

Analysis of Sanitation Independence Against Environmentally Based Disease Risks in Coastal Areas of Pangkep Regency

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ABSTRACT

Introduction: Environmental health issues in Indonesia's coastal regions are exacerbated by inadequate sanitation, economic limitations, and insufficient government focus. The 2023 Indonesian Health Survey reveals communities using contaminated water and poor waste disposal practices, heightening risks for diseases like diarrhea, cholera, and stunting. This study investigates how traditional leaders impact the prevalence of these environmentally related diseases in Tamangapa Village, Pangkep Regency. **Methods:** This study employed an analytic observational design using a cross-sectional approach. The study population consisted of 1,137 household heads, with a sample of 92 respondents selected using accidental sampling. Data were collected through questionnaire-based interviews to assess sanitation independence and factors related to the risk of environmentally related diseases. The data were analyzed using linear regression. **Results:** The results showed that sanitation availability had a significant effect on the risk of environmentally related diseases ($p = 0.003$). In contrast, sanitation knowledge ($p = 0.124$) and the role of the government ($p = 0.068$) did not have significant effects. The role of traditional leaders ($p < 0.001$) and financial capacity ($p < 0.001$) had significant effects on the risk of environmentally related diseases. **Conclusion:** Sanitation availability, the role of traditional leaders, and financial capacity are important factors associated with the risk of environmentally related diseases among coastal communities. Strengthening sanitation infrastructure, community economic capacity, and the involvement of traditional leaders may contribute to reducing environmental health risks in coastal areas.

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INTRODUCTION

Environmental health issues in Indonesia are still dominated by basic issues such as inadequate housing, limited access to clean water, inadequate household toilets, and inadequate household waste and sewage management systems. According to the World Bank's Water and Sanitation Program (WSP) report, Indonesia ranks second among countries with the worst sanitation in the world (Hafizah, 2022). This demonstrates that sanitation remains a major challenge in public health development.

As a maritime nation with over 17,000 islands, Indonesia faces unique challenges in equitable development, particularly in coastal areas. Approximately 16.4 million people live in coastal areas spread across 8,090 villages (Dewi, 2019). However, coastal communities tend to face higher risks of environmental health problems due to limited infrastructure, technology, and government attention to providing basic facilities such as healthcare and education (Sandifer, 2023; Firdausi et al., 2023; Sumampouw, 2022).

One real and often overlooked problem is poor environmental sanitation in coastal areas (Yusriani & Gafur, 2020). Sanitation facilities in these areas are generally very limited and disproportionate to the population (Haque et al., 2010). Yet, sanitation has been a global agenda item in the Sustainable Development Goals (SDGs), particularly Goal 6, which targets universal access to clean water and adequate sanitation (Youth SDG Camp, 2015).

Data from the 2023 Indonesian Health Survey (SKI) shows that 2.5% of the population still uses contaminated water, 3% do not have access to toilet facilities, and 55.1% dispose of household waste directly into the environment without treatment (Ministry of Health of the Republic of Indonesia, 2023; Daud et al., 2024). This situation is very concerning because poor sanitation can cause more than 10,000 deaths annually. Various diseases such as diarrhea, cholera, dysentery, typhus, intestinal worm infections, polio, and stunting are direct impacts of poor sanitation management (Amraeni & Nirwan, 2021; Novianti, 2020; Puspitasari et al., 2023).

Field observations in Ma'rang District, Pangkep Regency, show that although public awareness of open defecation (ODP) practices has improved, many fecal waste drains still flow directly into the sea or ponds. Some communities also still practice open defecation in rivers and the sea. Furthermore, clean water sources do not meet physical standards due to color, odor, and taste. Household liquid waste is discharged directly into the surrounding environment, such as rivers, ponds, and the sea, similar to domestic waste that is disposed of carelessly (Mahmud et al., 2023; Hafizah, 2022). Ironically, contaminated marine and fishpond products are still traded as a source of livelihood for the community, which means that not only the local community is at risk of health risks, but people outside the village who are consumers can also be threatened.

