International Journal of Infectious Diseases 164 (2026) 108346

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Delayed patient isolation and associated factors during the mpox outbreak in Uganda, July-December 2024

Hannington Katumba[1,*], Richard Migisha[1], Allan Komakech[1,2], Daniel Wenani[1], Joyce Owens Kobusingye[1], Emmanuel Mfitundinda[1], Jane Frances Zalwango[1], Ruth Kaliisa[3], Inyeong Park[3], Dansan Atim[4], Allan N. Muruta[4], Benon Kwesiga[1], Lillian Bulage[1], Ivan Lukabwe[1], Alex Riolexus Ario[1]

[1] Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda
[2] School of Public Health, Clarke International University, Kampala, Uganda
[3] Korea Foundation for International Healthcare, Kampala, Uganda
[4] Ministry of Health, Kampala, Uganda

ARTICLE INFO

Article history:
Received 24 July 2025
Revised 5 December 2025
Accepted 21 December 2025

Keywords:
Mpox
Disease outbreak
Health seeking
Patient isolation
Uganda

ABSTRACT

Objective: Rapid detection and isolation of mpox mpox patients reduces transmission. We assessed delays in patient isolation and associated factors during the mpox outbreak in Uganda from July to December 2024 to inform response efforts.

Methods: We selected all laboratory-confirmed cases isolated at two mpox isolation centers in Uganda from July 24 to December 29, 2024. Time-to-Isolation (TTI) was number of days from symptom onset to isolation, categorized as 'short' (0-3 days) or 'delayed' (>3 days) based on operational benchmarks for rapid containment of a highly infectious disease and the biological urgency of early isolation of mpox cases. We summarized data from case narratives into descriptive statistics and used multivariable logistic regression to measure the level of association of individual factors with delayed TTI which was the outcome variable. Reasons for short or delayed TTI were obtained from qualitative interviews.

Results: Among 832 mpox patients, 709 (91%) had delayed TTI, 473 (57%) were males, 713 (86%) were ≥18 years old, 698 (83%) had not visited a health facility before isolation, and 742 (89%) had self-medicated before isolation. Age ≥18 years (aOR = 2.6, 95% CI = 1.6-4.2) and self-medication (aOR = 5.4, 95% CI = 1.7-17.1) were associated with delayed TTI. Interviewed mpox patients with delayed TTI (n = 9) attributed this to lack of diagnostic skills among healthcare workers and attributed their delayed care-seeking to personal economic concerns. Mpox patients with short TTIs (n = 6) attributed this to prior knowledge about mpox from social media and response teams.

Conclusion: Most mpox patients experienced delayed TTI, associated with being older than 18 years and self-medication, and driven by misdiagnosis and individual economic concerns. Targeting risk communication and strengthening frontline diagnostic capacity could improve early case detection and management.

Introduction

Mpox is a highly infectious zoonotic viral disease that spreads through close contact between infected and susceptible individuals [1]. Since its outbreak in the Democratic Republic of Congo (DRC), the disease has rapidly spread to other countries, posing a significant threat to health systems and economies. The incubation period ranged from 1 to 21 days. Affected individuals can experience painful rashes, enlarged lymph nodes, fever, headache, muscle aches, back pain and low energy. Its symptoms resemble those of other infections, such as chickenpox, measles, bacterial skin infections, scabies, herpes, syphilis, sexually transmitted infections, and medication-associated allergies. The disease is typically self-limiting within 14-28 days, although symptoms may persist longer

* Corresponding author. Hannington Katumba, Uganda Public Health Fellowship Program, Uganda National Institute of Public Health, Kampala, Uganda.
E-mail address: hkatumba@uniph.go.ug (H. Katumba).

https://doi.org/10.1016/j.ijid.2025.108346

in individuals with compromised immune systems. It can also co-occur with these or other comorbidities, making its diagnosis more complex [2–4].

The disease has been shown to spread mainly through contact. Undetected or untreated patients can develop complications, which may progress to more severe forms of the disease, such as necrotizing lesions, secondary bacterial infections, pneumonia, encephalitis, or even death [1]. The window for effective containment is often narrow, underscoring the importance of rapid patient isolation within the initial days of symptom onset to mitigate community spread. It is crucial for health systems to detect mpox cases and quickly isolate them to prevent further transmission. Previous studies have shown different reasons for possible delays in the isolation of mpox patients [5,6].

