Strengthening post-disaster disease surveillance through field epidemiology support in Indonesia, 2025

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Problem: Natural disasters increase the risk of communicable disease transmission while disrupting routine disease surveillance systems, leading to delayed detection of outbreaks and weakened public health decision-making during emergency responses.

Context: Indonesia is vulnerable to natural hazards, and Aceh Province has experienced recurrent disasters with significant public health impacts. In late 2025, major flooding and landslides affected Aceh Tamiang District, disrupting health services. Field epidemiology support was deployed to strengthen post-disaster disease surveillance during the emergency response.

Action: A field epidemiologist strengthened case detection and registration at health posts, standardized disease recording, verified suspected clusters, and established centralized data compilation, analysis and situation reporting via the Health Emergency Operations Centre. Activities were aligned with World Health Organization functions and were adapted to emergency conditions.

Outcome: There was substantial disruption to routine health services, with severe damage to 12 of 15 primary health-care centres and the district health office, and moderate damage to two hospitals. Nevertheless, core surveillance functions were maintained during the emergency response, facilitating the reporting and documentation of multiple outbreak-prone diseases, including typhoid, measles and varicella. Surveillance outputs were used to inform timely risk assessment and response actions, including mobilizing laboratory surge capacity to support diagnostic activities.

Discussion: Concrete actions translate field data into timely, structured public health responses. Field epidemiologists can help maintain system functionality in resource-constrained emergencies by adapting to paper and mobile tools, synthesizing fragmented data and coordinating directly with laboratory personnel for case confirmation.

PROBLEM

Natural disasters substantially increase the risk of outbreaks of communicable diseases, particularly in the post-disaster period when water, sanitation and hygiene conditions may deteriorate and access to health services may be compromised. Natural disasters are frequently associated with outbreaks of waterborne and vector-borne diseases, while overcrowded living conditions in evacuation settings further amplify transmission risks.[1,2] Therefore, efficient disease surveillance is critical to early warning and to protecting against emerging infectious diseases during disaster response.[3]

However, during emergencies, routine disease surveillance systems are often disrupted due to damaged health facilities, limited human resources and competing response priorities.[4] In these circumstances, sustaining surveillance activities and ensuring the continuity of data flow to aid public health decision-making become major challenges. Despite their recognized importance, the

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Published: 01 September 2026
doi: 10.5365/wpsar.2026.17.3.1399

specific operational contributions of field epidemiologists to post-disaster disease surveillance, particularly in low- and middle-income countries, remain inadequately documented in the scientific literature.[5,6]

CONTEXT

Field epidemiology is a core public health discipline that applies epidemiological methods to generate timely, actionable evidence for decision-making, particularly in settings where health systems are under pressure.[7] Field epidemiologists play a critical role in disease surveillance by detecting cases, reporting, analysing and interpreting health data, and translating surveillance findings into public health action. Their role is especially important in emergency and disaster settings, where routine health information systems may be disrupted.[5] During natural disasters, field epidemiology contributes to maintaining essential surveillance functions, enabling the early detection of outbreak-prone diseases and supporting evidence-based response activities.[8,9]

Indonesia is highly vulnerable to natural hazards, and provinces such as Aceh have experienced recurrent disasters that have had substantial impacts on infrastructure and population health. In late 2025, Aceh Tamiang District in Aceh Province was among the areas severely affected by major flooding and landslides that struck the island of Sumatra. International media reports described widespread destruction, large-scale population displacement and urgent humanitarian needs, with the broader disaster across Sumatra linked to more than 900 fatalities and significant disruption of essential services.[10]

In this context, the ability of field epidemiologists to adapt surveillance approaches, coordinate across sectors and synthesize fragmented data became crucial for protecting public health during the emergency response.

ACTION

During the emergency response, one field epidemiologist was deployed as part of a medical response team from Universitas Airlangga that also included clinicians and other public health personnel. The field epidemiologist was integrated into the district Health Emergency Operations Centre (HEOC) to support and coordinate surveillance activities. The entire medical response team, including the field epidemiologist, was deployed together for 12 days, from 8 to 20 December 2025, during the emergency response phase. Throughout this deployment, the operational activities of the field epidemiologist followed a clear chronological timeline. Initially, operations prioritized rapid situational assessments and the stabilization of fragmented, unstructured data transmitted via WhatsApp and paper records across evacuation centres. Mid-deployment, data collection was streamlined through the introduction of a centralized Google Forms database. In the final phase, this digitized mechanism facilitated systematic data verification, expedited daily situation reporting, and supported three preliminary epidemiological investigations (**Fig. 1**).

