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# Sanitation factors and environmentally-based diseases in slum areas of Padang

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## Abstract

**Purpose:** This study aimed to analyze the relationship between sanitation factors and the incidence of environmentally based diseases in the slum areas of Padang. **Methods:** An analytical cross-sectional study was conducted involving 373 households selected through proportional random sampling from 11 sub-districts categorized as slum areas. Data were collected using structured interviews and environmental assessments. Statistical analysis was performed to examine the association between sanitation factors and disease incidence using chi-square tests. **Results:** Among the total respondents, 74.8% reported experiencing environmentally related diseases. A significant association was found between the source of clean water and disease incidence (p=0.035), with individuals using unprotected water sources being more likely to experience illness. Toilet conditions were also significantly associated (p=0.042), with households having poor toilet facilities exhibiting a higher incidence of disease. Waste management practices and wastewater drainage were associated with disease incidence (p=0.042), suggesting that inadequate disposal methods may contribute to health risks. The presence of mosquito larvae around households was significantly correlated with higher disease rates (p=0.010), indicating the role of vector-borne transmission. Furthermore, healthy home conditions were significantly related to disease incidence (p=0.046), highlighting the importance of proper housing infrastructure in disease prevention. **Conclusion:** Sanitation factors, including access to clean water, proper toilet facilities, effective waste management, control of mosquito breeding sites, and healthy housing conditions, play a crucial role in reducing environmentally based diseases in slum communities. Public health interventions focusing on improving sanitation infrastructure and promoting hygiene practices are urgently needed.

**Keywords:** environmentally-based diseases; sanitation; slum areas

## INTRODUCTION

Sanitation is a fundamental element in promoting public health and improving the quality of human life. Poor sanitation conditions have far-reaching consequences, including the deterioration of the living environment, contamination of drinking water sources, and the increased prevalence of environmentally based diseases [1]. Inadequate sanitation practices can trigger a cycle of ill health, poverty, and environmental degradation, posing significant challenges for sustainable development and public health interventions.

Environmentally-based diseases such as dengue fever, diarrhea, tuberculosis, and acute respiratory infections remain major public health issues in Indonesia [2]. These diseases consistently rank among

the top ten reported in primary health centers nationwide, reflecting persistent challenges in sanitation and hygiene. The continued high incidence of environmentally based diseases is a clear indicator of inadequate environmental health coverage, ineffective sanitation infrastructure, and low levels of clean and healthy living behaviors within communities [2].

In Padang, the trend of environmentally based diseases has shown a significant increase over the past two years. Dengue fever cases rose dramatically from 366 cases in 2021, with an incidence rate of 37.2%, to 824 cases in 2022, corresponding to an incidence rate of 82.6%. Similarly, cases of diarrhea among toddlers increased from 906 cases in 2021 to 1,199 cases in 2022. Total diarrhea cases across all age groups rose from 4,114 cases in 2021 to 5,970 cases in 2022. Furthermore, the number of tuberculosis cases also surged from 2,488 in 2021 to 3,454 in 2022 [3]. These data illustrate the urgent need to strengthen environmental health measures to reduce disease transmission in urban settings.

Slum areas are among the environments most vulnerable to poor sanitation and environmentally based diseases. According to Law Number 1 of 2011 on Housing and Residential Areas, slums are characterized by substandard living conditions, including violations of spatial planning, overcrowding, inadequate and unsafe infrastructure, vulnerability to disease, and social and environmental deterioration [4]. In Padang City, slum areas account for approximately 20% of the city's total area, covering 22 sub-districts out of 104. These settlements are characterized by poor access to clean water, inadequate sanitation facilities, ineffective waste management, and deteriorating environmental conditions, all of which contribute to heightened public health risks.

Although previous studies have recognized the link between sanitation factors and the incidence of environmentally based disease, research specifically addressing multiple sanitation components in the slum areas of Padang City remains limited. Most existing research focuses on general associations without examining contextual factors that influence sanitation practices in urban slums. Therefore, this study aims to analyze the relationship between key environmental sanitation factors—namely, clean water availability, toilet conditions, waste management, presence of mosquito breeding sites, and housing quality—and the incidence of environmentally based diseases in the slum areas of Padang. The findings are expected to provide localized evidence to guide targeted public health interventions and inform urban environmental health policies.