On July 24, 2024, two mpox cases were confirmed in the Kasese district. The outbreak progressed rapidly, and cases were reported in 73 districts in Uganda by December 29, 2024. As it is a re-emerging disease, the factors that may influence how quickly cases are isolated are not well studied. Some studies have indicated that delayed clinical recognition, often due to a low index of suspicion among health workers, and mpox patients mistaking it for other skin diseases, such as chickenpox, leads to delayed care. Other studies have found that communities prefer and indeed first seek traditional healthcare, only visiting health facilities, ultimately contributing to community transmission [6–8]. We assessed the time to isolation among confirmed cases and identified factors associated with delayed isolation to inform responses to this and future mpox outbreaks in similar settings.

Methods

Study design and setting

We conducted a mixed-methods study employing both quantitative and qualitative methods. The target outcome was Delayed TTI, either at Nakasongola Health Centre IV (HCIV), located in Nakasongola District, or Entebbe Regional Referral Hospital (ERRH), located in Wakiso District, within the Kampala Metropolitan Area (KMA). The KMA comprises three districts: Kampala, Mukono, and Wakiso. Nakasongola HCIV and ERRH were the only mpox isolation centers in Uganda at the time, located in Nakasongola District and KMA, both of which had the highest number of confirmed mpox cases (Figure 1). We selected all cases confirmed and isolated at the two centers, from the start of the outbreak in July 2024 to December 2024. We chose this time frame because it was still early in the outbreak, when the country had only two isolation units in place. Later, due to the rapidly rising number of cases, additional isolation units were established in other districts, and guidelines for home-based mpox care were rolled out.

Data sources and study variables

We obtained data from a review of medical records at Nakasongola Health Centre IV (HC IV) in Nakasongola District and ERRH. We documented demographic variables, date of symptom onset, health facilities visited, and date of isolation. We determined the time in days from the date of symptom onset to the date of isolation at the mpox treatment center; this is the time to isolation

