

## Research Article

# Assessment of Capacity for Surveillance, Preparedness, and Response to Public Health Emergencies in Healthcare Facilities; Ethiopia

## Abstract

**Introduction:** Healthcare facilities at all levels of the system play a central role in the delivery of health services. However, comprehensive information on the capacity of healthcare facilities for surveillance, preparedness, and response at all system levels is lacking in Ethiopia. This study aims to bridge this gap and generate evidence to improve the PHEM system.

**Methods:** A health facility-based cross-sectional study design was employed to assess 197 public and private health facilities in five regions and two city administrations. Data were collected from July 1–30, 2022, through interviews using a structured questionnaire supplemented with observation and document reviews. Data analysis was performed using SPSS Version 26, and findings were triangulated with findings from after- and intra-action reviews and sentinel site reports. Results were presented using health system building blocks, tables, and figures.

**Results:** There were significant variations and gaps among facilities. Key infrastructure challenges include lack of internet connection (46.7%), phone access (35.5%), electricity (6%), and isolation centers (51.2%). Human resource shortcomings are evident, with a lack of dedicated surveillance officers (87.8%), a lack of training in PHEM for over half of the staff (53.3%), and ineffective or absent rapid response teams (17% lack, 54% non-functional). While most facilities have internal (88%) and external (84%) communication mechanisms for emergencies, only 34% have prepositioned emergency supplies.

**Conclusion:** The review shows major gaps in the capacity for surveillance, preparedness, and response of health facilities. The findings underscore the need for further improvement. Sustained and concerted efforts and more investments in human resources, diagnostics, and infrastructure, including periodic supportive supervision, are recommended.

**Keywords:** Health, Preparedness, Response, Emergency, Ethiopia

## Introduction

Globally, public health events have been increasing steadily, as reported by the World Health Organization (WHO) from 2001 to 2016. Preparedness for public health emergencies at all levels of the health system is more crucial than ever due to this significant rise in public health events [1,2]. In response, WHO has developed and disseminated several guidelines and tools to help countries strengthen their capacities to address these threats. These include tools for conducting After Action Reviews (AARs) following outbreak responses and, more recently, Intra-Action Reviews (IARs) to enhance ongoing efforts. Ethiopia, in particular, is highly vulnerable to recurrent natural and man-made shocks. The frequent occurrence of outbreaks such as measles, yellow fever, and cholera continues to pose substantial challenges to the country's health system [3].

As health facilities are the gateway of index cases for potential outbreaks and also the initial front-line responders for all sorts of natural and manmade disasters, it is vital to bring more focus towards them. The COVID-19 pandemic has tested healthcare facilities' emergency plans and exposed vulnerabilities in healthcare emergency preparedness on a scale unexperienced in recent history [2,5].

Additionally, studies conducted in 15 hospitals from different areas of Italy have shown 12 facilities to have an insufficient level of preparedness; only 3 were considered to have an effective level of preparedness. The average preparedness of all components was lower than the optimal level suggested by the WHO checklist of hospital emergency response tools [6]. The main purpose of this study was to identify the current public health emergency management (PHEM) practices at health facilities in terms of preparedness, surveillance, and response.

## Methods and Materials

### Study Setting

At the time of this study, Ethiopia operated under a federal administrative system consisting of

