Proceedings Academic Universitas Jambi
Volume 2, Issue 3, September, 2026

Knowledge and Behaviour Gap Post-Flood: Surveillance of Risk Factors and Tropical Disease Literacy of Residents Affected by Flash Floods in Lambung Bukit, Padang

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Abstract

Background: Floods are the most frequent hydrometeorological disaster in Indonesia, exposing survivors to a compounded burden of tropical and vector-borne diseases. **Objective:** This study aimed to describe the demographic profile, environmental risk exposure, self-reported health complaints, protective behaviour, and post-disaster tropical disease knowledge of flood-affected residents, and to explore the association between flood exposure severity and self-reported skin symptoms. **Methods:** A cross-sectional community surveillance study was conducted among 65 flood-affected residents of Lambung Bukit, Pauh District, Padang City, approximately two to three months after the 27 November 2025 flash flood, using a structured 55-item interviewer-administered questionnaire. Data were analysed descriptively with cross-tabulation. **Results:** Respondents were predominantly women. The most common 14-day complaints were headache and myalgia and itching/skin rash. However, the proportion reporting itching/rash did not show a clear dose-response gradient across flood-exposure categories, suggesting that behavioural and household-level factors beyond direct water contact also shape skin symptom risk. **Conclusions:** Despite generally high tropical disease knowledge and good baseline hygiene practices, a specific and actionable knowledge-behaviour gap persists around post-disaster diarrhoea management, and skin symptoms remain common regardless of flood-exposure severity, indicating that post-flood health education should be symptom-specific and household-targeted rather than assuming uniform benefit from generally adequate knowledge.

Keywords: Disease Surveillance; Disaster Health; Flood; Knowledge-Attitude-Practice; Tropical Diseases; Risk Factors

Cite This Article

Fitriyanti, Harahap H., Dia EIA., Istarini A. (2026). Knowledge and Behaviour Gap Post-Flood: Surveillance of Risk Factors and Tropical Disease Literacy of Residents Affected by Flash Floods in Lambung Bukit, Padang. Proceedings Academic Universitas Jambi, 2(3): e59973. DOI: 10.22437/proca.v2i3.60023

Editor

Dr. Azolla Degita Azis, MBA., M.Ak.

Article info

Received: August 05, 2026 . Revised: August 20, 2026 . Accepted: September 2, 2026

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INTRODUCTION

Flooding is a hydrometeorological hazard whose frequency and intensity continue to increase in Indonesia due to changing environmental conditions driven by climate change. [1] Changes in global river flow patterns also increase flood risk in densely populated downstream areas. [2] Extreme flood events, such as the 2021 Zhengzhou flood in China, illustrate how the interaction between extreme weather and inadequate preparedness and response can significantly worsen disaster impacts. [3] National data indicate that floods are the most frequent disaster in Indonesia every year, with West Sumatra being one of the provinces repeatedly affected by flash floods. [4]

From a health perspective, floods are not only physical and economic disasters but also trigger disturbances and outbreaks of infectious disease. A comprehensive review of post-flood studies in Rio Grande do Sul, Brazil (2024) documented a surge in zoonotic diseases, waterborne infections, and mould-related health problems during the post-flood period. [5] Similar patterns were reported in the post-flood health crisis in Pakistan, which included increased health risks among children, multiple infectious diseases, and disruption of health and emergency services that were not yet ready to face a surge in cases. [6,7,8,9]

The skin is the organ most commonly exposed directly to murky, contaminated floodwater, so itching and rash are among the most frequently reported symptoms among flood-affected residents. [10,11] These symptoms have also been reported to affect a substantial proportion of inhabitants. [12,13] Updates from the Climate Change Committee of the International Society of Dermatology affirm that rapid, education-based access to clean water supply is the main pillar of post-flood dermatosis control. [14] Prolonged humidity is a risk factor for superficial fungal infections, as confirmed by recent reviews on the impact of climate change on fungal infection epidemiology. [15,16] Post-disaster residential density and limited access to skin health services contribute to increased rates of contagious skin infection, including scabies, as documented in large refugee populations and post-disaster skin health needs assessments. [17,18,19,20]

