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Association of Basic Sanitation Access and Personal Hygiene with Skin Disease Occurrence among Flood-Affected Communities in Padang City, Indonesia

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ABSTRACT
Flooding is a hydrometeorological disaster that increases the risk of skin diseases due to poor sanitation and inadequate personal hygiene. This study aimed to analyze the relationship between access to basic sanitation and personal hygiene with the occurrence of skin diseases among flood-affected communities in Padang City in 2025. A quantitative study with a cross-sectional design was conducted involving 150 respondents selected using simple random sampling. Data were collected through structured questionnaires and observations and analyzed using chi-square tests and logistic regression. The results showed that 62.7% of respondents experienced skin diseases. There were significant associations between access to basic sanitation (p = 0.003) and personal hygiene (p = 0.001) with the occurrence of skin diseases. Multivariate analysis indicated that inadequate sanitation was associated with a 2.4-times higher likelihood of skin diseases (OR = 2.40; 95% CI: 1.35–4.26), while poor personal hygiene was associated with a 3.1-times higher likelihood of skin diseases (OR = 3.10; 95% CI: 1.68–5.72). It was concluded that personal hygiene was the most dominant factor associated with the occurrence of skin diseases. Therefore, integrated hygiene-based interventions and the provision of adequate sanitation are important to reduce the risk of skin diseases among flood-affected communities.

Keywords: *Basic Sanitation, Personal Hygiene, Skin Diseases, Flood, Environmental Health*

INTRODUCTION

Flooding is one of the most prevalent hydrometeorological disasters in Indonesia and has continued to increase in frequency over the past decade due to climate change, urbanization, and environmental degradation (Badan Nasional Penanggulangan Bencana, 2023). In the western coastal region of Sumatra, particularly the city of Padang and several regencies in West Sumatra, floods frequently occur due to heavy rainfall, low-lying topography, and suboptimal drainage systems. These

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conditions disrupt access to clean water and sanitation facilities, thereby increasing the risk of environment-related diseases, including skin diseases (Dinas Kesehatan Kota Padang, 2024).

According to the (World Health Organization, 2020), skin conditions such as dermatitis, scabies, and fungal infections are among the most common health impacts in emergency and disaster situations, particularly among populations with poor sanitation and high population density. Recent global studies also indicate that exposure to contaminated water during floods increases the risk of skin infections by up to three times compared to normal conditions (Casanova, Walters, & Naghshineh, 2020; World Health Organization, 2020). In Indonesia, the Ministry of Health reports that skin diseases rank among the top five most common illnesses among flood disaster evacuees (Kementerian Kesehatan Republik Indonesia, 2022).

Basic sanitation, as a determinant of environmental health, includes access to safe drinking water, adequate toilet facilities, and waste management that meets health standards. According to Law No. 17 of 2023 on Health, sanitation is an integral part of promotive and preventive efforts within the national health system. Furthermore, Minister of Health Regulation No. 3 of 2014 on Community-Based Total Sanitation emphasizes that changing community behavior through the Community-Based Total Sanitation (CBTS) approach is key to reducing environment-related diseases.

In the context of disasters, limited sanitation facilities often lead to open defecation, the use of contaminated water, and a lack of handwashing facilities. This is reinforced by a (United Nations Children's Fund (UNICEF), 2022) stating that more than 60% of the disaster-affected population in developing countries experience limited access to adequate sanitation during the emergency response phase. These conditions directly increase the risk of skin diseases and other infections. From a behavioral perspective, personal hygiene is a key factor in preventing skin diseases. Recent studies indicate that poor personal hygiene practices significantly contribute to the incidence of dermatitis and fungal infections among flood-affected populations (Wolf, Hunter, Freeman, & dst, 2018; Prüss-Ustün, Wolf, Bartram, & dst, 2019). Furthermore, a study by (Cairncross, Bartram, Cumming, & Brocklehurst, 2021) confirms that hygiene-based interventions can reduce the risk of skin diseases by up to 35% in communities with limited sanitation.