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Received Date: 06 Dec 2024

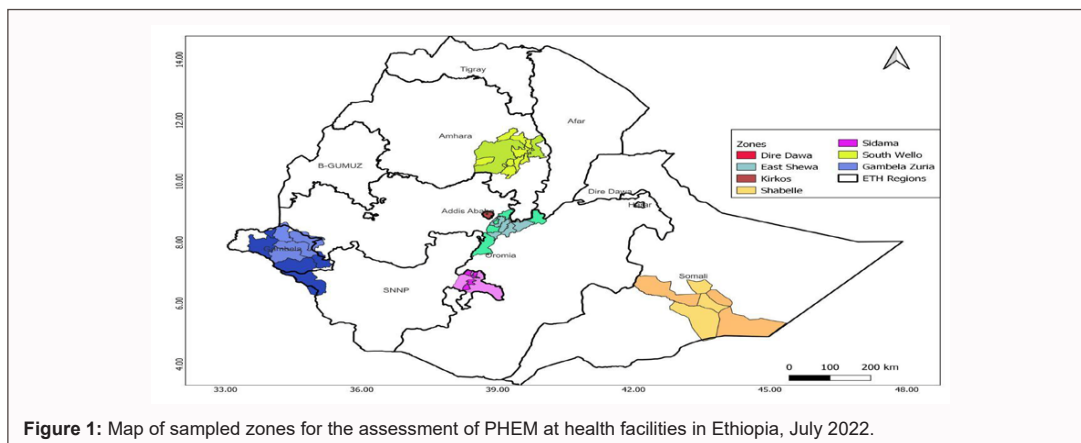
Accepted Date: 22 Dec 2024

Published Date: 22 Jan 2025

### Citation:

Fufa Y, Makango B, Abera N,  
Fikre N, Tilahun ST, Barba A,  
et al. Assessment of Capacity  
for Surveillance, Preparedness,  
and Response to Public Health  
Emergencies in Healthcare Facilities;  
Ethiopia. *Collect J Publ Health*. 2025;  
1: ART0051.





**Figure 1:** Map of sampled zones for the assessment of PHEM at health facilities in Ethiopia, July 2022.

12 administrative regions and two city administrations (this number has since increased to 15). The population was predominantly rural, although urban settlements were increasing steadily. The regions could generally be classified into three main categories based on their dominant economic activities and population density: urban, agrarian, and pastoral [9].

This assessment was conducted over a one-month period, from July 1 to July 30, 2022. A stratified sampling approach was employed to ensure representation across these three classifications. Specific woredas (districts) and health facilities within each classification were purposively selected to account for regional diversity and variations in public health system functionality. The sampling methodology aimed to provide comprehensive insights into the preparedness and response capacities of the health system across Ethiopia’s varied contexts.

**Study Design, Sample Size and Selection Criteria**

The study used a descriptive cross-sectional study. The study employed a multi-stage sampling technique to select regions and health facilities based on climate conditions and livelihoods. Regions were categorized as agrarian, pastoralist, and urban. Based on these, three agrarian regions (Amhara, Oromia, and Sidama), two pastoralists (Gambella and Somali), and two city administrations (Addis Ababa and Dire Dawa) were selected (Figure 1). In consultation with regions, city administration health Bureaus, and Public Health Institutes; hospitals, and catchment health facilities were identified. A total of 197 health facilities (43 hospitals, 113 health centers, 39 private clinics, and two charity organizations) were selected and enrolled for data collection.

**Data collection tool**

The ODK tool was adapted from the WHO’s hospital safety index evaluation [10] and customized using WHO health system building blocks [11]. The checklist was tailored to collect data on infrastructure, human workforce, emergency preparedness, capacity building, coordination of disaster management, response and recovery, risk communication, community engagement, logistics, finance, patient care, and health information management systems. The data was collected from 197 governmental, private, and charitable healthcare facilities.

**Data quality assurance**

Public health professionals with a minimum first degree and experience at national and regional PHEM were selected and trained on data collection tools using the ODK data collection kit, with daily data monitored centrally. The quality and completeness of the data were monitored by central supervisors, and feedback was provided to the data collection team.

**Data analysis**

Data was exported to Excel data sheets, then cleaned, and variables for analysis were identified. The closed-ended questionnaire and the checklist were analysed quantitatively using SPSS version 26. To complement these reports from After Action Reviews (from 2019 to 2022) and periodic/sentinel site reports were analysed. The WHO health systems building blocks (i.e., leadership and governance, workforce, service delivery, infrastructure, supplies, health information, health finance, and community) were used to summarize the findings.

**Results**

**General profile**

Data was collected from all 197 public and private/NGO health facilities across five regional states and two city administrations (with a 100 percent completion/response rate). These include 50 from the Amhara region,

**Table 1:** Distribution of assessed health facilities among regional states in Ethiopia, July 2022.  
NB: Values in the parenthesis indicate percentage values.

Region	Types of health facility							Total
	Specialized Hospital	General Hospital	Primary Hospital	Private Hospital	Health Center	Private Clinic	Others*	
Amhara	1(2.0)	2(4.0)	3(6.0)	3(6.0)	38(76.0)	3(6.0)	0	50(25.4)
Oromia	1(2.3)	0	2(4.7)	3(7.0)	22(51.2)	14(32.6)	1(2.3)	43(21.8)
Somali	0	1(11.1)	0	0	7(77.8)	0	1(11.1)	9(4.6)
Gambella	0	1(3.4)	3(10.3)	0	13(44.8)	12(41.4)	0	29(14.7)
Sidama	0	2(9.1)	5(22.7)	4(18.2)	10(45.5)	1(4.5)	0	22(11.2)
Dire Dawa	1(4.2)	1(4.2)	0	5(20.8)	15(62.5)	2(8.3)	0	24(12.2)
Addis Ababa	0	2(10.0)	0	3(15.0)	8(40.0)	7(35.0)	0	20(10.2)
<b>Total</b>	<b>3(1.5)</b>	<b>9(4.6)</b>	<b>13(6.6)</b>	<b>18(9.1)</b>	<b>113(57.4)</b>	<b>39(19.8)</b>	<b>2(1.0)</b>	<b>197(100)</b>