At the initial stage, the field epidemiologist operationalized case detection and registration protocols across health posts, evacuation centres and primary health-care facilities. They achieved this by identifying suspected cases using standard case definitions and distributing daily surveillance line lists to ensure data were systematically recorded. Priority communicable diseases were selected through rapid coordination within the HEOC and the District Health Office (DHO) based on their outbreak potential in post-flood settings (such as waterborne, vector-borne and vaccine-preventable diseases). Despite disruptions to routine services – including severe damage to 12 of 15 primary health-care centres and the DHO, as well as moderate damage to two hospitals – the field epidemiologist ensured the continuity of data collection at service points by introducing and distributing simplified, paper-based recording tools and the line list. This targeted action counteracted potentially severe disruptions to routine reporting systems caused by infrastructure damage and the loss of data systems at the DHO.

Due to the disruption of routine electronic surveillance systems, case data were initially recorded at health posts and evacuation centres using paper-based tools and simplified daily line lists. The field epidemiologist initiated and designed a Google Forms reporting system to structure the raw case reports that were shared via WhatsApp groups. The field epidemiologist distributed the submission links to field volunteers and was responsible for compiling data from WhatsApp reporting and Google Forms into a unified database. Through this integrated approach, the field epidemiologist maintained centralized data management at the HEOC and conducted daily analysis and interpretation of reported cases to monitor trends and identify priority diseases during the emergency

Table 1. **WHO core emergency disease surveillance functions operationalized by the deployed field epidemiologist during the disaster response phase, Aceh Tamiang, Indonesia, 2025**

WHO core surveillance function	Field epidemiology activities during the emergency response	Data source	Output produced
Case detection	Identified suspected cases at health posts using standard case definitions under disrupted service conditions	Health posts, primary health-care facilities	Records of suspected cases
Case registration	Simplified paper-based case recording and daily reporting using line lists due to disruption of electronic systems	Health posts, primary health-care facilities	Daily surveillance records and line lists
Case confirmation	Verified cases, conducted preliminary epidemiological assessment and coordinated specimen collection with the regional health laboratory in Banda Aceh	Health facilities, surveillance reports, laboratory teams	Investigation summaries and laboratory requests
Reporting	Compiled data from WhatsApp reporting and Google Forms for centralized reporting at the HEOC	Health facilities, surveillance officers	Consolidated surveillance database
Data analysis and interpretation	Conducted daily analysis of reported cases at the HEOC to monitor trends and identify priority diseases during the emergency response	HEOC surveillance database	Analytical summaries and alerts
Epidemic preparedness	Identified outbreak-prone diseases and supported preparedness for rapid response during the emergency phase	Surveillance and investigation outputs	Early warning alerts
Feedback	Disseminated surveillance findings through situation reports and coordination meetings	HEOC, coordination forums	Daily situation reports

HEOC: Health Emergency Operations Centre; WHO: World Health Organization.
Source: Adapted from WHO's Communicable disease surveillance and response systems: a guide to planning.[11]

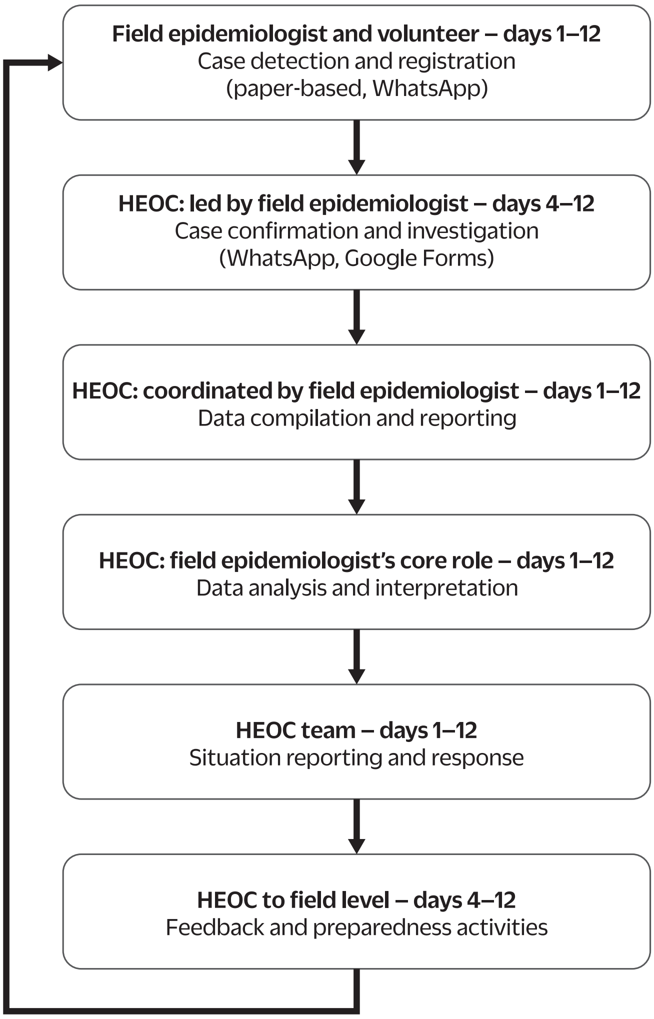
response. These surveillance activities followed World Health Organization (WHO) core surveillance functions and were operationalized during the emergency response (**Table 1**, **Fig. 1**).[11]