The coastal area of Pangkep faces significant sanitation challenges, exacerbated by geographic and economic conditions, and limited basic infrastructure. This makes coastal communities more vulnerable to environmental-based diseases. Data shows that 38.3% of toddlers have experienced infectious diseases, and 44.8% live in environments with poor sanitation. In this context, sanitation independence is a crucial factor. Sanitation independence refers to the ability of individuals, families, and communities to manage and maintain environmental cleanliness independently without relying entirely on external intervention. Therefore, it is important to analyze the extent to which the level of sanitation independence of coastal communities is related to the potential risk of environmental-based diseases, particularly in the coastal areas of Pangkep Regency, by examining ownership of sanitation access, knowledge, institutionalization (government involvement) and traditional leaders, as well as the financial capacity of coastal communities.

LITERATURE REVIEW

Environmental sanitation in coastal areas has long been recognized as playing a crucial role in determining the risk of environmentally-related diseases. Research in various coastal areas in Indonesia shows that limited access to adequate toilets, clean water, and waste disposal systems increases the incidence of diseases such as diarrhea and skin diseases (Firdausi et al., 2023; Hafizah, 2022). Coastal geography, which is vulnerable to seawater pollution and waste accumulation, increases the potential for pathogen exposure, making sanitation availability a key factor in preventing environmentally-related diseases.

In addition to the physical aspects of sanitation, community knowledge regarding clean and healthy living behaviors is also often studied as a determinant of environmental health. However, research shows that good knowledge levels do not always correlate with healthy sanitation practices. A cross-regional study in rural Indian communities found a significant gap between handwashing knowledge and actual practice, influenced by limited access to facilities and environmental conditions (Chatterjee et al., 2022). Similar findings were also reported in coastal areas of Indonesia, where structural factors outweighed individual knowledge alone (Firdausi et al., 2023).

The role of institutions, particularly government involvement, is also a focus in coastal environmental health research. Several studies report that government interventions in sanitation have not consistently reduced disease risk, particularly when program implementation is uneven and lacks sustainability (de Wit et al., 2024). This situation suggests that the existence of sanitation programs alone is insufficient without strong implementation support, regular monitoring, and active involvement of coastal communities.

On the other hand, the role of traditional leaders or figure customs starts to get attention in studying the health environment. Research shows that figure customs have a significant influence in forming social norms and behavior through legitimacy, social and approach-based wisdom locally (Nilyati et al., 2023). In coastal areas, the involvement of traditional leaders has proven capable of increasing community compliance with sanitation and hygiene practices, especially when formal intervention from the government is still limited.

The financial capacity of coastal communities also plays an important role in determining the risk of environmentally related diseases. Recent studies have shown that socioeconomic status influences household access to adequate sanitation facilities, clean water, and health services, which can directly affect the risk of environmentally related diseases (Irankhah et al., 2024). However, research integrating sanitation availability, sanitation knowledge, the role of government, the role of traditional leaders, and financial capacity within a single analytical framework remains limited. Therefore, this study seeks to address this gap by adopting a more holistic approach to understanding the determinants of environmentally related disease risk in coastal communities.

METHOD

This study was conducted in the coastal area of Ma'rang District, Pangkep Regency, South Sulawesi, Indonesia, specifically in Tamangapa Village, from August to November 2026. Tamangapa Village was selected because it is a coastal community characterized by aquaculture and marine-related activities and faces environmental sanitation challenges, including limited access to sanitation facilities and sanitation services.

This analytical observational study employed a cross-sectional design. The study population consisted of 1,137 household heads based on official records from the Tamangapa Village Office for 2025. The sample size was calculated using Slovin's formula, $n = N / [1 + N(e^2)]$, where $N = 1,137$ and the margin of error was set at 10%. The calculation

yielded 91.92 respondents, which was rounded up to 92 respondents. Participants were selected using accidental sampling.

The inclusion criteria were household heads aged ≥ 18 years who had resided in Tamangapa Village for at least five years, were able to communicate and complete the interview, and provided written informed consent. Respondents who were unable to complete the interview or provided incomplete information were excluded from the study.

