

## Evaluation of Mpox Surveillance System in Imo State, South-eastern Nigeria

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**Okoroama Chibuzo Linda<sup>1</sup>, Wadzingi Williams-Bassi<sup>2</sup>, Angela Izegebune<sup>2</sup>, Adeniran Adeniyi Ayobami<sup>2\*</sup>, Aibinuomo Ayomide Oluwaseyi<sup>2</sup>, Eronini Ebubechi C<sup>2</sup>, Alfred Ineife<sup>2</sup>, Victor Nnawuba Iheyi<sup>2</sup>, Nosike Job Chibuzo<sup>2</sup>, Ogah Ikechukwu Alo<sup>2</sup>, Akakuru Kingsley Ogbonnaya<sup>1</sup>, Awah Chukwuma Quintus<sup>1</sup>, Egbuna Hyacinth Chukwuebuka<sup>3</sup>, Ihemba Vivian Ngozi<sup>3</sup>, Chinyere Maureen Obejili-Ezeh<sup>3</sup>, Ihedioha Leonard<sup>4</sup>, Stan-Ekezie Ijeoma Doris<sup>5</sup>, Ugo Enebeli<sup>6</sup>, Kalu Ugonna Anthony<sup>6</sup>, Inumanye N Ojule<sup>7</sup>, Okoroama Emeka Casmir<sup>8</sup> and Ihedioha Anthony<sup>9</sup>**

*1Imo State Primary healthcare development Agency, Owerri, Imo State*

*2World Health Organization*

*3Epidemiology and Surveillance Unit, Department of Public Health, State Ministry of Health, Imo State*

*4Imo State Public Health Laboratory, Ministry of Health, Imo State*

*5Veterinary Epidemiology Unit, Ministry of livestock development, Imo State*

*6John Snow Research and Training Institute Inc*

*7Department of Community Medicine, University of Port Harcourt Teaching Hospital, Port-Harcourt, Nigeria*

*8Department of Accident and Emergency, Federal Teaching Hospital, Owerri, Imo State*

*9Department of Public Health, Imo State University, Nigeria*

**\*Corresponding Author:** Adeniran Adeniyi Ayobami, World Health Organization.

## Chapter One

### Introduction

Public health surveillance is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in taking public health action geared towards the reduction of morbidity and mortality associated with the disease or health-related event [1].

Data disseminated by a public health surveillance system can be used for immediate public health action, program planning and evaluation, and formulating research hypotheses [1]. Periodic evaluation of public health surveillance systems ensures that problems of public health importance are being monitored efficiently and effectively [1].

Human Mpox is a zoonotic smallpox-like illness caused by the Mpox virus [2, 3]. The Mpox disease (formerly monkeypox) is caused by the Mpox virus (MPXV), an enveloped double-stranded DNA virus of the *Orthopoxvirus* genus in the *Poxviridae* family, with two genetic clades, clades I and II [3].

The virus was discovered in Denmark in 1958 among monkeys kept for research. The first reported human case of Mpox disease was in a nine-month-old boy in the Democratic Republic of the Congo [3, 4]. The disease is spread from person to person or occasionally from animals to human [3]. The natural reservoir of the virus is unknown; however, various small mammals such as squirrels and monkeys have been listed as probable reservoirs [4]. Following the eradication of smallpox in 1980 and the end of smallpox vaccination worldwide, Mpox steadily emerged in Central, East, and West Africa [3-5]. There was a global outbreak of the disease in 2022-2023 [2].

Person-to-person transmission of Mpox can occur through direct contact with infectious skin or other lesions such as in the mouth or on the genitals [2]. The virus then enters the body through broken skin, mucosal surfaces (e.g. oral, pharyngeal, ocular, genital, anorectal), or via the respiratory tract. People with multiple sexual partners are known to be at higher risk as the emergence of a new strain of clade I (known as clade Ib) has revealed sexual transmission as an additional route propagating the spread amongst high-risk groups (MSM, sex workers and their clients, etc.) [9].