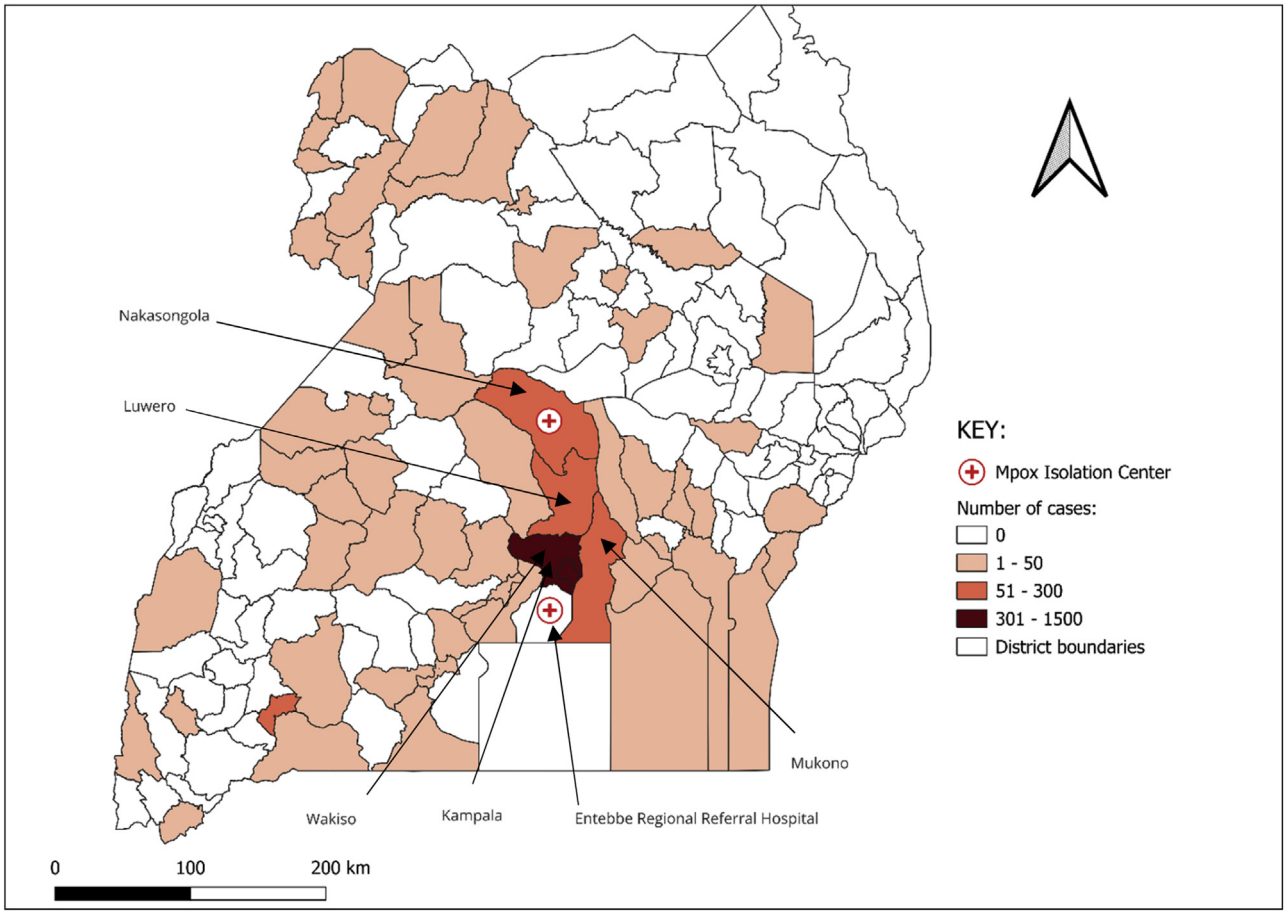

Figure 1. Number of mpox cases reported across various districts and the location of mpox isolation units in Uganda, July-December 2024.

(TTI), which we categorized as a short TTI (1-3 days) or Delayed TTI (>34 days). This binary categorization of TTI and subsequent determination of Delayed TTI as >3 days was established based on operational benchmarks for rapid containment of highly infectious diseases, such as Viral Hemorrhagic Fevers (VHFs) in the Democratic Republic of Congo (DRC), where early isolation within the first few days of symptom onset is critical for breaking chains of transmission. While a definitive, universally validated threshold for mpox TTI is not yet widely established in the literature, our chosen cut-off reflects the public health urgency to distinguish between acceptably rapid isolation and concerning delays during an active mpox outbreak, particularly given the early infectivity of mpox. We then evaluated the delay to isolation based on age, risk category, the number and type of health facilities visited before isolation, and explored differences based on a self-reported history of self-medication.

Qualitative study

According to the Ministry of Health (MoH) guidance, suspected mpox patients were withdrawn from the community and taken to a holding area at a health facility within the district where mpox samples were collected. Once the results were returned, patients with positive test results were transferred to the isolation unit, either at Nakasongola HC IV or the Entebbe RRH Isolation Unit. We included mpox mpox patients and survivors who had been isolated early and those who had delayed isolation to identify the factors responsible for their TTI outcomes. Additionally, we interviewed health workers from health facilities where patients were usually referred to the mpox treatment centers in Nakasongola and ERRH, as well as health workers at Nakasongola HC IV and ERRH. The number of informants was purposively determined to ensure representation of diverse perspectives and achieve thematic saturation.

The interviewers were first trained on the application of the interview guide in the field. At the study sites, we employed two members of the district health team (DHT) to assist in gaining entry into the mpox treatment unit, as did the various health facilities, which referred mpox patients to these units. Additionally, we collaborated with community health workers (CHWs) in Uganda, known as village health teams (VHTs), to identify mpox patients in their communities for the interviews. The VHTs also assisted with language translation as needed. We used mobile devices (phones and tablets) to record the interviews after obtaining consent from the respondents.

The respondents were asked about the factors they believe contributed to their delayed or early isolation. We also asked health workers from facilities that referred mpox patients early and those who delayed referring patients to the mpox treatment units in the study areas. Interviews were conducted in English or local languages, audio-recorded with the participants' consent, transcribed, and translated as needed. These factors were categorized as individual/patient factors, community/social factors, or hospital/health-system factors.

Data management and analysis

The quantitative data were summarized in an Excel spreadsheet and transferred to Stata (SE 14.0) for analysis. We summarized the data into descriptive statistics. Continuous variables were summarized as means and medians with interquartile ranges (IQR), while categorical variables were presented as frequencies and percentages. Our primary outcome of interest was Delayed TTI, defined as any TTI which was >3 days from date of symptom onset to isolation.

To identify factors associated with Delayed TTI, we employed multivariable logistic regression. Potential confounders were identified *a priori* based on a comprehensive review of existing mpox epidemiology literature and expert clinical opinion. These included demographic characteristics such as age, sex and occupation, and access-to-care indicators such as number of healthcare facilities visited, type of health facilities visited, geographical location, and history of self-medication.

In the initial phase, univariate logistic regression models were constructed for each potential independent variable against the Delayed TTI. Variables demonstrating a statistically significant association with delayed TTI (defined as a P-value < 0.20) were considered for inclusion in the multivariable model, alongside those deemed clinically relevant regardless of their univariate P-value to ensure comprehensive control for confounding.

