Original Research Article One

Mpox in Kayamba Village, Nsama District, Zambia : A Case Series Report

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Abstract

Background: Mpox is a zoonotic viral disease historically endemic to Central and West Africa, with recent emergence in non-endemic regions, including Zambia. On May 27, 2025, Nsama District recorded its first suspected Mpox case, prompting an investigation into a household cluster in Kayamba Village. This case series study aimed to describe the epidemiological, clinical, and temporal characteristics of the affected household cluster.

Methods: A descriptive case series study was conducted involving four epidemiologically linked household members (one confirmed and three probable cases). Demographic and outpatient clinical data were collected via a structured questionnaire in KoboToolbox and clinical record review. Specimens from the confirmed case were processed at the Zambia National Public Health Reference Laboratory. Data were cleaned in Microsoft Excel and analyzed using R statistical software.

Results: Four Mpox cases (three males, one female) were identified in a seven-member household (median age: 34.5 years; range: 13–44). The index case, a 44-year-old HIV-positive male, tested PCR-positive. Symptom onset ranged from May 27 to June 17, 2025. One additional adult male was HIV-positive. Time from symptom onset to healthcare ranged from 1 to 17 days. The household secondary attack rate was 50% (3/6).

Conclusion: The investigation confirmed localized household transmission of Mpox in Nsama District, involving four epidemiologically linked cases. It demonstrated significant intra-household transmission and heightened risk among people living with HIV. Timely case identification, specimen collection, and active contact tracing are critical to containment. Continued surveillance and community engagement are essential, particularly during the 21-day observation period following the last case, to prevent wider transmission and guide public health response.

Keywords: Mpox, household transmission, case series, HIV comorbidity, Zambia

Introduction

Mpox, caused by the monkeypox virus (Orthopoxvirus genus), is a zoonotic disease of increasing global public health concern [1]. First identified in monkeys in 1958 and subsequently in humans in 1970 in the Democratic Republic of Congo (DRC) [1, 2], Mpox was long considered a rare, self-limiting illness confined to forested regions of Central and West Africa [1]. However, over the past two decades, the global epidemiological landscape has shifted. In 2022, multiple countries outside Africa, particularly in Europe, the Americas, and parts of Asia, reported significant outbreaks, highlighting the virus's capacity for sustained human-to-human transmission [1, 3]. These events underscored the need for global surveillance and challenged long-standing assumptions about Mpox's geographic limitations.

Regionally, the burden of Mpox in sub-Saharan Africa remains underreported and under-researched [4]. Countries such as the DRC and Nigeria have documented recurring outbreaks [5], yet weak surveillance systems, limited laboratory infrastructure, and clinical similarities with other febrile rash illnesses (e.g., measles

and chickenpox) contribute to frequent misdiagnosis and underdiagnosis [6]. Furthermore, many questions remain unanswered regarding the virus's transmission routes, the potential for asymptomatic spread, environmental reservoirs, and the efficacy of available countermeasures, including vaccines and antivirals, in African populations [7]. These knowledge gaps hinder timely detection and evidence-based control strategies, particularly in rural or resource-limited settings.

In Zambia, Mpox has not historically been recognized as a notifiable disease, and no endemic transmission had been documented until recently [8]. However, the emergence of suspected and confirmed cases in different parts of the country, including rural areas, has raised concerns about silent transmission chains and gaps in surveillance. Understanding the transmission dynamics, risk factors, and clinical presentations of Mpox in the Zambian context is vital for national preparedness and regional public health response. Given the cross-border mobility and environmental similarities with endemic regions, Zambia faces increasing vulnerability to the spread of Mpox.

On May 29, 2025, a suspected Mpox case was reported at Kampinda Rural Health Centre (RHC) in Nsama District, Northern Province, a district with no prior Mpox history. This triggered an urgent field investigation. During the investigation, four epidemiologically linked cases (one confirmed, three probable) were identified within a single household in Kayamba Village. This event represents the first documented household cluster in the district and provides critical insights into the potential community transmission of Mpox in rural Zambia. The purpose of this study was to describe the epidemiological, clinical, and temporal characteristics of the four Mpox cases within a single household in Kayamba Village, Nsama District, from May to June 2025. Specifically, the study sought to: (1) determine the likely mode and sequence of transmission within the household, (2) identify potential within-household risk factors or shared exposures, (3) characterise the clinical spectrum and outcomes of all cases in the cluster, and (4) calculate the household secondary attack rate.

Methods

Design

A descriptive case series design was used to document and analyse the four epidemiologically linked Mpox cases within a single household.

