



## The Determinants of the Incidence of Diarrhea in Underfive Children in Urban Coastal Areas: A Cross-sectional Study

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### ABSTRACT

Toddlers in metropolitan coastal locations like Bitung City still have a high rate of diarrhea, which fluctuates. The environment, health services, and host factors are some of the causes of diarrhea in toddlers. This study aims to quantify the factors that influence the prevalence of diarrhea in young children living in coastal urban settings. This study uses a cross-sectional methodology and is an analytical survey. This study was conducted in coastal urban regions. The state of the latrines, supplies of clean water, and the frequency of diarrhea in toddlers were the study's variables. Observations and interviews were used to gather data. Mothers of toddlers were interviewed, and researchers made observations using pre-existing forms and questionnaires. Both univariate and bivariate analysis are used in the study analysis. Both the square time test and the square khi test are used in bivariate analysis. The SPSS program, version 16.0, was used to conduct this analysis. According to the findings, 54.3% of children had diarrhea within the previous three months. 40% of drilled wells and up to 60% of dug wells are used as sources of drinking water by families under five. Gooseneck latrines with septic tanks and infiltration are used by up to 40% of families with children under five. The results of the bivariate analysis demonstrated that there is a relationship between the incidence of diarrhea in toddlers and the condition of clean water sources, with a p-value of 0.030 ( $p < 0.05$ ). Additionally, a p value of 0.005 ( $p < 0.05$ ) was found for the association between the latrine's condition and the incidence of diarrhea in toddlers, indicating that there is a relationship. In metropolitan coastal locations, the incidence of diarrhea in toddlers is determined by the state of latrines and clean water sources

## **INTRODUCTION**

Diarrhea is clinically defined as the passage of three or more loose or watery stools within a 24-hour period (Sumampouw, 2017; Napitupulu et al., 2022), which in severe cases may consist solely of fluid. When someone has loose or liquid bowel motions more than three times a day, even if they are just water, they are said to have diarrhea. The illness known as diarrhea is defined by an increase in the frequency of bowel movements (more than three times per day) and a change in the stool's consistency, which can be mushy or liquid with or without blood or mucus (Sumampouw 2017; WHO 2023). There are two types of diarrhea: acute diarrhea and persistent/chronic diarrhea. Chronic diarrhea lasts more than 14 days, whereas acute diarrhea lasts less than 14 days. There are three types of diarrhea: exudative, secretory, and osmotic (Sumampouw 2017).

Generally speaking, children under five are more vulnerable to the transmission of bacteria that cause diarrhea since their immune systems are still developing and they are in the oral phase. In Indonesia, diarrhea continues to be the leading cause of death for children. All age groups are susceptible to diarrhea, including children, adults, and children under five. However, infants and children under five are more likely to experience severe diarrheal illnesses that have a high death rate. Diarrhea was found to be associated with a number of issues, particularly in children under five. The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) say that diarrhea is the second leading cause of death for children under five, with 2 billion cases reported annually worldwide. Diarrhea is the primary cause of malnutrition in children under five (WHO 2023) and the top cause of death for children under five worldwide, accounting for around 800,000 fatalities annually (UNICEF 2023; Ministry of Health of the Republic of Indonesia 2021).

Diarrhea in children under five is a common public health issue. According to the Indonesian Ministry of Health, there were 1,591,944 cases (40%) of diarrhea among children under five in 2019, 1,140,503 cases (28.8%) in 2020, and 879,596 cases (23.8%) in 2021. The national target of 20% is still exceeded by this data (Juliansyah & Pratama 2022). According to the North Sulawesi Provincial Health Office, 25,661 children under five had diarrhea in 2018. In North Sulawesi, the majority of cases of diarrhea in children under five occur in coastal regions and islands, particularly in urban coastal areas like Bitung City. According to the Bitung City Health Office, there were 296 instances of diarrhea in children under five in 2021, 538 cases in 2021, and 747 cases in 2023. Furthermore, one under-five kid died from diarrhea in each of the years 2022 and 2023 (North Sulawesi Health Office 2018; Lumintang et al 2019).