For the multivariable logistic regression model, we checked to ensure the assumptions for logistic regression were met. We employed backward stepwise selection guided by the Akaike Information Criterion (AIC), to arrive at the most parsimonious model that best explained the variability in delayed TTI. To assess and mitigate collinearity among independent variables within the multivariable model, Variance Inflation Factors (VIFs) were calculated for each predictor. Variables exhibiting VIF values above a predefined threshold of 5 were systematically reviewed and, if deemed appropriate, excluded from the final model to ensure the stability and interpretability of the adjusted odds ratios (aORs). The robustness of logistic regression to the observed skewed outcome distribution was leveraged, as it models the log-odds of the outcome and does not assume normality or homoscedasticity. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) for factors associated with Delayed TTI were reported from the final multivariable model.

Our quantitative findings from the logistic regression model were integrated with qualitative data to provide a holistic understanding. While the logistic regression identified statistical associations with delayed TTI, the qualitative data provided contextual understanding and elucidated the underlying reasons and barriers contributing to these statistically identified factors. We used thematic analysis for the qualitative study; transcripts and recordings were manually coded and analyzed thematically to identify key patterns and insights. Findings are presented narratively, with selected quotes illustrating individual, community-level and health system barriers and enablers of timely isolation.

Quantitative results

Demographic characteristics

From the 2163 case records reviewed, there were six deaths. These were from 73 reporting districts at the time, with seven (9.6%) districts having reported more than 20 confirmed cases since the outbreak began. Kampala District (38/100,000) and Nakasongola (34/100,000) had the highest attack rates (Table 1).

From the 2163 cases, we excluded 810 (37.4%) that had not been confirmed. Among the 1353 confirmed, 395 (29.2%) had not been isolated, and 126 (9.3%) had missing data. We included 832 confirmed isolated cases, with a mean age of 27.7 (SD = 11.4), and 473 (57%) were male. The majority were residents of Wakiso (51.1%) and Kampala districts (46.0%) (which are both in the Kampala Metropolitan area). There were 111 (13%) mpox patients who were students; the rest reported being employed. We found that 698 (83%) had not visited a health facility before isolation, while 140 (17%) had previously visited at least one health facility for medical care for mpox before being isolated. Only 123 (9.3%) were isolated within 3 days or less from their date of symptom onset (Table 2).

Table 1
Mpox attack rates among districts with more than 20 confirmed cases during the mpox outbreak in Uganda, December 29, 2024.

District	Cumulative cases	Attack rate per 100,000
Kampala	708	38
Nakasongola	77	34
Mbarara	38	9
Luwero	40	7
Wakiso	214	6
Mayuge	27	5
Mukono	32	3

Table 2
Demographic characteristics of mpox confirmed isolated patients during the mpox outbreak in Uganda, July-December 2024.

	Cases	%
Gender (n = 832)		
Female	359	43
Male	473	57
District of residence (n = 832)		
Wakiso	425	51.1
Kampala	383	46.0
Nakasongola	11	1.3
Mukono	4	0.5
Kasese	2	0.2
Masindi	2	0.2
Iganga	1	0.1
Kayunga	1	0.1
Pallisa	1	0.1
Mayuge	1	0.1
Mityana	1	0.1
Age categories (n = 832)		
<10	64	7.7
10-19	83	10.0
20-29	329	39.5
30-39	246	29.7
40-49	86	10.3
50-59	21	2.5
≥60	3	0.3
Time to isolation (n = 832)		
Short (≤3 days)	123	9.3
Delayed (≥4 days)	709	90.7
Visited other facilities before isolation (n = 832)		
No facility visited	698	83.0
Visited 1	122	14.8
Visited 2	13	1.6
Visited 3	5	0.6
Risk category (n = 832)		
Student/Pupil	111	13
Nonstudent	721	87

A multivariable analysis showed that being older than 18 years (aOR: 2.6, 95% CI = 1.6-4.2) and self-medication (OR: 5.4, 95% CI = 1.7-17.1) were associated with Delayed TTI (Table 3).

Qualitative results

We conducted 21 key informant interviews among 8 (38%) mpox patients, 7 (33%) mpox survivors, and 6 (29%) healthcare workers who were actively involved in the outbreak. Among the 15 mpox mpox patients and survivors, 9 (60%) had delayed TTI.

From these qualitative interviews, we identified several individual, community or health system factors that influenced whether patients were isolated promptly or not during the mpox outbreak (Table 4).

