

Evaluation of the Mpox Surveillance System in the Wangata Health Zone, Équateur Province, Democratic Republic of Congo: January to December 2025

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ABSTRACT

Background: Mpox (formerly monkeypox) is a re-emerging viral zoonosis that has become a significant public health concern in the Democratic Republic of Congo. Équateur Province, particularly the Wangata Health Zone, has been identified as a high-risk area with recurrent outbreaks. An effective surveillance system is essential for early detection, rapid response, and outbreak control.

Objective: This study aimed to evaluate the performance of the Mpox surveillance system in the Wangata Health Zone, Équateur Province, from January to December 2025, by assessing its essential functions, support functions, and key attributes as recommended by the World Health Organization and the Centers for Disease Control and Prevention.

Methods: A descriptive cross-sectional evaluative study was conducted. Data were collected from 14 health facilities, 18 healthcare providers involved in Mpox surveillance and response, and surveillance records of 173 suspected cases reported during the study period. A standardized questionnaire was administered, and surveillance records were reviewed. Key attributes assessed included usefulness, simplicity, sensitivity, specificity, acceptability, stability, timeliness, data quality, and representativeness.

Results: All health facilities (100%) had investigation forms and response plans. Line lists were available in 86% of facilities, contact identification and follow-up forms in 79%. However, only 29% had up-to-date dashboards, and 21% had epidemiological graphs. Timeliness was relatively good, with 89% of samples arriving at the laboratory within 72 hours and results received within 48 hours. The positive predictive value was 47% (81 confirmed among 173 suspected cases), and sample adequacy was 53%. Data quality was poor, with only 21% of notification forms being complete. The system demonstrated high usefulness (100%) and specificity (100%), moderate simplicity (71%) and acceptability (72%), but low sensitivity (64%) and very low stability (14%). Most providers (78%) were trained in Integrated Disease Surveillance and Response, but only 50% had training in biosafety, 56% in sample management, and 44% in database management.

Conclusion: The Mpox surveillance system in the Wangata Health Zone is functional and useful but faces critical challenges in stability, data quality, and sensitivity. Strengthening provider training, ensuring adequate resources, and improving feedback mechanisms are essential for enhancing system performance and achieving effective outbreak control.

Keywords: Mpox, monkeypox, surveillance system evaluation, Wangata Health Zone, Democratic Republic of Congo, IDSR, public health.

1. INTRODUCTION

1.1 Background

Mpox is a viral zoonosis caused by the monkeypox virus, a member of the genus *Orthopoxvirus* within the family *Poxviridae*. The virus was first isolated in 1958 in a Danish laboratory from monkeys imported from Singapore (Magnus et al., 1959). The first human case was identified in 1970 in the Democratic Republic of Congo (DRC) during the smallpox eradication campaign (Breman et al., 1980). Mpox is characterized by fever, intense headache, lymphadenopathy, back pain, myalgia, and a characteristic rash that progresses from macules to papules, vesicles, pustules, and crusts (Di Giulio & Eckburg, 2004).

The disease is transmitted through direct contact with infected animals (primarily rodents and non-human primates) or through human-to-human transmission via respiratory droplets, direct contact with body fluids or lesions, and contaminated fomites (Reynolds et al., 2012). Two distinct clades have been identified: the Congo Basin clade (clade I) and the West African clade (clade II), with the Congo Basin clade being more virulent (Likos et al., 2005).

1.2 Global and Regional Epidemiology

Since the cessation of routine smallpox vaccination in 1980, which provided cross-protection against Mpox, the incidence of Mpox has increased significantly in Central and West Africa (Rimoin et al., 2010). Between 1970 and 1986, 404 cases were reported, with 386 (96%) occurring in the DRC (Ježek & Fenner, 1988). A major outbreak occurred in the Sankuru district of DRC between 1996 and 1997, with 511 suspected cases and documented human-to-human transmission up to eight generations (Hutin et al., 2001).

In 2022, a global outbreak of Mpox (clade IIb) spread to over 100 non-endemic countries, leading the World Health Organization (WHO) to declare a Public Health Emergency of International Concern (PHEIC) in July 2022 (WHO, 2022). The outbreak highlighted significant gaps in global surveillance capacity and preparedness.