In Indonesia, a number of risk factors are thought to either directly or indirectly cause diarrheal illnesses in infants and children under five. There are both direct and indirect causes of diarrheal illness. Environmental, health care, and host factors can all contribute to this diarrheal illness (Wahyuni 2021; Khairunnisa et al 2020). Poor personal hygiene, under-five children who are not exclusively breastfed, malnutrition, measles, mothers' and under-five children's habit of not washing their hands while preparing food or after defecating (BAB),

and immunodeficiency are all factors that contribute to diarrheal diseases (Ministry of Health of the Republic of Indonesia 2022; Rahman et al 2016). Access to health care and the availability of infrastructure and facilities are examples of health service factors (Widoyono 2021).

## LITERATURE REVIEW

There are two types of causes of diarrhea: direct causes, which are bacteria that enter the body through food and drink, and indirect causes, which include things like hand washing practices and the use of hygienic toilets in homes (Napitupulu et al, 2022; Sumampouw 2018; Nurhayati et al 2015; Ashkenazi & Schwartz 2020; Sumampouw 2019).

Both at the individual and population levels, disease incidence is influenced by disease risk factors (Indriani & Yanti 2022). Diarrhea in children under five is caused by a number of risk factors. According to a number of studies, there are four main categories of risk factors for diarrhea in children under five: mother, child, behavior, and environmental variables. Age, education, occupation, handwashing habits, and feces habits are examples of host factors (Mother). Age, gender, nutritional status, exclusive breastfeeding, neonatal visits, and immunization status are the host factors (children) that are measured. Environmental elements include toilet quality, clean water amenities, and family socioeconomic status. Access and availability are linked to health service characteristics (Sumampouw 2017; Wahyuni 2021; Iryanto et al 2021; Wibisono 2020; Shafira et al 2021; Heryanto et al 2022).

There are three categories of diarrhea prevention for children under five: basic, secondary, and tertiary. Primary prevention of diarrheal illnesses might focus on host, environmental, and causal variables. Different attempts are attempted to eradicate the microorganisms that cause diarrhea in order to address the causal issues. To alter the environment, efforts are made to improve the biological environment, clean water, and environmental sanitation. Improving dietary condition and immunization can boost the host's immune system. Children who have experienced diarrhea or who are at risk of developing it are the target of this second level of prevention, which focuses on early diagnosis, prompt and appropriate treatment, and avoiding side effects and consequences. People who have diarrhea shouldn't die from dehydration, according to the third level of preventive. Diarrhea victims are currently attempting to regain as much of their physical and mental abilities as they can. At this stage, diarrheal disease side effects are also prevented through rehabilitation efforts (Juliansyah 2021; Noventi et al 2023; Muaja et al 2020; Sumampouw 2021).

This research is urgent since diarrhea is one of the major infectious diseases in North Sulawesi, particularly in urban coastal areas, especially in children under five. Diarrhea in children under five must therefore be prevented and controlled. Finding a structural model of the prevalence of diarrhea in children under five in urban coastal areas is one of the initiatives to prevent and control diarrhea in children under five in urban coastal areas. Given the issues mentioned above, a more thorough investigation is required to develop a model

of the incidence of diarrhea in children under five, particularly in metropolitan coastal locations. In light of this, the goal of this study is to examine the prevalence of diarrhea in children under five who live in urban coastal areas.

## **METHODS**

### **Study Design and Period**

A cross-sectional investigation was undertaken in July and August 2024, during which data were obtained exclusively through interviewer-administered questionnaires.

### **Study Setting**

Girian Bawah Village, in Bitung City's Girian District, is the site of the study. Girian Bawah Village was chosen because it has the highest rate of diarrhea cases among children under five in Bitung City and has poor environmental sanitation conditions, such as people whose drilled and dug wells still don't meet the standards. These include the distance of less than 10 meters between the clean water source and the septic tank, the state of the latrines near the clean water source, and the state of the water that is still tainted with seawater, which can lead to pollution. Densely crowded areas, people without personal latrines, and many people still only have access to emergency latrines, among other things. According to Bitung City's Regional Spatial Plan (Spatial and Regional Plan/RTRW) (BPS 2024; Seridity et al 2016), the Fish Processing Industrial Estate is a Certain Industrial Development Area situated in the coastal Girian District, which is the hub of urban and environmental development, particularly Girian Bawah Village. According to data from Bitung City's Central Statistics Agency, Girian Bawah sub-district is 73.56 Ha (8.56% of Girian District's total area). There are 6285 people living in this community, with 3214 men and 3071 women. According to Seridity et al. (2016), the Girian Bawah sub-district's land use includes rivers, green areas, plantations, industries, communities, and its proximity to the shore.