Study Setting

The study was conducted in Nsama District, which borders the Democratic Republic of Congo, and has an estimated population of 87,347 [9,10]. Investigations primarily focused on Kampinda Rural Health Centre (RHC) and the nearby Kayamba Village, which was identified as the epicenter of the household cluster. Kampinda, one of the smaller communities within the district, has a population of approximately 12,229 [10]. It is surrounded by rural landscapes and is part of a network of villages including Mikose, Roma, and Kabuta, all situated within a 20-25 km radius [10].

Case definitions

The following case definitions were employed for this investigation, based on national guidelines [8] and tailored for the local situation:

- **Suspected Case:** Defined as the presence of clinically compatible signs and symptoms in an individual with a reported exposure or travel history to the Kampinda zone.

- **Probable Case:** Characterized by clinically compatible features and a documented epidemiological link to a laboratory-confirmed case, in the absence of laboratory confirmation.
- **Confirmed Case:** A laboratory-confirmed diagnosis of Mpox infection through real-time Polymerase Chain Reaction (PCR) for viral DNA.

Data collection

Data relevant to this investigation were obtained from both primary and secondary sources. A structured questionnaire administered to household members using KoboToolbox captured demographic information (e.g., age, sex, household size), clinical details (e.g., dates of symptom onset, signs and symptoms), and exposure history (e.g., travel, animal contact, or interaction with symptomatic individuals). Secondary data were extracted from the outpatient department (OPD) medical records at Kampinda Rural Health Centre and the district-level Mpox line list, supplementing information on symptom presentation and healthcare utilization.

Skin lesion swabs were collected from the index case by the District Rapid Response Team (RRT) prior to the arrival of the investigation team. These were tested using real-time PCR at the Zambia National Public

Health Reference Laboratory, and the results informed case classification and linkage to the other household members.

To ensure data quality, the team developed a standardized questionnaire, conducted daily checks for completeness and consistency, and held regular debriefings to address discrepancies. All collected data were securely uploaded into KoboToolbox, with restricted access, and managed according to standardized procedures for cleaning and verification.

Data Analysis

Data collected via KoboToolbox were exported in CSV format and first processed in Microsoft Excel for cleaning, including checking for completeness, correcting entry errors, and standardizing variable formats. The cleaned dataset was then imported into R statistical software (version 4.4.1) for analysis.

Descriptive statistics were used to summarize demographic characteristics, clinical features, and symptom onset timelines. Categorical variables such as sex, symptom presence, comorbidities, and case classification were tabulated. Continuous and temporal variables, including age and the interval between symptom onset and health facility visit, were analyzed using measures of central tendency and case-by-case timelines. The household secondary attack rate (SAR) was calculated based on the number of new cases among susceptible household members. Key outputs included summary tables of case characteristics and visual timelines to illustrate the interval between symptom onset and healthcare seeking.

Results

Case Descriptions

Four epidemiologically linked mpox cases were identified within a single household in Nsama District, Zambia. One case was laboratory-confirmed, and three met the probable case definition. Age ranged from 13–44 years, with a median age of 34.5 years. Symptom onset occurred between May 27 and June 17, 2025. Clinical characteristics are summarized in table 1.

Symptom Onset and Facility Visit

Figure 1 shows the interval between symptom onset and subsequent health facility visit for each case. The time lag varied across individuals, ranging from within a day to 17 days.

Secondary Attack Rate

A total of 7 individuals resided in the affected household. One individual was identified as the index case, leaving 6 susceptible household contacts. Among these, 3 developed probable Mpox (the brother, sexual partner, and child), resulting in a household Secondary Attack Rate (SAR) of 50%.

Table 1: Household-Level Mpox Case Summary for Kapanda Village Outbreak, Nsama District, May–June 2025

Name	Age/Sex	Date of Onset	Symptoms	Comorbidity	Classification
Index	44/M	27-May-2025	Fever, rash (itchy vesiculo-pustular lesions), headache, sore throat, eye irritation	HIV Positive	Confirmed
Brother	34/M	27-May-2025	Fever, rash (itchy vesiculo-pustular lesions), lymphadenopathy, headache	HIV/AIDS	Probable
Sexual partner	35/F	28-May-2025	Fever, rash (itchy vesiculo-pustular lesions) covering face, groin and feet.	None	Probable
Child	13/M	17-Jun-2025	Fever, rash (itchy vesiculo-pustular lesions), lymphadenopathy	None	Probable

M = Male; F = Female; HIV = Human Immunodeficiency Virus; AIDS = Acquired Immunodeficiency Syndrome

