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Dear Reader,

We take great pleasure in welcoming you to Issue 2 Volume 11 of the Uganda Public Health Bulletin.

We aim to inform the district, national, and global stakeholders on disease outbreak investigations, public health surveillance, and interventions undertaken in detecting, preventing, and responding to public health events in Uganda.

In this issue, we present a variety of articles including: Evaluation of the Laboratory Pillar Response during the Sudan Virus Disease Outbreak in Uganda, 2025: An After-Action Review: Enhanced detection of submicroscopic malaria using qPCR during an outbreak in central Uganda: implications for surveillance and elimination: Comparison of cholera rapid diagnostic test and culture results during a cholera outbreak response, Moyo District, West Nile, Uganda, June - July 2025: Sporadic Crimean Congo Haemorrhagic Fever Outbreaks in Multiple Districts, Uganda, August–September, 2025: Temporal trends and spatial distribution of meningitis-related mortality in Uganda, 2021–2025: Trends and spatial distribution of acute undernutrition among pregnant and lactating women in Uganda, 2020–2024: Factors associated with delayed care seeking among mpox cases in Mbarara City, Uganda, October 2024–May 2025: National trends of vaccine wastage in Uganda, 2020–2025: A descriptive analysis of four tracer antigens: Uptake of the second dose of measles-rubella vaccine among children aged 18–23 months in Uganda, August, 2024: Measles outbreak linked to burial gatherings and household crowding in Amolatar District, Uganda, November 2025–February 2026: Investigation of a cross-district measles outbreak in Nwoya District, Uganda, December, 2025–February, 2026: Measles outbreak propagated by poor isolation practices in schools and health facilities, Mityana District, Uganda, March–August 2025: Chickenpox outbreak fuelled by lack of vaccination and congestion among pupils in school X, Kampala City, Uganda, August 2025:

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Thank you

this issue:

Continued from page 1

Evaluation of the Laboratory Pillar Response during the Sudan Virus Disease Outbreak in Uganda, 2025: An After-Action Review

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Summary

Background: Following the containment of the 2025 Sudan Virus Disease (SVD) outbreak in Uganda, the Ministry of Health conducted an After-Action Review (AAR) to document lessons across multiple response pillars as required by the International Health Regulations Monitoring and Evaluation Frame work. This paper evaluates the laboratory pillar's performance in containing the outbreak.
Methods: Using a working group AAR format, we conducted facilitated exercises to evaluate the response. We reviewed pre-existing capacities across four domains: plans, coordination, resources, and preparedness activities to establish a baseline.
We reconstructed the response timeline against an epidemiological curve and cross- validated milestones with other pillars. Performance gaps were identified by contrasting planned and actual outcomes, and the five whys technique was applied to determine the root causes of the identified challenges.
Results: Fifteen professionals from national and subnational levels participated. Pre-response enablers included the existence of the National laboratory guidelines for preparedness and response to public health emergencies, the Uganda National Health Laboratory Hub and sample network, National health laboratory policy, the Ebola 2022 response plan, the national laboratory budget, the national laboratory pillar, the Laboratory Leadership Program, the One Health platform, reference and mobile laboratories. The referral network confirmed the case within 72 hours; however, analysis revealed delays in the deployment of mobile laboratories and incomplete investigation forms. Key strengths included emergency information systems and biosafety protocols, while key constraints were limited funding, Low district-level involvement, and conflicting guidance on result dissemination. Root causes were traced to an inactive electronic logistics system and lack of pre-positioned supplies at the district level.
Conclusion: The laboratory pillar demonstrated functional preparedness and response capabilities. To ensure resilience against future high-consequence threats, we recommend standardizing communication protocols and strengthening emergency logistic systems.

Background

On 30 th January 2025, the Uganda Ministry of Health confirmed the eighth Ebola virus disease outbreak caused by Sudan Virus (SUDV). The outbreak affected Kampala, Wakiso, and Mbale and prompted mapping of seven additional high risk districts (1) . It resulted in 14 cases and four deaths case fatality rate 28.5%) and was declared over on 25 April 2025, 42 days after the last patient was discharged from hospital.
Ebola outbreaks require rapid detection, timely laboratory confirmation, effective case management, contact tracing, infection prevention and control, risk communication, and coordinated response across multiple pillars. After such an event, systematically reviewing the response is essential to identify what worked well, what did not work well, and what corrective actions are needed to strengthen preparedness and response for future outbreaks (2) .

Continued from page 2

After Action Review (AAR) is one of the components of the International Health Regulations (IHR) Monitoring and Evaluation Framework, alongside annual reporting on International health Regulation (IHR) capacities, Joint External Evaluation, and simulation exercises (3) . The AAR is a qualitative assessment of the actions taken in response to a public health event of concern (2) . It enables countries to assess the functionality of public health systems after an emergency, document best practices, identify gaps, and define immediate, medium-term, and long-term actions for strengthening IHR core capacities (3, 4) . Following the 2025 SVD outbreak, the Ministry of Health conducted an AAR in June 2025 to review actions undertaken during the preparedness, detection, and response phases of the outbreak. The review assessed performance across multiple response pillars, documented lessons learned, and identified priority corrective actions to strengthen Uganda's readiness for future Ebola outbreaks and other public health emergencies.
The laboratory pillar is central to Ebola outbreak detection and response because timely and accurate testing guides case confirmation, isolation, contact tracing, clinical management, and declaration of outbreak control milestones. Delays or gaps in laboratory preparedness and response can affect the speed and quality of outbreak control activities (5) . We assessed the laboratory pillar's preparedness and response to the 2025 Sudan virus disease outbreak in Uganda to identify pre- existing capacities, response performance, root causes of challenges, lessons learned, and priority actions for strengthening future Ebola diagnostic preparedness and response.

Methods
A three-day After-Action Review meeting was convened at Imperial Royale Hotel, Kampala, Uganda. Using a working group AAR format, facilitated exercises and plenary sessions were conducted to evaluate the response (2) . The discussions were led by a facilitator and documented by a note-taker proficient in laboratory functions. The group discussion comprised fifteen laboratory professionals from national and subnational levels in the seven high-risk districts and three cities, including Mbale district and Mbale City, Kabarole District and Fort Portal City, Kyegegwa, Ntoroko, Jinja District and Jinja City, Wakiso, and Kampala City (Figure 1).

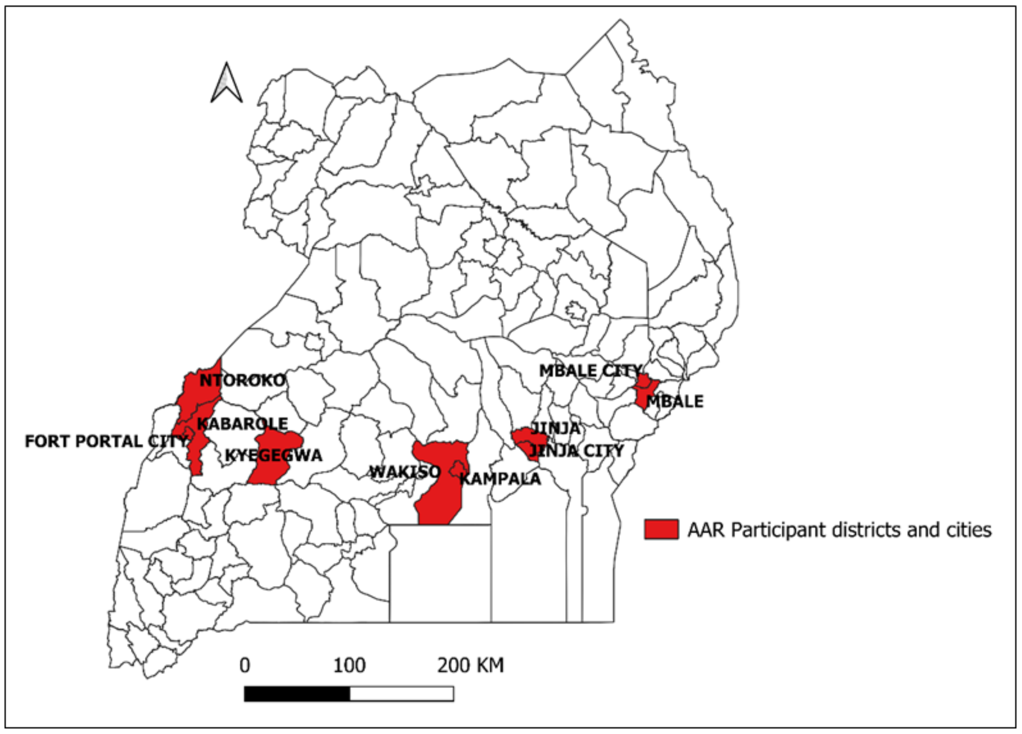

Figure 1: High-risk districts and cities included in the 2025 Ebola outbreak response from which after-action action review participants were selected

Continues to page 4

Continued from page 3

Preparedness assessment to Sudan Virus Disease outbreak
We reviewed pre-existing capacities across four domains: plans, coordination, resources, and prepareness activities to establish a baseline. We used Post-it sticky notes and compiled the notes in a table on a flipchart. We then reviewed the notes and discussed the findings during the plenary session.

Response assessment to Sudan Virus Disease outbreak.
We assessed the laboratory response timeline, and outcomes by reconstructing the response timeline against an epidemiological curve and compared milestones with other pillars. Performance gaps were identified by contrasting planned against actual outcomes, bottlenecks and enablers of timely performance were identified and the five whys technique was applied to determine root causes of identified challenges, improvement actions were proposed to address bottlenecks and improve future laboratory performance.

Results

Preparedness assessment findings
Fifteen professionals from national and subnational participated. Pre-response enablers included the existence of the National laboratory guidelines for preparedness and response to public health emergencies, Uganda national health laboratory hub and sample network, National health laboratory policy, Ebola 2022 response plan, National laboratory budget, National laboratory pillar, Laboratory leadership program, One health platform, and the existence of Reference and mobile laboratories.

Response assessment findings
The referral network confirmed the case within 72 hours. However, analysis revealed delays in deployment of mobile laboratories and incomplete investigation forms. Key strengths included availability of emergency information systems and biosafety protocols, while key constraints included limited funding, low district-level involvement, and conflicting result-dissemination guidance. Root causes were traced to an inactive electronic logistics system and lack of pre-positioned supplies at the district level.

Discussion

The preparedness and response strategies for laboratory Ebola response was informed by the availability and reference to pre-existing preparedness frameworks including national preparedness plans, policies and response structures such as reference and mobile laboratories and laboratory hub and sample network. Well defined frameworks such as sample collection protocols and sample referral networks ensured rapid turnaround time of 72 hours.
Despite the progress, we learnt that weaknesses in electronic logistic system can disrupt supply chain performance (6) while a lack of pre-positioned supplies at the district level, limited funding, delays in mobile laboratory deployment, low district-level involvement, conflicting result-dissemination guidance can greatly disrupt emergency response operations. By embracing lessons learned and addressing challenges, we can strengthen our national laboratory defenses and work across boundaries to protect public health against any emerging infectious disease.

Limitations: The information collected was based on self-reports, this could have been biased among the laboratory workers who may have been expected to take "best practice" actions but did not. However, this bias was minimized during the debrief sessions, during which laboratory workers were assured of confidentiality in participation. Additionally, the bias was reduced by triangulating information from other staff and other reports as much as possible.

Conclusion

The laboratory pillar demonstrated functional preparedness and response capabilities. Its response depended on the availability of pre-existing preparedness frameworks to support staff, sample referral networks, and coordination mechanisms. However, limited funding and lack of pre-positioned supplies disrupted critical laboratory functions, undermining the speed and efficiency of the response. The conflicting result-dissemination guidance disrupted data flow which limited the ability of the responders to make timely decisions and public trust in the outbreak response process was undermined.

Continued from page 4

Recommendation: To ensure resilience against future high-consequence threats, we recommend standardizing communication protocols and strengthening emergency logistic systems

Conflict of Interest: The authors declare no conflict of interest

Author contribution: CM led the study conceptualization, data collection, analysis, and article drafting. VN, MN, DN, DN, IM, RK, MO, BA, RMO, TN, JN contributed to data collection and writing. SG provided supervision, validation, and article review. All authors read and approved the final bulletin.

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Continues to page 6

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Enhanced detection of submicroscopic malaria using qPCR during an outbreak in central Uganda: implications for surveillance and elimination

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Summary

Background: In August 2025, Mubende District, Uganda, reported a cluster of unexplained childhood deaths with fever, vomiting, and rapid progression was reported to the Ministry of Health Uganda. We conducted a tiered laboratory investigation to identify the etiological agent responsible for the cluster of childhood deaths and guide public health response.
Methods: Twenty-two symptomatic household contacts of the deceased children from across three districts (Mubende, Kyankwanzi, Kakumiro) were investigated. Samples underwent routine testing, malaria diagnostics (microscopy, RDT, qPCR targeting varATS), and broad pathogen exclusion (viral hemorrhagic fevers, arboviruses, bacteria, toxicology, metagenomic sequencing).
Results: Malaria was confirmed as the predominant agent (63.6% prevalence by qPCR). Parasitemia ranged from 0.135–283,282 parasites/µL. Conventional methods (microscopy/RDT) detected only 50% of qPCR-positive infections, missing seven submicroscopic cases (31.8% of all samples). All alternative etiologies were negative.
Conclusion: Malaria caused the clustered deaths. Half of infections were submicroscopic and missed by routine diagnostics. Incorporating qPCR into tiered outbreak response enhances case detection and supports elimination efforts.

Background

Unexplained childhood deaths in sub-Saharan Africa demand rapid investigation (1). Uganda experiences endemic malaria, arboviruses, and viral hemorrhagic fevers (VHFs), complicating differential diagnosis (2,3). Recent outbreaks include Ebola (Sudan virus) in 2022 (1), Marburg in 2017 (4), and Crimean-Congo hemorrhagic fever (5). On August 9, 2025, Mubende's Public Health Emergency Operations Centre reported a cluster of childhood deaths presenting with acute fever, headache, vomiting, and death within 24–48 hours. While severe malaria is a leading cause of childhood mortality in Uganda (6), the rapid deterioration and clustering raised concerns about VHFs or toxic exposures.

Conventional malaria diagnostics i.e. microscopy (detection limit ~50–100 parasites/µL) and RDTs miss low-density infections (7–10). Molecular methods like qPCR targeting varATS detect <1 parasite/µL, identifying submicroscopic infections that sustain transmission (11–13). Such infections are epidemiologically important, often asymptomatic, and contribute to ongoing transmission (14,15). In Uganda, submicroscopic infections constitute a substantial hidden reservoir, particularly in school-aged children (16). We identified the etiological agents using tiered laboratory diagnostics and assessed the added value of quantitative polymerase chain reaction (q PCR) for malaria detection.

Methods

The clustered deaths occurred in Mubende, Kyankwanzi, and Kakumiro Districts (Figure 1) between August and September 2025. These rural districts have tropical climate, bimodal rainfall, and close human-animal interactions (17). The three districts had also experienced outbreaks of Ebola Virus Disease (EVD), including the 2022–2023 Sudan Ebola virus outbreak that originated in Mubende District.

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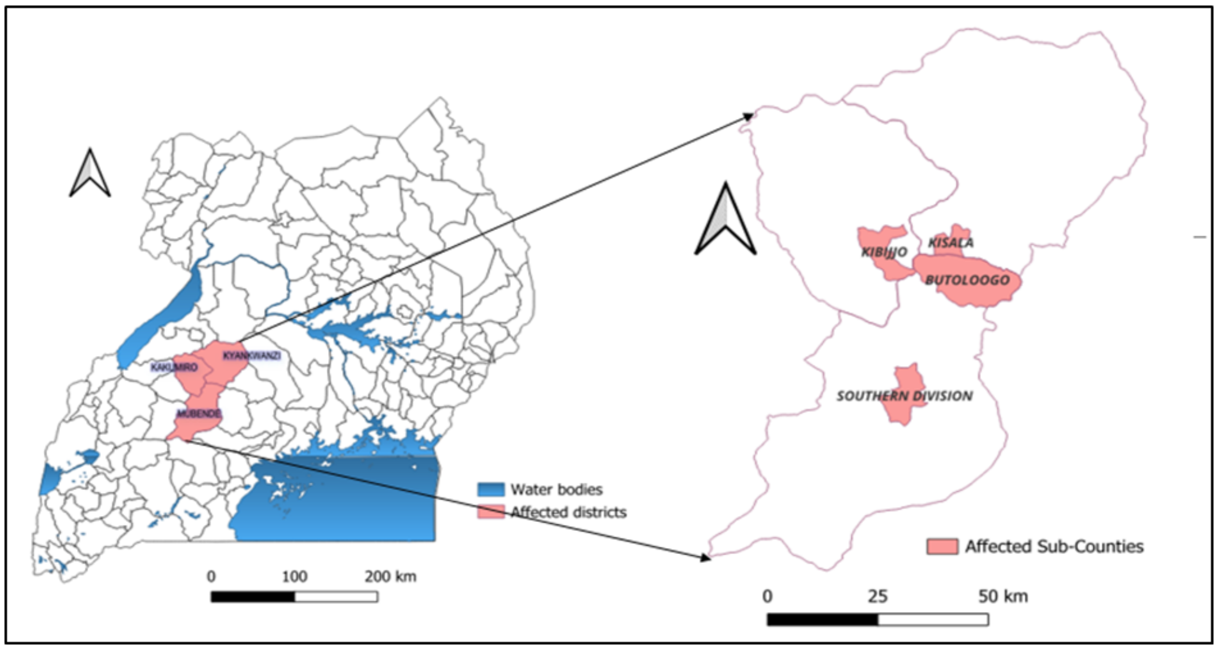

Figure 1: Location of Mubende, Kyankwanzi, and Kakumiro districts in central western Uganda

We collected specimens from 22 symptomatic household contacts of the deceased children identified through active case finding. Venous blood (EDTA and serum), stool, urine, and two water samples were collected and transported at 2–8°C to Mubende Regional Referral Hospital and national reference laboratories for analysis.

Baseline testing at Mubende included complete blood count, renal and liver function tests, and bacterial cultures. Microscopy (Field's stain), mRDT (SD Bioline Malaria Ag P.f/Pan), and qPCR targeting varATS (QIAamp DNA Mini Kit, real-time PCR, detection limit <1 parasite/μL) were performed. Samples were tested for VHFs (filoviruses, arenaviruses, bunyaviruses), arboviruses (dengue, chikungunya, Zika), bacterial pathogens, toxicological agents, and metagenomic sequencing at Mubende Regional Referral Hospital Laboratory and Central Emergency Response and Surveillance Laboratory(CERSL).

Descriptive statistics were used. qPCR served as the reference standard. Infections were categorized as high parasitemia (≥1,000 parasites/μL), submicroscopic (<10 parasites/μL, negative by microscopy/RDT), or negative.

We conducted this investigation in response to a public health emergency. The MoH authorized this investigation and the office of the Center for Global Health, US Centers for Disease Control and Prevention determined that this activity was not human subject research and with its primary intent being for public health practice or disease control. We obtained permission to conduct the investigation from the district health authorities of Mubende region where the cases were identified. We obtained verbal consent from the guardians and assent from the respondents since all were below 18years of age.

Results

Among 22 symptomatic household contacts, complete blood count and renal function tests were generally normal. Liver function tests showed mild alkaline phosphatase elevation in some individuals, but no severe abnormalities. qPCR detected malaria in 14/22 samples (63.6% prevalence). Parasitemia ranged from 0.135 to 283,282 parasites/μL.

Seven samples (31.8%) had high parasitemia (1,177–283,282 parasites/μL) and were positive by qPCR, RDT, and microscopy (perfect concordance). Seven samples (31.8%) were submicroscopic (0.135–5.155 parasites/μL), detected only by qPCR and missed by both RDT and microscopy. Eight samples (36.4%) were negative by all methods. Conventional diagnostics detected only 7 of 14 malaria-positive cases (50%). qPCR doubled case detection, increasing measured prevalence from 31.8% to 63.6% (Table 1).

Continues to page 8

Continued from page 7

All samples tested negative for VHFs, arboviruses, bacterial pathogens, toxicological agents, and novel pathogens by metagenomic sequencing.

Table 1. qPCR, mRDT, and microscopy results

Sample ID	qPCR (parasites/µL)	mRDT	Microscopy	Infection Category
CL017053	283,282.219	Positive	Malaria (+++)	High parasitemia
CL017050	93,706.039	Positive	Malaria (++)	High parasitemia
CL01511	84,244.117	Positive	Malaria (++)	High parasitemia
CL01512	51,312.836	Positive	Malaria (++)	High parasitemia
CL01510	7,474.972	Positive	Malaria (+)	High parasitemia
CL017051	3,438.362	Positive	Malaria (+)	High parasitemia
CL017052	1,177.444	Positive	Malaria (+)	High parasitemia
CL017058	5.155	Negative	No parasites	Submicroscopic
CL017063	2.097	Negative	No parasites	Submicroscopic
CL01508	1.561	Negative	Not done	Submicroscopic
CL017062	1.300	Negative	No parasites	Submicroscopic
CL017054	0.322	Negative	No parasites	Submicroscopic
CL017059	0.322	Negative	No parasites	Submicroscopic
CL017056	0.135	Negative	No parasites	Submicroscopic
CL01509	Negative	Negative	Not done	Negative
CL01513	Negative	Negative	Not done	Negative
CL01514	Negative	Negative	Not done	Negative
CL017049	Negative	Negative	No parasites	Negative
CL017055	Negative	Negative	No parasites	Negative
CL017057	Negative	Negative	No parasites	Negative
CL017060	Negative	Negative	No parasites	Negative
CL017061	Negative	Negative	No parasites	Negative

Discussion

This investigation identified malaria as the primary cause of clustered childhood deaths in Mubende, Kyankwanzi, and Kakumiro districts. The 63.6% malaria prevalence among symptomatic contacts, combined with comprehensive negative results for other high-consequence pathogens, confirms malaria as the predominant agent. This aligns with Uganda's high burden of severe malaria (6,18,19). The tiered approach demonstrated that qPCR detected low-density parasitemia missed by microscopy and RDTs, identifying seven additional infections (50% of all positives). This finding is consistent with studies from Ghana and Uganda showing qPCR sensitivity of 39.3% for microscopy and 55.7% for HRP2-based RDTs (7) . Field evaluations of the Bioline RDT in Uganda showed >91% sensitivity for high-density infections but frequent false negatives for low-density infections (9).Perfect concordance among methods for high-density infections (≥1,000 parasites/µL) validates RDTs for point-of-care diagnosis in resource-limited settings but highlights their limitation in detecting low-parasitemia cases (8,10). Doubling of case detection through qPCR (from 31.8% to 63.6% prevalence) shows that reliance on conventional diagnostics alone would have substantially underestimated outbreak magnitude. The detection of seven submicroscopic infections (31.8% of all samples, 50% of positives) reveals a substantial hidden reservoir invisible to conventional surveillance. Submicroscopic infections are often paucisymptomatic, persistent, and contribute to ongoing transmission (14,15). Their relative infectiousness to mosquitoes is approximately one-third that of patent infections, but their long duration and high prevalence make them epidemiologically important (20).

Continued from page 8

Longitudinal studies from eastern Uganda showed qPCR detected an additional 12.1 percentage points of prevalence above microscopy, with school-aged children producing >50% of mosquito infections (21). Other studies confirm that school-aged children harbor a disproportionate burden of submicroscopic infections (16,22,23). Global meta-analyses reveal that the proportion of submicroscopic infections is highest in low-transmission settings and varies geographically (24). For elimination programs, relying solely on microscopy or RDT risks underestimating prevalence and missing persistent transmission foci (25). Sensitive molecular diagnostics are essential for identifying the hidden reservoir (17).

Current Ugandan surveillance systems mainly use microscopy and RDTs, which under detect low-density infections. In our investigation, qPCR increased case detection from 31.8% to 63.6%, demonstrating that conventional methods miss a substantial proportion of infections. For outbreak investigations, molecular diagnostics improve characterization of outbreak magnitude and transmission patterns. For elimination programs, sensitive methods are critical for identifying submicroscopic infections that sustain residual transmission (17,26,27). However, implementation is limited by cost, infrastructure, and training needs (28).

Study limitations: The sample size was small (n=22) and non-random, limiting generalizability. We could not sample deceased children (already buried), precluding direct etiological confirmation in index cases. Clinical outcome data and treatment response were not systematically assessed. We did not perform gametocyte-specific assays or mosquito feeding experiments to directly assess transmission potential. Nonetheless, the investigation achieved its primary objectives.

Conclusion: This tiered investigation identified malaria as the primary cause of clustered childhood deaths in Mubende, Kyankwanzi, and Kakumiro Districts. Negative results for VHFs, arboviruses, bacteria, and toxic exposures ruled out other high-risk etiologies. qPCR detected twice as many infections as microscopy and RDTs, revealing a substantial submicroscopic reservoir missed by routine surveillance.

Recommendation: Integrate molecular diagnostics such as qPCR into tiered diagnostic strategies for malaria outbreak investigations, surveillance in elimination settings, and monitoring of control program effectiveness. While conventional diagnostics remain appropriate for clinical case management in high-transmission settings, molecular methods are essential for comprehensive case ascertainment, detection of transmission foci, and verification of elimination.

Conflict of Interest: The authors declare no conflict of interest.

Authors' contributions: VN took the lead in conceptualizing the project, data curation, investigation analysis writing the original draft. FN, MM, KM, NM, BM,KAK were involved investigation, designing methodology, writing, reviewing the article. SG, MRE were involved in supervision and editing to ensure scientific integrity. All authors read and approved the final article.