Beyond skin disease, post-flood sanitation and clean water access are consistently linked to diarrhoea incidence, particularly among children, as reported in multilevel studies in Bangladesh and cross-sectional studies in Pakistan. [21,22] Analysis of the water-environment-health nexus in Ghana also identifies environmental factors for waterborne disease in communities along river basins. [23] The risk of infectious disease and zoonoses likewise increases post-flood, as shown in reviews on climate change, malaria, and neglected tropical diseases; studies on the spatial distribution of post-flood malaria risk; and investigations into the historical epidemiology of leptospirosis in Brazil. [24,25,26] Taken together, these findings confirm that floods trigger a surge of multiple disease types simultaneously, so comprehensive surveillance rather than a focus on a single disease is important for planning appropriate health response targets. [27]

A review of observational studies across 168 countries and territories over three decades shows a significant association between flood incidents and increased incidence of infectious disease, with the magnitude of impact varying according to local health system readiness. [28] The latest systematic review of post-flood disease epidemiology confirms that emerging disease patterns are location-specific, so local epidemiological data remain essential for planning effective interventions. [29] The root of the major post-flood health risk lies in the gap between knowledge and preventive behaviour at the household level. Knowledge, attitudes, and practice (KAP) surveys have long been used as a standard instrument for identifying such gaps across

various infectious disease contexts, including leptospirosis among flood-vulnerable populations in India and Malaysia, Rift Valley fever associated with extreme rainfall in Tanzania, and other infectious diseases in various health crisis contexts. [30,31,32,33,34,35,36] These studies consistently show that high knowledge is not always followed by consistent preventive practice, particularly for specific aspects that are rarely targeted by routine education.

In Indonesia, studies on health literacy in disaster-vulnerable communities in Yogyakarta show that health literacy, risk perception, and preparedness together predict community resilience to disaster. [37] Other national reports have found that personal hygiene behaviour and environmental sanitation conditions are meaningfully related to disease incidence among affected residents. [38,39] National environmental health quality standards serve as the reference standard for adequate sanitation and clean water conditions post-disaster. [40]

Nevertheless, integrated surveillance data combining environmental exposure profiles, health complaints, preventive behaviour, and knowledge of post-disaster tropical disease within a single flood- and flash-flood-affected population in Indonesia are not yet available particularly for the population affected by the 27 November 2025 flash flood in Kelurahan Lambung Bukit, Pauh District, Padang City. Based on this gap, this study aimed to describe the demographic profile, environmental risk exposure, health complaints, preventive behaviour, and level of knowledge of post-disaster tropical disease among affected residents, and to explore the relationship between flood exposure and self-reported itching/skin rash complaints, as an evidence-based basis for designing more appropriate post-flood health education interventions.

METHODS

The methods section below explains the research procedure conducted, including study design; population, sample size, and sampling; instruments; procedure and data collection; statistical analysis; and ethical considerations.

This was a descriptive cross-sectional community surveillance study. The research was conducted in Kelurahan Lambung Bukit, Pauh District, Padang City, West Sumatra, an area affected by the flash flood of 27 November 2025. Data collection was carried out during the post-flood period, approximately two to three months after the disaster (January–February 2026).

The study sample consisted of 65 affected residents, selected consecutively during home visits and post-evacuation visits by trained enumerators. Inclusion criteria covered adult residents (or a guardian/family member) living in the flood-affected area who were willing to be interviewed.

Data were collected using the Post-Disaster Flood Tropical Disease Surveillance Sheet, a structured instrument developed by the research team, consisting of 55 items across five domains: (A) demographics (8 items: initials, address, age, education, gender, occupation, number of family members, income); (B) disaster and environmental exposure (12 items: housing status, duration of standing water, floodwater contact, distance from the river, sanitation conditions, presence of rats and open water containers, and similar items); (C) health status/14-day complaints (12 items: fever, headache, muscle/joint pain, diarrhoea, itching/skin rash, cough/cold, and others); (D) health behaviour and practices (12 items: drinking water source, water-boiling habits, footwear use, handwashing with soap, history of health counselling, health insurance ownership, and others); and (E) knowledge of post-disaster tropical disease (8 true/false/don't-know items covering knowledge of floodwater risk, leptospirosis, fever, mosquito vectors, and mites).