Enablers for timely isolation

Individual factors

At the individual level, having prior knowledge about mpox was a key enabler of timely isolation. Survivors with short TTIs attributed this to having prior information about mpox and its potential impact on their lives. Some of these individuals had received information through social media or from friends and relatives. A survivor shared: "*I used to receive information on WhatsApp groups. By the time I got sick, I already knew that mpox can be dangerous, so I rushed to the health facility*."—Mpox survivor, 20/F, Short TTI.

Health system enablers

Patients and survivors with short TTIs attributed their prior knowledge to the work done by the risk communication campaigns that were conducted during the outbreak. "*We used to receive health workers in our community telling us about the new disease. By the time he got sick, we already knew that mpox can be dangerous, so we rushed him to the health facility*."—Parents of mpox survivor, short TTI.

Barriers to timely isolation

Individual barriers

Conversely, delayed isolation was common among individuals who misinterpreted their symptoms or self-medicated at home. One participant whose isolation was delayed was quoted as saying: "*I felt like it was malaria. I used my own medicine at home first*."—Mpox survivor, 33/F, delayed TTI.

Additionally, others expressed individual economic concerns and the financial burden associated with isolation. Some respondents were not comfortable with being isolated, as they were concerned about potential stigma and the possibility of losing several income-generating activities in which they were engaged. For example, in Nakasongola District, where fishing is a primary livelihood activity and a daily occupation, affected individuals often struggle to leave their daily fishing work to seek mpox care. As a result, such people sought delayed solation. Similarly, respondents from urban areas also reported being heavily engaged in different daily income-generating businesses and consequently delaying the seeking of care. One of them was quoted thus: "*I am the one who runs this business, and I have to work every day. I have no other source of income for my family*."—Case-patient, 49/M, Delayed TTI.

Another case-patient showed concern about the perceived stigma and said: "*I didn't want to go to isolation because I feared I would be left naked among strangers at the health center. Besides, I had no income to sustain me during isolation.*"—Case-patient, 52/M, Delayed TTI.

Community-level barriers

At the community level, social norms, livelihood pressures, and health beliefs appeared to shape individual decisions. Additionally, cultural beliefs about witchcraft and low health literacy further delayed isolation. For example, respondents from fishing communities appeared to be primarily concerned about the continuity of their fishing activities. One health worker observed that "*People from fishing areas are always busy. They prefer going to drug shops first and come to us when they're already very sick*."—Health worker, 42/M.

Health system barriers

Inadequate diagnostic capacity at lower-level facilities led to misdiagnoses. One case-patient in isolation at the time of the study recounted, "*I visited the health facility several times, and I did not get well. I went to another one, and still I never got well. They all kept telling me it was Malaria and chickenpox. If the health workers had known and informed me earlier to come here, probably I wouldn't have reached this stage*."—Case-patient, 27/F, Delayed TTI.

Additional interaction with health workers revealed that people who lived far from the isolation center first explored other healthcare options, including herbal remedies, or sought treatment from

Table 3
Factors associated with time to isolation among mpox patients during the mpox outbreak in Uganda, July-December 2024.

Number of cases					
factor (n = 832)	Delayed TTI n (%)	Short TTI n (%)	cOR	aOR	*P* value
Gender					
Female	400 (56.4)	73 (59.4)	Ref		
Male	309 (43.6)	50 (40.6)	0.9 (0.6-1.3)	0.8 (0.6-1.3)	-
Age category					
<18	88 (12.4)	31 (25.2)	Ref		
≥18	621 (87.6)	92 (74.8)	2.4 (1.5-3.8)	2.6 (1.6-4.2)	<0.001
District location					
KMA	692 (97.6)	116 (94.3)	Ref		
Non-KMA	17 (2.4)	7 (5.7)	2.5 (0.9-6.1)	0.9 (0.3-2.6)	-
Self-medicated before isolation					
No	64 (9.0)	26 (21.1)	Ref		
Yes	645 (91.0)	97 (78.9)	2.7 (1.6-4.5)	5.4 (1.7-17.1)	0.0043
Visited other facilities before isolation					
No	599 (84.5)	93 (75.6)	Ref		
Yes	110 (15.5)	30 (24.4)	1.8 (1.1-2.8)	1.9 (0.7-5.3)	-
Number of facilities visited before isolation (n = 140)					
One facility	75 (85.1)	21 (56.2)	Ref		
Two or more facilities	23 (14.9)	19 (43.8)	0.2 (0.1-0.7)	2.1 (0.5-8.8)	-
Type of facility (n = 140)					
Private	28 (21.7)	18 (28.6)	Ref		
Government	66 (78.3)	27 (71.4)	1.4 (0.4-4.3)	0.6 (0.1-2.8)	-

aOR = adjusted odds ratio; cOR = crude odds ratio; KMA = Kampala Metropolitan area; TTI = time to isolation.