Although numerous studies have discussed the impact of flooding on environmental health, most previous research has focused only on one determinant, either sanitation access or hygiene behavior, without comprehensively analyzing the interaction between both variables in post-disaster settings. Several international studies were conducted in general emergency contexts and not specifically in recurrent urban flood-prone areas in Indonesia. In addition, empirical evidence examining skin disease occurrence among flood-affected populations in West Sumatra remains limited. Therefore, there is still a research gap regarding how inadequate sanitation and poor personal hygiene simultaneously contribute to skin disease incidence among communities exposed to recurrent flooding. The novelty of this study lies in the integration of environmental and behavioral determinants into a single analytical framework within the context of recurrent flooding in Padang City, Indonesia. Unlike previous studies that examined sanitation and hygiene separately, this study evaluates the combined contribution of both factors using multivariate analysis to identify the dominant determinant of skin disease occurrence among flood-affected communities. Furthermore, this study provides updated local evidence from disaster-prone urban communities in 2025, which may support evidence-based WASH policy development in Indonesia.

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METHODS

Research location map

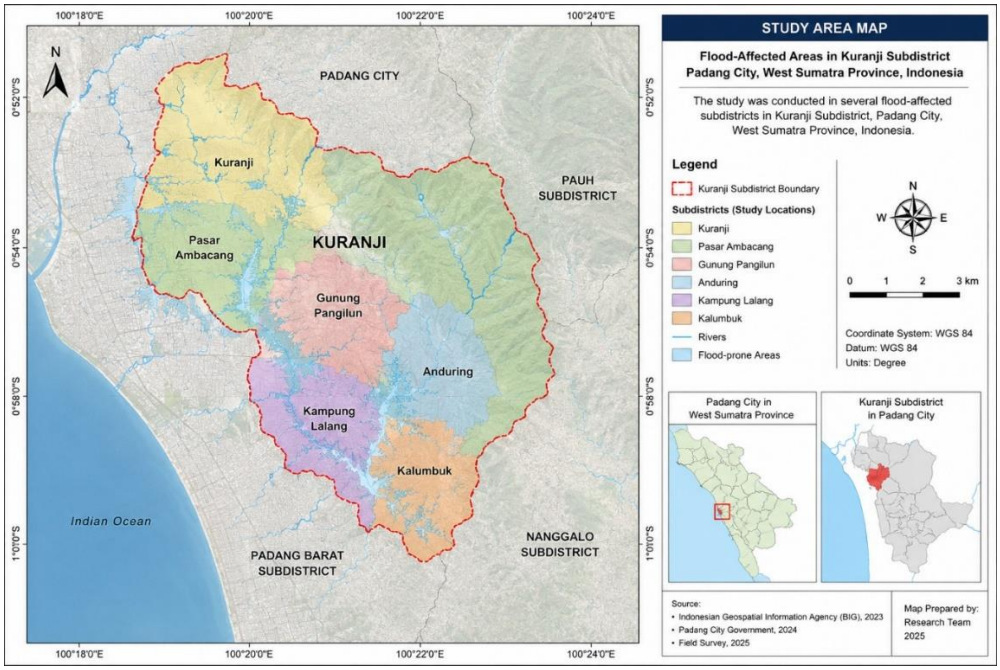

Figure 1. Study Area Map of Flood-Affected Communities in Kuranji Subdistrict, Padang City, West Sumatra Province, Indonesia