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Comparison of cholera rapid diagnostic test and culture results during a cholera outbreak response, Moyo District, West Nile, Uganda, June - July 2025

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Summary

Background: During outbreak response, cholera rapid diagnostic tests (RDTs) are used for rapid screening, while stool culture serves as the reference method for laboratory confirmation. However, the field performance of cholera RDTs may vary by setting, specimen quality, timing of collection, circulating strains, and implementation conditions. In Uganda, limited outbreak-specific evidence is available on how well cholera RDT results agree with stool culture results under routine response conditions. We compared the performance of cholera rapid diagnostic testing against culture and sensitivity results obtained from routine outbreak response specimen to determine the level of test accuracy of the cholera rapid diagnostic testing kit, Moyo District, Uganda, June-July 2025.

Methods: Stool specimens were collected from suspected cholera cases defined as was any person aged ≥5 years presenting with dehydration or a death from acute watery diarrhea in Moyo District during June-July 2026, and any person aged 2 years or more with acute watery diarrhea, Moyo District during June-July 2025. Samples were tested using the Crystal VC O1/O139 cholera RDT at field laboratories and subsequently transported in Cary-Blair transport medium under cold-chain conditions (2–8°C) to the national microbiology reference laboratory for culture confirmation. Results from specimens with both RDT and culture outcomes were matched and analyzed using a 2×2 contingency table. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall agreement were calculated using culture as the gold standard method.

Results: A total of 29 stool specimens underwent both RDT and culture testing. Twenty-two (75.9%) specimens tested positive by RDT, while 19 (65.5%) were confirmed positive by culture. Nineteen specimens were positive by both methods, three were RDT-positive but culture-negative, and no culture-positive specimens were missed by the RDT. The sensitivity of the RDT was 100% (19/19), specificity was 70% (7/10), PPV was 86% (19/22), NPV was 100% (7/7), and overall agreement between RDT and culture was 90% (26/29).

Conclusion: Cholera RDTs demonstrated optimal sensitivity and high agreement with culture testing under outbreak response conditions in a border district of Uganda. The findings support the use of RDTs for rapid screening and early detection of suspected cholera cases at peripheral health facilities. However, the occurrence of false-positive results highlights the continued importance of culture confirmation for outbreak verification, surveillance, and public health decision-making.

Continued from page 9

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and oscillations of submicroscopic Plasmodium falciparum and Plasmodium vivax infections over time

Continues to page 12

Continued from page 12

Introduction

Cholera is an acute diarrheal disease caused by toxigenic strains of *Vibrio cholerae* and remains a significant cause of morbidity and mortality globally, particularly in low-resource settings with poor access to clean water and sanitation [1]. Although cholera is preventable and treatable, outbreaks continue to occur frequently in many African countries, including Uganda [1,2].
Timely laboratory confirmation supports case management, surveillance, and implementation of public health interventions such as water sanitation measures and vaccination campaigns [3,4].

Stool culture remains the gold standard for confirmation of cholera [5]. However, culture capacity is often centralized at national reference laboratories, leading to delays in diagnosis and reporting during outbreaks occurring in remote districts. Cholera rapid diagnostic tests (RDTs) offer an important alternative for early screening and detection because they can be deployed at peripheral health facilities with minimal infrastructure requirements [6].

Despite RDT operational advantages, there is limited local information describing how the two testing methods compared under actual outbreak response conditions. Understanding the level of agreement between RDT and culture results is important for interpreting test results, supporting laboratory quality assurance, and informing the continued use of RDTs during outbreak response activities [7].

On 7 June 2025, the Ministry of Health confirmed a cholera outbreak in Moyo district in West Nile, Uganda. We compared the performance of cholera rapid diagnostic testing against culture and sensitivity results obtained from routine outbreak response specimen to determine the level of test accuracy of the cholera rapid diagnostic testing kit.

Methods

Study setting: The study was conducted in Moyo District, located in the West Nile region of northern Uganda along the Uganda–South Sudan border, where cross-border population movement increases vulnerability to cholera transmission. During the June–July 2025 cholera outbreak, suspected cases were identified at health facility level using the national case definition, and stool specimens were tested using cholera rapid diagnostic tests for rapid screening and immediate response action. In line with Uganda's cholera testing approach, specimens were also referred through the national specimen referral system to designated laboratories for stool culture and antimicrobial susceptibility testing, providing an opportunity to compare RDT results with culture findings under routine outbreak response conditions [8].

Sample collection, packaging, transportation, and testing

Stool specimens were collected from suspected cholera cases in Moyo District during June–July 2026 by trained healthcare workers following standard specimen collection and biosafety procedures. One fresh stool specimen was collected from each suspected case in a sterile, leak-proof container; a portion was tested onsite using the Crystal VC O1/O139 cholera rapid diagnostic test according to the manufacturer's instructions, while a portion from the same specimen was placed in Cary-Blair transport medium for culture confirmation and antimicrobial susceptibility testing at the National Microbiology Reference Laboratory. Specimens were assigned unique identification numbers, accompanied by completed case investigation forms, packaged using the triple packaging system, maintained at 2–8°C, and transported through the national specimen referral system. At the reference laboratory, specimens were cultured for *Vibrio cholerae* using standard procedures, with species identification and antimicrobial susceptibility testing performed using the VITEK® 2 Compact system; results were recorded and shared with the outbreak response team.

Data management and analysis

Data from specimens that had both RDT and culture results available were extracted from routine laboratory records. Results from the two testing methods were matched using specimen identification numbers and reviewed for completeness. A two-by-two comparison table was developed to determine agreement between the RDT and culture methods. The numbers of true positives, true negatives, false positives, and false negatives were calculated. Sensitivity, specificity, positive predictive value, negative predictive value, and overall agreement were subsequently determined to describe the level of comparability between the two methods.

Continues to page 14

Continued from page 13

Ethical considerations

This activity was conducted as a non-research determination to support laboratory quality assurance and program improvement during outbreak response activities. The assessment utilized generated outbreak response data and did not involve additional specimen collection or patient interventions beyond standard outbreak response procedures. Rapid diagnostic test and culture results were matched using anonymized patient identifiers.

Results

Cholera diagnostic cascade during the response

A total of 30 suspected cholera cases were sampled during the outbreak period. One sample didn't meet the laboratory acceptance criteria (lacked a request form) and was therefore not tested. Rapid diagnostic tests were performed on each of the 29 samples collected from suspected cases, of which 22 tested positive (Figure 1). Nineteen samples were confirmed positive for *Vibrio cholerae* by culture (Figure 1).

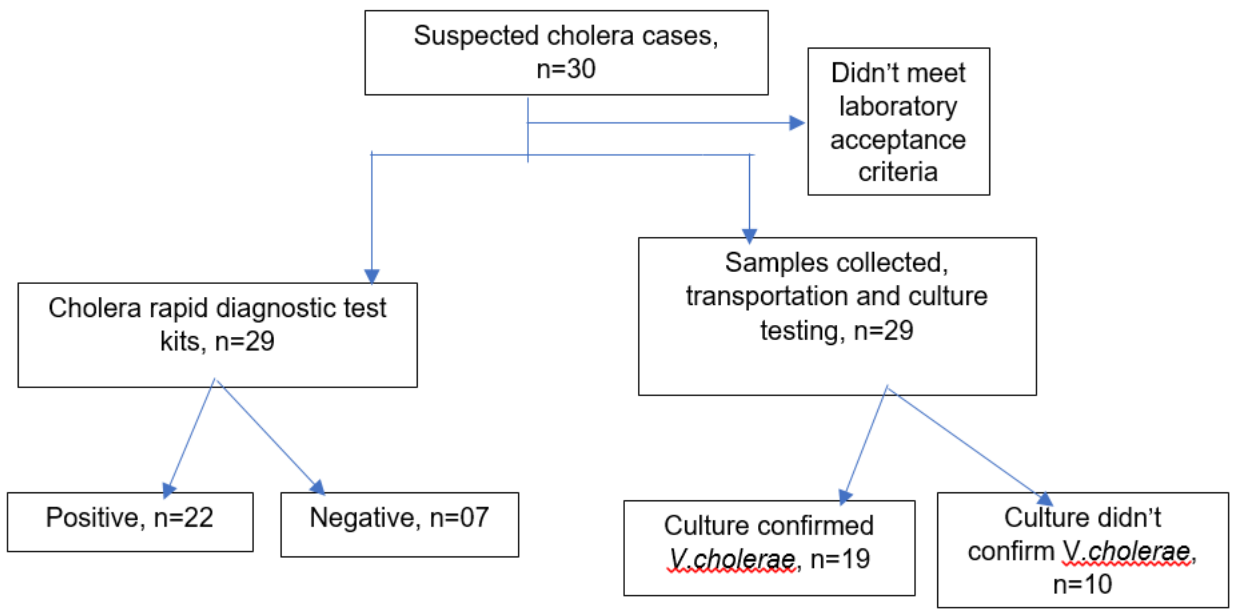

Figure 1: Rapid diagnostic and culture test results

Comparability of Cholera rapid diagnostic tests against culture testing

Table 1: Comparability between cholera rapid diagnostic tests and culture results

Test type	Positive	Negative	Total
RDT	22	7	29
Culture	19	10	29

A total of 29 samples were analysed using both rapid diagnostic tests (RDT) and culture methods. Of these, 22 samples tested positive by RDT, while 19 were confirmed positive by culture, the gold standard. Among the RDT-positive results, 19 corresponded with culture-confirmed cases, indicating that the RDT correctly identified all true cholera cases (Table 1). However, 3 samples tested positive by RDT but were negative by culture, representing false positives.

Continued from page 14

Table 2: 2X2 contingency table showing comparability between rapid diagnostic tests performed and culture results (gold standard)

	Culture (+)	Culture (-)	Total
RDT (+)	a=19	b=3	22
RDT (-)	c=0	d=7	7
Total	19	10	29

A total of 29 stool samples were tested using both the cholera rapid diagnostic test (RDT) and stool culture, with culture used as the gold standard. Of the 29 samples, 22 tested positive by RDT and 19 tested positive by culture. Nineteen samples were positive on both RDT and culture (true positives), three samples were RDT-positive but culture-negative (false positives), no samples were RDT-negative but culture-positive (false negatives), and seven samples were negative by both methods (true negatives) (Table 2).

The sensitivity of the RDT was 100% (19/19), and the specificity was 70% (7/10). The positive predictive value (PPV) was 86.4% (19/22), while the negative predictive value (NPV) was 100% (7/7). The overall accuracy of the RDT compared with culture was 90% (26/29).

Discussion

This evaluation assessed the performance of the cholera rapid diagnostic test (RDT) against stool culture as the gold standard in this outbreak response. The assessment found a high level of agreement between cholera RDT and culture results. All culture-confirmed cholera cases included in the assessment were detected by the RDT, indicating that the test was able to identify specimens that were confirmed positive by the gold standard method. Three specimens produced positive RDT results that were not confirmed by culture. This finding suggests that while cholera RDTs are useful for rapid screening and early outbreak detection, culture confirmation remains important for accurate diagnosis and surveillance reporting. Similar findings have been reported in evaluation of culture and cholera RDTs, where high sensitivity was observed and varying specificity [12,13]

Rapid diagnostic tests can play an important role in early case detection at district level, while culture testing remains essential for confirmation and surveillance [8,9].

Study limitations: Only 29 specimens were available for comparison, limiting the number of observations included in the assessment. Culture was used as the reference method for comparison; however, culture results may be affected by factors such as specimen quality, transport conditions, prior antimicrobial exposure, and laboratory processing procedures.

Conclusion: The assessment provides operational evidence that cholera RDTs can effectively support rapid screening during outbreak response activities, while culture testing remains important for laboratory confirmation and surveillance.

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Conflict of interest: The authors declare no competing interests.

Authorship contributions: PP drafted the initial version of the manuscript. SG, MN AND MO revised the article for substantial intellectual content. PP, PZ, MN and JW participated in the outbreak investigation. SG, GN, SN also supervised the field activity.

Continues to page 16

Continued from page 15

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Antimicrobial Susceptibility Testing Capacity in Selected Private Hospitals of Western Uganda, May–June, 2025

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Summary

Background: Antimicrobial resistance (AMR) poses a major public health threat globally, with bacterial AMR contributing to millions of deaths annually, disproportionately affecting low- and middle-income countries like Uganda. Reliable antimicrobial susceptibility testing (AST) is essential for guiding therapy, supporting stewardship, and informing surveillance. However, laboratory capacity remains limited in many settings, particularly in private hospitals, which play a significant role in healthcare delivery. We assessed the AST capacity in private hospitals in Western Uganda to identify gaps and inform integration into Uganda's national AMR response framework.

Methods: We conducted a cross-sectional assessment from May to June 2025 in three purposively selected private hospitals in Western Uganda (X and Y in Mbarara District; Z in Kabale District) with func-

Continued from page 16

Data were collected using the CDC- validated Laboratory Assessment of Antibiotic Resistance Testing Capacity (LAARC) tool, a self-scoring questionnaire with 15 modules covering infrastructure, human resources, quality assurance, organism identification, AST methods, panels, and data management. Four staff per hospital (manager, quality officer, bench personnel) responded. Scores ranged 0–100%, classified as low (0–49%), moderate (50–79%), or good (80–100%). Overall capacity was the average of module scores.

Results: The three laboratories had an overall average AST capacity of 53%. B scored highest at 61% (moderate), while A and C scored 49% each (low); none reached good capacity. Seven modules scored below 50%: identification methods (31%), AST quality control (34%), AST panels/policy/analysis (36%), overall quality control (43%), AST expert rules (46%), and processing (48%). These gaps compromised result reliability and surveillance utility.

Conclusion: Private hospitals in Western Uganda exhibit moderate-to-low AST capacity, with critical deficiencies in identification, quality control, and interpretive rules, consistent with regional challenges. Targeted interventions prioritizing training, standardized tools, reagent supply, laboratory information systems, and integration into national surveillance are essential to enhance readiness, support Uganda's NAP-AMR II, reduce empirical prescribing, and strengthen AMR containment in resource-limited settings.

Background

Antimicrobial resistance (AMR) is a major global public health threat that compromises the prevention and treatment of infectious diseases and was directly associated with approximately 1.27 million deaths in 2022 (1-3). The burden is greatest in low- and middle-income countries (LMICs), including Uganda, where health systems face limitations in diagnostic capacity, surveillance, antimicrobial regulation, data quality, digitalization, and resource availability (4, 5). Antimicrobial susceptibility testing (AST) is critical for guiding treatment, supporting antimicrobial stewardship, and generating AMR surveillance data, but its reliability depends on trained personnel, standardized procedures, quality systems, and appropriate laboratory infrastructure (6, 7).

Despite its importance, AST capacity in many LMICs remains constrained by inadequate infrastructure, limited skilled staff, inconsistent supplies, and weak quality management systems, leading to greater reliance on empirical treatment and accelerating AMR (8, 9). Although Uganda has strengthened AMR response efforts through national policies and surveillance initiatives, evidence on the capacity of private hospital laboratories to provide quality-assured AST remains limited(10). We assessed AST capacity in selected private hospitals in Western Uganda to identify gaps and support integration into Uganda's national AMR response framework.

Methods

Study design, setting and sampling

We conducted a cross-sectional assessment between May and June 2025 in three purposively selected private hospitals with functional microbiology laboratories in western Uganda. B and A hospitals in Mbarara District and C hospital in Kabale District. These hospitals had provided medical and surgical services for more than five years and had patient volumes comparable to Uganda's regional referral hospitals. The region was selected because of increasing antimicrobial resistance (AMR) trends reported in Uganda (11). Four laboratory personnel from each hospital, including the laboratory manager, quality officer, and bench personnel, participated, giving a total of 12 respondents.

Data collection

Data were collected using the CDC-validated Laboratory Assessment of Antibiotic Resistance Testing Capacity (LAARC) questionnaire administered in Microsoft Excel format. The LAARC tool is designed to assess laboratory readiness for reliable bacteriology and AMR testing in resource-limited settings. It consists of 15 modules: general, facility, laboratory information system, data management, quality assurance, media quality control, identification quality control, antimicrobial susceptibility testing (AST) quality control, specimen management, processing, identification methods and standard operating procedures, basic AST, AST expert rules, AST policy, and safety. Data collection was conducted by two clinical microbiology experts. Laboratory processes and supporting documents, including standard operating procedures, were reviewed over three days at each facility.

Data collection was conducted by two clinical microbiology experts.

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Continued from page 17

Data analysis: The LAARC tool uses a self-scoring approach in which indicators are scored from 0–100%. Scores were categorized as low capacity (0–49%), moderate capacity (50–79%), and good capacity (80–100%). Individual hospital scores were generated by averaging module scores, and overall AST capacity was calculated as the mean across facilities. Module-level analysis was used to identify the main factors affecting AMR testing performance.

Ethical consideration: This assessment was authorized by the Ministry of Health (MoH) and classified as a non-research public health activity. It was therefore exempted from full Institutional Review Board (IRB) review and conducted in accordance with applicable Centres for Disease Control and Prevention policies.

Results

This study enrolled three private hospital laboratories from two districts of western Uganda. All the three private hospital laboratories assessed had a physical laboratory infrastructure on site. However, none of the hospital laboratories had good capacity (80%) to conduct AMR testing. The overall average score for AMR testing capacity was 53%, with B hospital scoring highest with 61% (moderate capacity) with A and C Hospitals scoring 49% (low capacity).
Seven out of thirteen assessed modules were the key areas that affected the AMR testing performance as their scores were below 50%. These included processing 48%, AST expert rules 46%, Quality control 43%, AST-panels, policy and analysis36%, Quality control-AST 34%, and identification methods and SOPs at 31% (Figure 1).

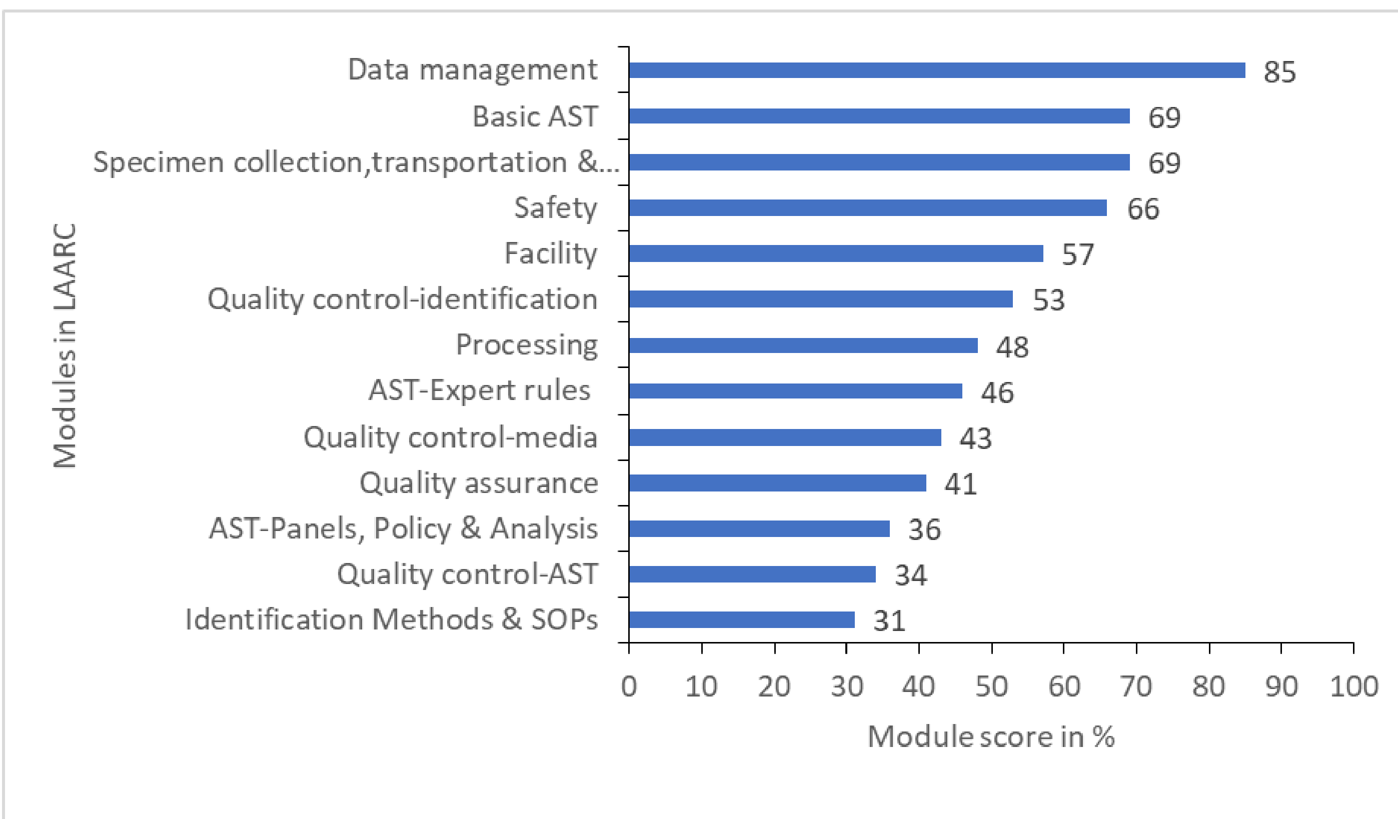

Figure 1: Key areas affecting antimicrobial resistance testing performance across the three selected private hospitals, western Uganda, May–June, 2025

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Discussion

This assessment using the Laboratory Assessment of Antibiotic Resistance Testing Capacity (LAARC) tool demonstrated moderate-to-low antimicrobial susceptibility testing (AST) capacity among private hospital laboratories in Western Uganda, with an overall average score of 53% and no facility achieving good capacity (≥80%). Hospital B demonstrated the highest overall performance. Across the assessed hospitals, the lowest-performing domains were identification methods, AST quality control, AST panels/policy/analysis, overall quality control, AST expert rules, and specimen processing, with performance ranging from 31% to 48%, indicating weaknesses that may compromise the accuracy and reliability of AST results and reduce their value for AMR surveillance.

These findings are consistent with evidence from Uganda and other sub-Saharan African settings showing persistent gaps in laboratory readiness for AMR testing, particularly in non-reference facilities (12). Uganda's Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (MAAP) assessment similarly demonstrated wide variation in laboratory readiness, with scores ranging from 36.8% to 81.6%, while facilities with characteristics comparable to those assessed in this study reported moderate performance levels(12). Routine surveillance data from Ugandan tertiary hospitals also show ongoing challenges associated with inconsistent AST practices and weak quality systems contributing to resistance trends (13). Similar barriers have been reported in private hospitals in Kampala, including limited antimicrobial stewardship implementation, inadequate training, and poor routine monitoring of susceptibility patterns (14, 15). Regional evidence further supports these findings. Studies from Zambia using the LAARC framework reported comparable deficiencies in AST quality control, pathogen identification, laboratory information systems, and specimen processing, highlighting shared constraints related to workforce capacity, reagent availability, infrastructure, and adherence to standard operating procedures (16-18). Collectively, these findings suggest that the challenges observed are systemic rather than facility-specific. Strengthening training in organism identification and quality control, improving access to standardized AST panels and expert rules, strengthening laboratory information systems and supply chains, and integrating private hospitals into national surveillance platforms are essential to support Uganda's National Action Plan on AMR (NAP-AMR II) and reduce reliance on empirical antimicrobial prescribing.

Study limitations and strengths: This assessment had some limitations. First, only three purposively selected private hospitals with functional microbiology laboratories were included, limiting the representativeness and generalizability of the findings to other private hospitals and healthcare facilities in Uganda. Second, the cross-sectional design provided a snapshot of AST capacity during the assessment period and may not reflect changes in laboratory performance over time. Despite these limitations, the assessment provides valuable insights into key gaps in AST capacity within selected private hospitals and highlights priority areas for strengthening laboratory systems to support AMR surveillance.

Conclusion: Private hospital laboratories in Western Uganda demonstrated moderate-to-low AST capacity, with critical deficiencies in organism identification, quality control, expert rules, and specimen processing. These gaps limit reliable AMR surveillance and evidence-based antimicrobial use. Targeted investments in laboratory strengthening, standardized testing systems, workforce development, improved reagent availability, implementation of laboratory information systems, and integration into national AMR surveillance structures are necessary to strengthen diagnostic readiness and support AMR containment efforts in Uganda.

Conflict of interest: The authors declare that they have no conflict of interest.

Author contribution: NV took the lead in conceptualizing the project, data curation, investigation analysis writing the original draft. BS, BM, KM were involved investigation, designing methods, writing, reviewing the article. SG, MRE were involved in supervision and editing to ensure scientific integrity. All authors read and approved the final article.

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Continues to page 20

Continued from page 19

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Sporadic Crimean Congo Hemorrhagic Fever Outbreaks in Multiple Districts, Uganda, August–September, 2025

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Summary

Background: Crimean Congo hemorrhagic fever (CCHF) is a zoonotic tick-borne viral disease caused by the CCHF virus. On August 30, 2025, the Uganda Ministry of Health confirmed a CCHF case at a private hospital in Kampala District, with rumors of suspected CCHF cases in multiple districts. We investigated the outbreaks to describe characteristics of the confirmed CCHF cases and identify potential exposures in the affected districts to inform control and prevention measures.

Methods: We defined a confirmed CCHF case as a resident of Nakasongola, Nakaseke, Wakiso, Kiruhura, or Kyotera District during August 1 to September 30, 2025 with a laboratory confirmation of CCHF by Polymerase Chain Reaction. We conducted interviews with case-patients, relatives, employers and clinicians to explore case-patient characteristics, disease progression and management. We conducted environmental assessments at the case-patients' homes to observe for potential exposures.