Table 4
Summary of barriers and enablers to timely isolation during the mpox outbreak in Uganda, July–December 2024.

Level	Enablers to timely isolation	Barriers to timely isolation
Individual	• Prior awareness of mpox from campaigns, media or peers • Fear of infecting family members	• Misinterpretation of symptoms (e.g., malaria) • Self-medication • Financial constraints • Stigma or privacy concerns
Community	• Effective risk communication and community engagement • Support from informed peers	• Cultural beliefs (e.g., witchcraft) • Low literacy • Livelihood pressures (e.g., fishing) • Preference for alternative medication • local drug shops
Health system	• Effective community outreach via risk communication campaigns	• Limited diagnostic knowledge among frontline healthcare workers • Long distances from communities to health facilities • Transport/logistics gaps (few ambulances)

nearby drug shops and health facilities. As a result, they are isolated when the disease tends to be severe. This was exacerbated by the fact that there was only one ambulance for the entire district, making it difficult to execute all the evacuations, especially at the outset of the outbreak. This is what one of the health workers had to say: "*The people in these distant communities have different perceptions of disease. There are low literacy levels, and they believe a lot in witchcraft. As a result, healthcare-seeking habits are poor. We need continuous affirmative action and engagement with these communities in particular*."—Health worker, 35/F.

Discussion

We report findings from an ongoing mpox outbreak with sustained community transmission in more than half of all the districts in Uganda, with males being more affected than females. Our evaluation found that the vast majority of confirmed mpox patients experienced delayed isolation, with only a small proportion isolated within 3 days of symptom onset. Being older than 18 years and self-medication, defined as obtaining medication without a prescription, had a negative impact on health-seeking behavior, being strongly associated with a delayed TTI. Additionally, individual factors such as stigma, economic concerns and community beliefs, exacerbated by health system factors like low index of suspicion, contributed to delayed isolation. Conversely, prior awareness, owing to ongoing risk communication campaigns and a fear of infecting family members, enabled timely isolation.

In this mpox outbreak in Uganda, 91% of mpox patients were isolated after at least 4 days or longer from the date of symptom onset a rate that significantly impedes effective outbreak control given the urgency of preventing further transmission and underscores a critical challenge in Uganda's mpox response. This delay could be partly explained by the limited awareness of mpox among communities, as well as health workers' low suspicion index for the disease. Being an emerging disease in Uganda, the disease was still relatively unfamiliar to communities and health workers early in the outbreak, contributing to missed or delayed recognition [9]. This finding was similarly reported in Uganda's Ebola outbreak in 2022, where cases were missed due to a low index of suspicion [6]. In Uganda, infectious disease outbreaks frequently encounter

significant gaps in early recognition and detection, which can affect subsequent public health measures. Delayed isolation prolongs community transmission and increases the risk of wider spread. It is essential to improve health workers' capacity to suspect and make initial diagnosis and referral where necessary, especially at the frontline [10,11]. Regular trainings, provision of updated case definitions and clinical guidelines, and regular simulation exercises could enhance early detection and timely referral, as well as timely isolation, ultimately reducing community transmission of emerging infectious diseases.

Being younger than 18 years was associated with early healthcare seeking, reflecting the finding that most mpox patients in this age category were children, including those of school-going age. The mpox patients who were older than 18 years were mostly non-school-aged and actively engaged in daily income-generating activities. These economic concerns contributed to delayed isolation, agreeing with what has been reported in previous studies [12,13]. Among the risk categories in this study, most mpox patients were involved in several economic activities that required them to be present at work daily to earn an income. Targeted risk communication could improve awareness of the risks associated with delayed isolation, thereby improving community health-seeking behavior.

We found a strong association between self-medication and delayed isolation. Our interactions with mpox patients, mpox survivors and healthcare workers in the study areas revealed a need for community engagement. Because it is an emerging disease and presents similarly to other known skin conditions, such as chickenpox and measles, many patients likely first thought the disease did not need medical attention. Some mpox patients reported having first resorted to herbal remedies, seeking medical care only when alternative medications were not effective. Self-medication is not a new phenomenon in Uganda or other developing countries, as shown by previous studies [14,15]. This further supports the need to increase awareness of healthcare seeking at the community level.

We found that mpox patients and survivors who had prior knowledge of mpox were more likely to have short TTI. They reported that this knowledge was obtained from social media, peers and health promotion campaigns. Some respondents attributed their early isolation from information shared on WhatsApp groups, which prompted them to seek care early after symptom onset. Similar experiences were reported during Uganda's outbreak of the Sudan Ebola virus disease in 2022, where individuals who had prior information on the disease proactively sought cases [6]. Furthermore, these findings reflect what has been reported in mpox outbreaks in similar settings in the east and central African regions, where participants' early healthcare seeking and subsequent isolation were facilitated by consistent messaging by trusted health entities [10].

