicates that parenting patterns were not a risk factor for diarrhea in this study. The confidence interval exceeding 1 also supports that the relationship is statistically insignificant.

The data shows that the majority of mothers, both in the case group (94.1%) and the control group (88.2%), have actually implemented parenting patterns categorized

as "Good." Parenting pattern indicators such as exclusive breastfeeding, taking children to Posyandu (Integrated Health Post), and maintaining children's physical hygiene are generally carried out diligently by mothers in Doro District.

These findings indicate that environmental factors far outweigh the mother's behavioral factors in this case study. Although a mother has tried to provide good child care (breastfeeding, routine immunizations), these efforts are "defeated" when the physical environment of the home is very poor. For example, a mother regularly cleans her child, but the water used for bathing or washing milk bottles is contaminated with bacteria from a septic tank (as found in the Clean Water variable). This confirms that good parenting alone is not enough to protect toddlers from diarrhea if it is not supported by adequate basic sanitation.

The findings of this study align with several previous studies showing that maternal parenting patterns are not always significantly associated with the incidence of diarrhea in toddlers. Research by (Putri et al., 2025) in the Mundu Community Health Center work area found that maternal parenting patterns were not significantly correlated with the incidence of diarrhea in toddlers, because most mothers had implemented good parenting patterns, resulting in low exposure variation. Similar results were also reported by (Pasaribu et al., 2025) who stated that even though mothers have good parenting practices, the incidence of diarrhea in children is still influenced by factors other than maternal behavior, especially environmental conditions and basic sanitation. The similarity of these results strengthens the findings of this study that good parenting patterns are not necessarily able to protect toddlers from diarrhea if not supported by healthy home conditions and proper sanitation.

The Relationship Between Family Toilet Facilities and the Incidence of Diarrhea

The results of the bivariate analysis showed a p-value of 0.002 ($p < 0.05$), meaning there is a significant relationship between family toilet facilities and the occurrence of diarrhea. The OR value of 10.563 with a 95% confidence interval of 2.165–51.529 indicates that people who use inadequate toilets have a 10.563 times greater risk of experiencing diarrhea than people who use adequate toilets. A confidence interval that does not include the number 1 indicates that toilet facilities are a risk factor for diarrhea. In the case group, 76.5% of respondents had toilets in the inadequate category. In contrast, in the control group, 76.5% of respondents already had adequate toilets.

Facts on the ground show that the term "having a toilet" does not always mean "healthy toilet." In the homes of respondents in the case (toddlers with diarrhea), many found "plengsengan" toilets, or toilets without goosenecks that do not close tightly,

allowing flies to enter and carry waste into the kitchen area. Another crucial problem is the lack of standard septic tanks; some waste is directly directed into rivers or open drains behind the house. In fact, several families still practice open defecation in gardens or rivers because the existing toilets are damaged or full. This open exposure to feces is a source of massive infection for toddlers playing around the area.

The findings of this study align with previous research showing that family toilet facilities are a significant factor triggering diarrhea in toddlers. Research by (Yantu et al., 2021) found a significant association between substandard family toilets and an increased risk of diarrhea in toddlers, particularly if the toilet lacks a swan neck and a safe fecal disposal system, thus increasing the likelihood of contamination of the home environment. Similar results were also reported by (Merid et al., 2023), who stated that access to adequate sanitation facilities, including the use of healthy latrines, is crucial in reducing the incidence of diarrhea in children under five years of age, while open defecation and unsafe fecal disposal systems actually increase the risk of fecal-borne diseases. These similarities in findings reinforce the idea that substandard family toilet facilities are a strong environmental factor influencing the increased incidence of diarrhea in toddlers.

The Relationship Between Waste Disposal Facilities and Diarrhea Incidents

Based on the results of the Chi-Square test, a p-value of 0.016 ($p < 0.05$) was obtained, indicating a significant relationship between waste disposal facilities and the incidence of diarrhea. The OR value of 5.760 with a 95% confidence interval of 1.317–25.187 indicates that people with poor waste disposal facilities have a 5.760 times greater risk of experiencing diarrhea than people with good waste disposal facilities. This indicates that waste management methods significantly influence the occurrence of diarrhea.

Distribution data shows that 70.6% of respondents in the case group had poor waste management, in contrast to the control group where 70.6% had managed waste well.

Poor waste management at the research site was characterized by two main factors: the absence of covered trash bins and irregular waste disposal. In the homes of toddlers with diarrhea, kitchen trash bins were often found open and full of wet food scraps. This situation invited fly vectors (*Muscadomestica*) to swarm the trash and then land on the toddler's food or eating utensils (mechanical transmission). Furthermore, the habit of piling up trash for more than three days before burning or disposing of it at the landfill (TPS) led to decomposition in the home environment, which triggered the rapid proliferation of disease vectors.