Flowchart of the research process

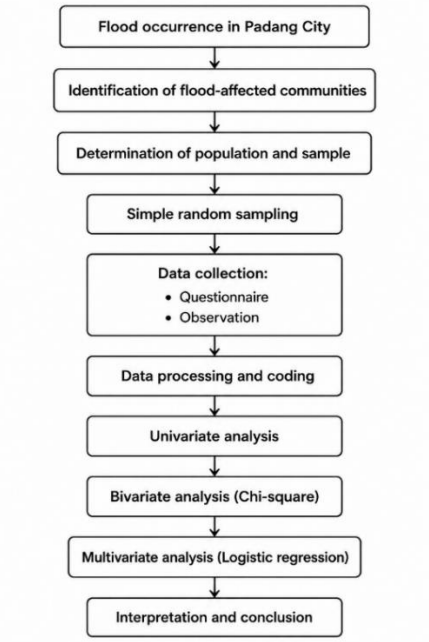

Figure 2. Research Flowchart of the Study on Basic Sanitation Access, Personal Hygiene, and Skin Disease Occurrence among Flood-Affected Communities

This study employed a quantitative design with a cross-sectional approach to analyze the relationship between access to basic sanitation and personal hygiene and the occurrence of skin diseases among flood-affected communities. The study was conducted in 2025 in flood-affected areas of Padang City and its surroundings in West Sumatra Province, Indonesia, a region prone to recurrent

flooding and at high risk for environment-related diseases. The study population consisted of all flood-affected residents in the study area. The study sample consisted of 150 respondents selected using simple random sampling to ensure that every member of the population had an equal chance of being selected.

The sample size was calculated using the Lemeshow formula for cross-sectional studies with a confidence level of 95%, precision level of 8%, and an estimated prevalence based on previous studies regarding skin diseases in disaster settings. Based on the calculation, the minimum required sample size was approximately 150 respondents. Inclusion criteria included residents who had lived in the flood-affected area for at least one week following the flood event and were willing to participate as respondents, while exclusion criteria included respondents who could not communicate effectively or did not complete the questionnaire.

The variables in this study consisted of independent and dependent variables. The independent variables included access to basic sanitation and personal hygiene, while the dependent variable was the occurrence of skin diseases among respondents during or after the flood. Measurements of access to basic sanitation included the availability of clean water, ownership of sanitary toilets, and waste disposal systems. Personal hygiene was assessed based on bathing habits, handwashing practices, and clothing cleanliness. Access to sanitation and personal hygiene were categorized based on questionnaire scoring results and observation findings according to predetermined cutoff points.

The research instruments used were a structured questionnaire and an observation sheet to directly assess environmental sanitation conditions. Prior to data collection, the questionnaire was tested for validity and reliability. The reliability test showed a Cronbach's alpha value of >0.70, indicating acceptable internal consistency. The data obtained were analyzed using univariate analysis to describe the frequency distribution of each variable. Subsequently, bivariate analysis was performed using the chi-square test to determine the relationship between independent and dependent variables. To identify the most influential factors, multivariate analysis was conducted using logistic regression with a 95% confidence level ($\alpha = 0.05$). Prior to data collection, all respondents received an explanation regarding the objectives and procedures of the study and were asked to sign an informed consent form as evidence of voluntary participation. Respondents were also informed that their confidentiality and anonymity would be maintained throughout the study. This study was conducted in accordance with ethical principles involving human subjects.

RESULTS

1. Respondent Characteristics

Table 1. Respondent Characteristics

Variable	Category	Frequency	Percentage
Age	<30 years	46	30.7
	30–45 years	71	47.3
	>45 years	33	22.0
Sex	Male	68	45.3
	Female	82	54.7
Education	Junior High School (SMP)	28	18.7
	Senior High School (SMA)	61	40.7
	Diploma (D3)	24	16.0
	Bachelor's Degree (S1)	29	19.3
	Master's Degree (S2)	8	5.3

Occupation	Civil Servant (PNS)	26	17.3
	State-Owned Enterprise Employee (BUMN)	18	12.0
	Private Employee	47	31.3
	Student	34	22.7
	Others	25	16.7
Flood exposure duration	<3 days	52	34.7
	3–7 days	71	47.3
	>7 days	27	18.0

2. Univariate Analysis

The results of the univariate analysis describing the frequency distribution of each study variable are presented in Table 2.