### **Survey Population**

All mothers and caregivers of children under five who had experienced diarrhea and received outpatient treatment at Girian Bawah Health Centers in Bitung City during the preceding six months made up the research population. The children were not included as respondents in this study; only the mother/caregiver was.

### **Sample Size and Sampling Methods**

The Lemeshow formula, which is appropriate for an unknown population, was used to calculate the sample size from the survey population. The equation indicated that 120 was the minimal sample size. Therefore, it was necessary to collect 140 respondents from four healthcare facilities, where

$$n = \frac{Z_{1-\alpha/2}^2 P (1-P)}{d^2}$$

$n$  = Minimum sample size

$d^2$  = Precision (level of confident = 90%)

$Z_{1-\alpha/2}^2$  = Distribution value in Z table (95% = 1.96)

$P$  = Proportion estimate = 50% (0.5)

The following inclusion criteria were used to choose the study participant:

1. Willingness to participate in the survey based on written informed consent
2. Had experienced diarrhea at least three months before to the research and had received treatment no more than once. This study included a time constraint in order to reduce data mistakes, assuming that respondents would still recall the behaviors and events they had encountered.
3. At home during the study's execution (interviews).

The following exclusion criteria were also used to choose the research participant:

1. Possessing a communicative impairment
2. Having a mental illness.

Based on the presumption that the respondents would be available for interviews, the interviews were conducted in the afternoon. The response candidate was chosen at random from the community health center's records of children who had been treated for diarrhea. 140 responders in all were chosen.

### **Data Collection**

All respondents were given structured questionnaires to complete in order to gather data. With the help of instructors, students, and trained staff from Sam Ratulangi University's Faculty of Public Health in Manado, Indonesia, the author conducted the interviews. To make sure they understood every question, the interviewer was briefed on the interview process in advance. The data from this questionnaire was collected in July 2024, and additional analysis was done.

### **Data Quality Management**

To preserve the quality of the data, in addition to validity and reliability testing, data collector training, editing, coding, processing, and cleaning were carried out. Editing include looking for any missing data on the questionnaire. Rerun the data collection procedure if the questionnaire was incomplete. When entering data into the SPSS program, coding is done. Processing, which is based on standard operating procedure, is carried out during the data analysis to verify the progress. Cleaning is completed at the end by double-checking whether the data are complete according to the questionnaire or if there are any missing data points.

### **Data Analysis**

First, the data from the questionnaire were then analyzed for its frequency distribution using a univariate test. The Chi Square test in the SPSS program was then used to examine the data for the correlation between independent and dependent variables.

## RESULT AND DISCUSSION

### Univariate Analysis

The distribution of characteristics of mothers under five and children under five, as well as the distribution of respondents according to study factors, were explained using univariate analysis. The following table illustrates this.

Table 1. Distribution of Characteristics of Underfive Children Mothers

Characteristic	Group	%
Age	18-25 Years	48,6
	26-30 Years	22,9
	31-35 Years	22,9
	36-40 Years	5,7
	Total	100,0
Job Type	Laborer	22,9
	Self employed	14,3
	Housewives	60,0
	Civil servants / Retired/ state army	2,9
	Total	100,0
Education Level	Elementary school	22,9
	Junior high school	14,3
	Senior high school	60,0
	Diploma/ Bachelor	2,9
	Total	100,0

According to Table 1, the majority of moms under five are between the ages of 18 and 25 (48.6%), housewives (60%), and have completed high school (60.0%). Additionally, the traits of children under five according to age and gender are described. The following table illustrates this.