1.3 The Congolese Context

The DRC remains the most affected country globally, accounting for approximately 85% of reported Mpox cases (Arita et al., 1985). Équateur Province has been particularly hard hit, with recurrent outbreaks documented in multiple health zones, including Wangata, Mbandaka, Bikoro, Ingende, Bolomba, and Basankusu. In 2024 alone, Équateur Province reported 8,576 cases with 404 deaths (case fatality rate of 4.7%). The Wangata Health Zone, which comprises 11 health areas, recorded a steady increase in cases starting from week 1 of 2024, with an attack rate of 5 cases per 1,000 exposed persons and 23 deaths (case fatality rate of 1.8%).

1.4 Problem Statement and Rationale

Despite ongoing surveillance efforts, Mpox cases continue to be reported in Équateur Province, suggesting potential gaps in the surveillance system. Preliminary observations indicated uneven case notification across health areas, with some areas having environmental characteristics favorable to Mpox emergence reporting very few cases. This pattern suggested that factors affecting surveillance performance, rather than true disease distribution, might be responsible for observed variations.

A functional surveillance system is essential for early detection, rapid investigation, and effective outbreak response. According to the Integrated Disease Surveillance and Response (IDSR) framework implemented by WHO in Africa, an effective surveillance system must detect cases early, confirm diagnoses, and trigger rapid response measures (WHO-AFRO, 2019). However, in resource-limited settings like the DRC, surveillance systems face numerous challenges, including inadequate human resources, poor data quality, logistical constraints, and insufficient funding.

This study therefore aimed to evaluate the Mpox surveillance system in the Wangata Health Zone to identify strengths, weaknesses, and areas for improvement.

1.5 Study Objectives

General objective: To evaluate the Mpox surveillance system in the Wangata Health Zone, Équateur Province, from January to December 2025.

Specific objectives:

1. Evaluate the essential surveillance functions (detection, notification, analysis, investigation, response preparation, response, and feedback) in the Wangata Health Zone
2. Evaluate the support functions (training, supervision, coordination) for Mpox surveillance
3. Assess the surveillance attributes (usefulness, sensitivity, simplicity, acceptability, flexibility, stability, representativeness, and timeliness)

2. METHODS

2.1 Study Design

This was a descriptive cross-sectional evaluative study conducted following CDC guidelines for evaluating public health surveillance systems (CDC, 2001).

2.2 Study Setting

The study was conducted in the Wangata Health Zone, located in Mbandaka city, Équateur Province, northwestern Democratic Republic of Congo. The health zone comprises 11 health areas and serves a population of approximately 150,000 inhabitants. The area is characterized by equatorial vegetation, proximity to the Congo River, and significant biodiversity, creating favorable conditions for zoonotic disease transmission.

2.3 Study Period

The study covered a one-year period from January 1 to December 31, 2025.

2.4 Study Population and Sampling

The study population included all healthcare providers involved in Mpox surveillance and response activities in the Wangata Health Zone. Convenience sampling was used, and 18 providers from 14 health facilities (Health Zone central office, one General Reference Hospital, 10 health centers, the Provincial Health Division, and the Provincial Laboratory) were included.

Inclusion criteria: Healthcare workers involved in priority disease surveillance who consented to participate.

Exclusion criteria: Healthcare workers not involved in Mpox surveillance or response activities.

2.5 Data Collection

Data were collected using:

1. A standardized questionnaire administered to 18 healthcare providers
2. Review of surveillance records for 173 suspected Mpox cases
3. Direct observation of surveillance tools and materials

The questionnaire assessed:

- Essential surveillance functions (detection, notification, analysis, investigation, response preparation, response, feedback)
- Support functions (training, supervision, coordination)
- Surveillance attributes (usefulness, simplicity, sensitivity, specificity, acceptability, stability, representativeness, timeliness, data quality, flexibility)

A pre-test of the questionnaire was conducted at the Mbandaka Health Zone central office and Mama wa Elikya Health Center.

2.6 Variables

Essential functions: Detection using case definitions, timeliness of notification, existence of up-to-date dashboards, proportion of cases investigated, response actions taken.

Support functions: Proportion of staff trained in IDSR and Mpox surveillance, regularity of supervisory visits, existence of coordination meetings.