**Table 2:** Health workforce among selected health facilities in Ethiopia, July 2022.  
NB: Values in the parenthesis indicate percentage values.

Indicator	Category	Types of health facility							Total
		Specialized Hospital	General Hospital	Primary Hospital	Private Hospital	Health Center	Private Clinic	Others	
Designated surveillance officer	Yes	2(66.7)	5(55.6)	4(30.8)	0	13(11.5)	0	0	24(12.2)
	No	1(33.3)	4(44.4)	9(69.2)	18(100)	100(88.5)	39(100)	2(100)	173(87.8)
PHEM basic training	Yes	3(100)	2(22.2)	7(53.8)	4(22.2)	70(61.9)	5(12.8)	1(50.0)	92(46.7)
	No	0	7(77.8)	6(46.2)	14(77.8)	43(38.1)	34(87.2)	1(50.0)	105(53.3)
Health system resilience training	Yes	2(66.7)	1(11.1)	3(23.1)	0	13(11.5)	0	0	19(9.6)
	No	1(33.3)	8(88.9)	10(76.9)	18(100)	100(88.5)	39(100)	2(100)	178(90.4)
Frontline field epidemiology training	Yes	0	3(33)	3(23)	0	16(14)	0	0	22(11)
	No	3(100)	6(67)	10(77)	18(100)	97(86)	39(100)	2(100)	175(89)
Experience of PHE	Yes	3(100)	7(78)	10(77)	10(56)	70(62)	11(28)	1(50)	112(57)
	No	0	2(22)	3(23)	8(44)	43(38)	28(72)	1(50)	85(43)

43 from Oromia, 29 from Gambella, 24 from Dire Dawa, 22 from Sidama, 20 from Addis Ababa, and 9 from the Somali region (Table 1).

### Infrastructure at the health facility

The majority of health facilities, including general hospitals, primary hospitals, health centers, and private clinics, lack cable internet connections, phone access, electricity, and isolation rooms for highly contagious cases. This disparity is significant, with 11.1% of general hospitals, 38.5% of primary hospitals, 56.6% of health centers, and 56.4% of private clinics lacking cable internet connections. Among the health facilities, 15.4% of primary hospitals, 47.8% of health centers, and 35.9% of private clinics do not have phone access, whereas 9.7% of health centers and 2.6% of private clinics do not have uninterrupted electricity. Ninety percent (90%) of health centers and private clinics do not have dedicated isolation rooms for managing highly infectious cases.

### Health workforce at a health facility

All government and private health facilities included in the study have PHEM focal persons. However, 33% of specialized, 44% of general, 69% of primary hospitals, 89% of health centers, and 100% of private hospitals and clinics lack a designated surveillance officer. Additionally, 53% of health professionals participating in PHEM activities were not trained in the basics of PHEM, most from hospitals and private clinics (Table 2)

### Leadership and coordination at health facilities

The study found that 22% of general hospitals, 83% of private hospitals, and 15% of health centers lack functional rapid response teams (RRTs). Among those with RRTs, 86% of hospitals, 77% of health centers, and 79% of clinics do not hold scheduled coordination meetings. The team composition lacks certain professions, such as epidemiologists and environmental health, mainly due to the absence of necessary professionals at the health facilities.

### Health information systems, guidelines, and other documents at health facilities

The majority (76%) of healthcare facilities do not have an emergency preparedness and response plan (EPRP).

**Table 3:** Distribution of emergency and disaster response and recovery activities among selected health facilities in Ethiopia, July 2022.

NB: Values in the parenthesis indicate percentage values.