The findings of this study align with those of (Falita et al., 2023), which showed that substandard household waste management, such as the absence of covered trash bins and irregular waste disposal, is significantly associated with increased cases of diarrhea in toddlers. This is because these conditions accelerate the proliferation of flies, which act as mechanical vectors that can spread disease-causing germs from trash to children's food or eating utensils. Similar findings were also found by (Maywati et al., 2023), which confirmed that poor waste management creates an unclean and polluted home environment, thereby increasing the risk of contracting diseases supported by the fecal-oral cycle, including diarrhea in toddlers. The similarity of the results from both studies confirms that inadequate waste disposal facilities are a major risk factor for diarrhea in toddlers, primarily through increased exposure to environments that support the spread of disease.

The Relationship Between Handwashing with Soap and the Incidence of Diarrhea

The results of the bivariate analysis showed a p-value = 1.000 ($p > 0.05$), so it can

be concluded that there is no significant relationship between the habit of washing hands with soap and the occurrence of diarrhea. The OR value is 1.000 with a 95% confidence interval between 0.171 to 5.833, which indicates that the risk of experiencing diarrhea in people who wash their hands with soap well or not well is the same. Because the confidence interval exceeds the number 1, it can be concluded that this variable is not a risk factor in this study.

The proportion of "Good" handwashing behavior was found to be exactly the same in the case and control groups, at 82.4%. Descriptively, the awareness of Doro District residents to wash their hands with soap is very high. They understand the important times to wash their hands (after defecating, before eating). However, why do toddlers in the case group still suffer from diarrhea even though their mothers wash their hands diligently? The answer again refers to water quality. Handwashing becomes ineffective if the rinsing water used is contaminated with *E. coli* bacteria. Washing hands with soap does kill germs on hands, but if rinsed with well water contaminated by fecal seepage (because the well is less than 10 meters from the septic tank), the mother's hands are re-exposed to bacteria immediately after rinsing. This is called re-contamination. Therefore, handwashing campaigns in this area must be accompanied by interventions to improve the quality of water sources so that clean living behavior is truly effective in preventing disease.

The results of this study differ from the findings of previous researchers who showed a significant relationship between the habit of washing hands with soap and the incidence of diarrhea in toddlers. Research conducted by (Awaldi et al., 2024) in RW 011, Baloi Permai Village, Batam City found that the habit of washing hands with soap was significantly associated with the incidence of diarrhea in toddlers (p-value = 0.024), namely toddlers from mothers who had poor handwashing habits with soap were more susceptible to diarrhea compared to

toddlers from mothers who had good handwashing habits with soap. Similar findings were also reported by (Heryanto et al., 2022) at the Sukaraya Community Health Center UPTD, OKU Regency, which showed that handwashing habits had a significant relationship with the incidence of diarrhea in toddlers ($p\text{-value} = 0.000$), so that if handwashing is not done, the risk of diarrhea increases. The difference in results between this study and previous studies is thought to be caused by differences in environmental context, especially the quality of clean water used for handwashing. Although handwashing with soap was well-established in the study area, its effectiveness could be reduced by the use of contaminated water, so the protective effect of handwashing with soap on diarrhea was not statistically evident.

The Relationship Between Clean Water Facilities and Diarrhea Incidents

Based on the results of the bivariate analysis, a $p\text{-value}$ of less than 0.001 was obtained, indicating a highly significant relationship between access to clean water and the occurrence of diarrhea. The Odds Ratio (OR) value of 35.00 indicates that people who do not meet the requirements for using clean water facilities have a 35 times higher risk of experiencing diarrhea than those who do. These results indicate that access to clean water is the main risk factor influencing the occurrence of diarrhea in this study. Statistically, the data shows extreme inequality: in the case group, as many as 88.2% of respondents had clean water facilities that did not meet the requirements (TMS), while in the control group only 17.6%.

Based on actual conditions in the field, this high risk is caused by the location of the water source. Many respondents in the case group rely on shallow dug wells as their primary source of water for drinking and cooking. The main problem identified is the distance between the dug well and the source of contamination (a septic tank or neighbor's pit), which is less than 10 meters. Although the water appears clear and odorless, this

proximity allows *E. coli* bacteria to infiltrate through the soil pores, especially during the rainy season when the groundwater level rises. Furthermore, several respondents admitted to only boiling water until it is "hot" but not boiling (100°C), so the pathogenic bacteria in the contaminated water are not completely killed by the time toddlers consume it.

The results of this study are supported by research by Oktavianisya (Oktavianisya et al., 2023), which showed that water sources have a fairly strong relationship with the incidence of diarrhea in toddlers ($p\text{-value} = 0.007$). The study explained that using water from unqualified sources can increase the risk of diarrhea due to the transmission mechanism through the fecal-oral route. The study stated that water from unprotected sources, such as shallow dug wells near fecal collection tanks or sewage drains, is at high risk of contamination with disease-causing bacteria. This makes this water a primary medium for the spread of diarrheal diseases. Furthermore, research by Safitri et al. (Safitri et al., 2025) also confirmed that access to clean water is an important environmental factor in preventing diarrhea. Even if the water appears clear and odorless, if its quality does not meet microbiological standards, it still carries a high risk of causing disease. This condition strengthens the findings of the study, which showed a very high odds ratio (OR) of 35.00. This figure shows that limited access to clean, adequate water is a major risk factor and plays a dominant role in the occurrence of diarrhea in toddlers.