Data were collected through face-to-face interviews using a structured questionnaire developed based on relevant literature and adapted to the local context. The dependent variable was sanitation independence, measured using a numerical score. The independent variables included sanitation availability, sanitation knowledge, government or institutional involvement, the role of traditional or community leaders, and household financial capacity. Potential confounding variables included age, education, occupation, household income, and household size. Each variable was operationally defined based on predetermined indicators, measurement scales, assessment procedures, and cut-off points.

Prior to data collection, the questionnaire was subjected to validity and reliability testing. To minimize potential selection and information biases, standardized eligibility criteria and interview procedures were applied. Interviewers were also trained to administer the questionnaire consistently and avoid influencing respondents' answers.

Data were analyzed using SPSS version 31. Descriptive statistics were used to summarize the characteristics of the respondents and study variables. Bivariate analyses were performed to examine the associations between each independent variable and sanitation independence. Multiple linear regression analysis was subsequently conducted to assess the simultaneous effects of the independent variables on sanitation independence while controlling for potential confounding factors. Regression results were presented as regression coefficients (β), 95% confidence intervals (95% CIs), and p -values. Statistical significance was set at $p < 0.05$.

Ethical approval was obtained from the Ethics Committee of the Muslim University of Indonesia (registration number UMI012508691). Written informed consent was obtained from all respondents before their participation in the study.

RESULTS AND DISCUSSION

A total of 92 household heads from Tamangapa Village participated in this study and completed the questionnaire. The results are presented in several stages, beginning with the respondents' sociodemographic characteristics and the distribution of the main study variables, followed by the results of the bivariate and multiple linear regression analyses. The analysis focused on sanitation independence as the dependent variable and examined its relationships with sanitation availability, sanitation knowledge, government or institutional involvement, the role of traditional or community leaders, and household financial capacity.

Table 1 Respondent Characteristics

Characteristics	Categories	Frequency (n)	Percentage (%)
Gender	Man	49	53.3
	Woman	43	46.7
Age Group	17 – 25 Years	5	5.4
	26 – 35 Years	11	12.0
	36 – 45 Years	57	62.0
	46 – 55 Years	8	8.7
	56 – 65 Years	6	6.5
	65 < Years	5	5.4

Based on Table 1, it is known that the most respondents were male, with 49 people (53.3%), while the least respondents were male, with 43 people (46.7%). The table above also explains that the most respondents were aged 36-45 years, with 57 people (62.0%), while the least respondents were aged 17-25 years and <65 years, with 5 people (46.7%).

Table 2. Variables Studied

Variables	Categories	Risk Disease Based Environment						P- value
		Low		Currently		Tall		
		(n)	(%)	(n)	(%)	(n)	(%)	
Availability Sanitation	Enough	3	3.3	8	8.7	9	21.7	0.003
	Not enough	3	3.3	10	10.9	59	64.1	
Knowledge Sanitation	Enough	3	3.3	10	10.9	21	37.0	0.124
	Not enough	3	3.3	8	8	47	63.0	
Role of Government	Enough	5	5.4	13	14.1	36	39.1	0.068
	Not enough	1	1.1	5	5.4	32	34.8	
The Role of Traditional Figures is	Sufficient	0	0.0	2	2.2	37	40.2	0,000
	Not enough	6	6.6	16	17.4	31	33.7	
Ability Financial	Enough	3	3.3	13	14.1	10	10.9	0,000
	Not enough	3	3.3	5	5.5	58	63.0	

Based on the table above, it shows The influence of sanitation knowledge in preventing environmental-based diseases in coastal areas. Bivariate analysis with regression with a p-value of $0.003 < 0.05$. These results explain that there is an influence of the role of sanitation availability on the risk of environmental-based diseases. The table above also shows The influence of sanitation knowledge in preventing environmentally-based diseases in coastal areas. Bivariate analysis with regression with a p-value of $0.124 > 0.05$. These results indicate that there is no influence of the role of sanitation availability on the risk of environmentally-based diseases. The table above also shows The influence of the government's role in preventing environmentally-based diseases in coastal areas. Bivariate analysis with regression showed a p-value of $0.068 > 0.05$. These results indicate that there is no influence of the government's role on the risk of environmentally-based diseases. The table above also shows The influence of the role of traditional leaders in preventing environmental-based diseases in coastal areas. Bivariate analysis with regression with a p-value of $0.000 < 0.05$. These results explain that there is an influence of the role of traditional leaders on the risk of environmental-based diseases. The table above also shows The influence of financial capacity on preventing environmental-based diseases in coastal areas. Bivariate analysis with regression with a p-value of $0.000 < 0.05$. These results explain that there is an influence of financial capacity on the risk of environmental-based diseases.