Conversely, several respondents attributed delayed isolation to individual financial hardships and economic concerns, as well as a misinterpretation of symptoms, which led them to believe it was a mere skin rash, and misconceptions about seeking healthcare. These factors caused mpox patients to postpone healthcare visits and resort to initial self-medication before eventual isolation. Such barriers to timely isolation were not different from those identified in the outbreak of Ebola in Uganda in 2022. Mpox patients described how engagement in daily income-generating activities made it difficult to report to the health facility for possible isolation. Health workers also observed that community members often sought treatment from local drug shops or relied on traditional herbal remedies [6,16]. These findings underscore the dire need for tailored approaches to address socio-cultural barriers, emphasizing continued community engagement to address stigma and misconceptions, and improving early isolation to mitigate community spread, especially in light of emerging and re-emerging infectious diseases.

Limitations

Our analysis included only confirmed and isolated cases with complete records. Exclusion of undocumented or undiagnosed cases could have potentially overestimated the true magnitude of delays in isolation and its associated factors.

Additionally, we acknowledge the limitation of the binary categorization of Time-to-Isolation which lacks established literature support. Our simplified categorization, while crucial for public health action and consistent with rapid containment benchmarks for highly infectious diseases sacrifices granularity or nuanced variations in isolation delays. Future studies might employ survival or ordinal regression for a more nuanced understanding of TTI as a continuous or multi-graded variable over an even longer duration of the mpox outbreak.

Furthermore, the logistic regression model we used encountered a highly skewed outcome, with 91% of cases showing delayed TTI. Although logistic regression is robust for binary outcomes with a large sample size to provide sufficient statistical power, we applied and appropriate model diagnostics by assessing adjusted odds ratios with 95% confidence intervals, and consideration of multicollinearity through Variance Inflation Factors to ensure the stability and validity of our estimates. We propose caution when interpreting the generalizability of predictive accuracy for rare events within such a skewed distribution.

Finally, as an observational study, unmeasured confounding remains a possibility despite efforts to control for a priori confounders and assess collinearity using Variance Inflation Factors.

Despite these limitations, our findings offer operationally relevant insights for mitigating mpox transmission.

Conclusion

This study highlights the individual-level and health system-level factors that affect timely access to appropriate mpox care in both rural and urban settings. It is crucial to understand and address these enablers and barriers to access to timely care to improve outcomes at the individual level and the population level.

Data availability

The datasets upon which our findings are based belong to the Uganda Public Health Fellowship Program. For confidentiality, these datasets are not publicly available. The datasets however can be availed upon reasonable request from the corresponding author, with permission from the Uganda Public Health Fellowship Program.

Declaration of competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding

This study was supported by the Korean Foundation for International Healthcare (KOFIH) under the project titled "Strengthening Health Systems to Prevent, Detect and Respond to Infectious Diseases in Uganda" in collaboration with the Uganda National Institute of Public Health (UNIPH).

Ethical approval

This study was conducted as part of a response to a public health emergency, and as such, it was determined to be non-research. The MoH authorized this study, and the Office of the Associate Director for Science, Center for Global Health, US Centers for Disease Control and Prevention (CDC) determined that this activity was not human subject research and that its primary intent was for public health practice or disease control. This activity was reviewed by the CDC and was conducted in accordance with applicable federal law and CDC policy. §§See, e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. Additional approval was obtained from the study sites by the District Health Officer Nakasongola and the Administration of Entebbe Regional Referral Hospital (ERRH).

Acknowledgments

We acknowledge the health facility staff at Nakasongola Health Centre IV and the Entebbe Regional Referral Hospital (ERRH) Isolation Unit. Additionally, we appreciate the officers in charge of both health facilities and the health staff involved in caring for mpox patients, particularly Ms Allen Bateise, who supported the records review to ensure the accuracy of the data. Special appreciation goes to the district surveillance focal person for Nakasongola district, Mr Ronald Kirya, for the tireless effort in assisting the study teams in reaching the homes of the mpox survivors. Finally, we appreciate the Uganda Ministry of Health for the overall guidance and approval provided, as well as the dedicated effort in response to the mpox outbreak amidst resource constraints. The findings and conclusions of this report are those of the authors, and do not necessarily reflect the official position of the US Centers of Disease Control and Prevention, or that of the Korean Foundation for International Healthcare.