Table 2. Distribution of Underfive Children Characteristics

Characteristic	Group	%
Gender	Man	60,0
	Woman	40,0
	Total	100,0
Age	1 Year	22,9
	2 Years	34,3
	3 Years	25,7
	4 Years	17,1
	Total	100,0
Types of clean water sources	Dig Well	60,0
	Drilled Wells	40,0
	Total	100,0

According to Table 2, the majority are male (60.0%), two years old (34.3%), and have a well-dug pure water source (60.0%). Additionally, as shown in the following table, the distribution of respondents according to research variables is explained.

Table 3. Distribution of Respondents Based on Research Variables

Characteristic	Group	%
Toilet Condition	Good	60,0
	Not good	40,0
	Total	100,0
Clean Water Source	Healthy	54,3
	Unhealthy	45,7
	Total	100,0
Incidence of Diarrhea	Yes	54,3
	Not	45,7
	Total	100,0

According to the study's findings, 54.3% of children under five reported having diarrhea within the previous three months. Uncovered dug wells are an unhealthy source of clean water used by up to 45.7% of households under five. Up to 40% of families with children under five use poor toilets (latrines without septic tanks and infiltration).

Water that satisfies health standards and can be consumed after cooking is referred to as clean water. One of the things that people need in order to live healthier lives is clean water. The most crucial factor for every person, whether they live in an urban or rural region, is the availability of sustainable and reasonably priced clean water (Pinontoan & Sumampouw, 2019).

Because it satisfies human requirements like drinking, bathing, washing, cleaning, and watering, which all require clean water, meeting human needs for clean water is a staple. For human health, prosperity, and well-being, clean water is essential. WHO claims that inadequate access to water and sanitation has an effect on poverty, mortality, and health (Sultan, 2021).

According to the Minister of Health Regulation No. 32 of 2017 concerning environmental health quality standards, clean water requirements for hygiene and sanitation purposes, swimming pools, solus per aqua, and public baths are as follows: the maximum levels permitted are odorless, tasteless, and colorful; the microbiological parameters for the amount of Coliform per 100 ml are 50 colonies for non-piped water and E. coli as much as 0/100 ml of water sample (Sasmita et al., 2022). In addition to having a negative impact on malnutrition, contaminated water can spread illnesses like cholera, dysentery, typhoid, polio, and diarrhea. Maintaining a sustainable supply is therefore essential to balancing the human need for clean water (Sultan, 2021).

A latrine is a facility for disposing of human waste that consists of a sitting or squatting area with a gooseneck and a water and manure reservoir for cleaning (Wahyuni, 2021). The two types of latrines that are utilized are cemplung latrines

and septic tengki latrines, often known as goose necks. Cemplung latrines are latrines with a pit-like shelter that serves to store, absorb, and settle waste into the soil. A lid is required for cemplung latrines in order to prevent odors. Gooseneck toilets, also known as septic tank latrines, are gooseneck-shaped latrines protected by a waterproof septic tank that serves as a container for the infiltration-equipped breakdown of human waste (Siregar et al., 2020).

Family latrines are beneficial for maintaining a hygienic, healthful, and odorless atmosphere as well as for preventing contamination of nearby water sources. Using hygienic and safe family latrines also keeps insects and flies away, which can lead to infectious disorders like diarrhea that are brought on by human waste (Firmansyah et al., 2021).

### Bivariate Analysis

The findings of the test when squared analysis of correlations between variables are explained in this section. Table 4 illustrates this.