The Influence of Sanitation Availability on the Risk of Environmentally Based Diseases in the Coastal Area of Tamangapa Village

The analysis results show that the availability of sanitation in the coastal area of Tamangapa Village still varies between households. Some residents have own access to clean water, but facility sanitation base like toilet healthy, channel disposal closed waste and systems adequate drainage Still Not yet evenly distributed. Condition This cause several residential areas is at in condition prone to to contamination environment, especially in areas located near the coastline and often affected puddle or wastewater runoff.

Analysis level risk disease-based environment showed that disease like diarrhea, dermatitis, and disorders channel breathing more often found at house hold that have

sanitation not enough adequate. Community groups that use toilet No worthy, have disposal waste liquid open, or own limited access to clean water show incident disease taller compared to house ladder with adequate sanitation standard health environment.

In a way overall, results study confirmed that availability sanitation influential significant to risk disease-based environment in the coastal area of Tamangapa Village. Households with sanitation No worthy own greater risk big experience disease-based environment consequence height potential exposure pathogen from water, land, and contaminated surfaces. Findings This emphasize importance improvement infrastructure sanitation as effort prevention disease as well as protection public health in the coast area.

This research aligns with research conducted by Wolf J et al., which revealed that sanitation interventions reduce the risk of diarrhea by up to 24%. WASH (Water, Sanitation, and Hygiene) interventions reduce the risk of diarrhea in children in low-income and middle-income countries (LMIC). Interventions that provide filtered water at the POU, better water quality from improved sources on-site, or basic sanitation services with sewerage connections are associated with increased reductions. Our results support the higher level of services listed in SDG 6. It is important to note that no study has yet evaluated interventions that provide access to safely managed *WASH services*, the level of service committed to universal coverage by 2030 in the SDGs (Wolf et al, 2022).

Similarly, research by Merid MW et al., which further explains the analysis of LMIC data, shows a reduction in the risk of diarrhea associated with better water and sanitation resources, suitable for the context of developing countries (Merid et al, 2023).

A cluster-RCT study in the Democratic Republic of Congo reported that a community-driven WASH intervention had no effect on diarrhea prevalence and did not improve child length -for-age Z-scores in the primary measure. The authors highlighted that although many villages implemented WASH plans, contextual factors and other environmental pathways prevented clinical effects from being detected (Quattrochi et al, 2023).

The Influence of Sanitation Knowledge on the Risk of Environmentally Based Diseases in the Coastal Area of Tamangapa Village

The analysis of the knowledge variable shows that the level of community knowledge regarding clean and healthy living behaviors, sanitation, and environmentally based disease prevention in the coastal area of Tamangapa Village varies, ranging from low to fairly good. Although some respondents have a sufficient understanding of disease risk factors, behavioral patterns and environmental conditions indicate a discrepancy between knowledge and daily practice.

Statistical tests conducted showed that knowledge did not have a significant influence on the risk of environmentally-based diseases in the coastal community of Tamangapa Village. The community with level People with high levels of knowledge and those with low levels of knowledge have relatively similar levels of disease risk. This indicates that the knowledge possessed is not always applied in behavior or is unable to balance environmental conditions that are indeed prone to.

This result indicates that the risk of environmentally-based diseases in the coastal area of Tamangapa Village is more influenced by physical environmental factors and sanitation conditions than by individual knowledge. The dense coastal environment, inadequate waste disposal systems, and exposure to water and soil contamination maintain a high risk of disease, despite some residents having a good level of knowledge. about prevention.