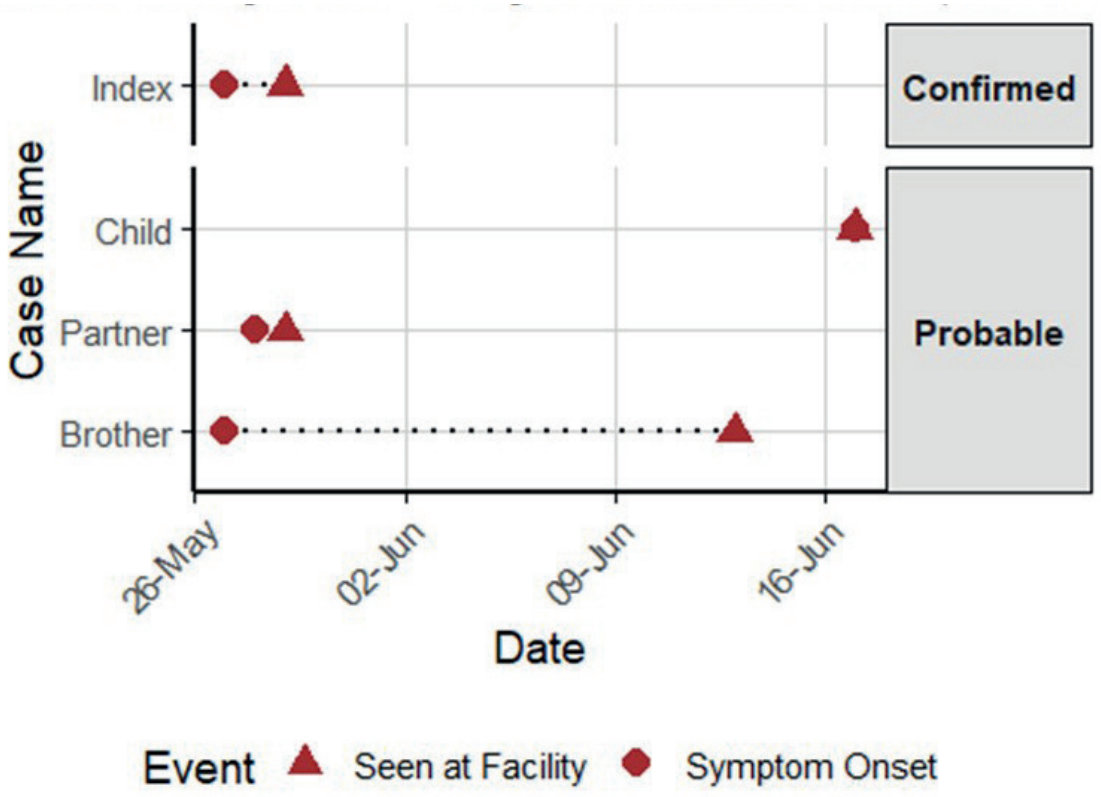

Figure 1: Timeline of Mpox Symptom Onset and Health Facility Visits by Case, Kayamba Village, Nsama District, Zambia: May-June, 2025

Discussion

This study presents the first documented Mpox outbreak and, specifically, the first detailed epidemiological and clinical characterization of a household cluster in Northern Province, Zambia. This is significant as it marks a notable shift in the region's epidemiological landscape, providing evidence of community transmission in a rural setting where Mpox had no prior documented history [8]. Our findings contribute substantially to the limited body of knowledge on Mpox in sub-Saharan Africa, particularly in rural and previously unaffected areas of Zambia, highlighting the evolving threat and the need for heightened surveillance.

A detailed epidemiological assessment supports the identification of the 44-year-old male as the index case, based on laboratory confirmation and his role as the earliest identified symptomatic individual. However, given that his 34-year-old brother developed symptoms on the same day and also resided in the household, the possibility of co-primary cases or alternative transmission pathways cannot be definitively excluded. One plausible scenario is that both adult males were exposed simultaneously to a common external source and developed symptoms concurrently. Alternatively, the brother, who had delayed presentation to the health facility, may have been the primary case and transmitted the virus to the confirmed case through close contact. Another possibility is that the 35-year-old female sexual partner, who developed symptoms one day later, introduced the infection into the household and subsequently infected both adult males.

Due to these uncertainties and overlapping timelines, caution is warranted in designating a definitive index case. This complexity underscores the challenges inherent in pinpointing the precise index case in real-world outbreak investigations, especially in close-contact settings. Nonetheless, the confirmed case's immunocompromised status and the sequence of subsequent probable cases suggest a high likelihood of intra-household transmission via close physical contact and shared living spaces.