Table 4. Results of Bivariate Analysis

		Incidence of Diarrhea in Underfive childrens			Total	Sig Value.
		Yes	Not			
Condition of Family Toilets	Not good	n	64	20	84	0,005*
		%	45.7%	14.3%	60.0%	
	Good	n	12	44	56	
		%	8.6%	31.4%	40.0%	
	Total	n	76	64	140	
		%	54.3%	45.7%	100.0%	
Clean water sources	Unhealthy	n	56	20	76	0,030*
		%	40.0%	14.3%	54.3%	
	Healthy	n	20	44	64	
		%	14.3%	31.4%	45.7%	
	Total	n	76	64	140	
		%	54.3%	45.7%	100.0%	

### The Correlation Between the Condition of Clean Water Sources and the Incidence of Diarrhea in Underfive Childrens

The study's findings indicate that there is a relationship between the incidence of diarrhea in children under five and the condition of clean water sources, with a p value of 0.030 ( $p < 0.05$ ) (Table 4). Clean water facilities must adhere to health regulations to avoid contamination, and the availability of clean water sources strives to deliver clean water to the population. According to the Ministry of Health of the Republic of Indonesia (1994) concerning Water Sanitation in the Clean Water Supply and Sanitation Program, clean water facilities include the facilities used, construction requirements and minimum distance from polluting sources, and the physical state of clean water supply

sources used for bathing, washing, and cooking (dug wells, drilled wells, deep/shallow hand pump wells) that are in accordance with the indicators of clean water sanitation inspection requirements.

Using clean water is one of the right and effective ways to prevent diarrhea because some of the bacteria that cause diarrhea can spread through the mouth, liquids, or objects contaminated with feces, such as drinking water, fingers, or food prepared in pots washed with contaminated water (Hamzah & Hamzah 2021).

This study supports Simatupang's (2014) findings that the incidence of diarrhea in children under five in Terjun Village is significantly correlated with clean water ( $p = 0.002$ ). The prevalence of diarrhea in children under five in Waleure Village is correlated with clean water facilities, according to research by Yantu et al. (2021). Research conducted by Utama et al (2019) in the working area of the Arosbaya Health Center concluded that the condition of clean water facilities that have met the requirements can reduce the incidence of diarrhea in Underfive childrens, but on the other hand, if the clean water facilities do not meet the requirements, the frequency of Underfive childrens experiencing diarrhea will increase.

All of the study's participants had access to clean water. None of the respondents used clean water sources from pipes; instead, the bulk of respondents used drilled and dug wells. The pipeline has not been included in the occupied region, which is the Coastal region, Lower Girian Village, according to the findings of respondent interviews.

There are still individuals who have not complied with the specifications for the building of dug wells, according to the findings of the inspection for the state of clean water facilities in respondents with clean water facilities of the type of dug wells overall. For instance, up to 33 (94.3%) respondents said "yes" when asked if there were latrines within a 10-meter radius of the well. Disease-causing pathogens will contaminate clean water if a well is dug less than ten meters from the toilet area. Clean water that is devoid of bacteria and disease seeds must be the source of the water utilized to meet everyday demands. Septic tanks should be built at least ten meters away from wells that have been excavated.

The American Public Health Association (APHA) and the World Health Organization (WHO) state that the presence of microorganisms in a drilled well determines the water's quality (Esther et al. 2019). Because bacteria from polluting sources can contaminate groundwater up to 10 meters away, excavated wells must be constructed at least 10 meters away from the source of bacteriological pollutants, in this case the human waste reservoir. According to research by Siswandi et al. (2020), the amount of Coliform will be higher the closer the dug well and other clean water sources are to the source of pollutants, such as latrines, and lower the farther the dug well is from the source of pollutants.

People in both rural and urban locations can obtain clean water from a variety of sources, including dug wells. Water from excavated wells is drawn from the soil layer next to the soil's surface, making it susceptible to contamination from domestic, animal, and human waste seepage. The

requirements must be followed when building dug wells. This is required to keep drilled well water safe and clean in compliance with the regulations (Ester et al. 2019). In this metropolitan coastal area, 40% of the population uses drilled wells as a daily source of clean water. Drilled wells are groundwater exploration conducted in the context of groundwater research and study to gather aquifer configuration and parameter data.