2. Qualitative Data Analysis

The results of this qualitative study were used to clarify the situation regarding diarrhea cases in toddlers. These findings indicate that diarrhea cases in toddlers are part of the general community diarrhea problem and are related to the diarrhea control system in place in the region.

a. Input

Inputs to the diarrhea management system include human resources, facilities, policies, and support from various sectors and communities. A second informant stated that the availability of ORS is a crucial yet limited input:

"For oralit, it is indeed quite minimal, stocks are not always available." (Informant 2)

Besides drugs, reporting applications are also part of the information system, although they often experience disruptions.

"Sometimes when I want to input data into the application, I run into problems, the application won't open." (Informant 2)

On the other hand, support from the village government and community organizations is also crucial. Informant 3 (Village Head) stated that the healthy toilet program has been supported by the Special Allocation Fund (DAK) and assistance from the central government.

"The Healthy Toilet program should have been realized almost 90%, that's from the DAK (Special Allocation Fund)... including the independent village category." (Informant 3)

However, community participation as social input is still less than optimal, especially in waste management:

"Regarding waste, that is still a matter of homework, not all people have the same level of awareness." (Informant 3)

b. Process

The processes within this system include treatment, epidemiological monitoring, education, and cross-sector collaboration. Informant 2 (Head of

the Community Health Center) explained the process for handling diarrhea cases, starting with services at the health facility and ending with home visits.

"If there are cases of diarrhea, we still serve them according to procedure, starting from treatment to education for the family." (Informant 1)

Epidemiological surveillance is carried out through application systems and field visits:

"If a diarrhea patient comes in, their data is first entered into the app. From there, we assess them. If there are several cases in one area, then we conduct a home visit." (Informant 2)

During the visit, officers immediately checked the environmental sanitation conditions:

"When we survey homes, we check the toilets, water, and waste disposal. If there's anything missing, we immediately report it and educate them." (Informant 2)

Inter-sector collaboration is also part of the process, which is carried out through quarterly meetings.

"Cross-sector, we have cross-sector meetings every 3 months... what we have here is us, the sub-district, the village, community organizations, PKK." (Informant 1)

c. Output

The expected outputs of this system include a reduction in diarrhea incidence, increased public awareness, and improved environmental sanitation. However, in the field, these achievements still face obstacles due to suboptimal input and process factors. The second informant expressed his hopes regarding the community's response to diarrhea cases:

"That's what we were hoping for. When a baby or child is diagnosed with DRN, their parents will immediately take them to a health facility." (Informant 1)

However, in reality there are often delays in handling due to a lack of understanding from parents:

"The child was taken when he was really weak... his mother probably didn't realize it." (Informant 1)

On the other hand, the health education provided has not yet had a real impact on changing people's behavior, because physical environmental factors are still the main determinant:

"Sometimes the mother actually washes her hands diligently and understands, but the water she uses is the problem." (Informant 2)

This strengthens the results of the quantitative analysis which shows that CTPS (Handwashing with Soap) behavior does not have a significant effect on the incidence of diarrhea compared to environmental factors such as water quality, toilet cleanliness, and waste management.

These findings indicate that the diarrhea management system in the Doro highlands is open-ended, with outcomes highly dependent on the quality of inputs, particularly basic sanitation infrastructure, as well as the effectiveness of processes, particularly related to cross-sector integration and community response. Without improvements in physical aspects such as clean water and adequate latrines, behavioral change efforts such as handwashing will have little impact—a phenomenon known as re-contamination. Therefore, the diarrhea management system needs

comprehensive reform, prioritizing infrastructure improvements, rather than simply behavioral change campaigns.

CONCLUSION

The results of the quantitative analysis showed a significant relationship between environmental factors and the incidence of diarrhea in toddlers. Variables such as access to clean water, the presence of a family toilet, and household waste management had a statistically significant relationship with the incidence of diarrhea in toddlers ($p < 0.05$), while hygiene behavior variables showed no significant relationship ($p > 0.05$). These findings demonstrate the important role of environmental sanitation conditions in the incidence of diarrhea in toddlers.

Qualitative results support the quantitative findings. Diarrhea management is carried out through routine health services, case surveillance, home visits, and education related to environmental sanitation. However, program implementation still faces several obstacles, including limited facilities, inadequate recording systems, and a lack of cross-sectoral collaboration. Therefore, comprehensive diarrhea management in toddlers requires improving environmental sanitation, strengthening diarrhea prevention programs, and enhancing coordination between community health centers (Puskesmas) and village governments.

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