Results: Six CCHF confirmed cases were identified, three of whom died. All were male, with a median age of 29 years (IQR:9-70). Of the six case-patients, two were soldiers; the remaining case-patients were an abattoir worker, a clerical officer, a logger, and a primary three pupil. Nakasongola District had two of the six case-patients, Kiruhura, Nakaseke, Wakiso, and Kyotera each had one case-patient. Four homes of the case-patients were observed to be near animal grazing grounds, two homes owned animals, ticks were observed on animals in or near five case-patient homes and half of the case-patients were involved in animal handling.

Conclusion: We identified multiple sporadic cases across five districts over two months, consistent with known risk zones, affecting multiple age groups. Potential exposures were bites of infected ticks resulting from occupational contact with animals and environmental risks. Sensitization of animal owners on effective tick control practices could reduce tick populations and limit human exposure to CCHF-infected ticks.

Continues to page 22

Continued from page 21

Introduction

Crimean Congo hemorrhagic fever (CCHF) is a tick-borne viral disease, caused by CCHF virus, in the Nairoviridae family (1). The CCHF virus is zoonotic, transmitted from infected animals to humans through bites of hard ticks. Humans also become infected through contact with blood, secretions, other bodily fluids or tissues of infected animals and persons or nosocomial infection (2). Farmers, herders, slaughter house workers and butchers, veterinarians and health workers are high risk occupational groups (3).

Effective tick control measures are crucial in limiting spread of CCH (4).The incubation period depends on the route of exposure; after a tick bite, it is 1-3 days (maximum up to 9 days), following contact with infected blood or tissue, it is 5-6 days (maximum up to 13 days) with a case fatality rate of 10-40% (5). Common symptoms include abrupt onset of fever, chills, myalgia, headache, muscle pain, general body weakness, abdominal pain, vomiting, diarrhea, photophobia, lymphadenopathy (6).

Most cases recorded in Uganda are concentrated within the geographic region called the cattle corridor (7). The cattle corridor is an extensive stretch of land extending from southwestern to northeastern Uganda, dominated by pastoral rangelands, characterized by high density of livestock farming. By 2017, a study on seroepidemiologic investigation of CCHF in livestock in Uganda revealed that CCHF virus was actively circulating in livestock, indicating a risk for human infection (8).

On August 30, 2025, the Uganda Ministry of Health (MoH) confirmed a CCHF case at a private hospital in Kampala District. Several other alerts of suspected CCHF cases in multiple districts within the same period prompted deployment of the national rapid response team to the affected districts. We investigated to describe the characteristics of the confirmed CCHF cases and identify potential exposures in the affected districts to inform control and prevention measures.

Methods

Outbreak area

The outbreaks occurred in five districts: Nakasongola, Nakaseke, Kyotera, Wakiso, and Kiruhura districts. Five of the outbreaks were in the cattle corridor districts, with two outbreaks in Nakasongola, one in Nakaseke, one in Kiruhura District, and one in Kyotera District. The cattle corridor is a semi-arid strip of land running from southwest to northeast of the country, covering over 30 districts. The cattle corridor has the highest concentration of cattle, goats, and sheep in the country and livestock rearing (large-scale ranching and pastoralism) is its major economic activity, favored by its climate and vegetation (9). One outbreak occurred in Wakiso, a peri-urban district surrounding Kampala City, with business and small-scale intensive livestock production as the major economic activities.

Case definition

We defined a confirmed CCHF case as a resident of either Nakasongola, Nakaseke, Wakiso, Kiruhura or Kyotera district from August 1 to September 30, 2025, with a laboratory confirmation of CCHF by reverse transcription-polymerase chain reaction from the Central Emergency Response and Surveillance Laboratory (CERSL) of the Ministry of Health.

Field investigation

Using the Ministry of Health standardized Viral Hemorrhagic Fever (VHF) case investigation form, we interviewed case-patients, close relatives of the case-patients and attending clinicians at the health facilities that managed the cases. The interviews focused on the case-patients' demographics, disease progression, management of the case-patients and possible exposures. We inspected the homes of the case-patients to observe and gather additional information on potential environmental exposures.

Data analysis

We performed descriptive analysis for quantitative data and reported frequencies for categorical variables. We used Quantum Geographic Information System (QGIS) to draw a map showing the affected districts and locations of cases.

Continued from page 22

Ethical considerations

We conducted this investigation in response to a public health emergency. The MoH authorized this investigation and the office of the Center for Global Health, US Centers for Disease Control and Prevention determined that this activity was not human subject research and with its primary intent being for public health practice or disease control. We obtained permission to conduct the investigation from the local governments of Kiruhura, Nakasongola, Nakaseke, Kyotera, and Wakiso districts where the cases were identified. We obtained verbal consent from all the respondents aged ≥18 years. For those below 18 years, we obtained verbal consent from their guardians and assent from the respondents.

Results

Descriptive epidemiology

Six CCHF confirmed cases were identified in five districts. Two of the cases were from Nakasongola district while Nakaseke, Kiruhura, Kyotera and Wakiso Districts had one case each. All the case-patients were male, with a median age of 29 years (range:9–70) years. Three of the six case-patients died. It took a range of 7-15 days after symptom onset to confirm the three dead case-patients with CCHF. Of the six case-patients, soldiers were two; the remaining case-patients were an abattoir worker, a clerical officer, a logging laborer, and a primary three pupil. All of the six case-patients presented with fever and malaise, five presented with bloody vomitus, body weakness and headache, while three had backache and abdominal pain (Figure 1).

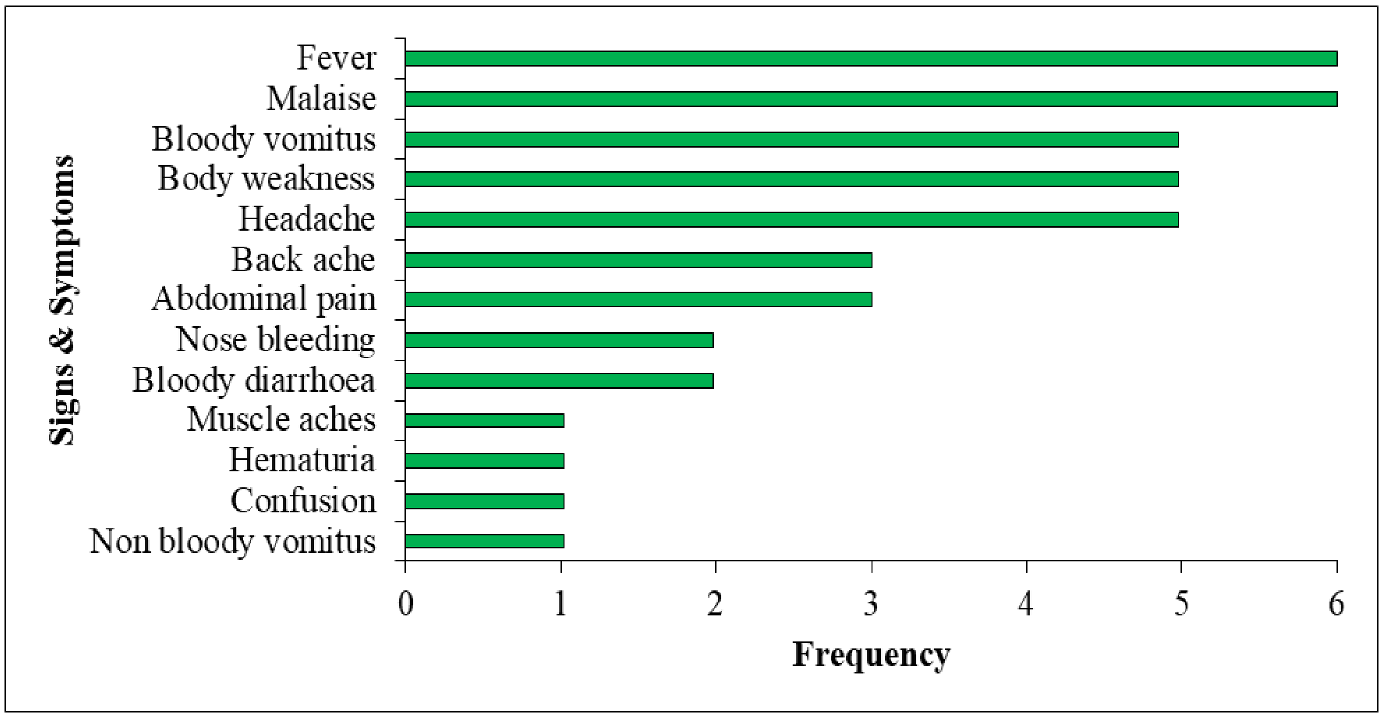

Figure 1: Clinical presentation of Crimean Congo hemorrhagic fever case-patients in multiple districts, Uganda, August–September, 2025

Detection, outcome, and possible exposures of Crimean Congo hemorrhagic fever case-patients in multiple districts, Uganda, August–September, 2025

Upon environmental assessment, we observed that four of the six case-patients' homes were located within animal grazing grounds. Half of the case-patients were involved in animal handling activities while ticks were observed on animals in or near five of the six case-patient homes (Table 1).

Continues to page 24

Continued from page 23

Table 1: Detection, outcome, and possible exposures of CCHF case-patients in multiple districts, Uganda, Aug–Sep, 2025

Case No.	District of residence	Travel history	Malaria test result	First diagnosis	Outcome	Possible exposures
1	Kiruhura	None	Negative	Helicobacter pylori, peptic ulcer disease	Alive	-Herded animals at a farm 7 days before symptom onset - Loaded & off-loaded animals from trucks -Ticks observed on animals at both farm and abattoir
2	Nakasongola	None	Negative	Typhoid, Cholecystitis, moderate peritonitis	Dead	-Cut and loaded logs onto trucks in a forest (habitant for ticks) -Reportedly had no interaction with animals
3	Nakasongola	None	Negative	Peptic ulcer disease	Dead	-Lived in a home surrounded by thickets (habitant for ticks) -Home in close proximity to a kraal -Ticks observed on animals in the kraal
4	Nakaseke	None	Test not done	Suspected viral hemorrhagic fever	Dead	-Lived in a home located within animal grazing grounds -Ticks observed on the animals
5	Wakiso	None	Positive	Malaria, moderate ascites,	Alive	-Lived in a home that shared the same compound with a kraal, -Father is a cattle trader, buys cattle frequently and keeps them at home before sale -Involved in care of the cattle -Ticks observed on the animals
6	Kyotera	None	Negative	Malaria	Alive	-Household owned goats -Ticks observed on goats during the visit -Cared for his animals when not at official duties -Home surrounded by grazing grounds shared by goats from neighbors

Discussion

The investigation found that four of the confirmed CCHF cases were residents of known CCHF risk zones. All case-patients were male, with a median age of 29 years (range:9–70 years) and half of the case-patients died. Majority of the case-patients were involved in animal handling and ticks were observed on animals in most of the case-patients' homes.

Recurrent sporadic cases occurring within known risk zones is consistent with patterns observed in previous CCHF outbreaks. Confirmed CCHF cases were previously identified in two of the affected districts: Nakaseke District with two cases and Kiruhura District with one case during July 2018 to January 2019 (10). Recurrence of cases in known risk zones suggests a geographic clustering of risk where environmental conditions or occupational practices favor transmission (11). All the case-patients were male. This finding is consistent with previous investigations that identified only male case-patients (11,12). This is likely related to the occupations of men such as herdsmen and abattoir workers, which keep them in close contact with animals. The affected age range of case-patients in this investigation is closely similar (9-68 years) to that of case-patients investigated in July 2018 (13). This finding is an indication that multiple age groups are consistently at risk, implying involvement in activities which expose them to bites of CCHF infected ticks or infected animal tissues. This is further explained by the high seroprevalence of CCHF in animals in Uganda (14).

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Study limitations: Although we collected animal blood and tick samples from animals in the households of case-patients to assess for CCHF virus presence, laboratory testing was not performed due to logistical limitations. As a result, we could not confirm active circulation of CCHF virus in livestock or ticks associated with affected households. Consequently, our findings regarding sources and pathways of transmission relied primarily on reported exposure history and environmental observations and should be interpreted cautiously.

Conclusion: The investigation identified recurrent sporadic cases consistent with known risk zones, affecting multiple age groups. Exposure was suspected to be from bites of infected ticks resulting from occupational contact with animals and environmental risk factors.

Recommendations: Conducting continuous medical education for health workers on recognition of CCHF could raise their suspicion index, facilitate early case detection, and improve treatment outcomes. Sensitization of animal owners on effective tick control practices could reduce tick populations and limit human exposure to CCHF-infected ticks.

Conflict of Interest: The authors declare no conflict of interest

Acknowledgements: The authors are grateful to Kiruhura, Nakasongola, Nakaseke, Kyotera, and Wakiso district local governments for the technical and administrative support offered during this investigation. We appreciate the Central Emergency Surveillance and Response Laboratory for testing the human samples and releasing results on time.

Author contributions: AN took lead in conceptualizing the project, data curation, investigation, data analysis and original draft writing. ALA, OKP, CM, VN, SN, JW, MDN, WN, BK and RM were involved in designing the methodology, investigation, writing, reviewing, and editing the article. JO, SML, and AW were involved in supervision, visualization, validation and editing the article to ensure scientific integrity. All authors read and approved the final article.

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Temporal trends and spatial distribution of meningitis-related mortality in Uganda, 2021–2025

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Summary

Background: Meningitis is an important cause of preventable mortality in Uganda, with deaths linked to epidemic-prone bacterial pathogens and HIV-associated opportunistic infections. Mortality trend data are useful for identifying high-burden populations and guiding prevention and case management priorities. We assessed temporal trends in meningitis-related mortality in Uganda during 2021–2025.

Methods: We analyzed aggregated meningitis mortality surveillance data reported by health facilities through the District Health Information Software during 2021–2025. A meningitis death was an inpatient death recorded under bacterial, viral, cryptococcal or other type of meningitis in the health unit inpatient monthly reporting form. Mortality rates per 100,000 population were calculated using reported meningitis deaths and annual projected population denominators from the Uganda Bureau of Statistics 2024 Census Report (2.9% annual growth). Mortality rates were disaggregated by year, age group, sex, and meningitis type. Temporal trends in mortality rates were assessed using the Mann-Kendall test.

Results: During 2021–2025, national mortality rates were highest in 2021 (1.26/100,000) and lowest in 2023 (1.07/100,000), representing a 15% decline from 2021 to 2023. Over the 5 years, mortality rates were highest among males (1.25–1.58/100,000), those aged ≥5 years (0.88–1.01/100,000), and for cryptococcal (0.36–0.49/100,000) and bacterial (0.43–0.46/100,000) meningitis. No statistically significant monotonic trends in mortality rates were observed by year, age group, sex or meningitis type. Five of 146 districts (3%) had statistically significant declining trends in mortality rates; Sembabule (τ=-0.95, p=0.04), Kasese, Kiboga, Mubende and Gulu City (all τ=-1.0, p=0.03).

Conclusion: During 2021–2025, meningitis mortality rates were highest among males and individuals aged ≥5 years. Declining mortality trends were observed in a few districts. Further clinical and programmatic review could identify opportunities to reduce meningitis-related deaths.

Continued from page 26

Background

Meningitis is inflammation of the membranes surrounding the brain and spinal cord. It may be caused by bacterial, viral, fungal, or non-infectious conditions and commonly presents with fever, headache, neck stiffness, confusion, photophobia, and vomiting (1). Bacterial meningitis is the most severe form because it can progress rapidly, cause outbreaks and lead to death or long-term complications (1,2).

Uganda lies within the extended African meningitis belt, a region affected by recurrent bacterial meningitis outbreaks (3–5). Although vaccination against major bacterial pathogens has reduced vaccine-preventable meningitis in many settings, meningitis remains a public health concern in Uganda, with a bacterial meningitis cluster reported in Obongi District in 2023 (3). In addition, Uganda's high HIV burden means that adult meningitis is also shaped by opportunistic infections, particularly cryptococcal meningitis (6–12).

Previous Ugandan studies have shown that cryptococcal meningitis is a leading cause of HIV-associated adult meningitis and continues to cause substantial mortality, even with ART expansion (10,11,13–15).

Both epidemic-prone bacterial pathogens and HIV-associated opportunistic infections therefore drive meningitis mortality in Uganda. However, most available studies have focused on clinical cohorts in referral hospitals, and less is known about national and regional mortality patterns using routine surveillance data. We described national, regional, and district trends in meningitis-related mortality in Uganda during 2021 to 2025.

Methods

Study setting: We utilized data generated by healthcare facilities in all districts and regions in Uganda. These healthcare facilities included health centre IIIs, health centre IVs, general hospitals, regional referrals, and national referral hospitals. Meningitis cases are managed as admitted cases in these facilities.

Study design and data source: We conducted a descriptive analysis of aggregated meningitis-related health facility mortality surveillance data in Uganda reported during 2021 to 2025. We abstracted annual meningitis mortality data, including meningitis deaths and cases reported by healthcare facilities through the Ministry of Health District Health Information Software using the Health Unit In-patient Monthly Reporting Form (HMIS108) for 2021 to 2025. Data cleaning, population projections and statistical analyses were conducted using R Statistical Computing software version 4.2.3. The study population included all meningitis deaths and cases reported in HMIS 108 from January 2021 to December 2025. A meningitis death was defined as an inpatient death recorded in HMIS 108 under diagnoses of bacterial, viral, cryptococcal or other types of meningitis. A meningitis case was defined as an inpatient admission recorded in HMIS 108 under diagnoses of bacterial, viral, cryptococcal or other types of meningitis.

Study variables: The outcome was the meningitis mortality rate, expressed per 100,000 population. We defined the meningitis mortality rate as the proportion of meningitis deaths in the total population. Mortality rates were disaggregated by year, region, age group, sex, and meningitis type. Annual meningitis deaths were summarized by year at national, and district levels. National-level deaths were further disaggregated by age group, sex, and meningitis type.

Data analysis and management: Population data were obtained from the 2024 Uganda National Population and Housing Census Report published by the Uganda Bureau of Statistics. Annual population denominators for 2021 to 2025 were estimated using 2.9% exponential annual growth projections (16). Projected population denominators were aligned with the relevant level of analysis, including national, regional, age-specific and sex-specific analyses. Meningitis mortality rates were calculated as the number of reported meningitis deaths, divided by the projected population for the same year, multiplied by 100,000.

Temporal trends in national, regional, and district mortality rates were assessed using the nonparametric Mann-Kendall test for monotonic trends. District meningitis mortality rates per 100,000 population over the 5 years were visualized using choropleth maps generated in Quantum Geographical

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Temporal trends in national, regional, and district mortality rates were assessed using the nonparametric Mann-Kendall test for monotonic trends. District meningitis mortality rates per 100,000 population over the 5 years were visualized using choropleth maps generated in Quantum Geographical Information Software.

Ethical considerations: This descriptive study was conducted under the direction of the Ministry of Health of Uganda. This analysis used aggregated surveillance data reported through DHIS2; no individual identifiers were accessed, and consent was not applicable. The Office of the Associate Director for Science at the US Centres for Disease Control and Prevention (CDC) Uganda determined that this investigation was non-research and that its primary intent was public health practice or disease control.

Results

Trends in meningitis mortality rates per 100,000 by year, sex, age group, meningitis type, region, and district, Uganda, 2021–2025

During 2021–2025, 2,657 deaths were reported. The national meningitis mortality rates by year ranged from 1.07−1.26 deaths per 100,000 population. Rates declined from 2021 to 2023, then increased by 2025, but the overall trend was not statistically significant (τ = -0.40, p = 0.46) (Figure 1).

Figure 1: Trend in overall meningitis mortality rates per 100,000 by year, Uganda, 2021–2025

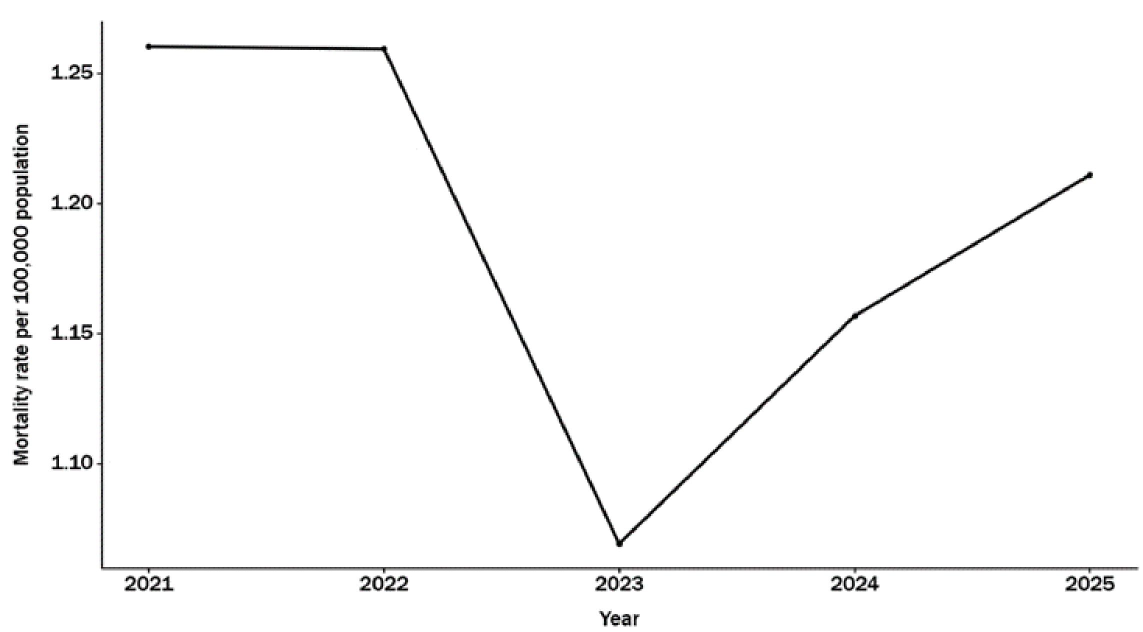

Figure 1: Trend in overall meningitis mortality rates per 100,000 by year, Uganda, 2021–2025

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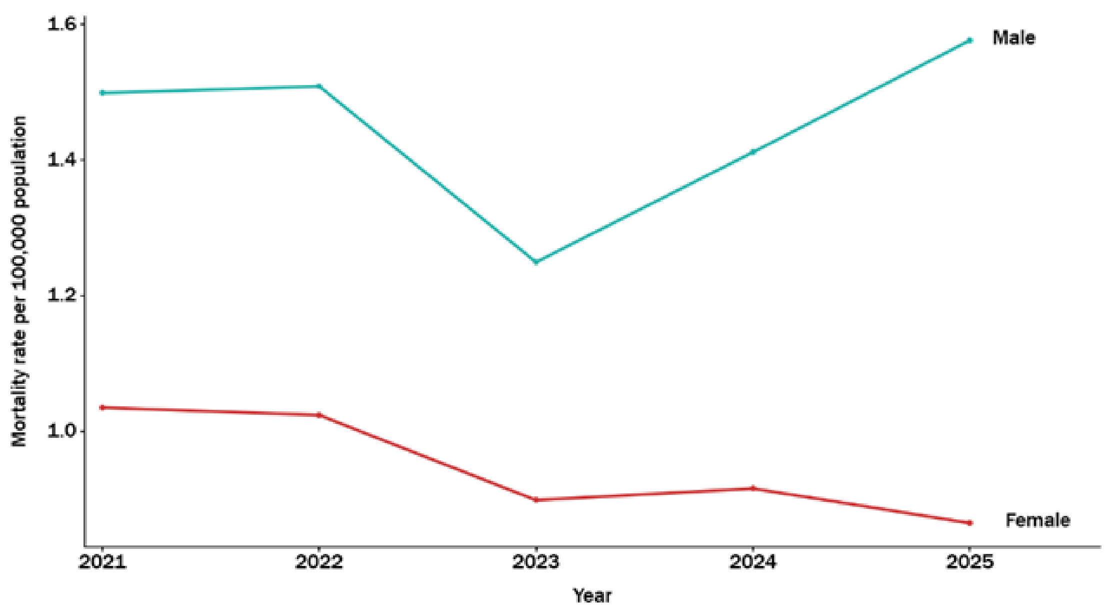

Figure 2: Trend in overall meningitis mortality rates per 100,000 by sex in Uganda, 2021–2025

Males accounted for 1,573/2,657 (59%) deaths compared with 1,084/2,657 (41%) among females. Meningitis mortality rate by sex ranged from 1.25−1.58 deaths/100,000 for males and from 0.87-1.03 deaths/100,000 for females for the

5-year period; with no statistically detectable trend in among males (τ = 0.20, p = 0.81) or females (τ = -0.80, p = 0.09) (Figure 2).