Indicator		Types of health facility							Total (%)
		Specialized Hospital	General Hospital	Primary Hospital	Private Hospital	Health Center	Private Clinic	Others	
Presence of EPRP	Yes	2(67)	5(56)	1(8)	0	40(35)	0	0	48(24)
	No	1(33)	4(44)	12(92)	18(100)	73(65)	39(100)	2(100)	149(76)
ED recovery plan	Yes	1(33)	5(56)	3(23)	0	7(6)	0	0	16(8)
	No	2(67)	4(44)	10(77)	18(100)	106(94)	39(100)	2(100)	181(92)
PHEM guideline	Yes	3(100)	7(78)	8(62)	5(28)	78(69)	4(10)	1(50)	106(54)
	No	0	2(22)	5(39)	13(72)	35(31)	35(90)	1(50)	91(46)
VRAM assessment	Yes	1(33)	0	0	0	16(14)	0	0	17(9)
	No	2(67)	9(100)	13(100)	18(100)	97(86)	39(100)	2(100)	180(91)
Case definitions	Yes	3(100)	8(89)	13(100)	9(50)	105(93)	18(47)	2(100)	158(81)
	No	0	1(11)	0	9(50)	8(7)	20(53)	0	38(19)
IPC manual	Yes	3(100)	9(100)	13(100)	15(83)	99(88)	27(69)	0	166(84)
	No	0	0	0	3(17)	14(12)	12(31)	2(100)	31(16)
Mechanism to collect & transport specimen	Yes	3(100)	9(100)	11(85)	16(89)	88(78)	13(33)	0	140(71)
	No	0	0	2(15)	2(11)	25(22)	26(67)	2(100)	57(29)

Moreover, 29% have not established mechanisms for safe specimen collection and transportation during public health emergencies. Nearly half (46%) lack PHEM guidelines, 16% lack IPC manuals, and in 19% of health facilities, there were no case definitions of priority diseases posted at IPDs and OPDs (Table 3).

### Risk communication and community engagement at health facilities

Most (88%) have established mechanisms for internal communication during emergencies, while 84% have also established mechanisms for external communication. In nearly a third (31%) of the facilities, risk communication focal persons liaise with the public and media. Most (81%) have a feedback mechanism to the next higher level, 56% have community engagement mechanisms, and 40% have resource mobilization mechanisms from the community during health emergencies.

### Finance, logistics, and supply at health facilities

Only one-third (34%) of assessed health facilities have a prepositioned PHE stock or supply, but 21% of HFs are inadequate. Regarding transportation, 79% of health facilities have some means of transportation for patients and supplies during an emergency. One-third (34%) of assessed health facilities do not have free services for communities affected by emergencies.

### Service delivery at health facilities

The findings show that only 43% of health facilities have an essential health service continuity plan. Nearly half (49%) lack a triage system for managing major or significant emergencies and disasters. More than three-quarters (76%) of the assessed facilities do not use triage tags. Almost all (98%) of facilities have established systems for referral, transfer, and reception of patients during public health emergencies (Table 4).

### Discussion

The study shows that, despite some encouraging findings, all types of healthcare facilities have gaps in one or more areas of the building blocks of the system.

### Infrastructure at health facilities

Ethiopia's health facilities face significant gaps in preparedness, surveillance, and response to public health emergencies. The findings of this study revealed that access to tertiary health services declines as one moves along the health sector tier system from higher to lower (from referral hospitals to primary healthcare), affecting public health emergency management at the nearest facility. Despite being widely available and accessible for rural communities, 90% of health centers and private clinics lack isolation rooms for highly contagious cases. A comparative assessment in Uganda revealed that only 39% of the studied health facilities were ready to manage COVID-19, with the rest placed in the work-to-do or not-ready category [12]. Similarly, Vietnam and China's grassroots health systems in rural areas are more likely to be vulnerable compared to their counterparts [13,14].

**Table 4:** Distribution of patient care and supportive services among selected health facilities in Ethiopia, July 2022.  
NB: Values in the parenthesis indicate percentage values

Indicator	Category	Types of health facility							Total
		Specialized Hospital	General Hospital	Primary Hospital	Private Hospital	Health Center	Private Clinic	Others	
Essential Health Service Continuity plan	Yes	3(100)	5(56)	9(69)	7(39)	55(49)	6(15)	0	85(43)
	No	0	4(44)	4(31)	11(61)	58(51)	33(85)	2(100)	112(57)
Space expansion during mass causality	Yes	3(100)	9(100)	9(69)	11(61)	67(59)	23(59)	1(50)	123(62)
	No	0	0	4(31)	7(39)	46(41)	16(41)	1(50)	74(38)
Triage for major emergencies	Yes	3(100)	9(100)	9(69)	16(89)	57(50)	6(15)	1(50)	101(51)
	No	0	0	4(31)	2(11)	56(50)	33(85)	1(50)	96(49)
Triage tags and other supplies	Yes	2(67)	8(89)	4(31)	7(39)	25(22)	1(3)	0	47(24)
	No	1(33)	1(11)	9(69)	11(61)	88(78)	38(97)	2(100)	150(76)
System for referral	Yes	3(100)	9(100)	13(100)	18(100)	111(98)	37(95)	2(100)	193(98)
	No	0	0	0	0	2(2)	2(5)	0	4(2)