## METHODS

This study employed an analytical observational design with a cross-sectional approach. The research was conducted in the slum areas of Padang, Indonesia, which were identified based on the Mayor of Padang's Decree Number 519 of 2020. The study population consisted of households residing in 22 sub-districts classified as slum areas, totaling 3,354 households. A minimum sample size of 373 households was calculated and obtained using a proportional random sampling technique to ensure equitable representation across different slum categories. Households were selected from low, medium, and high slum categories, covering sub-districts such as Pasar Ambacang, Piai Tangah, Banuaran, Tabing Banda Gadang, Pisang, Balai Gadang, Koto Lalang, Lubuk Begalung, Batipuh Panjang, Anduring, and Padang Besi. The inclusion criteria were households that had lived in the area for at least one year, residents aged 18 years or older, individuals willing to participate, and those able to communicate effectively. Households were excluded if the selected respondent was temporarily absent during data collection or if multiple respondents came from the same household.

Data were collected through structured interviews using a validated questionnaire and supported by direct environmental observations. Trained enumerators conducted interviews and assessments to maintain consistency and reduce bias. The collected information encompassed variables such as the adequacy of clean water sources, toilet conditions, waste management practices, the presence of mosquito larvae, the status of healthy housing, and the occurrence of environmentally based diseases.

Data analysis was conducted using the chi-square test to examine the association between sanitation variables and disease incidence. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using appropriate statistical software to ensure accuracy and validity.

## RESULTS

Table 1 presents the characteristics of sanitation factors among households in the slum areas of Padang. The majority of households relied on unsafe water sources, while most had access to toilet facilities categorized as good. Waste management practices varied, with a considerable proportion of households demonstrating poor waste and drainage management. In terms of vector control, a notable proportion of households reported no presence of mosquito larvae in

their immediate environment. Additionally, more than half of the households lived in homes classified as healthy based on basic housing criteria. These findings indicate variability in sanitation infrastructure and environmental conditions across slum communities, which may influence health outcomes.

**Table 1. Characteristics of sanitation factors among households in slum areas of Padang**

| Variables | n | % |
|---|---|---|
| **Clean water source** | | |
| Unsafe | 268 | 71.8 |
| Safe | 105 | 28.2 |
| **Toilet** | | |
| Poor | 77 | 20.6 |
| Good | 296 | 79.4 |
| **Waste management and drainage** | | |
| Poor | 142 | 38.1 |
| Good | 231 | 61.9 |
| **Presence of mosquito larvae** | | |
| No | 267 | 71.6 |
| Yes | 106 | 28.4 |
| **Healthy home condition** | | |
| Not healthy | 166 | 44.5 |
| Healthy | 207 | 55.5 |

**Table 2. Bivariate analysis of sanitation factors and the incidence of environmentally-based diseases**

| Variables | Sick n(%) | Not sick n(%) | p-value |
|---|---|---|---|
| **Clean water source** | | | |
| Unsafe | 76 (28.4) | 192 (71.6) | 0.035 |
| Safe | 18 (17.1) | 87 (82.9) | |
| **Toilet** | | | |
| Poor | 12 (15.6) | 65 (84.4) | 0.042 |
| Good | 82 (27.7) | 214 (72.3) | |
| **Waste management and drainage** | | | |
| Poor | 27 (19.0) | 115 (81.0) | 0.042 |
| Good | 67 (29.0) | 164 (71.0) | |
| **Presence of mosquito larvae** | | | |
| No | 57 (21.3) | 210 (78.7) | 0.010 |
| Yes | 37 (34.9) | 69 (65.1) | |
| **Healthy home condition** | | | |
| Not Healthy | 33 (19.9) | 133 (80.1) | 0.046 |
| Healthy | 61 (29.5) | 146 (70.5) | |

Table 2 summarizes the results of the bivariate analysis examining the relationship between environmental sanitation factors and the incidence of environmentally based diseases. Significant associations were identified between disease occurrence and several factors, including clean water sources, toilet conditions, waste management practices, the presence of mosquito larvae, and healthy housing conditions. Households with inadequate sanitation facilities, unsafe water sources, poor waste management, visible mosquito larvae, and substandard housing were more likely to report environmentally related diseases. These findings highlight the crucial role of comprehensive sanitation interventions in preventing disease transmission among vulnerable populations in slums.