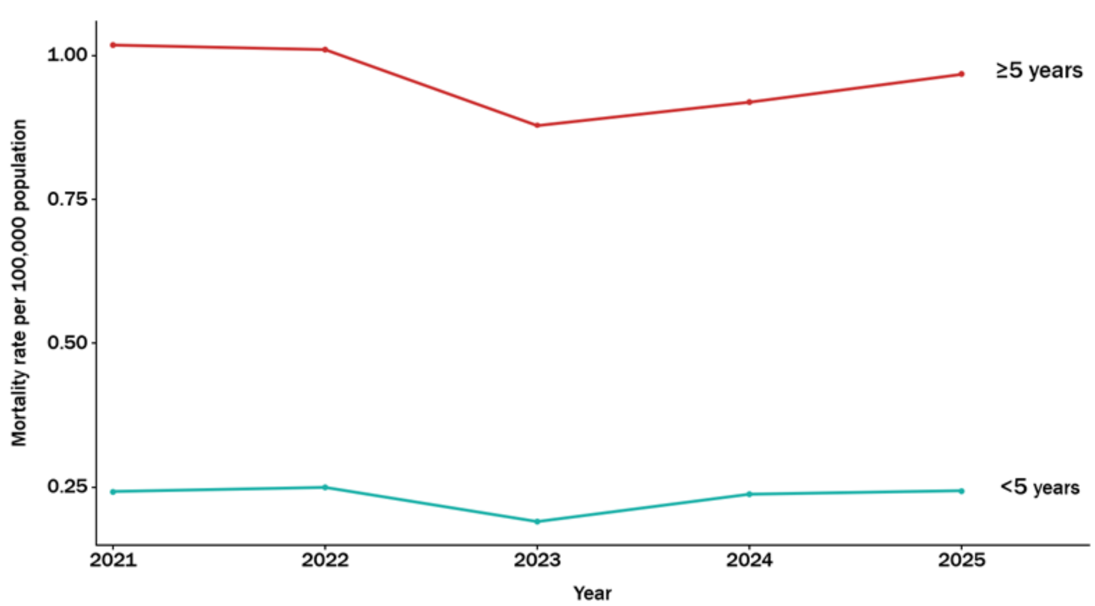

Figure 3: Trend in overall meningitis mortality rates per 100,000 by age in Uganda, 2021–2025

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Among those aged ≥5 years, 2,138/2,657 (80%) deaths occurred compared to 519/2,657 (20%) deaths among those aged <5 years. Meningitis mortality rate by age group ranged from 0.88-1.02 deaths/100,000 for those aged ≥5 years and from 0.19−0.25 deaths/100,000 for those aged <5 years for the 5 years. Similarly, trends were not significant for the≥5 years age group (τ = −0.4, p = 0.46) or the <5 years age group (τ = 0.0, p = 1.0) (Figure 3).

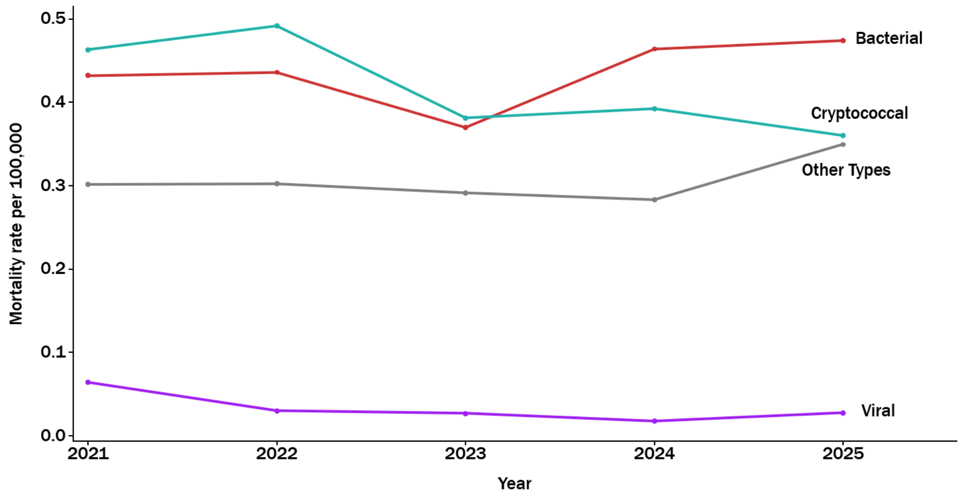

Figure 4: Trend in meningitis mortality rates per 100,000 by meningitis type in Uganda, 2021–2025

Bacterial meningitis accounted for 973/2,657 (37%) deaths, cryptococcal meningitis for 928/2,657 (35%) deaths, other types of meningitis for 683/2,657 (26%) deaths and viral meningitis for 73/2,657 (3%) deaths. Meningitis mortality rate by meningitis type ranged from 0.37−0.47 deaths/100,000 for bacterial meningitis, from 0.36-0.49 deaths/100,000 for cryptococcal meningitis, from 0.28−0.35 deaths/100,000 for other types of meningitis, and from 0.02-0.06 deaths/100,000 for viral meningitis for the 5 years. There was no statistically significant trend by meningitis type (bacterial: τ = 0.60, p = 0.22, cryptococcal: τ = -0.60, p = 0.22, other types: τ = 0.00, p = 1.00, viral: τ = -0.60, p = 0.22) (Figure 4).

Spatial distribution of mortality rates by district in Uganda, 2021–2025

At the district level, higher mortality rates were observed in several small urban districts (cities) which have regional referral hospitals, and this pattern of higher mortality persisted for the 5 years. These cities include: Kampala City, Gulu City, Lira City, Soroti City, Mbale City, Hoima City, Fort Portal City, Masaka City, Mbarara City and Kabale District (Figure 5).

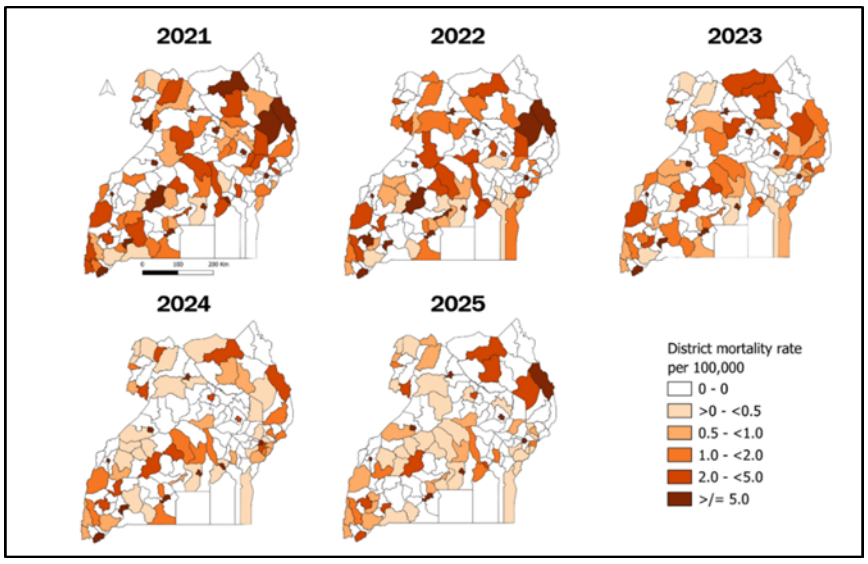

Figure 5: Spatial distribution of annual meningitis mortality rates by district in Uganda, 2021-2025

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Discussion

This analysis of national routine mortality surveillance data showed that meningitis-related mortality in Uganda fluctuated during 2021–2025, declining from 1.26 deaths per 100,000 population in 2021 to 1.07 in 2023, then increasing to 1.21 in 2025. No statistically detectable monotonic trend in overall mortality or within demographic or clinical subgroups were identified. This indicates that the observed year-to-year changes did not follow a consistent pattern during the study period.

Mortality was consistently higher among individuals aged ≥5 years than among children aged <5 years, with this age group accounting for 4 in 5 reported meningitis deaths. This may partly reflect the contribution of HIV-associated opportunistic infections (1,2), including cryptococcal meningitis, among older age groups (17,18).

Males also had consistently higher mortality rates than females. This pattern is consistent with evidence of poorer health-seeking behaviour and delayed engagement in care among men in sub-Saharan Africa (19). Some studies have reported higher mortality among women, particularly where anaemia is present (17,20).

By meningitis type, bacterial and cryptococcal meningitis had the highest mortality rates, while viral meningitis had the lowest. This finding suggests that meningitis mortality in Uganda is shaped by both epidemic-prone bacterial meningitis and HIV-associated opportunistic infections. This differs from settings where meningitis burden is dominated mainly by epidemic-prone bacterial disease. This is also consistent with Ugandan and regional evidence showing that cryptococcal meningitis remains an important cause of death among people living with HIV (4,5,8,9,21).

These findings are relevant to regional meningitis control priorities and the WHO roadmap to defeat meningitis by 2030, which emphasizes reducing meningitis deaths, strengthening surveillance, improving diagnosis and care and preventing long-term complications (22).

At district level, some of the highest mortality rates were observed in small urban districts or cities hosting regional referral hospitals. These areas may appear as hotspots because they receive referred patients from surrounding districts and may have stronger diagnostic and reporting capacity. Routine surveillance data are useful for describing broad national and subnational patterns, detecting outbreaks and estimating disease burden, but they provide less clinical detail than patient-level studies and depend on the quality of case detection, reporting and laboratory confirmation (23). Therefore, these findings should be interpreted as surveillance-based patterns of reported inpatient mortality rather than complete estimates of all meningitis deaths in the population.

Study limitations: Several limitations should be considered. The five-year study period provided only five annual time points, which limited the ability to detect trends, especially non-linear patterns. The analysis used aggregated routine surveillance data which may have masked local variation and may have been affected by incomplete reporting, delayed reporting, data entry errors or misclassification. Because the data were based on inpatient reports from healthcare facilities, meningitis cases and deaths occurring in the community or non-reporting units were not captured. Therefore, mortality rates may underestimate the total burden of meningitis-related deaths in the population. Population denominators were based on projections from the 2024 census and may not fully reflect regional demographic differences. Subgroup analyses also reduced the number of observations available for trend analysis.

Conclusion: No statistically detectable monotonic trend in overall mortality, case fatality, age, sex or meningitis type was observed during 2021–2025. Mortality was consistently higher among males and individuals aged ≥5 years, and bacterial and cryptococcal meningitis contributed the greatest mortality burden. The facility-level case fatality rate of 11% indicates substantial mortality among admitted cases. Further clinical and programmatic review could help to identify factors contributing to meningitis-related deaths and opportunities to improve patient outcomes.

Recommendations: The Ministry of Health could conduct focused clinical and programmatic reviews in facilities and districts reporting high meningitis deaths or high case fatality, especially for bacterial and cryptococcal meningitis. These reviews could assess diagnostic practices, referral pathways, treatment practices and outcomes among admitted patients, especially males and persons aged ≥5 years. Findings from these reviews could guide targeted improvements in diagnosis, inpatient care and meningitis surveillance within and outside healthcare facilities.

Continues to page 32

Continued from page 31

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Authors' contribution: KDA and RM conceived, designed, analyzed, interpreted the study and wrote the draft bulletin. IK, and BK reviewed the bulletin to ensure intellectual content.
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Trends and spatial distribution of acute undernutrition among pregnant and lactating women in Uganda, 2020–2024

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Summary

Background: Uganda continues to experience acute undernutrition among pregnant and lactating women (PLW), contributing to maternal complications, foetal growth restriction, low birth weight, and childhood stunting. The 2022 Uganda Demographic and Health Survey (UDHS) reported 9% of women of reproductive age as underweight. We assessed temporal trends and spatial distribution of acute undernutrition among PLW in Uganda, 2020–2024.

Methods: We conducted a retrospective descriptive analysis using District Health Information Software 2 (DHIS2) data reported monthly by health facilities from January 2020 to December 2024. Acute undernutrition was defined as mid-upper arm circumference (MUAC) <23 cm. We abstracted the number of PLW screened and those classified in yellow and red MUAC zones by region. We calculated overall prevalence as total undernourished PLW divided by total screened, multiplied by 100. We classified prevalence using WHO thresholds: <5% acceptable, 5–9% poor, 10–14% serious, and ≥15% critical. We assessed temporal trends using the Mann–Kendall test.

Results: Among 1,443,022 PLW screened, 152,503 (10.6%) were acutely undernourished. National prevalence declined from 24.1% in 2020 to 7.0% in 2024 (Mann–Kendall $\tau=-1.0$, $p=0.017$). In 2020, several regions had critical prevalence, including Bugisu (62.2%), Karamoja (57.1%), and Bunyoro (17.2%). By 2024, most regions had improved; Karamoja (21.6%) and Bugisu (9.5%) remained above the WHO acceptable threshold of <5%.

Continues to page 34

Continued from page 33

Conclusion: Acute undernutrition among PLW in Uganda declined significantly between 2020 and 2024. Persistent geographic disparities indicate that national progress conceals critical subnational disparities. Targeted interventions and causal investigation in high-burden regions could accelerate progress.

Background

Optimal maternal nutrition during pregnancy and lactation is critical to both maternal health and child survival, particularly during the first 1,000 days from conception to two years of age [1, 2]. During this period, women have significantly increased energy and nutrient requirements; failure to meet these needs contributes to maternal complications, foetal growth restriction, low birth weight, and perpetuates the intergenerational cycle of malnutrition [2, 3, 6]. Globally, 10–13% of women of reproductive age are chronically undernourished, well above the World Health Assembly target of 5% [4, 5].

In Uganda, the 2022 Uganda Demographic and Health Survey (UDHS) found that 9% of women of reproductive age were underweight [1], and a 2025 systematic review of sub-Saharan African data reported approximately 8–9% of lactating mothers as undernourished [3]. Previous analyses covering 2015–2018 showed clustering of acute malnutrition among Pregnant and Lactating Women (PLW) in Northern and Karamoja regions [2], but no updated national assessment existed for 2020–2024. The Uganda Nutrition Action Plan II (UNAP II, 2020/21–2024/25) emphasises scaling up efforts to reduce maternal malnutrition as part of broader national nutrition priorities, underscoring the need for routine surveillance data to track progress and identify priority areas. We described temporal trends and spatial distribution of acute undernutrition among PLW in Uganda from 2020–2024.

Methods

We conducted a retrospective descriptive analysis of routinely collected nutrition surveillance data from Uganda's District Health Information Software 2 (DHIS2), for the period January 2020 to December, 2024. The Health Management Information System (HMIS) captures Mid Upper Arm Circumference (MUAC) screening data for PLW through Form 105a at all health facilities [8]. Uganda has 15 administrative regions and an estimated population of 45 million persons in 2024 [7]. We extracted the following DHIS2 HMIS 097b indicators at regional level: VH14 (PLW screened for malnutrition using MUAC), VH15a (PLW with red MUAC), and VH15b (PLW with yellow MUAC). We also extracted HMIS 105a reporting rates to estimate completeness of reporting. Acute undernutrition in a PLW was defined as MUAC <23 cm, classified as red MUAC (severe acute malnutrition, <19 cm) or yellow MUAC (moderate acute malnutrition, ≥19 to <23 cm), consistent with Uganda Ministry of Health (MoH) Integrated Management of Acute Malnutrition (IMAM) guidelines [9].

We imported data from DHIS2 into R version 4.3 for analysis. We calculated overall prevalence across 2020–2024 as total undernourished PLW divided by total screened PLW, multiplied by 100. Annual prevalence was calculated similarly for each year separately. The median annual national prevalence was the unweighted median of the five annual national prevalence values. We computed the proportion of undernourished PLW with red versus yellow MUAC at national level. We assigned zero prevalence to any region-year where recorded prevalence exceeded 100%. We classified prevalence using WHO thresholds: <5% acceptable, 5–9% poor, 10–14% serious, and ≥15% critical [12, 13]. We assessed temporal trends using the Mann–Kendall test and Sen's slope estimator. We generated national trend graphs and used Quantum Geographic Information System (QGIS) version 3.4.2 to produce choropleth maps of spatial distribution by region.

Results

National prevalence of acute undernutrition among pregnant and lactating women in Uganda, 2020–2024

Continued from page 34

Among 1,443,022 PLW screened from 2020–2024, 152,503 (10.6%) were classified as acutely undernourished, yielding a five-year aggregate national prevalence of 10.6%, in the serious WHO category. The median annual national prevalence was 9.9% (range: 7.0%–24.1%), placing Uganda in the poor WHO category for most of the study period.

National temporal trend of acute undernutrition among pregnant and lactating women in Uganda, 2020–2024

National prevalence declined from 24.1% (45,759/189,999) in 2020 to 7.0% (27,100/389,658) in 2024, a 71% relative decrease. (Mann–Kendall $\tau=-1.0$, Sen's slope=−1.80 percentage points per year, $p=0.017$) (Figure 1). Over the same period, DHIS2 reporting rate increased from 73.9% (2020) to 79.2% (2023) and then dipped to 72.6% in 2024.

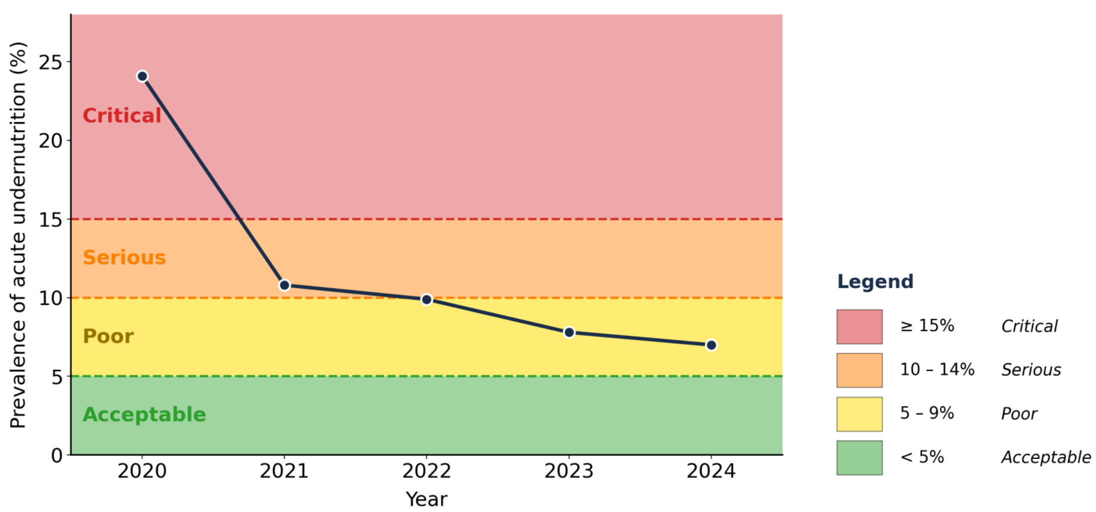

Figure 1: National trend in acute undernutrition prevalence (%) among pregnant and lactating women in Uganda, 2020–2024

Spatial distribution of acute undernutrition prevalence among pregnant and lactating women by region, Uganda, 2020–2024

In 2020, the three most affected regions were North Central, Bugisu, and Karamoja all in the critical category. By 2024, most regions had improved substantially, but Karamoja remained in the critical category and Kigezi crossed into the serious category. Western Uganda, particularly Ankole and Tooro regions had lower prevalences throughout the study period (Figure 2).

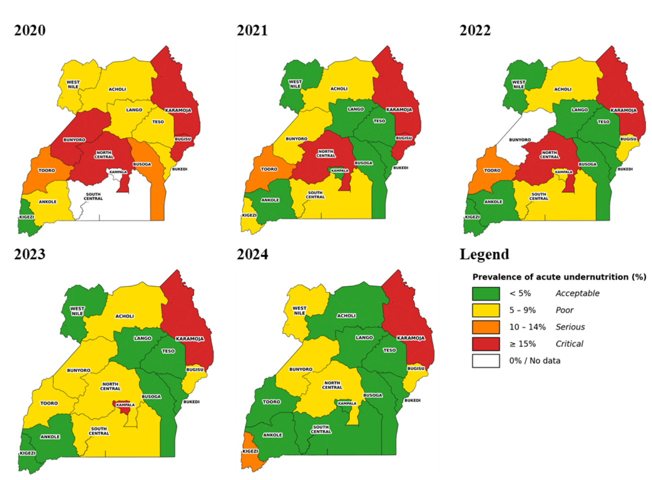

Figure 2: Spatial distribution of acute undernutrition prevalence among pregnant and lactating women by region, Uganda, 2020–2024

Continued from page 36

Continued from page 35

Discussion

We documented a decline in acute undernutrition prevalence among PLW in Uganda from 2020 to 2024, a pattern not previously documented for this five-year period. The five-year aggregate prevalence places Uganda in the serious WHO category nationally. The decline may reflect the cumulative impact of UNAP II implementation, expanded MUAC screening coverage, and improvements in maternal health service delivery during the study period.

The identification of Karamoja and Bugisu as persistent high-burden regions was consistent with patterns reported in the 2015–2018 analysis [2]. Karamoja remained in the critical category (≥15%) throughout all five years despite recording a decline. Plausible drivers could include recurrent food insecurity linked to climate variability, pastoralist livelihoods, and limited access to health services [5]. The 2020 values for North Central and Bugisu warrant cautious interpretation as possible data quality artefacts.

HMIS 105a reporting completeness remained below the 80% minimum target throughout, declining further in 2024. Low completeness may underestimate true burden, particularly in hard-to-reach areas.

Study limitations: Prevalence estimates reflect only PLW who accessed health facilities; community-level burden in hard-to-reach areas is likely underestimated, which may introduce selection bias. Reporting completeness varied by year and region, affecting the comparability of estimates over time. Denominator errors and data entry artefacts were identified and handled through data cleaning, but residual measurement error cannot be excluded. This analysis was descriptive and could not establish causal drivers of the observed trends.

Conclusion: Uganda achieved a national decline in acute undernutrition prevalence among PLW, reaching the poor WHO category nationally by 2024. Karamoja and Bugisu remained hotspots requiring intensified targeted response. We recommend causal investigation and intensified targeted interventions in Karamoja and Bugisu that could reduce the persistent critical burden in these regions, strengthening DHIS2 data quality through validation rules and regular HMIS 105a reporting supervision which could improve the reliability of future surveillance analyses.

Conflict of interest: The authors declare no competing interests.

Author Contributions: WN participated in the conception, design, analysis, and interpretation and wrote the draft article. RM and BK reviewed the draft and made multiple edits for intellectual content. JW, SN, AN, MDN, SN, IK, PE reviewed the article for intellectual content and scientific integrity. All authors read and approved the final article.

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Continued from page 36

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Continues to page 38

Continued from page 37

Factors associated with delayed care seeking among mpox cases in Mbarara City, Uganda, October 2024–May 2025

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Summary

Background: In April 2025, Mbarara City reported Uganda's highest mpox attack rate of 142/100,000 population. There were reported high infection rates and delayed healthcare seeking, which contribute to prolonged transmission, increased severity, and deaths. We assessed the magnitude and factors associated with delayed care-seeking and explored facilitators and barriers to delayed care-seeking among mpox cases in Mbarara City, October 2024–May 2025.
Methods: We conducted a cross-sectional study among suspected, probable, and confirmed mpox case-patients identified through active case finding in Nyamityobora Ward during October 2024–May 2025. Delayed care seeking was defined as seeking formal healthcare >2 days after symptom onset. We administered a standardized questionnaire and used modified Poisson regression with robust standard errors to estimate prevalence ratios and 95% confidence intervals for factors associated with delayed care seeking.
Results: Among 106 mpox cases (confirmed=53, probable=5, and suspected=48), 66 (62%) delayed care-seeking; the mean interval from symptom onset to care seeking was 4 days. Delayed care seeking was more common among case-patients whose rash began in the genital area than among those whose rash began elsewhere (adjusted prevalence ratio [aPR]=1.9; 95% confidence interval [CI]=1.39-2.59). Case-patients reporting severe pain were less likely to delay care than those reporting mild pain (aPR=0.6; 95% CI=0.46-0.78).
Conclusion: Delayed care seeking was common among mpox case-patients. Response efforts should promote early care-seeking for mild or genital symptoms, reduce stigma, strengthen confidentiality-sensitive services, and leverage trusted community networks to support timely referral and care.

Introduction

Mpox, formerly known as monkeypox, is a re-emerging viral disease caused by the monkeypox virus, which gained global public health importance following the 2022 multi-country outbreak (1, 2). Although mpox is usually self-limiting, delayed healthcare seeking after symptom onset increases the risk of transmission, severe disease, secondary infections, and death, particularly among immunocompromised individuals, such as people living with HIV (3-5). Early healthcare seeking is therefore essential for timely diagnosis, isolation, treatment, and contact tracing (6). Despite this critical role in outbreak control, studies have shown that many mpox patients delay seeking formal healthcare, undermining outbreak control efforts (7, 8). In African settings such as Uganda, delayed care seeking is driven by stigma, fear of isolation, misinformation, lesion location, and health system barriers, similar to challenges observed in Ebola, HIV, and tuberculosis control (6, 9). Mpox is transmitted through close contact with infected persons, animals, or contaminated materials. Symptoms, including fever, lymphadenopathy, malaise, and rash, often resemble other febrile illnesses and sexually transmitted infections, contributing to delayed recognition and care seeking (10). Despite continued mpox transmission in Uganda, evidence on the extent of delayed healthcare seeking and its associated factors remains limited. Uganda Ministry of Health declared a national mpox outbreak on August 2, 2024, following confirmation of 2 cases in Kasese District (9). By June 2025, the outbreak had spread to more than 100 districts with about 5,600 confirmed cases, initially affecting urban centers and fishing communities, particularly among high-risk sexual networks (11).

Continued from page 38

Mbarara City became a major hotspot and reported the country's highest attack rate by April 2025. Investigations at Mbarara Regional Referral Hospital found that many patients presented several days after symptom onset with severe disease, suggesting delayed care seeking. We investigated the magnitude and factors associated with delayed care seeking among mpox patients in Mbarara City to inform outbreak response and strengthen epidemic preparedness.

Methods

Mbarara City is located in southwestern Uganda and had an estimated population of 325,075 in 2024. Mbarara City is a major commercial and transport hub in southwestern Uganda. During Uganda's national mpox outbreak, the city reported its first confirmed mpox cases in November 2024. Nyamityobora Ward in Mbarara City was the most affected area, with 10 cells and a highly mobile urban population that may have facilitated rapid mpox transmission through frequent social and occupational interactions.

We defined mpox cases as suspected, probable, or confirmed. A suspected mpox case was defined as a resident of Nyamityobora ward with an acute onset of skin rash or genital lesions with ≥2 of the following symptoms: fever ≥38.5°C, headache, weakness, myalgia, back pain, genital discharge, lymphadenopathy, or mucosal lesions from October 2024–May 2025. A probable case as a suspected case with an epidemiological link to a confirmed mpox case in the 21 days before symptom onset. A confirmed case was a suspected case with RT-PCR-confirmed mpox infection. Delayed care seeking was defined as first seeking formal healthcare more than 2 days after symptom onset, based on previous Ebola studies in Uganda and World Health Organization mpox guidance recommending immediate care seeking after symptom onset (6, 9).