This indicates that the readiness of health facilities has decreased with the decreasing level of health facilities, with most of the lower-level facilities being poorly prepared to develop the capacity to reduce the impact of emerging and reemerging infectious diseases on population health.

This study showed that a significant portion of health facilities, including the majority of health centers and private clinics, lack cable internet connections. This is consistent with the CARES project finding from a study conducted in 2021 that documented only 36% of health facilities under the project using DHIS-2 to send weekly surveillance reports. However, the finding disagrees with the reviewed report from sentinel sites of 76 health facilities that indicated the majority (77%) of the facilities use DHIS-2 for monthly reporting [15]. This difference might be because sentinel sites are selected hospitals located in larger towns, and the current study included all types of sampled health facilities and was more representative. This finding indicates that improving internet access to health facilities for online reporting of surveillance data is crucial to strengthening or establishing a robust surveillance system with health information management using the available technologies.

Additionally, only 36% of health centers have isolation rooms for unusual case observation and management. As you go up, 100% of referral hospitals have isolation rooms, whereas in private hospitals and clinics, only 13% and 14% have isolation rooms, respectively. These findings also [15] show correlations in the COVID-19 readiness assessment in Uganda, showing that 65% of the health facilities reported that they could not find the additional space even to accommodate expanding treatment sections, and 71% of them did not include in their plans to expand if there was any upcoming surge [12]. Additionally, this study has shown that triage for patients with respiratory symptoms was lacking in lower-level health facilities and some referral health facilities; in addition, 59 (82%) of the lower-level health facilities and 8 (47%) referral facilities lacked a physical barrier to separate health workers and patients during the patient review. Fifty-four (76%) lower-level health facilities and two (29%) referral hospitals lacked areas to isolate patients with acute respiratory symptoms, showing comparative findings to our study.

#### Health workforce at health facilities

Most public health facilities and all private health facilities do not have a designated surveillance officer(s), but some have a surveillance focal person doubling in other roles. Similar findings in the Uganda report have shown that 48% of the facilities lacked personnel designated to report suspected or confirmed cases of COVID-19. Due to this, data quality will not only be compromised but the overall epidemic readiness of health facilities will also be compromised because there is a lack of accountability for who is responsible for analysing the surveillance data from the patients visiting to identify cases to report to the next level and provide the necessary response.

Those healthcare workers participating in PHEM activities as officers or focal persons lack necessary and basic training, like PHEM basic training. This could result in the inability to detect public health emergencies timely, resulting in a greater impact on the PHEs. Similar findings in the Uganda report showed that 35% of the lower-level health facilities in Uganda have additionally shown that they have not received basic training [12]. This marks the preparedness for PHEs at the facility level, which was also found questionable.

#### Finance, logistics, and supply at health facilities

In this study, only one-third (34%) of assessed health facilities have a prepositioned PHE stock or supply. Forty-four percent of general hospitals, 92% of primary hospitals, 65% of health centers, and private and NGO facilities do not have Emergency Preparedness and Response Plans (EPRPs). In Uganda, 82% of the referral health



facilities lacked essential medicines, 53% lacked adequate PPE, and 71% did not stock the minimum medications. Among lower-level facilities, all but one lacked medicine, and most had inadequate PPE supplies [12]. Additional findings in Vietnam health facilities in terms of preparedness for the COVID-19 outbreak show that the majority of the health facilities drastically lack the necessary PPE. Nearly all of the 20 facilities reported shortages of PPE and other essential supplies. COVID-19 is good evidence that a well-functioning health system provides some resilience in terms of sufficient resources, good morale, and reasonable capacity [16].

#### **Health information systems, guidelines, and other documents at health facilities**

Lack of necessary guidelines and job aids was also among the gaps identified at the facility level, which affects the standardized approach of PHEs among health facilities. It also affects the capability of the health workforce for PHE management. The utilization of electric and paper-based reporting systems was also inadequate. There was an identified gap in DHSI2 utilization on smartphones. This could affect the report's completeness as well as its timeliness.