## DISCUSSION

This study found a significant relationship between several sanitation factors and the incidence of environmentally based diseases in the slum areas of Padang. The availability of clean water sources, the presence of adequate toilet facilities, proper waste management, the presence of mosquito larvae, and healthy home conditions were all associated with disease occurrence.

The analysis revealed that households utilizing unsafe water sources experienced higher rates of environmentally based diseases compared to those using protected water sources. This finding is consistent with previous research, which reported that access to clean water significantly reduces the risk of diseases such as diarrhea, cholera, and typhoid fever [5]. Pathogenic microorganisms often proliferate in contaminated water, making it a critical vector for disease transmission [6]. Ensuring access to safe water remains an essential preventive measure for maintaining community health.

Regarding toilet conditions, the study demonstrated a significant association between inadequate sanitation facilities and disease incidence. Previous studies have shown that families without proper toilet facilities are more likely to experience fecal-oral transmitted diseases, including diarrhea and cholera [7,8]. Poor toilet infrastructure contributes to environmental contamination, supports the breeding of disease vectors, and increases community exposure to infectious agents [9]. Proper waste disposal through functional and sanitary toilets is essential to breaking the chain of infection.

The results also indicated that waste management and wastewater drainage practices were significantly associated with disease incidence. Inadequate waste management creates breeding grounds for pathogens and disease vectors, thereby increasing the risks of gastrointestinal and vector-borne diseases [6,10-12]. Waste accumulation in living environments not only degrades aesthetics but also facilitates the proliferation of harmful bacteria and viruses, ultimately affecting public health.

Furthermore, the presence of mosquito larvae around households was found to be strongly correlated with higher rates of environmentally based diseases,

particularly vector-borne illnesses such as dengue fever [13,14]. Poor environmental maintenance, including stagnant water in containers and clogged drainage systems, creates favorable conditions for mosquito breeding [15]. Effective community-level mosquito control programs are thus vital to reducing the burden of mosquito-borne diseases.

Ultimately, healthy home conditions have been shown to influence disease incidence significantly. This result aligns with prior findings, which suggest that well-constructed and well-maintained housing environments reduce exposure to physical, biological, and chemical hazards [16,17]. Factors such as proper ventilation, adequate lighting, sufficient space, and access to basic sanitation services are essential characteristics of a healthy home and are closely linked to improved health outcomes.

The findings of this study have important public health implications. Improving access to protected clean water sources, enhancing the availability of adequate sanitation facilities, promoting effective waste management, implementing vector control strategies, and ensuring healthy housing standards are crucial strategies for reducing the incidence of environmentally based diseases in slum communities. Public health campaigns emphasizing hygiene behavior, sanitation improvement, and environmental management must be prioritized to create sustainable and resilient health environments.

This study, however, has several limitations. The use of a cross-sectional design restricts the ability to infer causality between sanitation factors and environmentally based disease outcomes. Additionally, data on disease incidence were self-reported by respondents, which could introduce recall bias. Environmental assessments were also limited to observational methods without laboratory confirmation of water or vector contamination. Future research should incorporate longitudinal designs, microbiological assessments, and broader environmental monitoring to strengthen the evidence base.

## CONCLUSION

This study confirmed that sanitation factors, including access to clean water, toilet conditions, waste management, presence of mosquito larvae, and healthy housing, are significantly related to the incidence of environmentally based diseases in slum areas of Padang. Improving sanitation facilities, ensuring access to safe water sources, promoting effective waste management practices, controlling mosquito breeding, and enhancing housing quality are crucial steps in reducing disease occurrence. It is recommended that local authorities and communities collaborate to enhance sanitation infrastructure and promote hygiene practices, thereby supporting improved health outcomes.

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