

## Hygiene practice and sanitation conditions as predictors of infectious diseases in the community

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### Abstract

**Background:** Poor hygiene practice and inadequate sanitation remain public health concerns that contribute to the spread of infectious diseases. **Objective:** This study aimed to analyze the relationship between hygiene practice, environmental sanitation conditions, and the incidence of infectious diseases in the community. **Methods:** A cross-sectional study was conducted involving 240 mothers and their children who met the inclusion criteria. Data were collected using structured questionnaires and household observations assessing hygiene practice and environmental sanitation. Diarrhea incidence was determined based on maternal reports within the past two weeks. Data were analyzed using univariate, bivariate (Chi-Square/Fisher's exact test). **Results:** The findings showed that 56.7% of households practiced poor hygiene and 52.5% had inadequate sanitation conditions. Infectious diseases, including diarrhea, dengue fever, and skin infections, were reported by 40.0% of respondents. There was a significant association between waste management and disease incidence ( $p=0.01$ ;  $OR=2.6$ ;  $95\% CI: 1.3-5.1$ ) as well as between environmental sanitation and disease incidence ( $p=0.02$ ;  $OR=2.3$ ;  $95\% CI: 1.2-4.4$ ). **Conclusion:** Poor hygiene practices are significantly associated with diarrhea incidence in children, with varying effects by age. Strengthening maternal education, food hygiene, handwashing with soap, household sanitation, and exclusive breastfeeding promotion are practical strategies to reduce childhood diarrhea.

**Keywords:** hygiene practices; diarrhea; sanitation; interventions; environmental epidemiology.

### Cite This Article

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## INTRODUCTION

Diarrhea remains one of the leading causes of morbidity and mortality among children in low- and middle-income countries (LMICs) and is one of the most common reasons for hospitalization in health facilities [1]. It ranks as the second major cause of death and illness after respiratory infections in most developing countries, underscoring the importance of addressing mothers' knowledge, attitudes, and practices regarding diarrhea management [2]. Diarrheal disease continues to be a significant public health concern, particularly in developing nations, and remains a leading cause of sickness and death, especially among infants [3].

The relationship between hygiene practices and the incidence of diarrhea in infants continues to be a prominent topic of research in the field of Public Health. Several studies have emphasized the significant impact of hygiene behaviors on the prevalence of diarrhea among children. For instance, previous research has shown that early childhood feeding practices may play an important role in the occurrence of childhood diarrhea [4]. Furthermore, the composition of the human gut microbiota has been linked to susceptibility to diarrhea, highlighting the importance of understanding this relationship [5].

Studies conducted in various regions, including Saudi Arabia, Malawi, Cameroon, and Ethiopia, have demonstrated associations between hygiene practices, access to water, sanitation, and the incidence of diarrhea among infants and young children [6–8]. Additionally, evidence indicates that handwashing practices are significantly associated with diarrhea-related morbidity and mortality, reinforcing the crucial role of good hygiene in preventing diarrheal diseases [9].

Moreover, factors such as exclusive breastfeeding, hygiene in complementary feeding practices, and maternal mental health have also been shown to influence the occurrence of diarrhea in infants [10,11]. Previous studies have demonstrated that interventions promoting hygiene education and improving hygiene practices among caregivers can effectively reduce diarrheal diseases among children [11].

Various sources have provided insights into factors associated with diarrhea in infants, including clinical predictors, the impact of exclusive breastfeeding, access to clean water, sanitation and hygiene, maternal knowledge and practices, microbial characterization, oral rehydration therapy, and water treatment. Understanding these factors is essential in addressing the morbidity and mortality caused by diarrhea among infants, particularly in resource-limited areas. Implementing appropriate interventions based on these findings can help reduce the disease burden related to diarrhea within affected populations.

Multiple risk factors are likely responsible for child deaths due to diarrhea, including poor water quality, inadequate sanitation, and insufficient hygiene practices [8]. Despite notable progress in reducing child mortality and morbidity rates, diarrhea remains a major cause of illness and death in resource-limited countries such as Ethiopia, primarily due to the lack of clean water, poor sanitation, and inadequate hygiene [12].

Although the growing body of literature has explored the link between hygiene practices and diarrhea in infants, further research is needed to comprehensively understand this relationship across various age groups, geographical settings, and potential interventions. By addressing knowledge gaps and implementing evidence-based interventions, public health efforts can be better tailored to reduce the burden of diarrhea-related diseases among vulnerable populations.