Table 2. Distribution of Study Variables (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Access to Basic Sanitation	Adequate	60	40.0
	Inadequate	90	60.0
Personal Hygiene	Good	53	35.0
	Poor	97	65.0
Skin Disease Incidence	Yes	94	62.7
	No	56	37.3

3. Bivariate Analysis

The results of the chi-square test used to analyze the association between independent variables and the incidence of skin diseases are presented in Tables 3 and 4.

Table 3. Relationship between Access to Basic Sanitation and Skin Disease Incidence

Access to Sanitation	Skin Disease (Yes)	Skin Disease (No)	Total	p-value
Inadequate	68	22	90	0.003
Adequate	26	34	60	
Total	**94**	**56**	**150**	

Table 4. Relationship between Personal Hygiene and Skin Disease Incidence

Personal Hygiene	Skin Disease (Yes)	Skin Disease (No)	Total	p-value
Poor	72	25	97	0.001
Good	22	31	53	
Total	**94**	**56**	**150**	

4. Multivariate Analysis

The results of the logistic regression analysis identifying the dominant factors influencing the incidence of skin diseases are presented in Table 5.

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Table 5. Results of Logistic Regression Analysis on Skin Disease Incidence among Flood-Affected Communities in Padang City, 2025

Variable	B	p-value	Exp(B) / OR	95% CI
Inadequate sanitation	0.875	0.003	2.40	1.35 – 4.26
Poor personal hygiene	1.131	0.001	3.10	1.68 – 5.72

Based on respondent characteristics, most respondents were aged 30–45 years (47.3%) and female (54.7%). Regarding educational background, the majority had completed senior high school education (40.7%). Most respondents worked as private employees (31.3%). In addition, most respondents experienced flood exposure for 3–7 days (47.3%). These findings indicate that the respondents were predominantly productive-age adults with moderate educational backgrounds and substantial exposure to flood conditions.

Based on the results of a univariate analysis of 150 respondents, it was found that the majority of respondents had inadequate access to basic sanitation, namely 90 people (60.0%), while 60 respondents (40.0%) had adequate sanitation. Regarding personal hygiene, the majority of respondents fell into the "poor" category, totaling 97 people (65.0%), while 53 respondents (35.0%) had good personal hygiene. Furthermore, regarding the incidence of skin diseases, it was found that 94 respondents (62.7%) experienced skin diseases during or after the flood, while 56 respondents (37.3%) did not experience skin diseases. These findings indicate that the incidence of skin diseases is quite high among flood-affected communities in the study area.

The results of the bivariate analysis using the chi-square test indicate that there is a significant association between access to basic sanitation and the incidence of skin diseases ($p = 0.003$). Respondents with inadequate sanitation were more likely to experience skin diseases compared to those with adequate sanitation. Additionally, personal hygiene also showed a significant association with the incidence of skin diseases ($p = 0.001$), with respondents having poor personal hygiene experiencing skin diseases more frequently than those with good personal hygiene.

In addition, the results of multivariate analysis using logistic regression indicated that both independent variables significantly influenced the incidence of skin diseases. The inadequate sanitation variable had an odds ratio (OR) of 2.40 ($p = 0.003$; 95% CI: 1.35–4.26), meaning respondents with inadequate sanitation had a 2.4 times higher risk of developing skin diseases compared to those with adequate sanitation. Meanwhile, the variable of poor personal hygiene had an OR of 3.10 ($p = 0.001$; 95% CI: 1.68–5.72), indicating that respondents with poor personal hygiene had a 3.1-fold higher risk of developing skin diseases. Based on these results, it can be concluded that personal hygiene is the most significant factor influencing the incidence of skin diseases among flood-affected communities, followed by access to basic sanitation.