Interviews were conducted face-to-face by trained enumerators using the structured questionnaire. Collected data were entered and cleaned (free-text answers were standardised into categories) before being analysed.

Data were analysed descriptively, including frequency distributions and proportions for categorical variables and means with standard deviations for numerical variables, using Python and Microsoft Excel. Knowledge scores were calculated as the proportion of correct answers across the eight items in domain E and categorised as low (<60%), medium (60–79%), or high (≥80%). As an exploratory analysis, additional cross-tabulation was performed between degree of flood exposure (house submersion status) and self-reported itching/skin rash complaints. Given the descriptive-exploratory nature of the study and its limited sample size, no formal inferential hypothesis testing was performed; associations are reported descriptively and interpreted with caution.

The study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all respondents before the interview was conducted. Respondents' identities were recorded as initials and coded to protect data confidentiality, and the data used in the analysis were anonymised. [Ethics committee approval details to be completed by the authors.]

RESULTS

Report of the main outcomes and findings from the community surveillance is presented below, organised by demographic and exposure profile, health complaints, preventive behaviour, level of knowledge, and the exploratory relationship between flood exposure and skin symptoms.

Demographic Characteristics and Flood Exposure

Of the 65 respondents, the majority were female (93.3%), with a mean age of 47.4±15.7 years (range 20–80 years). The highest educational level was senior high school/vocational school/Islamic senior high school (52.7%), and most respondents were housewives (91.8%). The average number of family members was 5.0±2.2 people per household. A total of 33.3% of respondents reported that their homes were completely submerged (>1 m) during the flood, while 56.7% did not experience direct inundation inside their homes. Complete characteristics are presented in Table 1.

Table 1. Demographic Characteristics and Flood Exposure Status of Respondents (N=65)

Characteristics	n	%
Age (years), mean ± SD (n=60)	47.4 ± 15.7	–
Gender (n=60)		
Woman	56	93.3
Man	4	6.7
Last education (n=55)		
Elementary School/Islamic Elementary School	8	14.5
Junior High School/Islamic Junior High School	12	21.8
Senior High School/Vocational School/Islamic Senior High School	29	52.7
College/Diploma	6	10.9

Occupation (n=49)		
Housewife/not working	45	91.8
Working (civil servant/private/labourer/other)	4	8.2
Number of family members (persons), mean ± SD (n=54)	5.0 ± 2.2	–
House status during flood (n=60)		
Not submerged	34	56.7
Partially submerged (<1 m)	6	10.0
Fully submerged (>1 m)	20	33.3

SD: standard deviation. The value of n varies between variables because not all respondents answered all items.

Risk Factors and Health Complaints in the Last 14 Days

More than half of respondents (57.9%) reported the presence of rats around the house post-flood, and 31.0% reported the presence of open water containers that could become vector breeding sites. The most commonly reported health complaints within the last 14 days were headache and muscle/joint pain, each reported by 41.5% of respondents, followed by cough/cold (27.7%) and itching/skin rash (26.2%). Fever was reported by 15.4% of respondents. No respondents reported diarrhoea, jaundice, leg oedema, or foot/hand ulcers. A summary is presented in Table 2.