Surveillance attributes:

- Usefulness: Ability to use data for program management
- Simplicity: Ease of system operation
- Sensitivity: Ability to detect all real cases
- Specificity: Ability to exclude false cases
- Acceptability: Willingness of stakeholders to participate
- Stability: Continuity of system operation
- Timeliness: Speed of notification and response
- Data quality: Completeness of notification forms

- Representativeness: Geographic coverage

2.7 Data Analysis

Data were compiled in Microsoft Excel and analyzed using SPSS version 27. Descriptive statistics (frequencies, proportions, means) were calculated. Quantitative attributes were assessed using standard surveillance indicators.

2.8 Ethical Considerations

The research protocol was approved by the ISTM ethics committee. Administrative authorizations were obtained from the Provincial Health Division of Équateur and the Medical Chief of the Wangata Health Zone. Individual identifiers were not included in the results presentation. Informed consent was obtained from all participants.

3. RESULTS

3.1 Characteristics of Study Participants

Table 1. Participant Characteristics (N=18)

Characteristic	n	%
Sex		
Male	11	61.1
Female	7	38.9
Professional category		
Head Nurse (IT)	10	55.6
Assistant Head Nurse (ITA)	2	11.1

Characteristic	n	%
Physician	2	11.1
Supervisor (IS SSP)	1	5.6
Director of Nursing (DN)	1	5.6
Laboratory virology staff	1	5.6
Data manager	1	5.6
Years of experience		
1-5 years	2	11.1
6-10 years	7	38.9
>10 years	9	50.0

The majority of participants were male (61.1%), head nurses (55.6%), and had more than 10 years of experience (50.0%). A total of 14 health facilities were visited.

3.2 Essential Surveillance Functions

Table 2. Availability of Surveillance Tools in Health Facilities (N=14)

Surveillance tool	Available n (%)	Not available n (%)
Investigation forms	14 (100.0)	0 (0.0)
Up-to-date line list	12 (85.7)	2 (14.3)
Contact identification forms	11 (78.6)	3 (21.4)
Contact follow-up forms	11 (78.6)	3 (21.4)
Response plan	13 (92.9)	1 (7.1)
Up-to-date dashboard	4 (28.6)	10 (71.4)
Up-to-date graphs	3 (21.4)	11 (78.6)

Surveillance tool	Available n (%)	Not available n (%)
Information bulletins	1 (7.1)	13 (92.9)

All health facilities had investigation forms and response plans. The majority had line lists (85.7%) and contact identification/follow-up forms (78.6%). However, only 28.6% had up-to-date dashboards, 21.4% had epidemiological graphs, and information bulletins were produced only at the provincial level (7.1%).

Table 3. Investigation and Laboratory Performance (N=14 health facilities)

Indicator	Yes n (%)	No n (%)
Investigation forms archived case-by-case	14 (100.0)	0 (0.0)
Samples arrived at lab within 72 hours	12 (85.7)	2 (14.3)
Results received at health facility within 48 hours	14 (100.0)	0 (0.0)
Contact follow-up forms regularly completed	7 (50.0)	7 (50.0)
Sufficient Mpox sample collection kits	8 (57.1)	6 (42.9)
Mastery of sample conservation/transport techniques	10 (71.4)	4 (28.6)
Well-completed contact identification forms	3 (21.4)	11 (78.6)
Investigation forms available	12 (85.7)	2 (14.3)
Mastery of Mpox sample collection technique	14 (100.0)	0 (0.0)
Rapid response kits available	0 (0.0)	14 (100.0)

All health facilities mastered the sample collection technique and had samples arriving at the laboratory within 72 hours (85.7%) and results within 48 hours (100%). However, only half (50.0%) regularly completed contact follow-up forms, and none had rapid response kits available.