We conducted a cross-sectional study and conducted an active house-to-house case search in Nyamityobora Ward. Case-patients were interviewed using a standardized questionnaire to collect sociodemographic, clinical, health-seeking, and exposure information. Modified Poisson regression with robust standard errors to estimate prevalence ratios and 95% confidence intervals was used to identify factors associated with delayed care seeking.

Permission to conduct the investigation was obtained from the City Health Office and the leadership of Nyamityobora Ward cells. The Ministry of Health, Uganda, granted administrative clearance for this activity as part of routine national public health surveillance conducted during a public health emergency. A non-research determination was obtained from the Associate Director for Science, US CDC/Uganda. We obtained verbal informed consent from adult participants, while parental consent and minor assent were obtained for participants aged <18 years. Participation was voluntary, and all data were anonymized, password-protected, and accessible only to authorized study personnel.

Results

Descriptive epidemiology among mpox cases, Nyamityobora ward, Mbarara City, Uganda, October 2024–May 2025

We identified 106 mpox case-patients, including 53 confirmed, 5 probable, and 48 suspected cases. The median age was 29 years, with an interquartile range of 24-34 years. Overall, 57 (54%) were female, and 91 (86%) were aged 15-44 years. Most case-patients had primary education (52%) or secondary education (33%). Twenty-seven (25%) were sex workers, and 25 (24%) were businesspeople. Sixty-four (60%) case-patients reported severe pain at symptom onset, 49 (46%) had rash that began in the genital area, and 23 (22%) were HIV-positive.

Delayed care seeking and associated factors among mpox cases, Nyamityobora ward, Mbarara City, Uganda, October 2024–May 2025.

Of the 106 case-patients, 66 (62%) delayed care. Case-patients whose rash began in the genital area were 1.9 times more likely to delay care seeking compared to those whose rash started elsewhere (aPR=1.9; 95% CI:1.39-2.59). Patients reporting severe pain were 0.6 times less likely to delay care seeking compared to those reporting mild pain (aPR=0.6; 95% CI:0.46-0.78) (Table 1).

Continued from page 40

Continued from page 39

Table 1: Factors associated with delayed care seeking among mpox cases, Nyamityobora ward, Mbarara City, Uganda, October 2024–May 2025 (n=106)

Characteristic	cPR	95% CI	p-value	aPR	95% CI	p-value
Pain severity at symptom onset						
Mild pain	Ref			Ref		
Severe pain	0.55	0.41–0.73	<0.001	0.60	0.46–0.78	<0.001
Rash began in genital area						
No	Ref			Ref		
Yes	2.04	1.47–2.82	<0.001	1.90	1.39–2.59	<0.001

aPR: Adjusted prevalence ratio; **CI**: Confidence interval; **cPR**: Crude prevalence ratio; Ref: reference category

Discussion

More than half of mpox case-patients delayed care seeking. Delays were more common among patients reporting mild pain and those whose rash began in the genital area.
Delayed care seeking increases risks at both individual and community levels, including severe disease, secondary bacterial infections, prolonged morbidity, and death, as well as sustained transmission and weakened outbreak control (12). At the community level, it may prolong opportunities for onward disease transmission (13). Consistent with patient narratives, delays were also linked to stigma, fear, and reliance on traditional/herbal remedies.

Patients with mild symptoms were more likely to delay care seeking, often adopting a "wait-and-see" approach or self-treatment, consistent with findings from other studies (14). Similarly, genital-onset rash was associated with delayed care seeking, likely due to stigma, concerns about confidentiality, and misclassification as sexually transmitted infections such as syphilis (14).

Study limitation: Recall bias from self-reported symptom onset and care-seeking dates may have led to misclassification of delays, although local event calendars and probing were used to improve accuracy. Stigma may also have resulted in underreporting of symptoms such as genital rash and delayed care seeking; to minimize this, interviews were conducted privately and confidentially. Additionally, qualitative findings reflect perspectives from Mbarara City and may not be generalizable to other mpox patients in Uganda.
Conclusion: Delayed care seeking was common. Delays in care seeking were high among patients with a rash appearing first on the genital areas and those experiencing mild pain. Stigma and fear of isolation also contributed to delays. Community sensitization, led by trusted community members, may reduce stigma and fear and foster trust in the health system. This may lead to reduced delays in care seeking during the outbreak response.
Public health action: The investigation team provided health education to the residents of Nyamityobora Ward during active case searches in the community on causes, transmission, and prevention of mpox.

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Author contributions: ALA took the lead in conceptualizing the study idea, data collection, data analysis, bulletin writing, and editing. NA, KDA, MN, and NM were involved in the investigation, data collection, and bulletin writing. IK, BK, RM, PEO, PE were involved in supervision, validation, editing, and review of the bulletin. All authors read and approved the final bulletin.

Continued from page 40

Conflict of interest: The authors have no competing interests to declare.

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Continued from page 42

Continued from page 41

National trends of vaccine wastage in Uganda, 2020–2025: A descriptive analysis of four tracer antigens

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Summary

Background: Vaccine wastage reduces immunisation efficiency, increases costs, and complicates supply forecasting. Uganda routinely monitors vaccine use, but national evidence comparing observed wastage with World Health Organization (WHO) and Uganda-specific planning thresholds has been limited. We described national and sub-national trends for four tracer antigens between 2020–2025, to inform supply-chain planning and forecasting.

Methods: We conducted a retrospective descriptive analysis of routinely reported immunisation surveillance data from Uganda's District Health Information Software 2, for 2020–2025. We analysed Bacille Calmette–Guérin (BCG), measles–rubella (MR), oral polio vaccine (OPV), and Diphtheria–Tetanus–Pertussis-containing vaccine (DPT) data. We analysed wastage at national and lower and higher health facility levels Lower-level facilities were defined as Health Centre (HC) II and HC III; higher-level as HC IV, general hospitals, and referral hospitals. Vaccine wastage was calculated as the proportion of issued doses not administered. Annual wastage rates were summarised using medians, and temporal trends were assessed using the Mann–Kendall test. Observed wastage was compared with WHO thresholds: BCG≤50%, MR≤25%, OPV≤10%, DPT≤15%, and Uganda's planning thresholds: BCG≤70%, MR≤40%, OPV≤15%, DPT≤10%.

Results: During 2020–2025, median national wastage was 40.6% for BCG, 25.9% for MR, 10.0% for OPV, and 9.2% for DPT. OPV wastage declined from 12.8% in 2020 to 8.0% in 2025, with a significant downward trend (τ_b=−1.00; p=0.008). OPV and DPT wastage remained largely within their respective Uganda in-country thresholds (≤15% and ≤10%) for most of the study period, while BCG generally remained below the WHO threshold (≤50%) and MR frequently exceeded the WHO threshold (≤25%) but remained within Uganda's planning threshold (≤40%) in most years. Wastage was consistently higher in lower-level (Health Centre II and III) facilities, compared to higher level facilities.

Conclusions: OPV demonstrated the only statistically significant downward wastage trend and, together with DPT, remained within acceptable thresholds for most of the study period. BCG showed substantial variability without a significant trend, while MR frequently exceeded the WHO threshold though remaining within Uganda's national planning threshold in most years. Wastage was persistently higher at lower-level facilities across all four antigens. Strengthening session microplanning and multi-dose vial policy adherence at lower-level facilities, and revising quantification assumptions to reflect observed antigen-specific trends, could improve vaccine utilisation and supply forecasting.

Background

Vaccine wastage, doses issued but not administered, increases programme costs, reduces supply efficiency, and makes forecasting less accurate(1,2). Some wastage is inherent, particularly when vaccines are supplied in multi-dose vials and session attendance is low(3) . However, excessive wastage signals problems with session planning, stock management, cold-chain handling, or Multi-Dose Vial Policy (MDVP) compliance. The challenge is greatest for lyophilised vaccines such as Bacille Calmette–Guérin (BCG) and measles–rubella (MR), which must be discarded shortly after reconstitution, compared to preservative-containing liquid vaccines such as oral polio vaccine (OPV) and Diphtheria–Tetanus–Pertussis-containing vaccine (DPT), which can be retained for later use if MDVP conditions are met (3,4). Uganda's immunisation programme uses both World Health Organisation (WHO) global wastage thresholds and national planning thresholds for procurement and forecasting. Most previous Ugandan studies focused on selected districts or short observation periods, leaving national trends and threshold comparisons poorly characterised (5,6). We described national and sub-national trends for four tracer antigens to inform supply-chain planning and forecasting.

Continued from page 42

Methods

We conducted a retrospective descriptive analysis of routinely reported immunisation surveillance data extracted from DHIS2 for Uganda, covering January 2020 to December 2025. Four tracer antigens were selected: Bacille Calmette–Guérin (BCG-lyophilised, 20-dose vials), measles–rubella (MR-lyophilised, 10-dose vials), oral polio vaccine (OPV-liquid, 20-dose vials), and diphtheria–tetanus–pertussis-containing vaccine (DPT-liquid, 10-dose vials). We analysed wastage at national and lower and higher health facility levels. Lower-level facilities were defined as Health Centre (HC) II and HC III; higher-level as HC IV, general hospitals, and referral hospitals. Vaccine wastage was calculated as the proportion of issued doses not administered: Wastage Rate (%) = [(Doses issued − Doses administered) / Doses issued] × 100, where doses issued = (doses received + opening balance) − closing balance.

Observed wastage was compared against WHO thresholds (BCG ≤50%, MR ≤25%, OPV ≤10%, DPT ≤15%) and Uganda (National) planning thresholds (BCG ≤70%, MR ≤40%, OPV ≤15%, DPT ≤10%). Annual national wastage rates were summarised using medians, and temporal trends assessed using the Mann–Kendall test. Annual percentage change (APC) was calculated descriptively to characterise year-to-year variation. Approval to access and use DHIS2 and UNEPI supplementary data was obtained from the Ministry of Health (MOH). In addition, a non-research determination clearance was approved by the U.S. Centers for Disease Control and Prevention (CDC). The investigation was conducted in accordance with applicable U.S. federal regulations governing public health surveillance and data protection (see, for example, *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.*). As this analysis involved routine program and surveillance data and posed no more than minimal risk to participants, written informed consent was not required.

Results

Annual median vaccine wastage rates, Uganda, 2020-2025

Between 2020 and 2025, national BCG wastage had a median of 40.6% (IQR 39.9–44.6), generally below the WHO threshold ≤50% but with variability from 37.6% to 72.5%. Median wastage for MR was 25.9% (IQR 17.3–30.3), frequently exceeding the WHO threshold ≤25% but remaining within the national threshold ≤40% in most years. However, DPT median wastage was 9.2% (IQR 7.7–11.5) with moderate fluctuation, remaining within WHO and national acceptable thresholds. Similarly, OPV median wastage declined from 12.8% in 2020 to 8.0% in 2025, with low variability remaining within acceptable WHO and national thresholds (median 10.0%; IQR 9.4–10.7) (Figure 1).

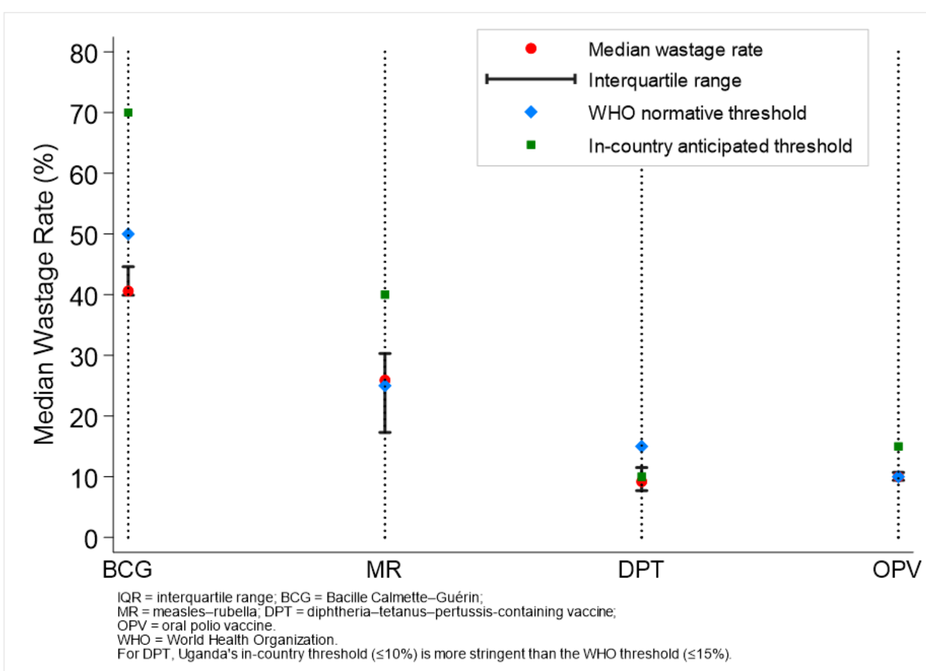

Figure 1: National median vaccine wastage rates compared against World Health Organization and Uganda thresholds, 2020–2025

Continued from page 44

Continued from page 43

Temporal trends in national vaccine wastage of BCG, MR, DPT, and OPV vaccines in, Uganda, 2020–2025

BCG wastage fluctuated markedly, with a non-significant estimated annual increase of 4.1% (95% CI −13%-+21%; p=0.554), and no observed monotonic trend (τ_b=0.07; p=1.000); (Figure 2A). Similarly, MR wastage showed substantial year-to-year variation, with an estimated annual change of +0.9% (95% CI −36.7 to 38.6; p=0.95), and a non-significant monotonic trend (τ_b=−0.07; p=1.000); (Figure 2B). A pronounced increase in BCG and MR wastage observed during 2023–2024 coincide with major programmatic events, including large-scale catch-up vaccination activities and operational adjustments following the introduction of the second dose of measles–rubella vaccine (MR2).

DPT wastage alternated across years, with the largest rise in 2023, before declining in 2024 and 2025; average annual reduction of −7.7% (p=0.52), with a moderate negative monotonic trend (τ_b=−0.60; p=0.13) that didn't reach statistical significance; (Figure 2C). In contrast, OPV wastage declined steadily with an estimated significant annual reduction of −7.6% (p=0.002) fully supported by a significant downward trend (τ_b=−1.00; p=0.008); (Figure 2D).

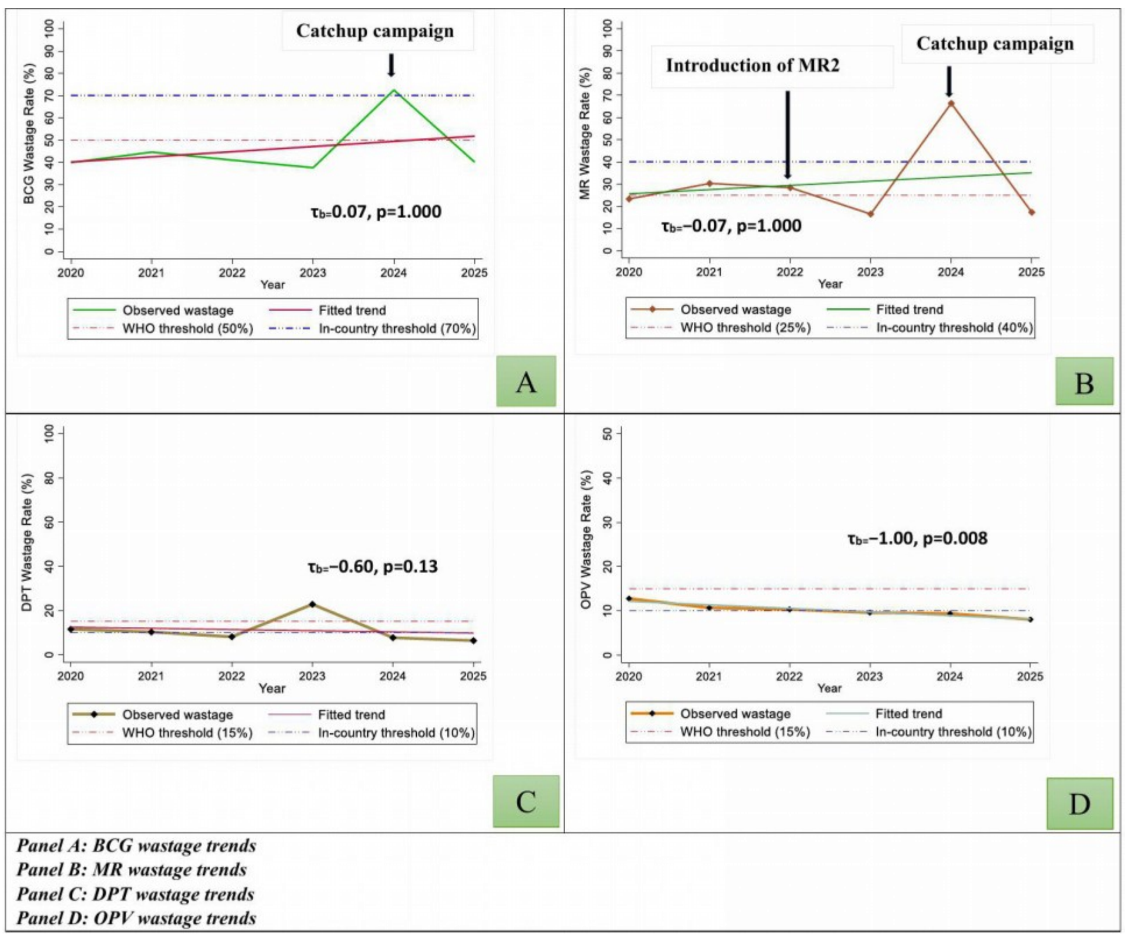

Figure 2: Temporal trends of National median vaccine wastage rates by antigen type, Uganda 2020-2025

Vaccine wastage trends by antigen and health facility category, Uganda, 2020–2025

Wastage was consistently higher at lower-level than higher-level facilities for all four antigens throughout the study period.

OPV wastage at lower-level facilities remained above the WHO threshold for most years despite a significant decline (22.0%-15.5%; APC −9.0%; p=0.019), while higher-level facilities maintained wastage below both thresholds (APC −20.9%; p=0.009). DPT wastage at lower-level facilities exceeded both thresholds for most years but declined from 18.1% to 13.5% (APC −5.9%; p=0.002).Wastage of MR vaccine at lower-level facilities fluctuated between 28.1% and 39.5% with no significant trend. BCG wastage at lower-level facilities approached or exceeded the WHO threshold in several years, peaking at 51.5% in 2024.

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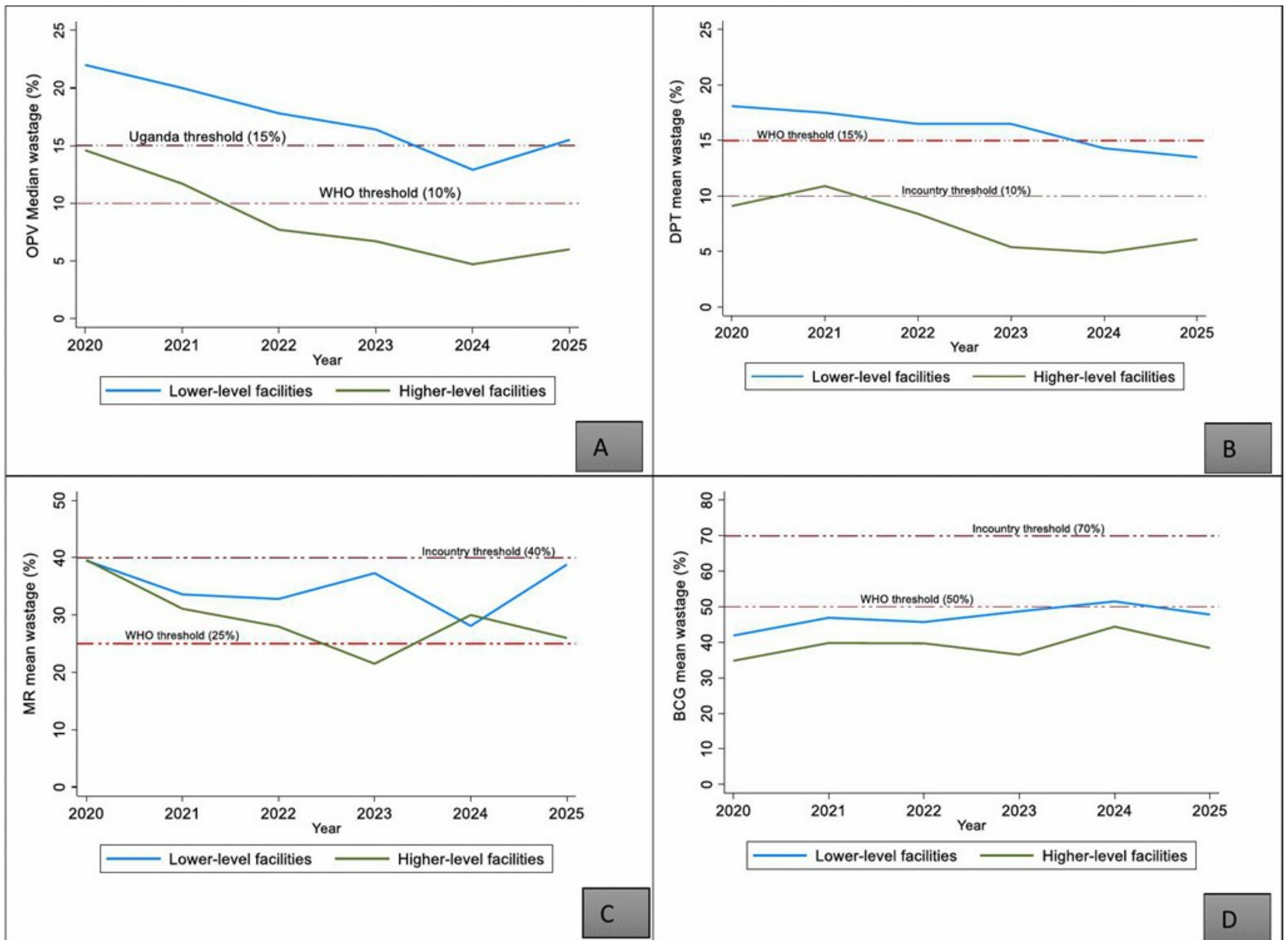

Figure A: Trends in OPV wastage rates by facility category
Figure B: Trends in DPT wastage rates by facility category
Figure C: Trends in MR wastage rates by facility category
Figure D: Trends in BCG wastage rates by facility category

Figure 4: Trends of vaccine wastage rates by antigen across health facility categories in Uganda, 2020–2025

Discussion

Three patterns characterise vaccine wastage in Uganda during 2020–2025. First, wastage declined most for OPV, consistent with better utilisation of MDVP-eligible liquid vaccines whose open vials can be retained across sessions if labelling and cold-chain conditions are met. Second, BCG, and MR, both lyophilised vaccines requiring discard shortly after reconstitution, showed greater year-to-year variability and remained harder to optimise. Third, wastage was persistently higher at lower-level facilities, where smaller session sizes and less predictable attendance amplify open-vial losses.

The 2023–2024 spike in BCG and MR wastage, coinciding with catch-up campaigns and MR2 introduction, illustrates the programme's vulnerability to operational shocks; campaign pre-positioning can result in under-attended sessions, and new vaccine introductions typically involve transitional wastage as quantification and demand-generation systems adjust (7–9) . The subsequent recovery in 2025 suggests system resilience but highlights the need for real-time monitoring to detect and correct abrupt deviations.

The facility-level gradient should not be interpreted solely as poor performance at lower levels. These facilities serve smaller catchment populations, conduct smaller sessions, and provide outreach services where attendance is less predictable(5,6,10,11).
A uniform national wastage target may therefore obscure important operational differences. For low-volume facilities, the realistic goal is reducing avoidable wastage while protecting access and timeliness. Piloting smaller vial presentations for BCG and MR at peripheral facilities, combined with session microplanning and demand aggregation, represents the most actionable approach to reducing open-vial losses at this level.

Continued from page 46

Continued from page 45

Study limitations: This analysis relied on routinely reported DHIS2 data, which may contain errors. Mitigation included range checks, consistency assessments, and triangulation with findings from the Effective Vaccine Monitoring reports. Annual aggregated data limited assessment of seasonal or session-level determinants. Unmeasured factors; supervision intensity, health worker turnover, and campaign activity, could confound observed trends.

Conclusion: Between 2020 and 2025, national vaccine wastage trends in Uganda diverged by antigen type and facility level. Oral Polio Vaccine was the only antigen that demonstrated a statistically significant downward and remaining within both WHO and Uganda planning thresholds for most of the study period. DPT similarly maintained low median wastage within acceptable thresholds, although its decline did not reach statistical significance. In contrast, BCG and MR, showed substantial year-to-year variability with no significant monotonic trends. BCG generally remained below the WHO threshold (≤50%), while MR frequently exceeded the WHO threshold (≤25%), though it remained within Uganda's national planning threshold (≤40%) in most years. Wastage was consistently higher at lower-level facilities (HC II and HC III) across all four antigens throughout the study period. To reduce avoidable open-vial losses, priority actions include strengthening session microplanning and MDVP adherence at lower- level facilities, exploring smaller vial presentations for BCG and MR at peripheral sites, and updating vaccine quantification assumptions to reflect the structural facility-level gradient and the sustained decline in OPV wastage documented in this analysis.

Conflict of interest: The authors declare no competing interests Acknowledgements: We acknowledge the Ministry of Health through the Uganda Expanded Program on Immunisation (UNEPI), and the Uganda Public Health Fellowship Program for their technical guidance and funding support.