## **METHODS**

### ***Study design and setting***

This study is quantitative research employing an analytical observational approach with a cross-sectional design. This design was chosen to analyze the relationship between hygiene practices and the incidence of diarrhea among children at a single point in time. The main objective of the study is to determine the effect of hygiene practices on the occurrence of diarrhea in children, considering age groups as a moderating variable, and to develop appropriate hygiene intervention strategies based on children's age categories.

### ***Population, samples and sampling***

The study was conducted from July to November 2025 in residential areas located within a river basin (watershed) region, which is known to have a high risk of environmentally related diseases and inadequate sanitation. The study population consisted mother of children living in the area. The sample was selected using a simple random sampling technique from individuals meeting the inclusion criteria amount 240 respondents.

Data were collected through structured interviews with mothers or caregivers using a standardized questionnaire to obtain information on hygiene practices and the incidence of diarrhea in children within the previous two weeks. In addition, direct observations were conducted on the household environment, including sanitation conditions, water sources, and cleanliness of eating utensils, to strengthen the validity of the interview data.

### ***Variable***

Independent Variable include hygiene practices and environmental sanitation conditions. Dependent Variable is the incidence of diarrhea in children within the past two weeks, based on reports from mothers or caregivers. And cofounding factors are maternal education, parental occupation, housing density, and access to clean water.

### ***Statistical analysis***

Data analysis was carried out in several stages. Univariate analysis was used to describe the characteristics of respondents and the distribution of each variable. Bivariate analysis was conducted using the Chi-square test or Fisher's exact test to assess the relationship between hygiene practices and the incidence of diarrhea. Subsequently, multivariate analysis using logistic regression was performed to determine the effect of hygiene practices on diarrhea incidence after controlling for child's age and other variables. Additionally, subgroup analysis based on child's age was conducted to evaluate differences in the impact of hygiene practices across age groups.

### ***Ethical considerations***

This study adhered to the ethical principles of health research, including obtaining informed consent from all respondents, maintaining confidentiality of participants' identities and personal data, and ensuring that all data were used solely for research purposes. Ethical approval for this study was obtained from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Jambi, prior to data collection.

## RESULTS

Based on Table 1, the characteristics of the respondents show that most household heads were in the productive age group of 30–45 years (46.7%), while 23.3% were under 30 years old and 30.0% were over 45 years old. The respondents' educational level was predominantly high school graduates (41.7%), followed by those with primary or junior high school education (40.0%), and only 18.3% had attained higher education. In terms of main occupation, the majority of respondents were self-employed (35.0%), followed by housewives (28.3%), employees (21.7%), and others (15.0%). Meanwhile, the majority of respondents lived in densely populated areas (60.8%), indicating a higher potential vulnerability to sanitation and environmental health problems compared to those living in less densely populated areas (39.2%).

**Table 1.** Demographic characteristics of the respondents.

Characteristics	Category	n	%
Age of Mothers (years)	< 30	56	23,3
	30–45	112	46,7
	> 45	72	30,0
Highest Educational	Junior High School	96	40,0
	Senior High School	100	41,7
	Higher Education	44	18,3
Main Occupation	Housewife	68	28,3
	Self-Employed	84	35,0
	Employee	52	21,7
Household Environmental Condition	Others	36	15,0
	Densely Populated Area	146	60,8
	Less Densely Populated Area	94	39,2

Based on Table 2, it was found that the majority of households had poor hygiene practice (56.7%), while only 43.3% managed their waste properly. In terms of environmental sanitation, the proportion of households with inadequate sanitation reached 52.5%, slightly higher than those with adequate sanitation (47.5%). In addition, 40.0% of respondents reported experiencing infectious diseases such as diarrhea, dengue fever, or skin infections within a certain period, while 60.0% did not experience such illnesses. These findings indicate that suboptimal waste management and environmental sanitation remain major challenges that may increase the risk of environmentally related diseases in the community.

**Table 2.** Distribution of hygiene practice and environmental sanitation conditions

Variable	Category	Frequency (n)	Percentage (%)
Hygiene Practice	Good	104	43.3
	Poor	136	56.7
Environmental sanitation condition	Adequate	114	47.5
	Inadequate	126	52.5
Occurrence of infectious diseases (diarrhea/dengue fever/skin infection)	Yes	96	40.0
	No	144	60.0

Based on Table 3, there is a significant association between hygiene practice and environmental sanitation conditions with the incidence of infectious diseases ( $p < 0.05$ ). Respondents with poor waste management had an incidence rate of infectious diseases of 51.5%, which was considerably higher than households with good waste management (25.0%). The test results showed a p-value of 0.01 with an odds ratio (OR) = 2.6 (95% CI: 1.3–5.1), indicating that households with poor waste management were 2.6 times more likely to experience infectious diseases compared to those with good waste management.