Typically for Mpox disease, fever, muscle aches, and sore throat appear first [3]. Rash later begins on the face and spreads over the body, extending to the palms of the hands and soles of the feet, and evolves over 2-4 weeks in stages - macules, papules, vesicles, pustules. Lesions dip in the center before crusting over after which scabs then fall off [2, 6]. Lymphadenopathy (swollen lymph nodes) is a classic feature of Mpox disease. Some people can be infected without developing any symptoms [2, 6].

The goal of treating Mpox disease is to take care of the rash, manage pain and prevent complications. Early and supportive care is important to help manage symptoms and avoid further complications [2]. Getting Mpox vaccine can help prevent infection. The vaccine is given within 4 days of contact with an infected person or within 14 days if there are no symptoms [4].

In September 2017, an outbreak of Mpox occurred in Nigeria after 40 years of no reported cases in the country [7]. As of November 2019, the country had reported 183 confirmed cases across 18 states [7]. As of 31st October 2021, Mpox cases have been recorded in 26 out of the 36 States in the country including the Federal Capital Territory [7, 8].

Inadequate surveillance and response capacity can endanger the population. Unfortunately, developing countries, like Nigeria, where there is the greatest risk for outbreaks, often lack the capacity to promptly detect and adequately respond to these outbreaks. This study aims to evaluate the effectiveness of Mpox surveillance system across the 27 LGAs in Imo State during 2022 outbreak.

## Methods

Imo State, nicknamed the "Eastern Heartland", with Owerri as her capital is the Southeast of Nigeria. The State is bordered by Anambra, Rivers and Abia States. The State was named after the Imo River which flows along the eastern border. Imo State consists of 27 Local Government Areas (LGAs) and 418 political wards. It has 1 tertiary health institution, 10 functional secondary health facilities, and 560 primary health facilities.

Respondents, which were purposively selected, included the 27 LGA Disease Surveillance and Notification Officers (DSNO), the State Epidemiologist, the State Disease Surveillance and Notification Officer (DSNO), and the Director of Public Health of the State Ministry of Health.

A semi-structured questionnaire and a checklist, both adapted from the CDC guideline; "*updated guidelines for evaluating public health surveillance systems*", published by the Center for Disease Control and Prevention for the evaluation of the surveillance system was administered to the 27 LGA DSNOs [1]. Additional information was extracted using Key Informant Interviews (KIIs) with the State Epidemiologist, State DSNO and the Director of Public Health of the State Ministry of Health.

In addition, Mpox surveillance secondary data from 2022 to 2023 was reviewed to check for system attributes like data quality, simplicity, completeness, and timeliness of the reporting system.