3.3 Support Functions for Surveillance and Response

Table 4. Training and Support Functions (N=18 providers unless indicated)

Indicator	Yes n (%)	No n (%)
Trained in IDSR (3rd edition)	14 (77.8)	4 (22.2)
Trained in Mpox surveillance/response	12 (66.7)	6 (33.3)
Presence of coordination teams (N=14 facilities)	14 (100.0)	0 (0.0)
Trained in biosafety	9 (50.0)	9 (50.0)
Trained in sample management	10 (55.6)	8 (44.4)
Trained in database management	8 (44.4)	10 (55.6)
Trained in infection prevention and control	9 (50.0)	9 (50.0)

Most providers (77.8%) had received IDSR training, and 66.7% had specific Mpox training. All facilities had well-organized coordination teams. However, training in biosafety (50.0%), sample management (55.6%), database management (44.4%), and infection prevention and control (50.0%) was less common.

3.4 Surveillance System Attributes

3.4.1 Quantitative Attributes

Table 5. Quantitative Attributes of the Mpox Surveillance System

Attribute	Cases expected	Cases found	%	Interpretation
Positive predictive value (PCR-confirmed)	173	81	46.8	Moderate
Sample adequacy (quality standards)	173	92	53.2	Moderate
Timeliness (72-hour target)	173	154	89.0	Good
Data quality (completeness)	173	36	20.8	Poor

Among 173 suspected Mpox cases notified during the study period, 46.8% were laboratory-confirmed by PCR. Fifty-three percent of samples met quality standards for collection, conservation, and transport. Timeliness was good, with 89.0% of cases meeting the 72-hour notification-to-analysis target. Data quality was very poor, with only 20.8% of notification forms being complete.

3.4.2 Qualitative Attributes

Table 6. Qualitative Attributes of the Mpox Surveillance System

Attribute	n/N	%	Interpretation
Usefulness	14/14	100.0	Excellent
Specificity	14/14	100.0	Excellent
Simplicity	10/14	71.4	Moderate
Acceptability	13/18	72.2	Moderate
Sensitivity	9/14	64.3	Moderate
Stability	2/14	14.3	Very poor

The surveillance system demonstrated excellent usefulness (100%) and specificity (100%). Simplicity was rated at 71.4%, and acceptability at 72.2%. Sensitivity was 64.3%, indicating under-detection of community cases. Stability was very low (14.3%), reflecting frequent stockouts of surveillance materials and dependence on external funding.

4. DISCUSSION

4.1 Interpretation of Findings

This evaluation of the Mpox surveillance system in the Wangata Health Zone revealed a system that is functional and useful but faces significant operational constraints.

Usefulness and Specificity: The finding that all health facilities (100%) considered the system useful and specific aligns with WHO guidelines, which emphasize that an effective surveillance system must be able to detect cases and guide public health interventions (WHO, 2022). The high specificity is likely attributable to the use of standardized case definitions and the availability of laboratory confirmation.

Availability of Tools: The universal availability of investigation forms (100%) and response plans (93%) is encouraging and reflects compliance with IDSR requirements. This finding is consistent with studies from other African countries where basic surveillance tools are generally available at the peripheral level (Nsubuga et al., 2006).

Timeliness: The high timeliness rate (89% of samples arriving at the laboratory within 72 hours and results within 48 hours) demonstrates good logistical coordination between health facilities and the provincial laboratory. This is critical for Mpox control, as rapid confirmation allows for prompt case management and contact tracing.

Data Quality and Analysis: The very low data quality (21% completeness) is concerning. This finding aligns with other evaluations in sub-Saharan Africa where data quality remains a persistent challenge (Mboera et al., 2021). The low availability of up-to-date dashboards (29%) and epidemiological graphs (21%) indicates weak local data analysis capacity, limiting evidence-based decision-making at the health facility level.

Training Gaps: While IDSR training coverage (78%) is satisfactory, critical gaps remain in biosafety (50%), sample management (56%), database management (44%), and infection prevention and control (50%). This is problematic given the high-risk nature of Mpox, where healthcare-associated transmission is a significant concern (Learned et al., 2005).

Stability: The very low stability (14%) is the most critical finding. This reflects the fragility of the surveillance system, which depends heavily on external funding and experiences frequent stockouts of essential supplies. This finding is consistent with evaluations from other resource-limited settings where surveillance systems are often donor-dependent and unsustainable (Nsubuga et al., 2006).

Sensitivity: The moderate sensitivity (64%) indicates that approximately one-third of Mpox cases in the community are not being detected. This underreporting may be due to several factors: lack of awareness among community members, poor access to health facilities, incomplete contact tracing, and underdiagnosis by healthcare providers.