#### **Service delivery at health facilities**

The majority of health facilities do not have an essential health service continuity plan (only 43% of the facilities have an essential health service continuity plan), which results in the discontinuity of essential health services during public health emergency response, resulting in avoidable morbidity and mortality to the extent that it might sometimes exceed the impacts of PHEs. The study's findings in the eastern Mediterranean region revealed shortcomings in several areas, most notably in planning, leadership, human resources, and crucial procedures (such as quick identification, uninterrupted provision of critical services, and surge capacity). The Eastern Mediterranean Region's restricted access to various healthcare services has been made evident by the COVID-19 pandemic, which has exposed inequalities in the region's health systems [11].

#### **Leadership and coordination at health facilities**

Hospital leaders were handling a pandemic for the first time, so it makes sense that their low score in the leadership domain was due to the new challenges they faced and the unusual tasks they had to complete, which may not have been part of their prior training or experience [17,18]. The overwhelming majority of the 296 healthcare workers who took part in the study (93.9%) thought that Yemen's healthcare system lacked the tools and capacity necessary to contain and handle a COVID-19 outbreak. Most (82.4%) respondents said their HCFs were either extremely poor or poor in terms of general preparation.

#### **Risk communication and community engagement at health facilities**

Public information and early warning are among the most important capabilities in emergency preparedness, as seen from the responses to several types of disasters. It helps mitigate the risks, supports the implementation of protective actions, and contributes to minimizing the negative mental health impacts of disasters [20]. Even though there are encouraging activities towards community risk communication and engagement in health facilities for public health emergency responses, there are still gaps in this area. Engaging the community not only helps in timely detection but also in the management of PHEs.

#### **Conclusions and Recommendations**

Health facilities play a crucial role in public health emergency management, as they are the first to encounter emergencies. However, there are significant gaps in enabling health facilities to detect, notify, and respond to emergencies. To address these gaps, improving health infrastructure, assigning dedicated Public Health Emergency Management (PHEM) officers, training healthcare workers on public health emergencies, advocating for health facility leadership, establishing coordination platforms, strengthening community participation in preparedness activities, strengthening electronic reporting systems, job aids, tools, and supplies, and enhancing policies on health facility attention to public health emergencies are recommended.

#### **Author Contributions**

YF, BM, NA, TS, NF, KM, TM, STT, AG, TG, EG, MB, TB, and NL: designed the study, coordinated data collection, performed thematic analysis and interpretation of the data, and drafted the manuscript. AB, AY, KK, and T D reviewed the first draft and interpreted the findings. All authors have read and approved the final manuscript for publication.

#### **Acknowledgments**

The authors express gratitude to all those involved in the article's realization, including the Public Health Emergency Management (PHEM) of the EPHI, other directorates and units of the EPHI, engaged regions, and partners like OPM, Africa CDC, and World Health Organizations (WHO) and EIB for their commitment to technical support while conducting this assessment. Last, but not least, the authors would like to thank all

participants and data collectors without whom this study would not have been fruitful.

### **Funding Statement**

There is no available fund to support the publication of this study by any organization.

### **Availability of Data and Materials**

The data analysed and/or generated during the current study are not publicly available because these data mainly contain countries' secret health policies and strategies but are available from the corresponding author upon reasonable request.

### **Ethical Approval and Consent to Participate**

The Ethiopian Public Health Institute (EPHI) holds the authority and responsibility to conduct on-site investigations during epidemics or public health emergencies. Its duties include verifying outbreaks, issuing alerts, providing warnings, disseminating information, conducting assessments, mobilizing resources, supporting response activities at woreda, zonal, and regional levels, and implementing international health regulations in cases of severe public health emergencies with international implications, as outlined in the Federal Negarit Gazeta of FDRE Regulation No. 301/2013 [21].

An official letter was sent by EPHI to the respective regions, outlining the objectives of the assessment. Similarly, official support letters were sent to the relevant zonal, district, or sub-city health offices and health facilities. Before data collection, informed oral consent was obtained from participants at the health facilities. No human or animal samples were collected through any invasive procedures.

### **Declaration of Conflict of Interests**

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

### **Consent for Publication**

Not applicable.

### **List of Acronyms**

AAR: After Action Review

EPHI: Ethiopian Public Health Institute

PHEM: Public Health Emergency Management

PHEOC: Public Health Emergency Operation Center

UHC: Universal Health Coverage

WHO: World Health Organization

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