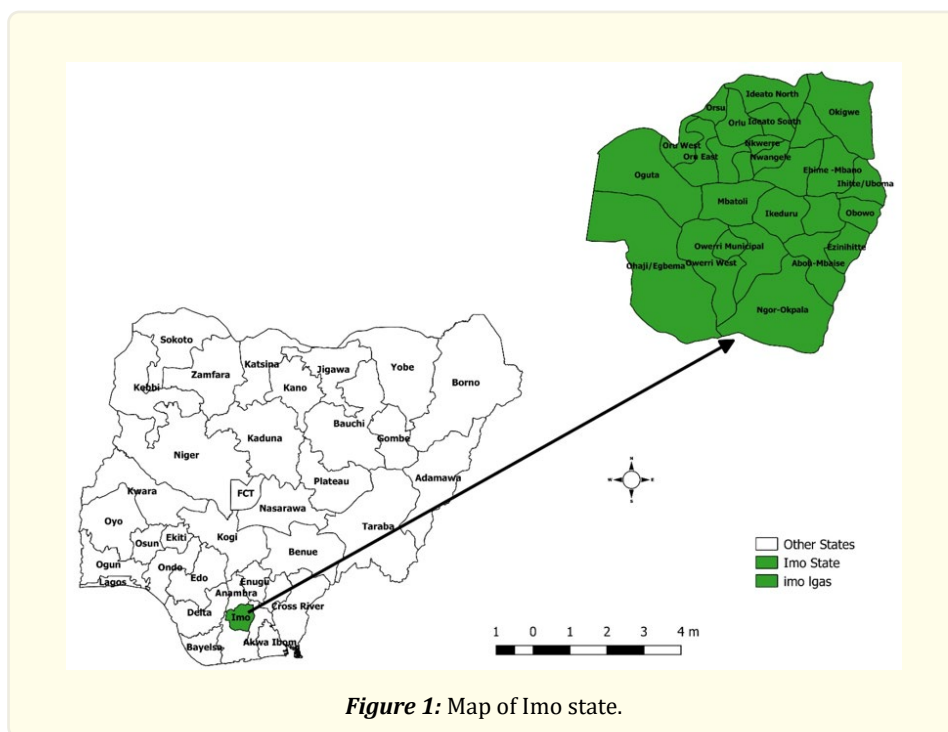


Figure 1: Map of Imo state.

**For the purpose of the study, standard case definitions of Mpox and other operational definitions adopted include:**

**Suspected case:** An acute illness with fever  $>38.3^{\circ}\text{C}$ , intense headache, lymphadenopathy, back pain, myalgia, and intense asthenia followed one to three days later by a progressively developing rash often beginning on the face (most dense) then spreading elsewhere on the body, including soles of feet and palms of the hand [9].

**Probable case:** A case that meets the clinical case definition, is not laboratory-confirmed but has an epidemiological link to a confirmed case [9].

**Confirmed case:** A clinically compatible case that is laboratory confirmed [9].

**Contact:** Any person who has been in direct or indirect contact with a confirmed case since the onset of symptoms i.e. contact with skin lesions, oral secretions, urine, feces, vomitus, blood, sexual contact, sharing a common space (anyone who has been in close proximity<sup>3</sup> with or without physical contact with a confirmed case) [9].

**Other operational definitions included:**

**Acceptability:** The extent to which individuals and groups are eager to engage in the assessment of the surveillance system was quantitatively assessed by examining the thoroughness of report forms submitted over the previous three months and the punctuality of data submission [1].

**Simplicity:** Simplicity, in the context of the surveillance system, refers to its design and user-friendliness. This aspect was evaluated by examining the percentage of healthcare personnel who could provide accurate explanations of how the system functions, understood the process of filling out case investigation forms and described the process as straightforward and not overly time-consuming [1].

**Flexibility:** A versatile public health surveillance system possesses the ability to adjust to evolving information requirements or operational circumstances with minimal additional time, manpower, or allocated resources [1].

**Data Quality:** is a measure of how thorough and accurate the data stored within the public health surveillance system is [1].

**Sensitivity:** pertains to the percentage of disease cases (or other health-related occurrences) that the surveillance system is capable of identifying or detecting [1].

**Positive Predictive:** Value signifies the percentage of reported cases that genuinely involve the health-related event being monitored [1].

**Representativeness:** refers to a public health monitoring system that effectively captures and depicts the occurrence of a health-related incident over time, as well as its prevalence across different locations and individuals, in a manner that accurately reflects the situation [1].

**Timeliness:** The time gap between the happening of a negative health incident and (i) the event being reported to the relevant health authority, (ii) the detection of patterns or outbreaks by that authority, or (iii) the initiation of preventive measures.

**Stability:** Stability pertains to the dependability, encompassing the system's ability to gather, handle, and furnish data without hiccups, and its availability, ensuring that it remains functional when required, in the context of a public health surveillance system [1].

**Usefulness:** The degree to which the system assists public health personnel in making informed decisions based on their interpretation and analysis of the data [1].

**Completeness:** The percentage of anticipated data that was submitted to the public health surveillance system [1].

Data was captured and analyzed using an Excel sheet to generate frequencies and graphs.

## Results

The study had 27 DSNOs as participants, among which 70% (n=19) were females, 30% (n=8) were males; 48% (n=13) were between 41-50 age group and about 75% (n=20) had spent over 6 years on the role of a DSNO. (Table 1).