The deployed field epidemiologist supported case confirmation by conducting case verification and preliminary descriptive assessments of disease trends by person, place and time to identify potential clusters. The field epidemiologist strengthened epidemic preparedness by identifying outbreak-prone diseases and coordinating specimen collection with the Regional Health Laboratory of Banda Aceh for definitive diagnostic confirmation.

Routine data analysis was conducted at the HEOC, with the deployed field epidemiologist analysing surveillance data to identify trends and early warning signals of outbreak-prone diseases, thus contributing to epidemic preparedness in the post-disaster context. This analytical process enabled potential outbreaks to be identified and prioritized for response. After identifying warning signals, the field epidemiologist issued early notifications and conducted rapid risk assessments before laboratory confirmation, enabling a timely response to potential threats. Finally, to close the feedback loop, surveillance findings were disseminated through daily situation reports and coordination meetings by the Head of Disease Prevention and Control of the Aceh Tamiang DHO, as part of the HEOC team. This provided vital feedback to decision-makers and response actors, ensuring that surveillance data informed operational actions (**Table 1**).

Fig. 1 illustrates the integrated surveillance flow during the emergency response in Aceh Tamiang, showing how case detection at service points was linked to verification, centralized analysis at the HEOC, and situation reporting to guide coordinated public health responses and preparedness. The figure highlights the interconnected roles of field-level surveillance and centralized coordination in maintaining surveillance continuity under emergency conditions.

Fig. 1. **WHO core emergency disease surveillance functions during the disaster response phase in Aceh Tamiang, Indonesia, 2025**



HEOC: Health Emergency Operations Centre (district level).

OUTCOME

As a result of field epidemiology support during the emergency response phase, essential disease surveillance functions in Aceh Tamiang were sustained despite substantial disruption to routine health services. During the emergency response period from 8 to 20 December 2025, surveillance activities recorded a substantial number of communicable disease cases. The most frequently reported conditions were acute respiratory infections (n = 2774), acute diarrhoea (n = 1596), skin diseases (n = 1466) and influenza-like illness (n = 151). In addition, suspected cases of outbreak-prone diseases were identified, including typhoid fever (n = 72); measles (n = 13); varicella (n = 10); dengue (n = 5); pulmonary tuberculosis (n = 4); hand, foot and mouth disease (n = 3); leptospirosis (n = 3); and pertussis (n = 1). At the HEOC, the field epidemiologist systematically compiled, verified and analysed these incoming data, enabling the ongoing monitoring of communicable disease trends.

Active surveillance facilitated the notification of several outbreak-prone diseases through routine reporting mechanisms. The field epidemiologist directly coordinated the verification and risk assessment processes at the district level and led three field epidemiological investigations, specifically targeting suspected cases of measles, varicella and leptospirosis. These cumulative efforts successfully established a structured reporting system and initiated data verification to serve as a potential operational reference for future emergency responses.

The field epidemiologist synthesized surveillance findings and produced daily situation reports that were communicated to relevant stakeholders. These reports were shared during coordination meetings and used to inform response activities, including the mobilization of laboratory surge capacity. Overall, surveillance activities were maintained across core functions during the emergency response, including case detection, verification, data analysis and reporting, enabling continuous monitoring of communicable disease risks in the post-disaster setting.