Table 2. Post-Flood Environmental Risk Factors and Health Complaints in the Last 14 Days

Variable	n	%
Presence of rats around the house (sometimes–often) (n=57)	33	57.9
Presence of open water containers (n=58)	18	31.0
Standing water still present around the house (n=59)	8	13.6
Headache (n=65)	27	41.5
Muscle/joint pain (n=65)	27	41.5
Cough/cold (n=65)	18	27.7
Itching/skin rash (n=65)	17	26.2
Fever in the last 14 days (n=65)	10	15.4
Diarrhoea, jaundice, leg oedema, foot/hand ulcers (each)	0	0.0

Preventive Health Behaviours and Practices

Most respondents demonstrated good preventive behaviour: 98.3% always wore footwear, 100% always washed their hands with soap before eating, and 90.2% of respondents whose drinking water originated from a well reported always boiling the water before consumption. In addition, 76.7% of respondents had received post-disaster health counselling, and 96.7% had health insurance, dominated by BPJS Contribution Assistance Recipient (PBI) membership at 80.3%. A summary is presented in Table 3.

Table 3. Respondents' Preventive Health Behaviours and Practices

Variable	n	%
Always wears footwear (n=60)	59	98.3
Always washes hands with soap before eating (n=61)	61	100.0
Always boils drinking water from wells (n=41)	37	90.2
Has received post-disaster health counselling (n=60)	46	76.7
Owns health insurance (n=61)	59	96.7
dominated by BPJS PBI	49	80.3

Level of Knowledge of Post-Disaster Tropical Disease

Overall, respondents' level of knowledge about post-disaster tropical disease was classified as good, with 94.3% (464/492) correct answers across the eight knowledge statement items; 90.3% of respondents (56/62) were classified as having high knowledge (score ≥80%). The highest knowledge was found for the statement that bathing in cloudy water can cause skin disease (100% correct). The lowest knowledge was found for the statement on managing post-disaster diarrhoea, where only 75.4% of respondents answered correctly that is, 24.6% of respondents incorrectly believed that post-disaster diarrhoea could be adequately treated with over-the-counter medication from roadside stalls. Details per item are presented in Table 4.

Table 4. Respondents' Level of Knowledge Regarding Post-Disaster Flood Tropical Disease per Item (n=61–62)

Statement	Correct/Total	%
Bathing in cloudy water can cause skin disease	61/61	100.0
Standing water is a place for mosquitoes to breed	61/62	98.4
Hanging dirty clothes can become a breeding place for mosquitoes	60/61	98.4
Wet/damp places become breeding places for mites	60/61	98.4
Cloudy floodwater can cause infectious and skin disease	60/62	96.8
High fever post-flood can be a symptom of serious disease	59/62	95.2
Areas with rats have the potential to spread leptospirosis	57/62	91.9
Post-disaster diarrhoea needs medical management, not just roadside-stall medication	46/61	75.4
Overall knowledge score	464/492	94.3

Relationship Between Degree of Flood Exposure and Itching/Skin Rash Complaints

Exploratory analysis showed that the proportion of respondents with itching/skin rash complaints did not show a clear gradient with increasing degree of flood exposure: 25.0% in the fully submerged house group (>1 m), 33.3% in the partially submerged house group (<1 m), and 29.4% in the non-submerged house group (Table 5). This pattern indicates that factors other than direct contact with floodwater inside the house

also contribute to skin complaints, such as floodwater contact outside the house, hygiene behaviour, and individual vulnerability.

Table 5. Cross-Tabulation of House Flooding Status and Itching/Skin Rash Complaints

House flooding status	No itching/rash, n (%)	Itching/rash, n (%)	Total
Fully submerged (>1 m)	15 (75.0)	5 (25.0)	20
Partially submerged (<1 m)	4 (66.7)	2 (33.3)	6
Not submerged	24 (70.6)	10 (29.4)	34

Percentages calculated by row. Analysis is descriptive-exploratory in nature, without formal hypothesis testing, given the small subgroup sizes.