Research result A similar study was conducted by Chaterjee et al., 2022, in India. This multi-district cross-sectional study found a significant gap between handwashing knowledge and practice in rural communities; context and access factors (not just knowledge) determine practice. Relevance: This supports the argument that high levels of knowledge do not necessarily reduce the risk of environmentally related diseases, as practices and environmental conditions also play a role (Roy MN, 2022). Studies in coastal areas have found limited implementation of practices despite adequate knowledge, and coastal environmental conditions (salinity, flooding, poor drainage) increase exposure (Khan et al, 2023).

Research that is not in line These results also found a relationship between knowledge and environmentally related diseases in coastal areas. This confirms the role of knowledge as a key contributor, which, when enhanced through outreach/education, can reduce the risk of environmentally related diseases (Susilawati, 2023; Lestari, 2022; M Saleh et al, 2024).

The Influence of Government Role on Environmentally Based Disease Risks in the Coastal Area of Tamangapa Village

The results of the data analysis indicate that the government's role does not have a significant influence on the Risk of Environmentally Based Diseases in the Coastal Area of Tamangapa Village, Pangkep Regency. Based on the statistical test conducted, the p-value is above the significance limit ($p > 0.05$), so statistically there is no relationship between the intensity of the government's role and the level of disease risk experienced by coastal communities.

These findings indicate that although the government has implemented several environmental health programs, such as basic sanitation outreach, limited clean water provision, and promotion of clean and healthy lifestyles, these programs have not had a significant impact on reducing the risk of environmentally-related diseases. This could be due to limited program coverage, low implementation consistency, or suboptimal monitoring and evaluation in the field.

Furthermore, other community-level factors, such as household sanitation conditions, waste management practices, water quality, and individual hygiene behaviors, appear to be more dominant in influencing disease risk than the government's role. Therefore, the results of this study emphasize the need for government efforts to be optimized through increased program intensity, cross-sector collaboration, and a more comprehensive community empowerment approach to more effectively control the risk of environmentally-based diseases in the coastal area of Tamangapa Village.

This is in line with the theory of policy implementation, which explains that government policies do not always have an immediate impact because their effectiveness depends heavily on the implementation process: coordination between institutions, adequate resources, consistency of implementation, and public compliance (Pressman and Wildavsky, 1984).

This study found that the government's role did not significantly impact the risk of environmentally-based diseases. This was because sanitation programs had not yet reached the entire community and focused more on outreach than on improving facilities and supervision. Meanwhile, disease risk was more influenced by household sanitation conditions and the economic factors of coastal communities. These results align with a global meta-analysis conducted by de Wit et al. (2024), which explained that evidence on the effectiveness of government-led sanitation and environmental health interventions is inconsistent because it depends on the quality of implementation on the ground. Furthermore, Quattrochi et al. (2025) showed that many government-based WASH

programs did not produce significant health improvements due to limited coverage, lack of monitoring, and low community adoption of these behaviors. These international research findings reinforce the findings of this study, which show that the existence of government programs may not necessarily reduce the risk of disease if not accompanied by optimal implementation and active community participation.

The Influence of the Role of Traditional Leaders on the Risk of Environmentally Based Diseases in the Coastal Area of Tamangapa Village

Environmental management in coastal areas in accordance with existing concepts must be carried out in a planned, rational and responsible manner in accordance with its carrying capacity, prioritizing the greatest prosperity of the people and paying attention to the preservation of the function and balance of the coastal area environment for sustainable development that does not pose a threat to environmental health risks.

Sanitation-related diseases pose significant health risks to coastal populations, necessitating effective sanitation management strategies. Studies have investigated the prevalence of waterborne diseases, such as cholera and typhoid fever, in coastal areas and the role of sanitation interventions in reducing health risks. These studies underscore the importance of improving sanitation infrastructure and promoting good hygiene practices to reduce the burden of disease (Ministry of Health, 2019).