Authors' contributions: SN conceptualized the study, led data collection and analysis, and drafted the manuscript. CA, RM, PS YN, CL and EOO supported data analysis and technical review of the draft manuscript. CA, RM, LB and BK supported revision of the first manuscript draft. NM, YN, PS and FN contributed to tool development, and data quality assurance. CA, ARA and RM, provided technical input during the study design and data interpretation. All authors read and approved the final manuscript.

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Continued from page 48

Continued from page 47

Uptake of the second dose of measles-rubella vaccine among children aged 18–23 months in Uganda, August, 2024

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Summary

Background: Uganda introduced the second dose of measles-rubella vaccine (MR2) in 2022 to strengthen protection in the second year of life, but routine coverage has remained low. A national survey was conducted to estimate MR2 coverage and identify factors associated with uptake among children aged 18–23 months in Uganda.
Methods: We conducted a nationally representative, two-stage stratified cluster household survey in Uganda's four regions. Caregivers of eligible children were interviewed using a structured electronic questionnaire, and MR2 status was verified from vaccination cards. Weighted estimates were calculated, and modified Poisson regression was used to assess factors associated with uptake.
Results: Among 750 children, national MR2 coverage was 32.0% (95% CI: 25.5–38.7), with marked regional differences. Coverage was highest in the Northern region (41.4%) and lowest in the Eastern region (22.0%), while the Western and Central regions recorded 34.5% and 27.6%, respectively. Several factors were associated with MR2 uptake. First-born children were more likely to be vaccinated than children of higher birth order (aPR=1.7; 95% CI: 1.1–2.6; p=0.02), and children in households with two or more eligible children had higher uptake than those in households with only one eligible child (aPR=2.4; 95% CI: 1.4–4.1; p=0.002). In contrast, caregiver-reported adverse events following immunization (aPR=0.4; 95% CI: 0.2–0.7), and dissatisfaction with vaccination services (aPR=0.2; 95% CI: 0.06–0.5) were associated with lower MR2 uptake.
Conclusions: MR2 coverage in Uganda remains far below the level (>95%) needed for measles and rubella elimination. Improving uptake will require stronger second-year-of-life vaccination strategies, better follow-up of eligible children, improved caregiver communication on vaccine safety, and better client experience at vaccination sites.

Background

Although one dose of measles-rubella (MR) vaccine prevents most infections, up to 15% of children may remain susceptible, particularly in high-transmission settings(1,2). To support measles elimination, WHO recommends two MR doses, with MR1 at 9 months and MR2 at 15–18 months, and global targets call for at least 95% coverage with two measles-containing vaccine doses in every district by 2030(3,4).

However, despite improvements in MR1 coverage in Uganda, MR2 uptake remains low. Uganda introduced MR2 into the routine immunization schedule in 2022 for children aged 18 months, but HMIS data showed a decline in MR2 coverage from 49% in 2022 to 21% in 2023, while MR1 coverage increased from 83% in 2013 to 93% in 2023(5–7). This widening gap highlights persistent weaknesses in second-year-of-life immunization delivery, including reduced caregiver engagement after infancy, weak defaulter tracking, limited reminders, concerns about adverse events following immunization, socio-cultural influences, regional inequities, inconsistent outreach, and low caregiver awareness of 2YL immunization schedules(8–11) Because determinants of MR2 uptake remain poorly characterized, particularly using behavioural frameworks such as the Behavioural and Social Drivers model, we conducted a cross-sectional household survey among children aged 18–23 months in Uganda during August–September 2024 to estimate MR2 coverage and identify factors associated with uptake.

Continued from page 48

Methods

We conducted a cross-sectional household survey in August–September 2024 across 15 districts in Uganda's four regions informed by selected enumeration areas to generate nationally representative estimates and assess regional variation in MR2 uptake. The study included children aged 18–23 months and their primary caregivers who had lived in the selected areas for at least six months; only children with vaccination cards were enrolled to allow objective verification of MR2 status.

A two-stage stratified cluster sampling design was used: 165 enumeration areas were selected proportional to population size from the Uganda Bureau of Statistics sampling frame, after which households were systematically sampled, and one eligible child was randomly selected per household using a lottery method. The minimum sample size was 750 children, based on an assumed MR2 coverage of 30%, 5% margin of error, 95% confidence level, design effect of 2.25, and 10% non-response allowance. Data were collected using a structured electronic questionnaire in KoboCollect adapted from the WHO vaccination cluster survey manual (12) and informed by the BeSD framework(13). The tool captured socio-demographic, household, health service, and behavioural factors, and was translated into Local languages, back-translated, and pilot-tested before use. Uptake of MR2was the outcome variable. Associations with potential determinants were assessed in Stata version 17 using weighted modified Poisson regression with robust standard errors, accounting for clustering and non-response. Sampling weights were derived as the inverse of the selection probabilities at EA and household levels and were adjusted for non-response.

This study was a secondary analysis of data collected through a national vaccination coverage survey conducted by the Uganda Ministry of Health and partners. The parent survey was administratively cleared by the Ministry of Health, and the U.S. Centers for Disease Control and Prevention determined the activity to be non-research public health practice. Participation was voluntary, written informed consent was obtained from all caregivers before participation, interviews were conducted in private settings, and all data were de-identified and securely stored to protect participant confidentiality.

Results

Characteristics of study participants

A total of 750 children aged 18–23 months and their primary caregivers were included in the study. The median age of children was 20 months (interquartile range [IQR] 19-22 months). Most children (70%; 544) were born in health facilities, and 566 (79%) received vaccinations at static health facility sessions. Public health facilities administered 86% of the vaccinations. Caregivers were predominantly female (93%; 702) and had a median age of 28 years (IQR 24-34). Nearly all (93%; 684) were the parents of the child.

National and Regional Measles Rubella 2 vaccine Uptake, Uganda, August 2024
The overall MR2 vaccine coverage was 32.0% (95% CI: 25.5–38.7). Coverage varied by region: Northern (41.4%, 95% CI: 29.6–54.2), Central (27.6%, 95% CI: 19.3–37.7), Western (34.5%, 95% CI: 23.3–47.8), and Eastern Uganda (22.0%, 95% CI: 14.6–31.8).

Factors associated with Measles Rubella 2 Vaccine uptake, Uganda, August 2024
In the adjusted multivariable analysis (Table 1), children whose caregivers were female had a lower prevalence of MR2 uptake compared with male caregivers (aPR=0.4; 95% CI: 0.4–0.9; p=0.01). Uptake was higher among first-born children (aPR=1.7; 95% CI: 1.1–2.6; p=0.02) and second-born children (aPR=1.5; 95% CI: 1.0–2.2; p=0.04), than children of fourth or higher birth order. Children from households with two or more eligible children had higher MR2 uptake than those from households with one eligible child (aPR=2.4; 95% CI: 1.4–4.1; p=0.002).). Increasing age modestly increased MR2 uptake (aPR=1.1; 95% CI: 1.0–1.2; p=0.04). A history of adverse events following immunization (AEFIs) was significantly associated with lower MR2 uptake (aPR=0.4; 95% CI: 0.2–0.7; p=0.002), as was caregiver dissatisfaction with vaccination services (aPR=0.2; 95% CI: 0.06–0.5; p=0.001).

Continued from page 50

Continued from page 49

Table 1: Factors associated with uptake of the second dose of measles–rubella vaccine among children aged 18–23 months, Uganda, August 2024

Variable	cPR (95%CI)	P-Value	aPR (95%CI)	P-value
Sex of caregiver				
Female	0.5 (0.4-0.8)	0.006	0.6 (0.4-0.9)	0.01
Male	Reference		Reference	
Age of the child				
18-23 months	1.1 (0.9-1.2)	0.08	1.1(1.0-1.2)	0.04
Birth order				
First born	1.7 (1.1-2.7)	0.03	1.7 (1.1-2.6)	0.02
2nd -3rd born	1.4 (0.9-2.2)	0.08	1.5(1.0-2.2)	0.04
4th or higher	Reference		Reference	
Number of eligible children in care				
Two or more	2.0 (1.2-3.4)	0.009	2.4 (1.4-4.1)	0.002
1 eligible child	Reference		Reference	
History of AEFIs**				
Yes	0.5 (0.3-0.9)	0.01	0.4 (0.2-0.7)	0.002
No	Reference		Reference	
Confidence in vaccine benefits				
Not confident	0.1 (0.02-0.8)	0.03	0.2 (0.03-1.9)	0.18
Confident	Reference		Reference	
Satisfaction with vaccination services				
Not satisfied	0.2 (0.05-0.5)	0.002	0.2 (0.06-0.5)	**0.001**
satisfied	Reference		Reference	

*****AEFI-Adverse events following immunisation***
PR = prevalence ratio; CI = confidence interval
aPRs were estimated using modified Poisson regression with robust standard errors
All models accounted for survey weights and clustering at enumeration area level

Discussion

Uptake of the second dose of MR vaccine among children aged 18–23 months in Uganda remains critically low, with coverage far below the level needed to interrupt measles transmission.

The large gap between MR1 coverage and MR2 uptake suggests that the health system is able to deliver infant vaccines but is less effective in sustaining vaccination into the second year of life. Regional disparities with lower uptake in the Eastern region and higher uptake in the Northern region, point to persistent inequities in access, outreach, and service delivery. This pattern is consistent with evidence from Uganda and other sub-Saharan African settings showing that missed opportunities, weak follow-up, and limited caregiver awareness continue to undermine completion of later-dose vaccine (7,14,15).

Birth order influenced MR2 uptake, with first-born children 70% more likely to receive MR2 than children of fourth and higher birth order. This aligns with global literature showing that later-born children often experience “resource dilution,” in which increased family responsibilities and logistical constraints reduce caregivers’ ability to complete multi-dose schedules (16–18). Additionally, parents may perceive firstborns as more vulnerable, prompting stricter adherence to recommended health behaviours, including immunization. Such challenges are especially pronounced for MR2, which requires a deliberate return visit during the 2YL. Conversely, children from households with multiple eligible children at survey time were more likely to receive MR2, possibly due to more frequent health system contact and synchronized care-seeking during child health days, outreach sessions, or under-five clinics (18–21).

Children whose caregivers reported previous AEFIs were 59% less likely to receive MR2, highlighting the powerful influence of real, perceived, or rumor-driven safety concerns on vaccination behaviour. Evidence consistently shows that fear of side effects is one of the strongest predictors of missed or delayed immunization, particularly for second or subsequent doses (18,22–24). Similarly, caregiver dissatisfaction with vaccination services was strongly associated with lower MR2 uptake, reflecting the critical importance of service quality, long waiting times, vaccine stock-outs, poor interpersonal interactions, and inadequate communication, all of which undermine trust and reduce the likelihood of returning for 2YL vaccines(9,11).

Continued from page 50

Study strength and limitations: This study's main strength was verification of MR2 status using child health cards, which improved accuracy and reduced recall bias. However, excluding children without cards may have introduced selection bias and limited generalizability. Other limitations included possible recall and social desirability bias in caregiver-reported AEFIs and service satisfaction, the inability of the cross-sectional design to establish causality and the absence of qualitative data to explain caregiver's experiences and decisions in greater depth.

Conclusion: Uptake of the second dose of measles-rubella vaccine in Uganda remains critically low, with substantial regional variations, highlighting persistent gaps in second-year-of-life immunization despite high MR1 coverage. Key determinants, including caregiver gender, birth order, household composition, prior AEFIs, and service dissatisfaction highlight the multifaceted barriers to timely completion of the second dose. Strengthening 2YL programming may require context-specific, household- and gender-responsive interventions, including enhanced caregiver education and engagement, improved service quality, strengthened AEFI surveillance and risk communication. Addressing these determinants could contribute to reducing immunity gaps, improving completion of the immunization schedule, and supporting progress toward national and global measles and rubella elimination targets.

Conflict of interest: The authors declare no competing interests.

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Authors' contributions: SN conceptualized the study, led data collection and analysis, and drafted the article. YN, AMN, NM supported data analysis and technical review of the draft article .PA, NM, AMN, CA, and EOO supported revision of the first article draft. RM, YN, NM, and AMN contributed to tool development, field coordination, and data quality assurance. RM, BK, CA and YN provided technical input during the study design and data interpretation. YN, BK and RM supervised the study and reviewed the article for critical intellectual content. All authors read and approved the final article.

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Continued from page 51

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Measles outbreak linked to burial gatherings and household crowding in Amolatar District, Uganda, November 2025–February 2026

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Summary

Background: In February 2026, Amolatar District in Northern Uganda reported a measles outbreak among children admitted into high-volume health facilities. We investigated to determine the magnitude of the outbreak, identify risk factors for infection, and assess vaccination coverage to recommend control measures.

Methods: We defined a suspected case as fever and maculopapular rash with ≥1 of cough, coryza, or conjunctivitis in an Amolatar District resident from November 1, 2025–February 20, 2026. A confirmed case was a suspected case with a positive measles-specific IgM test. Cases were identified through medical records review and active community search. We calculated attack rates (AR) by age, sex, and subcounty. We conducted an unmatched case-control study (1:3) and used logistic regression to identify risk factors. Controls were community-based and randomly selected from the same sub-counties as the cases. We estimated vaccination coverage (VC) using the proportion of vaccinated controls.

Results: We identified 120 cases (5 confirmed, 115 suspected); 75(63%) were female. Children aged 9–17 months (AR:360/100,000), females (AR:79/100,000), and Akwon Subcounty (AR:690/100,000) were most affected. The outbreak was propagated following a burial with peaks in November 2025 and January–February 2026. In a case-control analysis (87 cases and 261 controls), 44(51%) of cases and 176(67%) controls had received at least one dose of measles vaccine, while 23(26%) cases and 113(43%) controls had received both doses. Attending burial ceremonies (aOR=2.41;95%CI:1.21–4.78) and household crowding (aOR=3.38;95% CI:1.85–6.17) increased the odds of infection. Vaccination with one dose was protective (aOR=0.50; 95%CI:0.28–0.88) with a coverage of 67%.

Conclusion: Attending burial ceremonies, household crowding, and low vaccination coverage fueled measles transmission. Mass vaccination to increase coverage and strengthen surveillance and risk communication during social gatherings could prevent similar future outbreaks.

Introduction

Measles is a highly contagious, vaccine-preventable disease caused by the measles virus. [1]. It spreads primarily through inhalation of respiratory droplets or direct contact with an infected individual [2]. Due to its high transmissibility, where a single infected person can transmit the virus to 12–18 susceptible individuals, measles poses a significant public health threat, especially in areas with low immunisation coverage [3]. The disease has an incubation period of 7–21 days and presents with a characteristic maculopapular rash, fever, cough, coryza (runny nose), and conjunctivitis [4]. In severe cases, patients may develop complications such as corneal ulcers (wounds in the black spot of the eye), otitis media (ear discharge), and pneumonia (difficulty in breathing) [5].

Continued to page 54

Continued from page 53

Globally, measles remains one of the leading causes of death among young children, with over 95% of measles-related fatalities occurring in developing countries [6]. The disease can be effectively prevented through the Measles-Rubella (MR) vaccine, which in Uganda is administered in two doses at 9 and 18 months of age [7]. The World Health Organisation (WHO) recommends at least 95% vaccination coverage to establish herd immunity and interrupt transmission [8]. Additionally, timely isolation of suspected and confirmed cases is critical to curbing the spread of the virus [9].

In February 2026, measles emerged as a critical public health threat in Amolatar District, Uganda, when the Uganda Virus Research Institute (UVRI) confirmed an outbreak in the sub-counties of Akwon, Muntu, and Arwotcek following laboratory confirmation of five suspected cases. We estimated the magnitude, identified the source of the outbreak, assessed risk factors for transmission, established the vaccination coverage and vaccine effectiveness, and recommended evidence-based control and prevention measures.

Methods

We investigated in Amolatar District in Lango sub-region, Northern Uganda (Figure 1). The district comprises thirteen (13) sub-counties and two (2) town councils. However, Muntu and Akwon sub-counties lacked vaccination health facilities. The investigation was conducted in Akwon and Muntu Subcounties, the areas most affected by the measles outbreak.

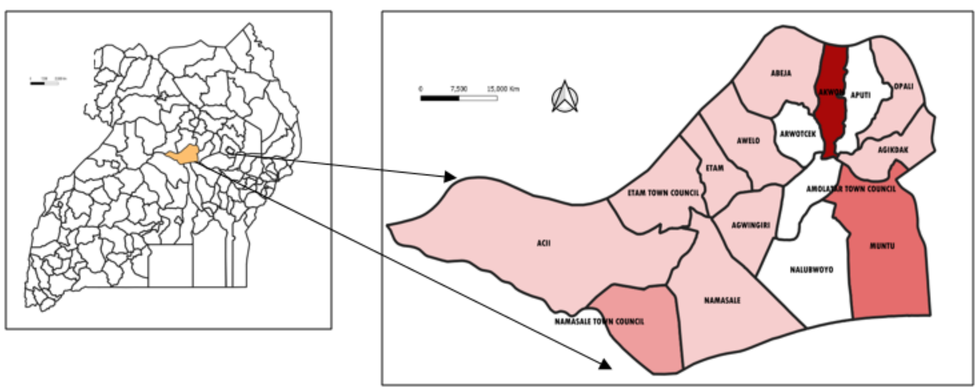

Figure 1: Affected sub-counties and town councils, Amolatar District, Uganda

We defined a suspected case as onset of fever and maculopapular rash plus ≥1 of the following symptoms cough, coryza (runny nose), or conjunctivitis (red eyes), in a resident of Amolatar District from November 1, 2025–February 20, 2026; and a confirmed case was as a suspected case with laboratory confirmation of measles-specific IgM antibodies in a resident Amolatar District from November 1, 2025–February 20, 2026. We line-listed suspected cases by reviewing health facility records. We used standard case investigation forms to collect data on patients' demographics, clinical characteristics, vaccination status, exposure history, and treatment and admission history.

We constructed an epidemic curve to determine the distribution of measles cases over time. We computed Attack Rates (AR) by person and place, using projected populations from Uganda Bureau of Statistics (UBOS) as the denominator. We described AR by place, depicting it on maps using Quantum Geographic Information System (QGIS).

We conducted 15 hypothesis-generating interviews with case patients using the measles investigation form. We asked caregivers about potential sources of exposure and interviewed the District Health Team (DHT) about these factors. We conducted an unmatched case-control study to evaluate the hypotheses generated. We recruited 87 case patients and 3 controls per case. We identified factors associated with measles using logistic regression.

We estimated VC using the percentage of controls with a history of measles in the case-control study, assuming that the controls were representative of the general population. We calculated VE using the formula: VE = (1 − aOR) × 100%, where aOR is the adjusted odds ratio for having received at least one dose of measles vaccine, estimated by conditional logistic regression and adjusted for risk factors significant in the univariate analysis. The Ministry of Health of Uganda issued a directive and approved the investigation of this outbreak. The office of the Associate Director for Science at the US Centres for Disease Control and Prevention (CDC), Uganda, determined that this research

Continued from page 54

did not involve human subject research and that its primary intent was public health practice or disease control. Verbal consent was obtained from participants or, if the interviewee was a minor, from their guardians before the start of the interview.

Results
Descriptive epidemiology

We identified 120 cases (86 suspected, 29 probable, and 5 confirmed), with no deaths. The epidemic curve shows a propagated pattern with multiple peaks (Figure 2). The outbreak began in Akwon Sub-County in November 2025 and progressively spread to other sub-counties, with sustained person-to-person transmission peaking in early February 2026.

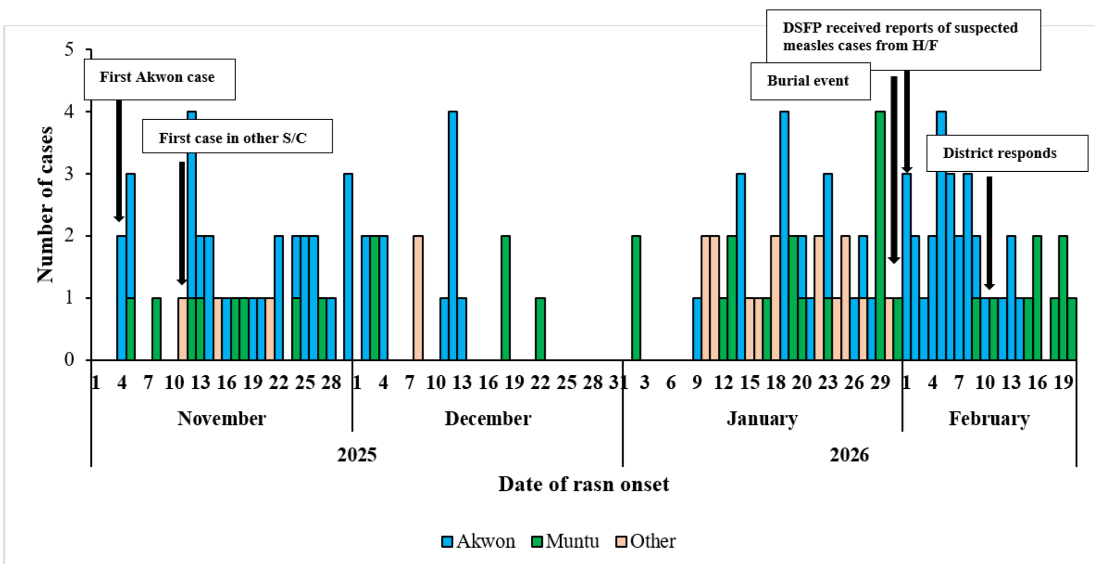

Figure 2: Distribution of case-patients by date of fever onset, during a measles outbreak, Amolatar District, Uganda, November 2025–February 2026, (n=120)

All cases presented with fever and generalised rash. Additionally, 86/120 (72%) had coryza, 85/120 (71%) had cough, 42/120 (35%) had conjunctivitis, and 3/120 (3%) had diarrhoea. The attack rate was higher among females (79/100,000) compared to males (49/100,000). By age group, the highest attack rate was observed in children aged 9–17 months (360/100,000), followed by those aged 0–8 months (167/100,000) and 18–59 months (159/100,000). The attack rate declined steadily with increasing age, with the lowest among individuals aged 15 years and older (22/100,000). Overall, the attack rate was 64/100,000 across both sexes and age groups. Attack rates varied across Amolatar District, with Akwon Sub-County recording the highest at 690/100,000, followed by Muntu Sub-county at 120/100,000 (Figure 3).

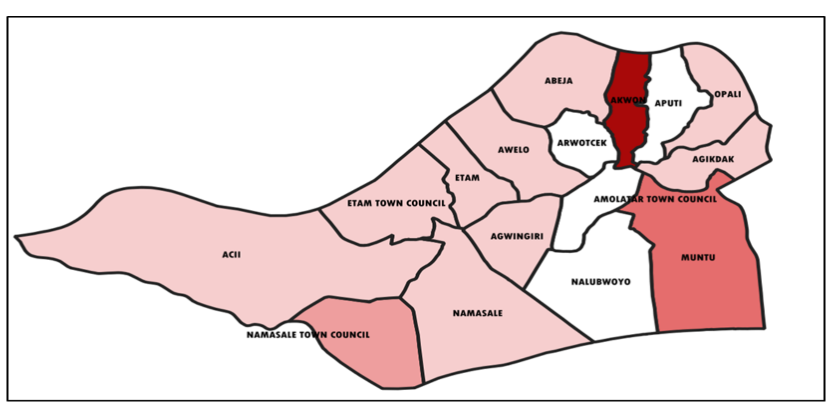

Figure 3: Attack Rate (per 10,000) by Sub- County of residence during a measles outbreak, Amolatar District, Uganda, November 2025–February 2026, (n=120)

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Hypothesis generation and case-control study findings
Of the 87 cases interviewed, 44 (50%) were not vaccinated, 43 (50%) hadn't received any measles vaccine, and 40 (57%) had a symptomatic case patient.

Risk factors for measles infection during an outbreak, Amolatar District, Uganda

Receipt of one measles-rubella vaccine dose was independently protective against measles infection (aOR=0.48; 95%CI:0.26–0.89; p=0.019), corresponding to approximately 52% lower odds of infection. Household exposure remained a significant risk factor for measles transmission, with individuals reporting a household member with measles having more than three times higher odds of infection compared to those without household exposure (aOR=3.38;95% CI:1.85–6.17; p<0.001) (Table 1).

Table 1: Risk factors for measles outbreak in Muntu and Akwon sub-counties, Amolatar District, Uganda, November 2025–February 2026 (n=261)

Risk factor	Number (% exposed)		cOR (95% CI)	p-value	aOR (95% CI)	p-value
	Cases n	Controls n				
Attending school						
No	72 (82.8)	230 (88.1)	Ref	–	Ref	–
Yes	15 (17.2)	31 (11.9)	1.54(0.78–3.02)	0.20	1.28 (0.60–2.73)	0.52
Visited social						
No	63 (72.4)	232 (88.9)	Ref	–	Ref	–
Yes	24 (27.6)	29 (11.1)	3.05(1.65–5.60)	<0.001	2.41 (1.21–4.78)	0.012
Household member with measles						
No	49 (56.3)	220 (84.3)	Ref	–	Ref	–
Yes	38 (43.7)	41 (15.7)	4.16(2.41–7.18)	<0.001	3.38 (1.85–6.17)	<0.001
Measles vac-						
No	43 (49.4)	85 (32.6)	Ref	–	Ref	
Yes	44 (50.6)	176 (67.4)	0.49(0.30–0.79)	0.004	0.50 (0.28–0.88)	0.0016
Measles vaccination (MR doses)						
No dose	43 (49.4)	85 (32.6)	Ref	–	Ref	–
One dose	23 (26.4)	113 (43.3)	0.40(0.22–0.71)	0.002	0.48 (0.26–0.89)	0.019
Two doses	21 (24.1)	63 (24.1)	0.66(0.35–1.21)	0.20	0.72 (0.38–1.36)	0.31

Measles vaccine coverage and vaccine effectiveness

The estimated VE was 50% (95%CI= 12%-72%). The estimated VC based on the percentage of controls with a history of measles vaccination was 67%.