4.2 Comparison with Existing Literature

These findings are consistent with evaluations of Mpox surveillance systems elsewhere in the DRC and Africa. Nolen et al. (2016) documented extended human-to-human transmission during a Mpox outbreak in the DRC, highlighting the importance of sensitive surveillance systems. A study by Doshi et al. (2019) in the DRC found that surveillance sensitivity was limited by case underreporting, a finding echoed in our study.

The training gaps identified in this study mirror those reported by Nsubuga et al. (2006), who found that inadequate training of healthcare workers was a major barrier to effective surveillance in Africa. Similarly, Mboera et al. (2021) reported that poor data quality and limited analytical capacity were common challenges in African surveillance systems.

The very low stability observed in this study is similar to findings from other resource-limited settings where surveillance systems are often fragile and donor-dependent. This underscores the need for sustainable domestic financing for public health surveillance.

4.3 Strengths and Weaknesses

Strengths:

- Universal availability of basic surveillance tools
- Good timeliness of sample transport and laboratory confirmation
- High usefulness and specificity
- Well-organized coordination teams

Weaknesses:

- Very low stability (14%)
- Poor data quality (21% completeness)
- Moderate sensitivity (64%)
- Insufficient training in critical areas (biosafety, database management, IPC)
- No rapid response kits available in any health facility

4.4 Limitations

This study has several limitations. First, the cross-sectional design does not allow for assessment of temporal trends in surveillance performance. Second, the evaluation was based primarily on provider reports and document review, which may introduce recall and reporting bias. Third, the sample size (18 providers) and number of health facilities (14) may limit generalizability. Fourth, the study period of one year may not capture seasonal variations in surveillance performance. Despite these limitations, this study provides important baseline data on Mpox surveillance performance in a typical Congolese health zone.

5. CONCLUSION

5.1 Summary of Findings

This evaluation of the Mpox surveillance system in the Wangata Health Zone demonstrated that the system is functional and useful, with several notable strengths: universal availability of investigation forms and response plans, good timeliness of sample transport and laboratory confirmation, and well-organized coordination teams. The system demonstrated excellent usefulness (100%) and specificity (100%).

However, significant gaps were identified that limit system performance:

1. **Very low stability (14%):** Frequent stockouts of surveillance materials and dependence on external funding threaten system continuity.

2. **Poor data quality (21%):** Incomplete and inconsistent data compromise the reliability of epidemiological analyses.
3. **Moderate sensitivity (64%):** Significant underreporting of community cases limits outbreak detection.
4. **Training gaps:** Insufficient training in biosafety (50%), database management (44%), and infection prevention and control (50%).
5. **No rapid response capacity:** Absence of rapid response kits in all health facilities delays outbreak control.

5.2 Recommendations

At the national level (Ministry of Health):

- Strengthen national epidemiological surveillance policy
- Ensure sustainable domestic financing for surveillance systems
- Decentralize diagnostic capacities to provincial laboratories
- Implement digital data transmission systems

At the provincial level (Équateur Province):

- Reduce confirmation delays by improving sample transport logistics
- Implement a digital surveillance system
- Strengthen supervision of health facilities
- Establish regular feedback mechanisms

At the health facility level:

- Train personnel on proper completion of notification forms
- Improve rapid case notification
- Strengthen data archiving
- Ensure availability of sample collection kits and rapid response kits

At the community level:

- Intensify awareness campaigns on Mpox
- Strengthen community health worker networks
- Combat stigma and promote early healthcare-seeking behavior

For partners and donors:

- Support digitalization of the surveillance system
- Strengthen technical and logistical capacities
- Promote sustainability of interventions through government co-financing

5.3 Final Conclusion

This study demonstrates that the Mpox surveillance system in the Wangata Health Zone is functional and useful but requires urgent strengthening in stability, data quality, sensitivity, and training. The very low stability (14%) and poor data quality (21%) are particularly concerning and require immediate attention. Without sustainable investment in training, logistics, infrastructure, and governance, the system's ability to detect and respond to Mpox outbreaks will remain compromised, leaving the population of Équateur Province vulnerable to this re-emerging zoonotic disease.

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