The results of the study show the influence of the role of traditional leaders in preventing the emergence of environmental-based disease risks. The results of the study indicate that the role of traditional leaders has a significant influence in efforts to prevent the emergence of environmental-based disease risks. Traditional leaders play a role in shaping community norms and behavior through customary rules, culture-based health education, and bridging communication between the community and the government in sanitation programs. Traditional leaders not only function as traditional leaders, but also as role models and directors in shaping behavior, habits, and social norms of the community, especially in coastal areas. Through their authority and influence, traditional leaders are able to instill important values about clean and healthy living behavior (PHBS) to the community. Their support encourages the community to be more disciplined in maintaining environmental cleanliness, such as not littering, using proper and hygienic latrines, and protecting clean water sources to maintain their quality.

Furthermore, traditional leaders also serve as bridges between the community and the government, strengthening health education programs based on local cultural values (Rahman, 2020). With a more contextual approach aligned with local wisdom, health messages are more easily accepted and implemented by the community. This strategic role of traditional leaders makes them effective agents of change in creating a healthy environment and strengthening social resilience against various environmental-based disease threats (Nilyati et al, 2023).

Similar research findings in Africa demonstrate how indigenous communities have developed solutions for symbiotic livelihood security and biodiversity conservation through decisions based on their long-standing ethos of rural development and conservation in preventing environmental-based diseases (Bardy et al, 2022). Successful collaboration requires a system of customary regulations that will be combined with modern laws or existing legislation to ensure sound environmental implementation (Kusuma and Pitrianingsih, 2025).

The Influence of the Role of Traditional Leaders on the Risk of Environmentally Based Diseases in the Coastal Area of Tamangapa Village

Research findings showing the influence of financial capacity on the risk of environmentally-based diseases indicate that economic factors play a significant role in determining the level of public health. Better financial well-being typically allows individuals or households to afford healthier facilities and lifestyles. For example, families with adequate income can meet basic needs such as clean water, proper sanitation, healthy housing, and access to health services. These factors directly reduce the potential for exposure to environmentally related diseases, such as diarrhea, skin diseases, acute respiratory infections (ARI), dengue fever.

Conversely, limited financial capacity can restrict households' access to adequate environmental health infrastructure and services. Poor housing conditions, overcrowding, inadequate ventilation, limited access to safe water, and improper waste management are more commonly observed among low-income households. These conditions can create potential sources of environmental contamination and increase the risk of disease transmission. In addition, households with limited financial resources may have less access to health information and fewer opportunities to adopt appropriate preventive practices, further increasing their vulnerability to environmentally related diseases.

Findings study This in line The theories of social determinants of health state that economic status is a key determinant of public health. Financial capacity influences not only access to physical facilities but also the ability to make health-promoting decisions, such as purchasing nutritious food, using personal protective equipment, or undergoing regular health checkups (WHO, 2008; Bloom, 1974; CDC, 2022).

Findings from the study reveal that controlling environmentally related diseases requires more than medical interventions; a comprehensive approach is essential. This includes improving socioeconomic conditions in coastal communities through empowerment programs, job training, and health awareness. The study aligns with Irankhah et al. (2024), highlighting that socioeconomic status affects disease prevalence by interacting with environmental and lifestyle factors. Specifically, household financial capacity influences sanitation conditions and disease risk, underscoring the need to address these determinants together rather than solely focusing on individual health behaviors (Irakhah et al, 2024). Similarly, Newton's study, which explains that social determinants of health, including socioeconomic conditions, impact the physical and mental health of populations, strengthens the evidence that SES cannot be ignored in public health epidemiological studies (Newton et al, 2024).

CONCLUSION

The availability of sanitation, the role of traditional leaders, and financial capacity have been shown to be key factors significantly influencing the risk of environmentally-related diseases. Inadequate sanitation increases the likelihood of community exposure to sources of pollution, while the active involvement of traditional leaders can strengthen compliance and environmental health practices through social legitimacy and local wisdom. Financial capacity, on the other hand, determines household access to adequate facilities and hygienic practices. These three factors interact and collectively shape the level of public health risk. Therefore, efforts to reduce environmentally-related diseases must be carried out through the provision of adequate sanitation, strengthening the role of traditional leaders in education and supervision, and increasing the economic capacity of communities to adopt sustainable healthy lifestyles.

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