Discussion
Children aged 9-17months and females were most affected during the outbreak. Attendance at social gatherings and household exposure were associated with measles

Continued from page 56

infection, while receipt of measles-containing vaccine was protective. These findings are consistent with the well-established epidemiology of measles and highlight the role of close-contact exposure and immunity gaps in facilitating transmission. Household exposure was the leading risk factor for measles infection in this investigation. This is consistent with the high transmissibility of measles in close-contact settings [10, 11]. The concentration of cases within households reflects sustained airborne exposure when infectious and susceptible individuals share living space over prolonged periods.

Social gatherings and community events were significant settings for transmission. Crowding increased contact between infectious and susceptible individuals[9]. In populations with incomplete vaccination coverage and herd immunity thresholds not met, even brief exposures in congregate settings can initiate chains of transmission that extend well beyond the initial event.

A large proportion of cases occurred in unvaccinated children, highlighting the role of measles vaccination. With one dose approximately 93% effective and two doses approximately 97% effective, the accumulation of unvaccinated children across successive birth cohorts creates susceptible pools that sustain and amplify outbreaks once measles is introduced into the community [12]. The observed vaccination coverage was below the level required for herd immunity, suggesting immunity gaps in affected communities. These gaps may have resulted from missed vaccination opportunities, barriers to access, or weaknesses in the routine immunisation system, particularly poor documentation and incomplete vaccination records [13]. This made it difficult to identify and follow up children who had missed doses, allowing susceptible individuals to accumulate over time.

School attendance was not a significant risk factor in this outbreak, indicating transmission was primarily community-based rather than school-driven. This aligns with evidence from other settings where uneven vaccination coverage creates immunity gaps at the community level, favouring community transmission over institutional amplification [14]. The absence of a school-based signal suggests susceptibility was distributed broadly across households and community spaces rather than concentrated in any single institutional setting.

Study limitations: This study had several limitations. Recall and information may have affected the accuracy of reported exposures and vaccination histories, potentially misclassifying cases and influencing estimated associations. Residual confounding from unmeasured factors such as population mobility and contact patterns, as well as possible selection bias in control recruitment, are additional limitations. Finally, findings are specific to Muntu and Akwon sub-counties and may not be generalizable to other settings.

Conclusion: The measles outbreak in Muntu and Akwon sub-counties was primarily driven by immunity gaps, delayed detection, and weaknesses in surveillance and reporting systems. Household exposure and social gatherings facilitated transmission, while measles vaccination provided protection, although vaccine effectiveness appeared lower than expected. The findings underscore the need to strengthen routine immunisation, improve surveillance and early case detection close immunity gaps and prevent future outbreaks.

Recommendations: Strengthening routine immunisation through targeted outreach, improved service delivery, and effective defaulter tracking is essential to close immunity gaps. Enhanced community engagement, early case detection, prompt isolation, risk communication, and strengthened preparedness, coordination, rapid response, and infection prevention measures are critical for reducing transmission and improving outbreak control.

Public health actions: Suspected measles cases were managed at health facilities, while infection prevention and control measures, risk communication, and community sensitisation activities were strengthened in affected sub-counties. The district implemented targeted vaccination and outreach services to improve coverage among unvaccinated and under-immunised children. Surveillance and outbreak response were enhanced through mentorship of health workers and activation of the District Task Force, which supported timely confirmation and response.

Conflict of interest: The authors declared no conflict of interest.

Continues to page 58

Continued from page 57

Author contribution: MDN conceptualised the study, led data collection and analysis, and drafted the article. SN and MM supported data analysis and technical review of the draft article. MDN and PE supported the revision of the first draft of the bulletin. MDN contributed to tool development, field coordination, and data quality assurance. RM and BKprovided technical input during the study design and data interpretation. All authors read and approved the final bulletin.

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Continued from page 58

Investigation of a cross-district measles outbreak in Nwoya District, Uganda, December, 2025–February, 2026

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Summary

Background: Measles is a major cause of vaccine-preventable morbidity and mortality in children. On February 5, 2026, the Uganda Ministry of Health was notified of a measles outbreak among residents in Nwoya District. We investigated to estimate the magnitude of the outbreak and risk factors for transmission to inform control and prevention measures.

Methods: We defined a suspected case as fever and maculopapular rash with ⩾1 of cough, coryza, or conjunctivitis in a resident of Nwoya District from December 16, 2025–February 18, 2026. A confirmed case was a suspected case that had a positive measles IgM test. Cases were identified through health facility records review and active community search. We calculated attack rates (AR) by sub-county, sex, and age group. We conducted an unmatched case-control study (1:3) to identify risk factors for transmission. We also estimated vaccine effectiveness (VE) and vaccination coverage (VC).

Results: We identified 100 cases (95 suspected, 5 confirmed) with no deaths. The index case was a 17-year-old male returning from Amuru District, who was experiencing a concurrent measles outbreak. Overall AR was 145/100,000 population. The most affected areas were Koch-Goma Town Council (381/100,000 and Lii Sub-county (154/100,000), with the highest AR among children aged 9–59 months (165/100,000). Receiving at least one MR dose (aOR=0.25: 95%CI=0.11–0.55) and staying at home (aOR=0.05:95%CI: 0.0070–0.34) were protective. Travel to Nwoya District (aOR=5.2:95%CI=1.5–19), receiving visitors from neighbouring districts (aOR=5.1:95 CI=1.7–15), and crowding around swamp water (aOR=18:95%CI=2.7–118) increased risk. Vaccine Coverage was 64% (96/150), and VE was 75%.

Conclusion: The outbreak was likely from a spillover from neighbouring districts propagated by low VC, crowding around swamps, and the reception of visitors. We recommend increasing the number of outreach vaccinations and household screening of visitors through community engagement. Avoiding crowding and strengthening cross-district disease surveillance and coordination mechanisms to improve detection and response timeliness.

Background

Measles is a highly transmissible, vaccine-preventable viral disease caused by the measles virus (1). It is transmitted primarily through respiratory droplets or direct contact with an infected person. Without vaccination, >90% of individuals can get infected before their 10th birthday(1). The incubation period of measles is 7–21 days (2). Its typical symptoms are high-grade fever, cough, coryza (runny nose), and conjunctivitis with maculopapular rash (1). Complications of measles include diarrhea, otitis media, corneal ulceration, pneumonia, and death(3). Measles remains a major cause of morbidity and mortality, particularly among children under five years of age. Vaccination, being one of the most effective strategies, averted about 60 million deaths in 2000–2023 (4).

Continues to page 60

Continued from page 59

In Uganda, the first dose of the Measles Rubella Vaccine has remained suboptimally low at 85% despite efforts to reach every district and child by the Uganda National Expanded Programme on Immunization (5). Hence, Uganda has continued to experience outbreaks due to immunity gaps. On February 5, 2026, a measles outbreak was reported in Nwoya District, Uganda, following confirmation by the Uganda Virus Research Institute (UVRI) in Lii Sub-county, Nwoya District. We estimated the magnitude of the outbreak and identified risk factors for transmission to inform control and prevention measures.

Methods

Nwoya District, is located in Acholi Region, Uganda. The district has an estimated population of 220,593, with 11 sub-counties, 44 parishes, and 124 villages. The outbreak primarily affected the Koch-Goma Town Council and Lii Sub-county with a total population of 108,032.

We defined a suspected case as the onset of fever and maculopapular rash plus ≥1 of the following symptoms: cough, coryza (runny nose), or conjunctivitis (red eyes), in a resident of Nwoya District from December 16, 2025–February 18, 2026; and a confirmed measles case was defined as a suspected case with laboratory confirmation of measles-specific IgM antibodies. We reviewed records and line-listed cases from Koch-Lii HC III, Koch-Goma HC III, Todora HC III, Anaka General Hospital, and Goro Medical Center in Nwoya District. Data on their demographics, clinical characteristics, vaccination status, exposure history, vitamin A supplementation, and outcome were collected. We conducted active case search through household visits and community register reviews. Immunization records were also reviewed. Blood samples from the first five suspected case-patients were tested for measles IgM antibodies.

We generated attack rates (AR) by age, sex, and sub-county. We drew choropleth maps using QGIS to illustrate attack rates by Sub-county. We described cases by time of symptom onset using an epidemiological curve. Hypothesis-generating interviews were conducted among 20 case-patients to identify potential exposures associated with infection, including vaccination status, recent arrival into the area, attendance at gatherings, contact with symptomatic persons at health facilities, and use of communal water points. We conducted an unmatched case-control study with 50 cases and 150 controls (1:3 ratio) to identify the risk factors for transmission. We defined a control as a resident of Koch Goma or Koch Lii Sub-counties, with no history of fever nor rash from December, 01 2025 to February 18, 2026. Vaccine coverage was estimated using vaccination status among controls, while VE was calculated as VE = (1 − aOR) × 100%.

The outbreak investigation was conducted as part of the public health emergency response and was classified as non-research/public health practice by the Uganda Ministry of Health and the US CDC. It was approved and reviewed by the US CDC in accordance with applicable federal laws, CDC policy, and the Declaration of Helsinki. Informed consent was obtained from participants aged ≥18 years, whereas parental/guardian consent and participant assent were obtained for those under 18 years.

Results

Descriptive epidemiology

We identified 100 case-patients (95 suspected, 5 confirmed, and no deaths). The overall attack rate was 45/100,000 population. All the cases were Ugandan nationals. The majority of cases were females (n=56, 54%) with an AR of 50/100,000 population (Table 1). Most (54%) case-patients were aged 9-59 months and were the most affected (AR 165/100,000 population). All cases presented with a fever and a rash followed by cough (92%) and coryza (90%).

Continued from page 60

Table 1: Attack rate by sex and age per 100,000 population December, 2025–February, 2026 (n=100)

Category	No. of cases	Population at risk	Attack rates per
Sex			
Male	44	107,748	41
Female	56	112,845	50
Overall	100	220,593	45
Age			
<6months	5	6,838	73
6-8months	8	5,735	140
9-59months	54	32,648	165
5-15years	25	47,207	53
≥15 years	8	127,944	6
Overall	100	220,593	45

Among the Sub-counties that reported cases, Koch-Goma Town Council was the most affected with an AR of 381cases/100,000 population, followed by Lii with 154/100,000 (Figure 1).

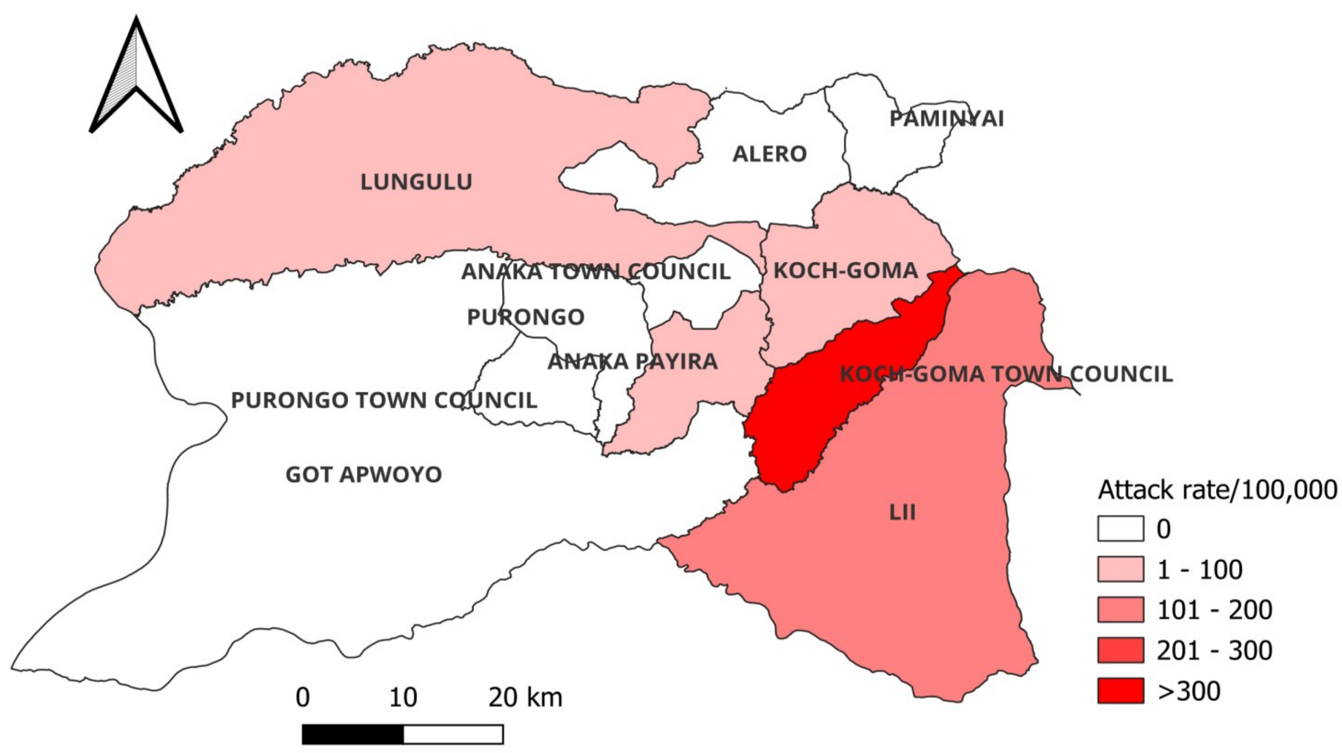

Figure 1: Measles attack rate by Sub-counties during an outbreak, Nwoya District December, 2025-February 2026 (n=100)

The epidemic curve indicated a propagated outbreak with peaks on January 24 and February 12, 2026, suggesting person-to-person transmission. The outbreak began in early January and persisted for over a month, likely fueled by movement from neighboring districts experiencing measles outbreaks. The index case, a 17-year-old male who returned from Amuru District on December 28, 2025, went to church, playgrounds, and water collection points while symptomatic and subsequently infected household and community contacts. He had received only one measles vaccine dose. The outbreak was declared on January 5, 2026, the National Rapid Response Team was deployed three days later, and a mass vaccination campaign was conducted on January 19, 2026 (Figure 2).

Continues to page 62

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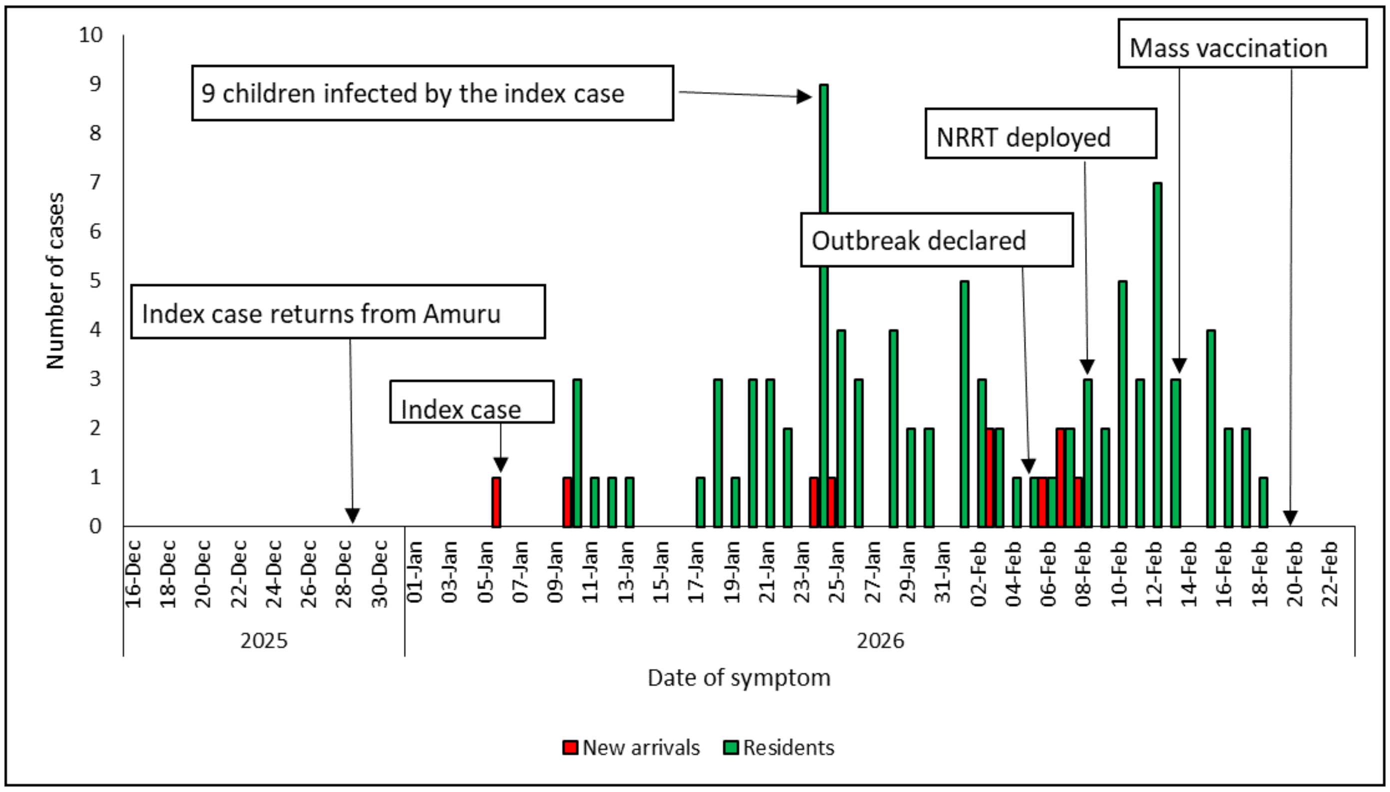

Figure 2: Distribution of case-patients by date of fever onset, during a measles outbreak in Koch Goma and Lii Sub-county, Nwoya District, Uganda, December, 2025–February 2026 (n=100)

Hypothesis generation findings: Among the 20 cases interviewed, 14 (70%) were unvaccinated, 12 (60%) had attended social gatherings, 10 (50%) had visited a health facility, 10 (50%) had used communal water points, and 6 (30%) had recently arrived in the community. We hypothesized that unvaccinated children aged 9–59 months and those exposed to social gatherings or symptomatic visitors were at increased risk of measles infection.

Case Control findings

Unvaccinated children were nine times more likely to develop measles than vaccinated children (aOR=9, 95%CI:1–80). Children who had recently received visitors were five times more likely to develop measles (aOR=5.07, 95%CI:1.7–15). Recent travel from districts with active outbreaks also increased risk fivefold (aOR=5, 95%CI:1.5–19). Collecting water from swamps increased odds 18-fold (aOR=18, 95%CI:2.7–118). In contrast, children who played at home were less likely to develop measles (aOR=0.05, 95%CI:0.007–0.34) (Table 2).

Table 2: Risk factors for measles outbreak in Koch-Goma Town council and Lii Sub-County District, Uganda, December 2025–February 2026 (n=200)

Continued from page 62

Risk factor	n(%) Cases (n=50)	n(%) Controls (n=150)	OR (95% CI)	p-value	aOR (95% CI)	p-value
Vaccination status						
≥ one MR dose	17(34)	108(72)	0.2 (0.10–0.4)	<0.005	0.25(0.11–0.55)	0.001
No vaccination	33(66)	42(28)	**Ref**			
Vaccination doses						
No vaccination	33(66)	42(28)	9.4(1.2–76)	0.035	9(1.0–80)	0.05
1st dose only	16(32)	96(64)	2(0.24–17)	0.52	2.4(0.27–22)	0.43
Two doses	1(2)	12(8)	**Ref**			
Source of water						
Swamp	8(16)	2(1)	20(3.7–104)	<0.001	18(2.7–118)	0.003
Borehole	29(58)	84(56)	1.7(0.82–3.5)	0.16	1.5(0.6–3.7)	0.38
Well	13(26)	64(43)	**Ref**			
Play area 3 weeks before						
Home	11(22)	52(35)	0.05(0.01–0.28)	0.001	0.05(0.007–0.34)	0.002
Neighborhood	31(62)	96(64)	0.081(0.016–0.4)	0.002	0.17(0.028–1.1)	0.06
Away from home	8(16)	2(1)	**Ref**			
Travelled to Nwoya						
Yes	10(20)	8(5)	4.4(1.6–12)	0.003	5.2(1.5–19)	0.011
No	40(80)	142(95)	**Ref**			
Received a visitor in the last 3 weeks						
Yes	15(30)	22(15)	2.5(1.2–5.3)	0.02	5.1(1.7–15)	0.003
No	35(70)	128(85)	**Ref**			
No	35(70)	128(85)	**Ref**			

[1] Water collection point, playground

Measles vaccine coverage and effectiveness: The vaccine coverage was 64% while the estimated effectiveness was 75% (aOR:0.25 (95% CI: 0.11–0.55, p=0.001)).

Discussion

Lack of measles vaccination, use of swamp water, recent travel to Nwoya, and receiving visitors at home were associated with measles transmission. However, vaccination and playing at home were protective against measles infection. These findings are consistent with the established epidemiology of measles and highlight both immunity gaps and opportunities for transmission within the community. Children who had not received any measles vaccination were nine times more likely to develop measles compared to those who had received two doses. This strong association reinforces the well-documented protective effect of measles-containing vaccines and aligns with evidence from outbreaks in similar settings where vaccination protects up to about 95% of children (6-8). Despite the availability of routine immunization services through the Ministry of Health and global guidance from the World Health Organization, immunity gaps persist, particularly among unvaccinated children. This trend suggests incomplete protection with a single dose, supporting the two-dose strategy recommended under the Uganda Expanded Programme on Immunization. The findings underscore the importance of achieving and sustaining high coverage with two doses to prevent outbreaks and interrupt transmission.

Continues to page 64

Continued from page 63

Use of swamp water was independently associated with a markedly increased risk of measles infection. While measles is primarily transmitted via respiratory droplets rather than water, this association may reflect underlying socioeconomic and environmental vulnerabilities. Households relying on swamp water may represent more remote or underserved communities with reduced access to health services, including immunization. Such settings may also facilitate clustering of susceptible individuals, increasing the likelihood of outbreak propagation. These findings are similar to those from Mayuge District in Uganda (9). This finding highlights the importance of addressing broader social determinants of health in measles prevention strategies.

Children who played at home were significantly less likely to develop measles compared to those who played away from home; this is similar to findings from Ssemuto (2). This shows that social interactions among susceptible individuals increase the chances of measles transmission. Likewise, those who had received visitors at home had five times higher odds of infection.

Receiving visitors may have introduced the virus into households, particularly in communities with low immunity levels. These results are consistent with the known high basic reproduction number (R_0) of measles, which is about 12-18 susceptible individuals infected during an outbreak, where even brief contact with an infectious person can result in transmission among susceptible individuals. These findings are similar to findings in Australia, where the role of travel was significant in measles outbreaks (10).

Study limitations: The study may have been limited by recall bias, as some exposures like contact with a case and attendance at crowded social gatherings, were self-reported. This may have resulted in exposure misclassification and inaccurate reporting of risk factors.
Conclusion: The outbreak was driven by low vaccination coverage, social mixing, and population movement. We recommend strengthening two-dose measles vaccination, expanding targeted outreach services, and improving surveillance as critical to preventing future outbreaks. Also, community engagement to identify symptomatic new arrivals, and training health workers and Village Health Teams on case detection and timely reporting.

Conflict of interest: The authors declare no conflict of interest.
Authors' contribution: PA drafted the initial version of the manuscript. RM, WN, JW, BK, EM, ALA, JO, DM, SPK, YN, and DM revised the article for substantial intellectual content. WN, JW, and EM participated in the outbreak investigation. RM also supervised the field data collection and reviewed the draft article for substantial intellectual content. All authors read and approved the final article.

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Measles outbreak propagated by poor isolation practices in schools and health facilities, Mityana District, Uganda, March–August 2025

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Summary

Background: In April 2025, Mityana District in Central Uganda confirmed a measles outbreak. We investigated to determine the outbreak's magnitude, identify risk factors for transmission, assess vaccine coverage (VC), and provide evidence-based recommendations to prevent future outbreaks.
Methods: We defined a suspected case as acute fever and maculopapular rash with cough, coryza, or conjunctivitis in a Mityana resident from March to August 2025; a confirmed case was a suspected case who was IgM-positive for measles. We found cases through health facility records review and community case search using a house-to-house approach and snowballing and developed a line list. We conducted a matched case-control study to identify factors associated with measles transmission. We estimated VC as the proportion of vaccinated controls. We conducted environmental assessments in health facilities, households, and schools to evaluate patient flow, isolation practices, and levels of crowding that could facilitate disease transmission.
Results: We identified 100 case-patients. Median age was 3 years (IQR: 1-5 years). The earliest case-patient was a 12-months old male from Kiboga District with a reported on-going measles outbreak. Receipt of MR was protective (aOR 0.24, 95% CI: 0.095-0.53), while attending school (aOR 4.0, 95% CI: 1.2-12) and visiting a health facility 3 weeks before onset (aOR=2.6, 95% CI=1.2-5.7) were risk factors. The VC was 84% (95% CI=74-91). Environmental assessment revealed overcrowding in schools and lack of isolation at health facilities.
Conclusions: The outbreak was likely introduced from a neighboring district, Kiboga and driven by low vaccination coverage. These were exacerbated by transmission in schools and nosocomial transmission at health facilities. We recommended mass immunization campaigns targeting children, strengthening triage and isolation in schools and health facilities, and intensified community sensitization on early recognition and isolation of measles cases. Following implementation of these interventions, the number of reported cases progressively declined.