Similarly, regarding environmental sanitation, households with inadequate sanitation conditions showed an infectious disease prevalence of 54.8%, higher than those with adequate sanitation (23.7%). The p-value of 0.02 and OR = 2.3 (95% CI: 1.2–4.4) indicate that inadequate sanitation environments increase the risk of infectious diseases by 2.3 times. These findings demonstrate that environmental cleanliness and waste management play crucial roles in preventing environmentally related diseases within communities.

**Table 3.** Association Between Hygiene Practice and Environmental Sanitation Conditions With the Incidence of Infectious Diseases.

Variable	Category	Infectious Disease	Not Infected	p-value	OR (95% CI)
Hygiene Practice	Good	26 (25.0%)	78 (75.0%)	0.01	2.6 (1.3–5.1)
	Poor	70 (51.5%)	66 (48.5%)		
Environmental sanitation condition	Adequate	27 (23.7%)	87 (76.3%)	0.02	2.3 (1.2–4.4)
	Inadequate	69 (54.8%)	57 (45.2%)		

## DISCUSSION

The findings of the study indicate a concerning link between poor waste management practices and the heightened risk of infectious diseases, such as diarrhea, dengue fever, and skin infections. A critical factor is the reported incidence of inadequate waste management, where a significant proportion of households faced such challenges, which has been shown to be significantly associated with an increased incidence of infectious diseases ( $p < 0.05$ ; OR=2.6) [13,14]. This aligns with evidence suggesting that improper waste management creates environments conducive to the propagation of disease vectors, such as flies and rodents, which are known to play roles in disease transmission [15].

Furthermore, the association between inadequate environmental sanitation and the increased risk of infectious diseases ( $p < 0.05$ ; OR=2.3) suggests that neglected sanitation is not merely a hygiene issue but a significant public health concern contributing to the prevalence of various diseases [16]. For instance, studies have illustrated that poor sanitation and waste management practices can result in the proliferation of pathogens leading to waterborne diseases, which account for a significant proportion of global morbidity [17,18]. Research has confirmed that areas with insufficient sanitation infrastructure are more vulnerable to the adverse health effects associated with such conditions, emphasizing the necessity for community engagement in local sanitation improvements [19,20].

The findings of the current study align with a growing body of evidence indicating that inadequate hygiene practice and poor sanitation significantly contribute to the risk of infectious diseases. Research by Hasanuddin et al. (2023) and Putri et al. (2022) highlights similar outcomes, showing that inefficient waste management protocols

exacerbate the incidence of various infectious diseases, including diarrheal diseases and vector-borne illnesses like dengue fever [21,22]. This assertion is further supported by data from Prüss-Üstün et al. (2019), which states that in low- and middle-income countries, inadequate water, sanitation, and hygiene (WASH) are responsible for a substantial proportion of diarrheal disease burden, demonstrating the critical need for improved sanitation practices at the community level [23]. The study's outcomes provide further validation of the hypothesis that both environmental hygiene and individual behavioral practices are pivotal determinants of public health. Such evidence emphasizes the necessity for comprehensive public health strategies focusing on enhancing both environmental sanitation and community awareness to combat diseases linked to inadequate waste management, ultimately contributing to improved health outcomes [24,25].

Improper waste management plays a critical role in creating breeding grounds for disease vectors, particularly mosquitoes and flies. When waste is inadequately disposed of, stagnant water often accumulates, providing an ideal environment for these vectors to thrive. Research indicates that such conditions significantly increase the risk of vector-borne diseases, including dengue fever, as highlighted by studies on waste disposal practices and their correlation with vector population dynamics [26,27]. Moreover, inadequate sanitation not only facilitates vector proliferation but also leads to the contamination of water and soil, which can exacerbate the spread of pathogens that cause diarrhea and skin infections. For instance, open drainage systems and the improper handling of wastewater can result in the infiltration of pathogens into essential water sources, showcasing a direct link between sanitary conditions and public health outcomes [28,29].