<b>Variable</b>	<b>Frequency</b>
<b>Age:</b>	
31-40	6(22%)
41-50	13(48%)
>50	8(30%)
<b>Sex:</b>	
Male	8(30%)
Female	19(70%)
<b>Duration on current role (Years):</b>	
<1	4(14.8%)
1-5	3(11.1%)
≥6	20(74.1%)

**Table 1:** Socio-demographics characteristics of respondents.

All the respondents perceived Mpox as a disease of public health importance, 77.8% mentioned that Mpox surveillance met the goal it was set for, 74.1% identified that the Mpox surveillance system data collection method is appropriate; 55.6% believed that the system does not detect anticipated increase in the occurrence of Mpox in the State while 70.4% mentioned that Mpox cases are detected effectively by the system.

**Key attributes of system and processes:**

**Simplicity:** 77.8 % of respondent perceived the system to be simple. Almost all agreed that case definition is easy to understand, and all case investigations are done through home visit.

**Flexibility:** Among the 27 DSNOs who participated in the evaluation, all agreed that data collection tools for Mpox surveillance can accommodate any change in the system and staff are willing to handle any change in the system. They all also agreed that the forms are flexible since they have space for additional information to be added. It was observed that staff were eager in predisposition in dealing with changes or additional information in the system.

**Acceptability:** All the 27 respondents (DSNOs) agreed to continue to participate in the Mpox surveillance system. Twenty-four (89%) mentioned that there are challenges in carrying out surveillance work effectively, and challenges mentioned included; non-reporting of cases by health workers at the facilities, unavailability of data tools, lack of funding support for Mpox surveillance and difficulty reaching hard-to-reach areas. Poor attitude of health workers, need for computers for data entry, and need for training & retraining of personnel were also mentioned. Twenty respondents (74%) expressed that the State health authorities appreciate their effort on Mpox surveillance.

To improve the surveillance system, the respondents suggested funding support for active case search, intensify sensitization to caregivers, training & retraining of surveillance officers, need for motorcycles to reach hard to reach area, and effective funding for surveillance activities.

**Timeliness:** Twenty-five respondents (92.6%) stated that there are clear agreements or policies on timeliness of data and also mentioned that there are challenges in receiving data from lower level that is, from the communities and health facilities. The challenges mentioned include late reporting, need to incentivize reporting, inadequate health staff, too many paper forms to fill and high cost of transportation to transmit paper reports.

**Sensitivity:** All the respondents mentioned that current case definition of Mpox is appropriate and 81.5% agreed that the surveillance system detects most Mpox cases. Majority (77.8%) agreed that there are frequent missed cases of Mpox and suggestions for improvement include continuous sensitization of healthcare workers and caregivers during routine immunization and campaign, need for training, incentives for field case investigation and need for provision of operational fund.

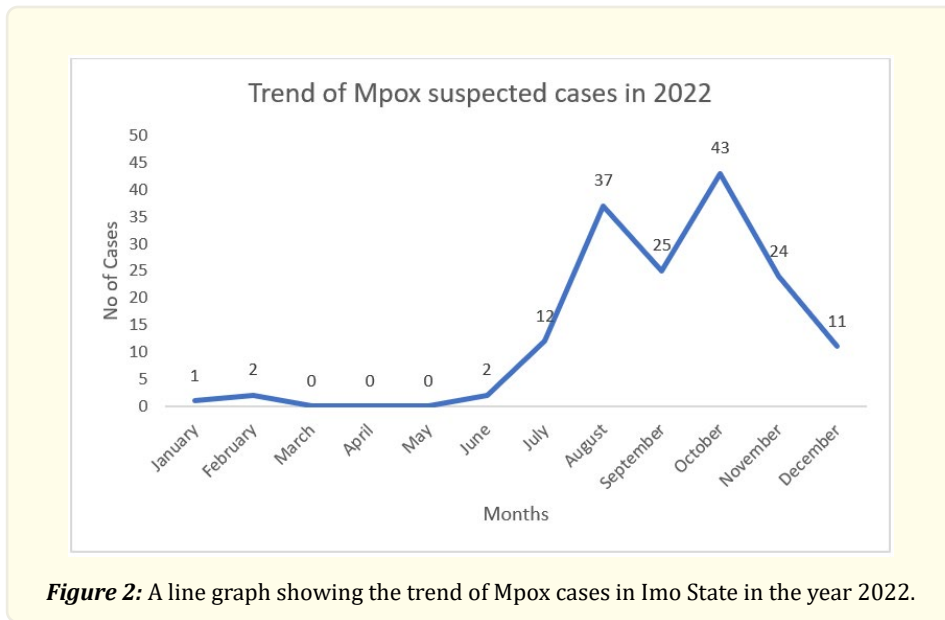
**Representativeness:** Majority (85.2%) mentioned that the system captures Mpox cases appropriately in terms of time, place, and person.