DISCUSSION

The activities of the field epidemiologist enabled the continuation of core disease surveillance functions in Aceh Tamiang despite significant disruption to routine health services caused by flooding. By being integrated within the HEOC, the deployed field epidemiologist helped to adapt surveillance processes to the post-disaster context by transitioning unstructured WhatsApp reports into a centralized Google Forms database. This adaptation ensured that the system remained functional, allowing for the timely detection and notification of outbreak-prone diseases. Importantly, the field epidemiologist contributed to maintaining minimum surveillance standards under emergency conditions by sustaining verification, analysis and structured reporting functions, ensuring that surveillance data were rapidly translated into situation reports and coordinated public health actions.[12,13]

Building on this continuity, surveillance activities during the emergency response were implemented across core functions. The linkage between field-level data generation and centralized compilation and analysis at the HEOC facilitated the maintenance of structured surveillance processes under disrupted conditions (**Table 1**, **Fig. 1**). This highlights the importance of being able to adapt surveillance systems, as demonstrated by the simplified use of reporting mechanisms (paper-based tools, WhatsApp and Google Forms), and the continued detection of communicable diseases during the 12-day emergency response period. This observation is consistent with WHO guidance, which emphasizes that fragmented surveillance systems in post-disaster settings can delay outbreak detection and weaken response effectiveness.[11]

As a result of this integrated surveillance system, multiple outbreak-prone diseases were identified, reflecting active surveillance during the emergency response to support coordination and response activities. This finding aligns with literature highlighting the potential for risks from communicable diseases in post-disaster settings.[2] However, without comparative baseline data, these findings do not facilitate conclusions to be drawn about changes in disease transmission. Instead, they reflect the continuation of routine surveillance activity under emergency conditions, underscoring the importance of sensitive surveillance systems for early outbreak detection.[14]

Central to enabling the management of this early warning and response system was the integration of the deployed field epidemiologist within the HEOC, which functioned as a surveillance and decision-making hub. By supporting data compilation and analysis, outbreak notification and coordination, the field epidemiologist enhanced situational awareness during the emergency response. Centralized analysis and routine situational reporting facilitated the translation of surveillance data into timely operational decision-making and coordinated public health action.[15]

This linkage between surveillance and response was further demonstrated by how surveillance outputs triggered immediate field investigations (such as the rapid case verification of suspected measles and leptospirosis), informing concrete public health actions through mechanisms for routine reporting and coordination, and highlighting the importance of integrated surveillance systems in guiding timely and appropriate emergency responses.

This study has several limitations. The absence of baseline surveillance data limited the assessment of changes in disease incidence following the disaster. Surveillance under emergency conditions, with limited resources and damaged infrastructure, may have affected data completeness and timeliness. Simplified reporting mechanisms may also have introduced inconsistencies in data recording and transmission. Additionally, coordination challenges affected case classification, from the intermittent availability of networks to delays in confirmation caused by non-operational local laboratories to the more than 24 hours required to transport samples over land to the provincial laboratory.

Additionally, this report reflects the experience of a single district and may not be generalizable to other settings. Underreporting may have occurred during the acute emergency phase due to disruptions in access to health services and reporting systems; for example, the total number of active reporting sites and reporting completeness were not consistently documented. In addition, as this study was conducted by the deployed field epidemiologist, there is a potential risk of positive reporting bias in the interpretation of findings. Despite these limitations, adaptive strategies were implemented to maintain surveillance continuity during the emergency response, providing practical insights for similar settings.

Taken together, these operational experiences illustrate the vital role of field epidemiology in sustaining surveillance functions during disaster response in real-world emergency settings. The experience from Aceh Tamiang, including surveillance activities conducted during the emergency deployment using simplified reporting mechanisms, is particularly relevant for other disaster-prone low- and middle-income countries, where routine surveillance systems are often disrupted. This study highlights approaches for integrating field epidemiology into post-disaster disease surveillance and response.

Acknowledgements

The first author is an alumnus of the Field Epidemiology Training Program, and the skills and competencies gained through the programme informed the field epidemiology activities described in this article. The authors would like to acknowledge Universitas Airlangga for supporting participation in the emergency response activities. Appreciation is also extended to the Aceh Tamiang DHO and all health-care workers involved in the disaster response. Special thanks are given to the Medical and Disaster Response Team of Universitas Airlangga for their collaboration and support during the field deployment.

Elicit AI (version 2024) was used to support literature searching and identification of relevant references. ChatGPT (OpenAI, GPT-4, 2024) was used solely for language polishing and improving clarity of expression. No AI tools were used for data analysis, interpretation of results or generation of scientific content.

Conflicts of interest

The authors have no conflicts of interest to declare.

Ethics statement

This article is based on operational surveillance activities conducted during an emergency response and did not involve the collection of individual-level data or the use of human or animal samples. Ethical approval was, therefore, not required.

Funding

The first author's field deployment as a volunteer during the emergency response in Aceh Tamiang was supported by Universitas Airlangga. No external funding was used in the development, analysis or writing of this manuscript.

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