DISCUSSION

The main finding of this study is a specific knowledge gap within an overall high level of general knowledge: despite high overall knowledge (94.3%), specific misconceptions persisted, particularly regarding the management of post-disaster diarrhoea, where almost a quarter of respondents still believed that treatment from a roadside stall was sufficient without needing a doctor. This pattern is consistent with findings from various KAP studies on infectious disease, which repeatedly show that high aggregate knowledge does not guarantee equal understanding across all clinical and behavioural aspects of prevention. [30,31,32,33] Studies on leptospirosis among flood-vulnerable populations in India and Malaysia similarly confirm that knowledge gaps tend to be concentrated in specific, less commonly targeted aspects of routine education, rather than being spread evenly across all knowledge domains. [30,31]

Misconceptions about diarrhoea management represent a clinically risky reality, given that disruptions to sanitation and clean water post-flood are consistently associated with increased diarrhoea incidence in affected populations, and delays in seeking medical care can worsen clinical outcomes, particularly among groups prone to diarrhoea such as children and the elderly. [21,22] Although no diarrhoea cases were identified at the time of the survey, the absence of cases at that point should not be interpreted as an absence of risk; the misconceptions identified remain a relevant target for education to anticipate potential diarrhoea cases in the following days.

Itching/skin rash was reported by 26.2% of respondents, consistent with the literature that consistently places skin complaints among the most common symptoms in post-flood-affected populations, even though these complaints often receive lower priority than infectious disease in health emergency responses. [10,11,12,14] Interestingly, the exploratory cross-tabulation showed no clear dose-response gradient between degree of house flooding and skin complaints (25.0–33.3% across all exposure categories), differing from the general assumption that skin risk increases linearly with the duration or intensity of floodwater contact inside the house. [13] Possible explanations include floodwater exposure occurring outside the house (for example, during evacuation or post-flood cleaning activities) that is not captured by indoor flooding status, differences in individual hygiene behaviour, or pre-existing skin vulnerability so that house flooding status alone is insufficient to predict individual-level skin complaint risk.

From an environmental risk factor perspective, the high proportion of houses with rats present (57.9%) and open water containers (31.0%) confirms that post-flood infectious disease risk at the study site is not limited to skin disease alone, but also includes leptospirosis and vector-borne diseases such as dengue haemorrhagic fever. [24,25,26] This is consistent with respondents' relatively good knowledge regarding leptospirosis-related risks from rats (91.9% correct); however, good knowledge needs to be balanced with active vector-control behaviour at the household level, such as management of open water containers, which was not yet fully optimised in the study population.

The generally good preventive behaviour already demonstrated by respondents in this study such as boiling drinking water, wearing footwear, and washing hands with soap supports findings in the Indonesian context that personal hygiene behaviour is related to post-flood skin disease incidence, and, conversely, that consistent hygiene practice has the potential to become a protective factor. [38,39] The relatively high coverage of post-disaster counselling (76.7%) also supports the notion that health literacy plays an important role in disaster-affected community resilience. [37] However, high counselling coverage does not yet fully close the specific knowledge gaps identified in this study; this indicates that general education materials need to be complemented with symptom-specific messaging, in line with methodological recommendations for compiling KAP surveys and interventions in public health emergency situations. [34,35,36]

CONCLUSIONS

Residents affected by the flash flood in Lambung Bukit Village, Pauh District, Padang City demonstrated a generally high level of post-disaster knowledge of tropical disease and relatively good basic preventive behaviour. Nevertheless, specific and clinically significant knowledge gaps remained regarding post-disaster diarrhoea management. Itching/skin rash was found in more than a quarter of respondents without a clear gradient according to the degree of home inundation, indicating that post-flood skin risk factors are multifactorial and cannot be predicted solely from indoor water exposure. Environmental risk factors such as the presence of rats and open water containers remained prevalent; hence, the risk of vector-borne disease and leptospirosis still requires vigilance despite respondents' relatively good knowledge of these risks. These findings support the need for more symptom-specific post-flood health education, particularly regarding the rapid management of diarrhoea and skin complaints, to complement general outreach materials in the post-disaster public health response.

CONFLICT OF INTEREST

The authors declare the following statement: *"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."*

FUNDING

"*This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.* [Authors: please confirm or replace with the actual funding source, including grant number if applicable.]

ACKNOWLEDGMENT

The authors would like to thank the residents of Kelurahan Lambung Bukit, Pauh District, Padang City, and the enumerators involved in data collection for their cooperation and support. [Authors: please edit or complete this section as appropriate.]

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

"*We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems".*

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