### **The Correlation Between the Condition of the Latrines and the Incidence of Diarrhea in Underfive Childrens**

The study's findings demonstrated that there is a correlation between the latrine's condition and the incidence of diarrhea in children under five, with a p value of 0.005 ( $p < 0.05$ ) (Table 4). In Raanan Baru Village, West Motoling District, South Minahasa Regency, research by Sengkey et al. (2020) revealed a relationship between the prevalence of diarrhea in under-five children aged 24-59 months and the presence of latrines. This study supports Simatupang's (2014) findings that the incidence of diarrhea is significantly correlated with toilet sanitation, particularly the use of latrines ( $p = 0.015$ ). This study supports Simatupang's (2014) findings that the incidence of diarrhea in children under five in Terjun Village is significantly correlated with toilet sanitation, particularly the use of latrines ( $p = 0.015$ ). The majority of family restrooms are in poor condition or do not adhere to health regulations, which increases the risk of spreading diarrheal agents, according to the researcher's observations. Rahim et al. (2016) found a link between the prevalence of diarrhea in children under five in the Banggai Health Center's operational area in Banggai Laut Regency and basic sanitation amenities, such as well-maintained latrines. The incidence of diarrhea in children under five in Sangaji Village, Ternate City, was found to be correlated with environmental factors (latrine conditions), according to research by Soamole et al. (2017).

Research from Pricilia et al (2021) states that improper stool disposal will facilitate the spread of diseases that can be transmitted through feces, such as diarrheal diseases. Households that have the habit of defecating in accordance with the rules will increase the risk of diarrhea in Underfive childrens by 2 times compared to households that have the habit of defecating according to the rules. Toilets that do not meet the requirements can be seen in terms of cleanliness, aesthetics, the condition of smelly latrines or latrines that are not covered. Latrines that do not meet these requirements can be a medium for disease transmission, especially diarrheal diseases.

The environmental aspect, especially in the aspect of having an unhealthy latrine, affects the incidence of diarrhea in Underfive childrens, the researcher assumes, because having a poor latrine will have a greater risk of contracting the disease. Economic issues may contribute to the lack of adequate latrines. The prominent risk factor in the incidence of diarrhea in Underfive childrens is the socioeconomic status of the family. The lower the economic level, the higher the risk of diarrhea because poverty and health are interconnected. Developing countries tend to have people with lower health status compared to other countries.

The prevention of diarrheal illnesses in children under five is associated with family socioeconomic characteristics, such as family income. Additionally,

households who live near rivers (deltas and estuaries) may be more susceptible to illnesses like diarrhea due to their socioeconomic fragility, particularly during floods. Furthermore, the frequency of illness outbreaks is influenced by environmental and socioeconomic factors (Sumampouw 2017; Sumampouw et al 2019; Noventi et al 2023).

Human excrement can spread diarrheal illnesses, thus all households should use latrines and keep them clean to prevent insects from spreading illness or contaminating food. The incidence of diarrhea in children under five is doubled in households with noncompliant defecation habits compared to households with compliant defecation habits (Hamzah & Hamzah 2021).

The Minister of Health Regulation No. 3 of 2014 states that the health standards and requirements of toilet buildings include: the upper building of the latrine, which consists of the walls and roof; the middle building, which is a sanitary pit for the disposal of feces (feces and urine) with a gooseneck construction; the floor of the latrine, which is made of waterproof materials and has channels for wastewater disposal; and underbuildings that function to prevent contamination from feces through disease vectors, either directly or indirectly (Opu et al., 2021).

A healthy latrine is one that doesn't contaminate the source of drinking water, is situated 10 to 15 meters away from it, doesn't smell, and has a wide enough distance and slopes towards the squat hole so that it doesn't contaminate the surrounding soil. It should also be easy to clean and safe to use, have protective walls and roofs, waterproof and colored walls, good lighting and ventilation, a waterproof floor, and water and cleaning supplies. According to the Ministry of Health of the Republic of Indonesia (2017), the benefits and functions of healthy latrines include protecting the public's health from diseases, preventing odor and aesthetic disturbances, preventing insects from becoming disease vectors, and preventing pollution in the environment and clean water supply.

## **CONCLUSION AND RECOMMENDATION**

The incidence of diarrhea in children under five in urban coastal regions can be determined by the state of latrines and clean water sources. As a result, public education regarding clean water and latrines is essential to preventing and eliminating diarrhea in children under five. The government must also play a part in initiatives to offer family latrines that adhere to health regulations and clean water amenities.

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