**Stability:** Twenty-four (88.9%, n=24) respondents mentioned that they rely confidently on the existing system to provide timely and accurate data to take appropriate actions. Late feedback from the higher authorities was however reported by the other three respondents as the reason for their belief that the system is not as stable as expected.

**Data Quality:** Only 66.7% (n=18) of the respondents described the level of completeness of data generated from the system as always complete.

**Secondary data analysis**

The data shows that in 2022, there was an increase in cases in August, September, and October, then began to decline in November and December. The total number of suspected cases was 157 amongst which there were 39 laboratory confirmed positive cases.



**Figure 2:** A line graph showing the trend of Mpox cases in Imo State in the year 2022.

**Timeliness and completeness of reporting**

DSNOs are expected to report weekly and monthly using the routine weekly and monthly reporting forms (IDSR 002 and IDSR 003). Timeliness of reporting by LGA was calculated as the “total number of timely reports divided by the expected number of reports” expressed in percentage. Completeness of reporting was calculated as “total number of reports expected minus total number of reports not received divided by Total number of reports expected” expressed in percentage. Timeliness and completeness of reporting were calculated for each month.

<b>Months (2022)</b>	<b>Percentage of Timeliness of Reporting</b>	<b>Percentage of Completeness of Reporting</b>
January	96.3	100
February	92.6	100
March	92.6	100
April	92.6	92.6
May	85.2	96.3
June	88.9	96.3
July	96.3	88.9
August	96.3	100
September	88.9	92.6
October	88.9	96.3
November	85.2	100
December	85.2	96.3

**Table 2:** A table showing timeliness and completeness of reporting summarized monthly.

**Discussion**

The effectiveness of the Mpox surveillance system within the study period in Imo State appears to be optimal in fulfilling its intended purpose and objectives. Evaluation of the system indicates several characteristics indicative of a well-functioning surveillance framework. Specifically, the system is regarded as valuable, uncomplicated, adaptable, inclusive, acceptable, and punctual in its operations.

Feedback from key stakeholders at both State and local government levels confirms the system's user-friendliness and operational simplicity. Its structure is well-defined and capable of accommodating necessary adjustments as required.

Studies have reported concerns about the capacity of Africa to conduct effective Mpox surveillance. These challenges include lack of adequate laboratory infrastructure and health care workers, weak disease surveillance systems, and lack of MPX knowledge among health care workers and communities [12].

The AfricaCDC established a standardized approach for surveillance of Mpox to improve early detection and reporting of Mpox cases [9]. The protocol aims to enhance existing Mpox surveillance in Africa, identify the populations most at risk to guide targeted interventions for mpox prevention and control, accurately provide situational awareness of mpox in Africa and to understand the epidemiology, natural history and risk factors associated with the disease [9].

The interim guidance provided by the WHO in March 2024 sets the overall goal of continued Mpox surveillance, case investigation and contact tracing as to detect new outbreaks and stop transmission to contain the global outbreak, protect people at risk in endemic and new settings, and make progress towards elimination of human-to-human transmission [13].

Overall, the Mpox surveillance system in Imo State during this period were satisfactory and reflected the prevailing conditions on the ground. Reported challenges within the system include insufficient funding, limited or restricted movement due to insecurity, inadequate laboratory infrastructure, and difficulties in reaching remote areas.

**Limitation of the study:** Limited relevant literature of Mpox surveillance systems.

**Ethical approval:** Department of Planning, Research and Statistics, Ministry of health, Imo State.

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