The clinical spectrum observed across all four cases was largely consistent with known Mpox presentations described globally, commonly including fever, painful and itchy vesiculo-pustular lesions, lymphadenopathy, and headache [1,2]. Furthermore, some cases presented with involvement of oral and genital mucosa, which is also a recognized feature of Mpox. Notably, the index case exhibited the most severe symptoms and a full-body rash, a likely consequence of his immunosuppressed state. This observation reinforces the critical importance of Antiretroviral Therapy (ART)

adherence and diligent monitoring for opportunistic infections, including Mpox, in populations living with HIV [11,12], providing real-world evidence of this interaction from an African context.

The calculated Household SAR of 50% within this household setting underscores the high infectiousness of Mpox in close-contact environments [1,2]. This finding is at the higher end of reported household secondary attack rates for Mpox, particularly for Clade IIb, observed during the 2022 global outbreaks, where SARs often ranged from 10% to 30% in many household settings [12,13]. The elevated SAR in this cluster likely reflects the intense and prolonged close physical contact among family members sharing a living space, compounded by the immunocompromised status of the index case, which might have led to increased viral shedding and transmissibility. This finding emphasises the urgent need for rapid case identification, immediate isolation of infected individuals, and thorough contact tracing to mitigate further spread, particularly in settings with high household occupancy [11,12].

Public Health Response and Implications

Following the identification of the household Mpox cluster, a coordinated public health response was rapidly implemented by the District Health Office and the RRT. Core outbreak control activities included immediate case isolation, contact tracing, risk communication, and targeted community sensitization within Kayamba Village.

Active surveillance was established among all household members and extended to the surrounding community. As of July 2nd, 15 days had passed since the symptom onset of the last identified case (June 17, 2025). No additional suspected or confirmed Mpox cases were reported during that period.

While the absence of new cases was an encouraging sign, it was considered premature to declare the outbreak contained, as the full 21-day maximum incubation period recommended by the World Health Organization (WHO) had not yet elapsed [15,16]. Continued active monitoring and heightened community awareness were regarded as critical for the early detection of any further transmission.

The public health response demonstrated the value of rapid mobilization, use of clinical case definitions, and community engagement in limiting potential spread. Ongoing vigilance was emphasized to prevent escalation and ensure timely intervention.

Limitations

This investigation faced some limitations that may have affected the completeness and interpretation of findings. First, only one of the four reported cases was laboratory-confirmed due to limited specimen availability and logistical constraints during the early phase of the response. As a result, the classification of the remaining three cases relied on clinical and epidemiological criteria, which, although consistent with WHO definitions [17], introduces some uncertainty in case confirmation.

Second, recall bias may have influenced the accuracy of symptom onset dates and exposure histories, as data collection was conducted retrospectively through interviews. To minimize this, interviews were conducted as soon as the investigation team arrived, and respondents were probed using a structured tool to enhance recall consistency.

Third, the small sample size limited the ability to draw broader statistical inferences or detect subtle transmission patterns. However, as a descriptive case series, the primary goal was to characterize the cluster, not to generalize findings beyond the household.

Lastly, incomplete testing of all household members meant that asymptomatic or subclinical infections may have gone undetected. Active symptom monitoring and repeated follow-ups helped mitigate this by ensuring all symptomatic individuals were promptly evaluated and classified according to standard criteria.

Despite these limitations, the investigation yielded valuable insights into household transmission dynamics, clinical patterns, and public health response needs in a rural Zambian setting.

Conclusion and Recommendations

Our investigation confirmed localized household transmission of Mpox in Nsama District, involving four epidemiologically linked cases. This highlighted the critical role of timely diagnosis, specimen collection, effective contact tracing, and prompt isolation in controlling the spread of infection. The identification of comorbidities, particularly HIV, among two adult cases underscored the need to prioritize vulnerable populations during outbreak response.

Although no additional cases were reported within 15 days following the last symptom onset on June 17, 2025, the outbreak remained under surveillance and could not yet be declared contained. We emphasized the essential need for continued vigilance throughout the full 21-day incubation period, consistent with WHO criteria for outbreak closure, to ensure early detection of any new cases and confirm interruption of transmission.

To support outbreak control and prevent further spread, we recommended that active surveillance activities, including case finding, contact monitoring, and health facility alerts, be maintained for the duration of the outbreak. We also recommended strengthening diagnostic capacity, including improving health facility readiness for timely specimen collection and laboratory confirmation, to expedite case classification and public health response. Integration of Mpox symptom screening into routine HIV care services was crucial to facilitate early identification among high-risk individuals. Furthermore, we advised enhanced risk communication and community engagement strategies, utilizing culturally appropriate messaging, to encourage early reporting and reduce stigma. Finally, we proposed the establishment of a district-level Mpox outbreak preparedness plan to improve future response capabilities, including rapid mobilization, logistics management, and contact tracing protocols.

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