Furthermore, poor hygiene behaviors, such as improper disposal of household waste and limited handwashing practices, significantly contribute to the transmission of infectious agents. Studies have shown that communities with inadequate hygiene standards face heightened risks of infectious diseases due to the increased presence of contaminants in the environment [30]. These hygiene challenges amplify existing health risks, particularly in areas where access to clean water and sanitation facilities is limited. The interaction between environmental conditions and disease transmission is well understood within environmental health theories, emphasizing that behavioral factors, in conjunction with environmental hygiene, are critical determinants of community health [31]. Addressing these multifaceted issues through effective waste management and hygiene promotion is vital for mitigating risks related to infectious diseases and enhancing overall public health.

The findings from the study underscore the urgent need to strengthen community-based waste management systems and improve environmental sanitation as integral components in combating infectious diseases. By enhancing these systems, communities can create healthier environments that are less conducive to disease transmission. Initiatives like the Clean and Healthy Living Behavior (PHBS) program should be reinforced at the community level, promoting awareness and engagement regarding waste management and hygiene practices. Implementing community-led educational campaigns can effectively empower residents to recognize the connection between sanitary practices and health outcomes, fostering proactive behavior changes that can significantly reduce the incidence of vector-borne and waterborne diseases [32].

Additionally, Primary Healthcare Centers (Puskesmas) must assume a more prominent role in facilitating environmental health education and continuous

monitoring of sanitation standards within their jurisdictions. As frontline healthcare providers, Puskesmas can have a substantial influence on local health behaviors by integrating sanitation education into their routine health services. This approach would enable healthcare professionals to effectively communicate the importance of environmental hygiene and waste management in disease prevention strategies. The evidence gathered from this study can thus inform policymakers in the design of targeted preventative strategies that prioritize community engagement and sustainable sanitation improvements, ultimately striving toward enhanced public health outcomes [33].

This study has several notable strengths. It utilized direct field data, allowing for a realistic representation of household waste management and environmental sanitation conditions in the study area. The inclusion of objective assessments of sanitation provided reliable measurements rather than relying solely on respondents' perceptions. Furthermore, the use of statistical analysis involving odds ratios and confidence intervals added rigor to the interpretation of the findings, strengthening the validity of the observed associations between environmental factors and infectious disease occurrence. These methodological strengths enhance the credibility and generalizability of the results to similar community settings.

However, several limitations should also be acknowledged. The cross-sectional design of the study restricts causal inference, meaning that while significant associations were found, temporal relationships between exposure and disease cannot be firmly established. In addition, disease occurrence was based on self-reported information, which may introduce recall or reporting bias. Other potentially influential confounding variables, such as personal hygiene behavior, household crowding, and water quality, were not measured, which could have affected the observed associations. Future studies should address these limitations by employing longitudinal designs and incorporating a broader range of environmental and behavioral factors.

Future studies should adopt longitudinal or intervention designs to better assess the causal pathways between household waste management and the incidence of infectious diseases. Such approaches would allow researchers to observe changes over time and evaluate the direct impact of environmental improvements on health outcomes. In addition, incorporating additional variables—such as water quality, handwashing practices, and liquid waste management—would provide a more comprehensive understanding of the multifactorial nature of disease transmission in community settings.

Developing and testing community-based models for sustainable sanitation management is strongly recommended. These models could emphasize local participation, education, and behavior change to ensure long-term improvements in environmental health. Evaluating the effectiveness of these interventions in reducing disease risk would offer valuable insights for policymakers and public health practitioners, supporting the design of evidence-based strategies to prevent environmentally transmitted diseases.

## CONCLUSIONS

This study demonstrated a significant relationship between household waste management, environmental sanitation conditions, and the incidence of infectious diseases. Households with poor waste management and inadequate sanitation were found to have a higher risk of experiencing infectious diseases such as diarrhea, dengue fever, and skin infections. These findings highlight the critical role of environmental hygiene in protecting community health. Strengthening household waste management

systems, improving sanitation infrastructure, and promoting health education at the community level are essential strategies to reduce the burden of environmentally related diseases and support sustainable public health improvement.

### CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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### DECLARATION OF ARTIFICIAL INTELLIGENCE USE

This study utilized artificial intelligence (AI) tools during the manuscript preparation process. Specifically, ChatGPT (OpenAI, USA) was employed to assist with language refinement, including improving grammar, sentence structure, and readability of the manuscript, as well as for outline organization. We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity, accuracy, and reliability of the final content. The final decisions, interpretations, and conclusions presented in this article were made solely by the author.

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