DISCUSSION

The high prevalence of skin diseases found in this study (62.7%) indicates that flood conditions substantially increased community exposure to environmental health risks. Similar findings were reported by (Nurfajriyani, Sopandi, Fadilatussaniatun, Yusup, & Kurniati, 2020), who found that poor environmental sanitation and limited hygiene practices significantly increased the occurrence of skin-related diseases in disaster-prone communities in Indonesia. Several factors may explain this finding. First, prolonged contact with contaminated floodwater exposes the skin to pathogenic microorganisms, irritants, and pollutants originating from sewage overflow, household waste, and drainage systems (Casanova, Walters, & Naghshineh, 2020). Second, overcrowded conditions in evacuation shelters potentially accelerated the transmission of contagious skin diseases such as scabies and fungal

infections (World Health Organization, 2021). Third, limited access to clean water during the emergency response period reduced the community's ability to maintain adequate personal hygiene practices, including bathing, handwashing, and changing into dry clothing. In addition, high humidity and prolonged use of wet clothing created favorable conditions for microbial growth on the skin. Similar findings were reported by (Prüss-Ustün, Wolf, Bartram, & dst, 2019) and (Freeman, Stocks, Cumming, & dst, 2020), who found that inadequate sanitation and poor hygiene practices significantly increase the occurrence of environment-related skin diseases in disaster-affected populations. These conditions collectively contributed to the high occurrence of skin diseases among flood-affected communities in Padang City.

From a policy perspective, these findings emphasize the importance of strengthening WASH (Water, Sanitation, and Hygiene) interventions in disaster management. In emergency situations, the provision of clean water, temporary sanitation facilities, handwashing stations, hygiene kits, and hygiene promotion activities should become integral components of disaster response programs. An integrated WASH approach is essential not only to prevent diarrheal diseases but also to reduce the transmission of skin infections and other environment-related diseases among displaced populations. Recent studies have shown that integrated WASH interventions significantly reduce the burden of communicable diseases during disasters and emergency situations (United Nations Children's Fund (UNICEF), 2022; Sphere Association, 2021). Therefore, local governments and health authorities should integrate WASH preparedness into flood mitigation and emergency response planning, particularly in recurrent flood-prone areas such as Padang City.

1. The Relationship Between Access to Basic Sanitation and the Incidence of Skin Diseases

The results of the bivariate analysis indicate a significant association between access to basic sanitation and the incidence of skin diseases ($p = 0.003$). Respondents with inadequate sanitation experienced skin diseases more frequently than those with adequate sanitation. These findings confirm that sanitation is an environmental determinant that directly influences skin health, particularly in the aftermath of flood disasters. Biologically, the skin is a protective organ that is vulnerable to exposure to the external environment. During floods, standing water is typically contaminated by various pathogenic agents such as bacteria (e.g., Staphylococcus), fungi (Candida), and parasites causing scabies. Repeated exposure to this contaminated water can damage the skin's protective barrier, thereby facilitating infections and irritation. This condition is exacerbated by high humidity, which creates an ideal environment for the growth of microorganisms.

A national study conducted by (Sari, Widodo, & Lestari, 2021) also reported that inadequate sanitation facilities and limited access to clean water were associated with increased skin disease complaints among flood-affected populations in urban settlements. According to the (World Health Organization, 2020), inadequate sanitation contributes to increased exposure to environmental pathogens, which significantly raises the risk of skin diseases among disaster-affected populations. This is further supported by (Wolf, Hunter, Freeman, & dst, 2018), who state that poor access to sanitation correlates with an increased incidence of skin infections due to poor water quality and high levels of environmental contamination. Furthermore, in the context of the floods in Padang City, damage to sanitation facilities such as submerged toilets, contaminated clean water sources, and wastewater systems that are not functioning optimally has forced the community to use water that does not meet health standards. These conditions collectively increase the risk of skin diseases at the community level. From a public health perspective, these findings indicate that environment-based interventions such as the provision of emergency sanitation, clean water distribution, and rapid and appropriate waste

management are crucial during the emergency response phase of a disaster. Without such interventions, the risk of skin diseases will continue to rise and has the potential to become a broader public health issue.