Author contributions

HK participated in the conception, design, analysis and interpretation of the study results, and wrote the draft manuscript. HK, RM, DW, JOK, EM, JFZ, AK, RK, IP, DA, ANM, BK, LB, IL, ARA reviewed the report, reviewed the drafts of the manuscript for intellectual content and made multiple edits to the draft manuscript. RM, AK, ARA reviewed the manuscript to ensure intellectual content and scientific integrity. All authors read and approved the final manuscript.

References

[1] Tesini B.L. Mpox (Monkeypox) MSD manual professional edition: MSD manual. 2023. https://www.msdmanuals.com/professional/infectious-diseases/pox-viruses/mpox-monkeypox. (Accessed April 1, 2025).
[2] Meşe, E.A., Mpox*: A Re-emerging Disease and its Public Health Implications.* LOKMAN HEKIM HEALTH SCIENCES Учредители: Kare Publishing, 2024: p. 57-58.
[3] Jiang L, Xu A, Guan L, Tang Y, Chai G, Feng J, et al. A review of mpox: biological characteristics, epidemiology, clinical features, diagnosis, treatment, and prevention strategies *Experimental Dermatology*. Hoboken, NJ: Wiley; 2024. doi:10.1002/exp.20230112.
[4] Titanji BK, Hazra A, Zucker J. Mpox clinical presentation, diagnostic approaches, and treatment strategies: a review. *JAMA* 2024;**332**(19):1652–62.
[5] Nkengurutse L, Otshudiema JO, Kamwenubusa G, Diallo I, Nsavyimana O, Mbonicura JC, et al. Clinical predictors and determinants of mpox complications in hospitalized patients: a prospective cohort study from Burundi. *Viruses* 2025;**17**(4):480.
[6] Akunzirwe R, Carter S, Simbwa BN, Wanyana MW, Ahirirwe SR, Namubiru SK, et al. Time to care and factors influencing appropriate Sudan virus disease care among Mpox patients in Uganda, September to November 2022. *Int J Infect Dis* 2024;**145**:107073.
[7] Al-Tawfiq JA, Pan Q, Schlagenhauf P. Mpox outbreak in South Africa: a wake-up call for strengthening preparedness and response. *New Microbes New Infections* 2024;**62**:101454.
[8] Adegoke O, Schmidt-Sane M, Kunnuji M, Abbas S, Lawanson A, Jegede A, et al. Diagnosis, treatment, and management of mpox in urban Informal Settlements in Southwestern Nigeria: an ethnographic approach. In: BMC Public Health, 25; 2025. p. 115.
[9] World Health Organization. *Disease outbreak news; mpox in African Region*; 2024 *https://www.who.int/publications/m/item/multi-country-outbreak-of-mpox--external-situation-report--45---11-january-2025*.
[10] Mambo SB, Nja GME, Bunu UO, Bizimana GN, M'Yisa Makelele A, Sonia FD, et al. Promoting risk communication and community engagement during mpox outbreak in fragile conflict zones of Eastern DRC. *One Health* 2025;**20**:101012.
[11] Ngongo N, Boum Y, Mercy K, Tsague LD, Cho WN, Folefack Tengomo GL, et al. *Community health workers: a key to halting Africa's mpox outbreak. Cape Town (South Africa)*; 2025 *AOSIS*:1439.
[12] Glanz K, Rimer BK, Viswanath K. Theory, research, and practice in health behavior and health education. In: K Glanz, BK Rimer, K Viswanath, editors. *Health behavior and health education: Theory, research, and practice 4th ed*. Jossey-Bass/Wiley; 2008. p. 23–40 https://psycnet.apa.org/record/2008-17146-000.
[13] Tsadik M, Lam L, Hadush Z. Delayedhealth care seeking is high among patients presenting with sexually transmitted infections in HIV hotspot areas, Gambella town, Ethiopia. *HIV/AIDS* 2019;**11**:201–9.
[14] Nakato G, Adongo PR, Iramiot JS, Epuitai J. Practices and drivers of self-medication with antibiotics among undergraduate medical students in Eastern Uganda: a cross-sectional study. *PLoS One* 2023;**18**(12):e0293685.
[15] Hussain S, Malik F, Ashfaq KM, Parveen G, Hameed A, Ahmad S, et al. Prevalence of self-medication and health-seeking behavior in a developing country. *Afr J Pharm Pharmacol* 2011;**5**(7):972–8.
[16] Fakunle SO. Mpox and the medley of cultural factors: a rural Nigerian perspective. *Discov Glob Soc* 2025;**3**(1):63.