2. The Relationship Between Personal Hygiene and the Incidence of Skin Diseases

The analysis results indicate that personal hygiene has a significant association with the incidence of skin diseases ($p = 0.001$). Respondents with poor personal hygiene experienced skin diseases more frequently than those with good personal hygiene. These findings confirm that behavioral factors play a crucial role in maintaining skin health, particularly in unfavorable environmental conditions. Theoretically, personal hygiene serves as the first line of defense against the entry of microorganisms into the body. Practices such as regular bathing, handwashing with soap, and changing into clean clothing can reduce the number of microorganisms adhering to the skin. During floods, these practices are often disrupted due to limited access to clean water and sanitation facilities, thereby increasing the risk of microbial colonization on the skin.

Wearing wet or damp clothing for extended periods is also a significant risk factor commonly observed in flood-affected communities. A damp environment on the skin's surface can promote the growth of fungi and bacteria, which in turn can lead to skin infections such as dermatophytosis and dermatitis. Research by (Freeman, Garn, Sclar, & dst, 2017) indicates that improved personal hygiene practices significantly reduce the incidence of environment-related diseases. Additionally (Cairncross, Bartram, Cumming, & Brocklehurst, 2021) confirm that hygiene interventions have a significant impact on reducing skin diseases, particularly among populations with limited access to sanitation. In the local context of Padang City, overcrowded refugee camps and limited access to bathing facilities and clean water have led to poor personal hygiene practices among the community. This indicates that, in addition to environmental factors, behavioral change through health education and promotion is a critical component in the prevention of skin diseases. In addition, a study by (Putri & Handayani, 2022) showed that poor personal hygiene behaviors, particularly irregular bathing and infrequent handwashing, significantly contributed to the occurrence of dermatitis and fungal infections among communities living in humid environments.

3. Dominant Factors Influencing the Incidence of Skin Diseases

The results of the multivariate analysis indicate that both access to basic sanitation and personal hygiene significantly influence the incidence of skin diseases; however, personal hygiene is the most dominant factor (OR = 3.10) compared to basic sanitation (OR = 2.40). These findings suggest that under the same environmental conditions (e.g., both affected by flooding), individuals with better personal hygiene practices still have a lower risk compared to those with poor personal hygiene. This implies that behavioral factors have a strong protective effect even when environmental conditions are not entirely ideal. This finding is consistent with research conducted by (Rahman, Yusuf, & Dewi, 2023), which demonstrated that behavioral factors, especially hygiene practices, were more dominant than environmental factors in determining the occurrence of communicable skin diseases in post-disaster settings.

Conceptually, this aligns with the health determinants theory, which states that behavior is the most influential factor affecting health status. In this context, personal hygiene serves as a "second barrier" after the environment, capable of breaking the chain of disease transmission even when environmental exposure persists. Furthermore, the interaction between sanitation and personal hygiene must also be considered. Poor sanitation without being balanced by good personal hygiene

increases the risk of disease; conversely, good personal hygiene can mitigate the negative impacts of inadequate sanitation. This is reinforced by (United Nations Children's Fund (UNICEF), 2022), which states that an integrated approach combining sanitation provision and hygiene promotion yields more effective results than standalone interventions.

In a policy context, these findings indicate that health interventions in disaster situations must not only focus on providing sanitation infrastructure but must also be accompanied by intensive education regarding personal hygiene. Programs such as the promotion of healthy lifestyle practices (PHBS), the distribution of hygiene kits, and community-based health education are highly relevant strategies to implement in flood-affected areas such as the city of Padang. Thus, this study confirms that an approach integrating environmental and behavioral factors is key to reducing the incidence of skin diseases among flood-affected communities.

CONCLUSIONS

This study found that the incidence of skin diseases among flood-affected communities in Padang City was relatively high (62.7%). Access to basic sanitation and personal hygiene were significantly associated with the incidence of skin diseases. Respondents with inadequate sanitation and poor personal hygiene had a higher likelihood of experiencing skin diseases, with personal hygiene identified as the most dominant associated factor. These findings highlight the importance of improving sanitation access and strengthening hygiene promotion programs in flood-prone communities to reduce environment-related health risks.

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