Continues to page 66

Continued from page 65

Background

Measles is a highly infectious vaccine-preventable disease caused by measles virus. It is transmitted via droplets from the nose, mouth, or throat of infected persons. Measles presents with high-grade fever, maculopapular rash, cough, coryza and conjunctivitis. The rash develops 14 (range: 7-21) days after exposure, starting on the face and upper neck and gradually spreading downwards. Patients are infectious starting approximately four days before to four days after rash onset (1). Measles infection can result in severe complications including diarrhea, pneumonia, encephalitis, and vision loss, with pneumonia being the leading cause of measles-related deaths. These complications contribute to high morbidity and mortality, particularly in sub-Saharan Africa, where malnutrition, limited healthcare access, and gaps in vaccination coverage amplify the disease burden (2-5).

Vaccination remains one of the most effective strategies for preventing measles and limiting its transmission. Globally, measles vaccination is estimated to have saved approximately 60 million deaths between 2000 and 2023 (6). To achieve herd immunity and prevent outbreaks, the WHO recommends a vaccine coverage (VC) of at least 95% for any antigen (7). Globally, the coverage is below the WHO recommendation with approximately 83% of children had received the first dose of the measles-containing vaccine (MCV1).

In Uganda, the national immunization program provides two doses of the measles-rubella (MR) vaccine, as recommended by WHO (8). The first dose (MR1), is administered at 9 months, while the second dose (MR2) is given at 18 months. Despite these efforts, Uganda's vaccination coverage remains suboptimal with MR1 coverage at 96% and MR2 at only 52% as of the first quarter of the 2024/2025 financial year (MoH DHIS2 data). Consequently, Uganda continues to experience recurrent measles outbreaks, reflecting persistent immunity gaps. From January to August 17, 2025, 53 districts had been confirmed to have measles outbreaks according to the Uganda National Expanded Program on Immunization (UNEPI) report. On 19th April 2025, Mityana District confirmed a measles outbreak after suspected measles cases were admitted at Mityana General Hospital. We investigated the outbreak to determine its scope, assess risk factors for disease transmission, assess vaccine coverage and recommend evidenced-based interventions.

Methods

The investigation was conducted in Mityana District where MR vaccination coverage was 88% before the outbreak (DHIS2, June 2025). We defined a suspected measles case as acute onset of fever and maculopapular rash and any of the following symptoms: cough, coryza, and conjunctivitis in a resident of Mityana District from March 1st to 30th August, 2025. A confirmed case was a suspected case that tested positive for IgM measles-specific antibodies. We conducted active case search in both health facilities and communities. In health facilities, we reviewed health records including out-patient department (OPD) and in-patient department (IPD) registers. In the communities, with the help of village health teams (VHTs) and health assistants, we conducted house to house search and also found cases through snowballing. We calculated attack rates (AR) by age, sex, and sub-county using population denominators obtained from the Uganda Bureau of Statistics 2024 for Mityana District. We constructed choropleth maps using QGIS software to describe the ARs by sub-county for Mityana District. We conducted an environmental assessment in the pediatric ward, focusing on patient flow and isolation practices. In addition, we inspected households and schools in the outbreak area to assess levels of crowding.

To identify factors associated with infection, we conducted an age-matched case-control study among children aged ≤14 years residing in the two most affected divisions, Ttamu and Busimbi. Controls were selected from the same villages as cases and had no history of fever or rash during the outbreak period. Vaccination status was verified using vaccination cards where available or caretaker recall when both the vaccination date and site could be accurately reported. VC for MR1 was estimated as the percentage of controls aged ≥9 months who had received the MR vaccine, by age groups (9-17 months, 18-59 months, and 5-14 years), assuming that the controls were representative of the general population.

This outbreak investigation was conducted as part of a public health emergency response and was classified as non-research/public health practice by the Uganda Ministry of Health and the US CDC. The investigation was approved by the US CDC in accordance with applicable federal laws, CDC policy, and the Declaration of Helsinki. Written informed consent was obtained from participants aged 18 years and above, while parental/guardian consent and participant assent were obtained for individuals below 18 years.

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Results

Descriptive epidemiology

We interviewed 100 case-patients, of which five were confirmed, 95 were suspected, and one died. Of the 100 cases, 6 (6%) were aged <8 months, 11 (11%) were 9-17 months, 48 (48%) were aged 18-59 months, and 35 (35%) were aged between 5 and 14 years. Median age was 3 years (IQR: 1-5 years). Children aged 9-17 months (AR=11/10,000) and those aged 18-59 months (AR=10/10,000) were the most affected. Males and females were equally affected. Vaccination status was assessed using vaccination cards for 47% (47) of the case-patients. Overall, 7% (7) of all case-patients had received both MR vaccine doses. Regarding education status, 62% (62) were attending school. Most case-patients 95% (95) were not isolated during illness, while 24% (24) were admitted to hospital. Additionally, 29% (29) of the case-patients came from households that had other case-patients.

Six out of the 13 (46%) sub-counties in Mityana District were affected with measles infection with Ttamu (77/10,000) and Busimbi (60/10,000) divisions being most affected (Figure 1). According to DHIS2 data, Ttamu and Busimbi had a lower MR1 coverage of 55% and 60% respectively compared to the recommended MR coverage of 95% (9).

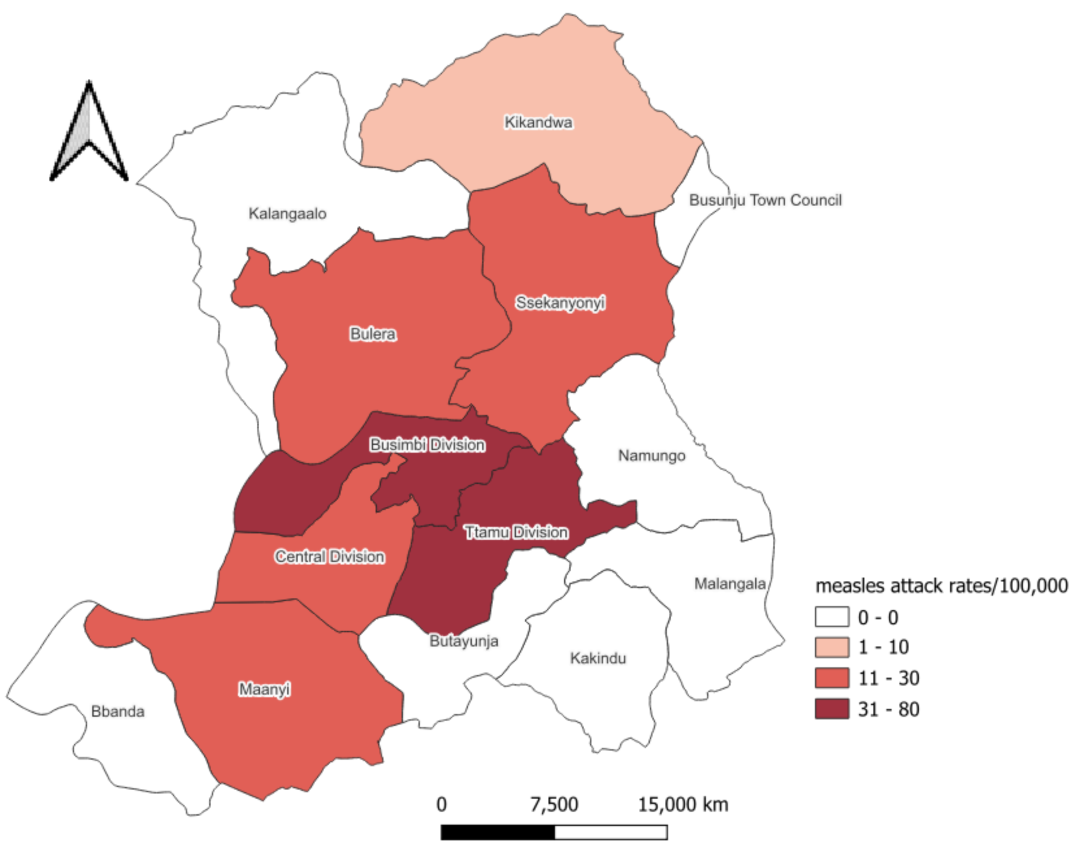

Figure 1: Attack rate (per 100,000) by sub-county of residence in measles outbreak, Mityana District, Uganda, March–August 2025

On 7th March, 2025, case A, a 12-month-old male from Kiboga District, sought care at Mityana General Hospital. A few days later, more measles cases were suspected at the hospital. Between May 1-9, a selective vaccination campaign was conducted targeting children who had missed any of the MR doses. However, the campaign was limited to only three divisions and achieved just 24% coverage, which was insufficient to break the transmission as cases continued to rise. Consequently, the National Rapid Response Team (NRRT) was deployed to Mityana from July 28 to August 7, 2025, to investigate the outbreak. We recommended a non-selection vaccination campaign which was conducted between 22nd August to 1st September.

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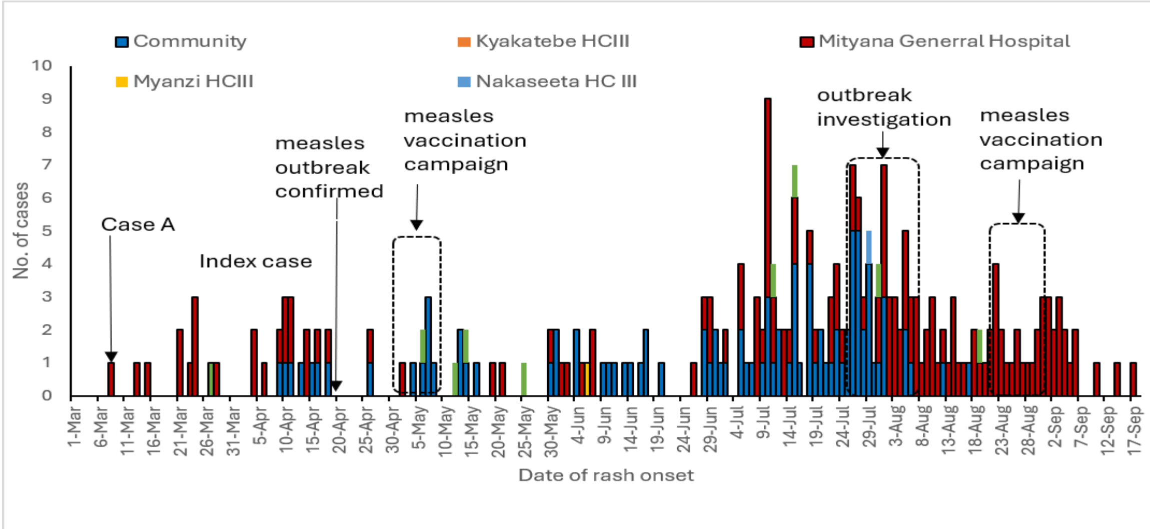

Figure 2: Distribution of symptom onset dates of measles case-patients stratified by location in Mityana District, March–August 2025 (n=100)

Environmental assessment findings: At Mityana General Hospital, we observed that children with suspected or confirmed measles were not separated from other patients in OPD. In the pediatric ward, measles cases were admitted in the same space as non- measles patients, resulting in mixing of infected and uninfected children. Similarly, in schools, children with measles were not isolated from their classmates, which could have propagated the measles transmission in schools.
Case-Control study findings: In multivariable analysis (Table 1) factors significantly associated with measles infection were; having received one dose of MR1 (aOR=0.24, 95%CI=0.095-0.53), attending school (aOR 4.0, 95%CI 1.2-12), and having visited a health facility three weeks prior to onset of symptoms (aOR=2.6, 95%CI=1.2-5.7).

Table 1: Factors associated with measles infection in Mityana District, March–August 2025

Variable	Case n (%)	Control n (%)	cOR (95% CI)	p-value	aOR (95% CI)	p-value
MR doses						
Zero dose	39 (39)	19 (19)				
One dose	54 (54)	69 (69)	0.23 (0.09-0.58)	0.002	0.24 (0.095-0.53)	0.001
Two doses	7 (7)	12 (12)	0.19 (0.05-0.8)	0.022	0.23 (0.059-1.00)	0.05
Attended school						
No	38 (38)	52 (52)				
Yes	62 (62)	48 (48)	3.8 (1.4-10)	0.008	4.0 (1.2-12)	0.017
Attended social gath-erings						
No	7 (7)	98 (98)				
Yes	93 (93)	2 (2)	3.5 (0.72-17)	0.12		
Plays with other chil-dren						
No	85 (85)	93 (93)				
Yes	15 (15)	7 (7)	2.2 (0.87-5.2)	0.098		
Visited a health facility						
No	56 (56)	76 (76)				
Yes	44 (44)	21 (21)	2.8 (1.4-5.3)	0.003	2.6 (1.2-5.7)	0.012

Continued from page 68

Vaccine coverage
Overall, among children aged 9 months to 14 years, coverage was 84% (95% CI=74-91).

Discussion

The measles outbreak in Mityana District was propagated by non-vaccination for measles, exposure to a measles case-patient in schools and in health facilities and most likely originated as a spillover from the neighboring Kiboga District, which had been experiencing an ongoing outbreak since February 2025.

Children aged 9-17 months were affected the most, highlighting the vulnerability among children who are due for the second MR vaccine. In Mityana, this vulnerability was likely exacerbated by a low MR coverage. These findings are similar with investigations in Nakaseke and Kakumiro districts (10, 11).

School attendance increased odds of having a measles infection by four times, with clusters emerging in MF Primary School. Schools are recognized amplifiers of measles outbreaks due to crowding, prolonged indoor exposure, and challenges in implementing isolation measures. Similarly, children who visited health facilities within three weeks prior to symptom onset were 2.6 times more likely to get a measles infection than those who did not. Similar findings were documented in Lyantonde District (11) and in Moroto District (12). In Mityana, absence of triage systems and lack of isolation rooms likely created opportunities for transmission in health facilities.

Study limitations: Some exposures such as attendance at social gatherings and contact with suspected cases relied on self-reported data, which is subject to reporting bias and, not all suspected cases were laboratory-confirmed; thus, some misclassification of rash illnesses as measles cannot be ruled out.

Conclusion: The measles outbreak in Mityana District resulted from cross-district importation and was sustained by low vaccination coverage. Transmission was amplified in schools and health facilities due to overcrowding and inadequate isolation .

Public Health Actions: Mityana District conducted a non-selective mass vaccination campaign targeting all eligible children across the 13 sub-counties. Additionally, the pediatric ward at Mityana General Hospital established a dedicated isolation unit for children presenting with measles symptoms. This intervention was critical in reducing nosocomial transmission by separating suspected measles cases from other pediatric patients. Health workers were oriented on infection prevention and control measures, including triage of febrile rash illnesses, use of personal protective equipment, and early referral of suspected cases.

Recommendations: Strengthening routine immunization with emphasis on timely completion of the two-dose MR schedule, improving triage and isolation in schools and health facilities, and enhancing cross-district surveillance and coordination are critical to preventing similar measles outbreaks in the future.

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Author contributions: MN conceptualized the study idea, collected data, analyzed it, and wrote the bulletin. NM, JW, RM, YN conceptualized the study idea, collected data and reviewed the bulletin. YN RM, and BK supported in editing, and reviewing of the bulletin.

Conflict of interest: The authors declare no conflict of interest

Continues to page 70

Continued from page 73

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Chickenpox outbreak fueled by lack of vaccination and congestion among pupils in school X, Kampala City, Uganda, August 2025

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Summary

Background: In July 2025, an unusual febrile rash illness was reported among pupils at a primary school X in the Greater Kampala Metropolitan Area (GKMA). We investigated to determine the cause and magnitude of the outbreak, identify exposures to inform evidence-based prevention and control measures.
Methods: We defined a case as onset of papular, vesicular, or papulovesicular rash in a pupil of school X from 1st July–30th August 2025. We conducted active case search among all pupils at school X and collected data on clinical, demographic and exposure variables using an electronic case investigation form administered to parents or guardians. We conducted an environmental assessment focusing on classroom ventilation, crowding, shared play and resting areas. Laboratory samples from the first nine cases were tested at the Uganda Virus Research Institute using polymerase chain reaction for varicella-zoster virus (VZV), Mpox virus, measles, rubella, and enteroviruses using national standard operating procedures. We conducted descriptive epidemiology (proportions and attack rates by age group, sex and class).

We conducted descriptive epidemiology (proportions and attack rates by age group, sex and class).
Results: From a school of 780 pupils, we identified 44 cases with no deaths yielding an overall attack rate (AR) of 56.4 per 1,000 pupils. All (100%) of cases were not vaccinated against VZV. The median age of cases was 4 (IQR: 3-8 years). Males (AR=57.8/1,000) and females (AR=54.8/1,000) were similarly affected. Kindergarten pupils were the most affected (AR=112/1,000). All (100%) cases presented with an itchy rash. The rash appeared on the hands in 41/44 (93%) and on the feet in 27/44 (61%) of cases. Papulo-vesicular type of rash was present in 25/44 (56%) of cases. We found 17/44 (39%) of cases had an affected household member. We observed 25/44 (56%) of cases shared sleeping and play spaces. Laboratory testing identified 2/9 (22%) varicella-positive cases and all 9 samples tested negative for measles, rubella, and Hand Foot and Mouth Disease (HFMD).
Conclusion: This was varicella zoster (chickenpox) with atypical clinical presentation fueled by lack of VZV vaccination and sharing of napping spaces among kindergarten pupils. Implementing daily screening of children and minimizing shared sleeping or napping spaces may support early case identification and help prevent further spread of the illness.

Background

Acute febrile illnesses accompanied by rash are common among children and represent a frequent cause of outbreaks in school settings (1) . In low- and middle-income countries, including Uganda, such presentations pose diagnostic and public health challenges because several viral and non-viral conditions share overlapping clinical features. Common childhood illnesses characterized by fever and rash include measles, rubella, varicella (chickenpox), hand, foot and mouth disease (HFMD), parvovirus infection, adenoviral infections, and allergic or bacterial skin conditions (2) .Varicella Zoster Virus (VZV) is one of the frequent causes of exenthematous outbreaks among school children (1) . It is highly contagious but usually self-limiting, predominantly affecting young children (1) . Transmission of VZV is primarily acquired through the airborne route. Aerosolized VZV virions from lesions infect new hosts via the respiratory tract, almost exclusively in persons who have not had varicella or been vaccinated against the disease (2) . Exposure has most commonly occurred from other persons with varicella but can also be from persons with herpes zoster rash (3,4) . A primary viremia develops 4–6 days later, and approximately 14–16 days (range 10–21 days) after exposure, the onset of rash occurs. The infection manifests as a generalized, pruritic, maculopapular and vesicular rash, typically consisting of 250 to 500 skin lesions surrounded by an erythematous base (3) . Although VZV infections in children are often mild and resolve within 21 days, outbreaks in congregate settings such as schools can result in rapid transmission and significant absenteeism, cause anxiety and embarrassment. In rare cases, these cases can be associated with complications including aseptic meningitis, encephalitis, and acute flaccid paralysis (7) . Therefore recognition of their common and atypical presentations is necessary to differentiate them from other skin conditions of similar morphology (8). In July 2025, School X in the Greater Kampala Metropolitan Area (GKMA) reported an unusual rise in children presenting with an itchy rash, oral ulcers and fever. The Ministry of Health together with Kampala City Authority, initiated an investigation to determine the magnitude of the illness and recommend evidence-based prevention and control measures.

Methods

The outbreak occurred at a Primary School X in Ntinda Parish, Nakawa Division, Kampala, a mixed day and boarding school with 780 kindergarten and primary pupils. We defined a case as the onset of a papular, vesicular, or papulovesicular rash in a pupil between 1 July and 30 August 2025. We conducted active case search among all pupils and collected demographic, clinical, vaccination and exposure information from parents or guardians using an electronic case investigation form administered with support from school staff. Descriptive analysis was conducted by age, sex, clinical presentation and class. We also calculated attack rates using enrollment data obtained from the school administration. An environmental assessment was conducted to evaluate pupil density, shared play and resting areas and the availability of health education materials. We also collected laboratory samples including whole blood, lesion and oropharyngeal swabs from the first nine consenting cases and tested at the Uganda Virus Research Institute for Mpox virus, varicella-zoster virus, measles, rubella, enteroviruses and picornaviruses using standard national laboratory protocols.

Continues to page 76

Continued from page 71

This investigation was undertaken as part of a Ministry of Health and Kampala Capital City Authority outbreak response. The CDC Uganda Office of the Associate Director for Science determined that the activity constituted public health practice rather than human subjects research. Permission was obtained from the school administration, and verbal informed consent was secured from parents or guardians before interviews.

Results

Descriptive epidemiology

We identified 44 cases with no deaths yielding an overall attack rate (AR) of 56.4/1,000 pupils (Table 1). All (100%) of cases were not vaccinated against VZV. The median age of cases was 4 (IQR: 3-8 years) with 28/44(64%) in the 1-5year age category (Figure 2). Males (AR=57.8/1,000) and females (AR=54.8/1,000) were similarly affected (Table 1). Kindergarten pupils were the most affected (AR=112/1,000) (Table 1). All (100%) cases presented with a rash (Figure 1). The rash appeared on the hands in 41/44 (93%) and on the feet in 27/44 (61%) of cases. Papulo-vesicular type of rash was present in 25/44 (56%). We found 17/44(39%) of cases had an affected household member. Most cases originated from Ntinda and Kyanja parishes in Nakawa Division (Figure 3). Cases peaked in July and started to decline after the health break (Figure 4).

Table 1: Cases identified during the investigation of a chickenpox outbreak in school X, Greater Kampala Metropolitan Area, disaggregated by class and sex, August 2025

Characteristic	No. of Pupils	No. of cases	AR/1000
Class			
Kindergarten	242	27	112
P.1	90	3	33.3
P.2	88	3	34.1
P.3	80	3	37.5
P.4	91	5	54.9
P.5	76	3	39.5
P.6	52	0	0.0
P.7	61	0	0.0
Sex			
Males	398	23	57.8
Females	382	21	54.8
Total	780	44	56.4

Continued from page 72

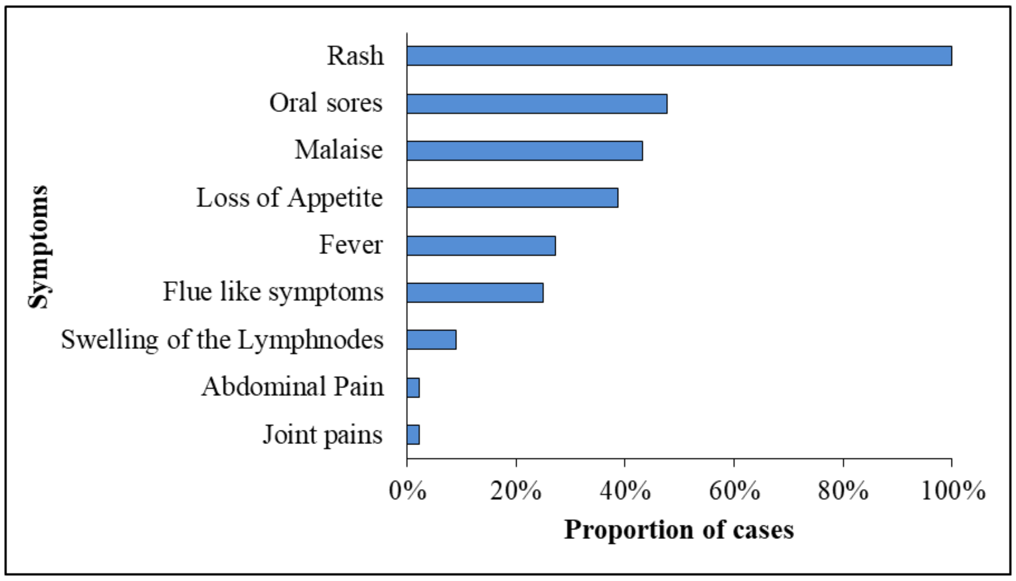

Figure 1: Symptom profile during the investigation of a chickenpox outbreak, school X in Greater Kampala Metropolitan Area, August 2025

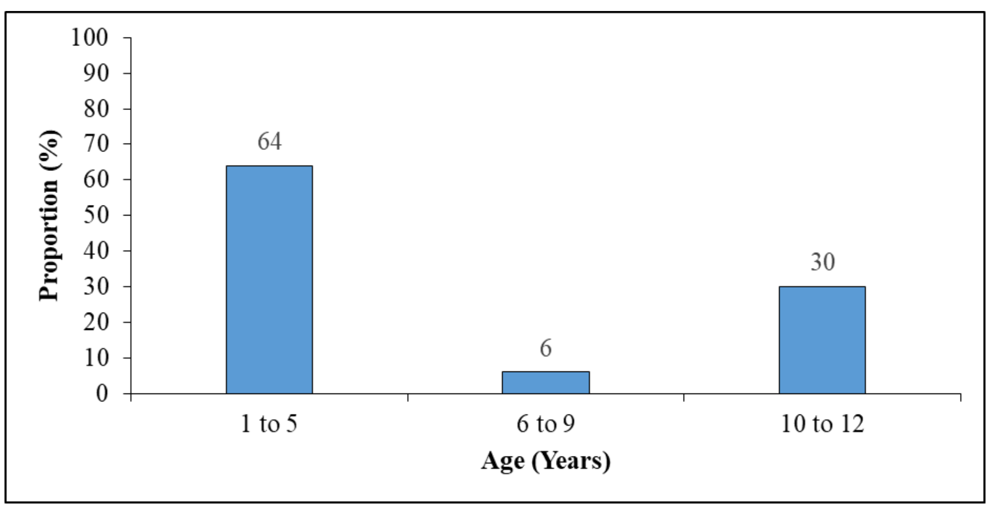

Figure 2: Cases disaggregated by age group during the investigation of a chickenpox out-break in school X in Greater Kampala Metropolitan Area, August 2025

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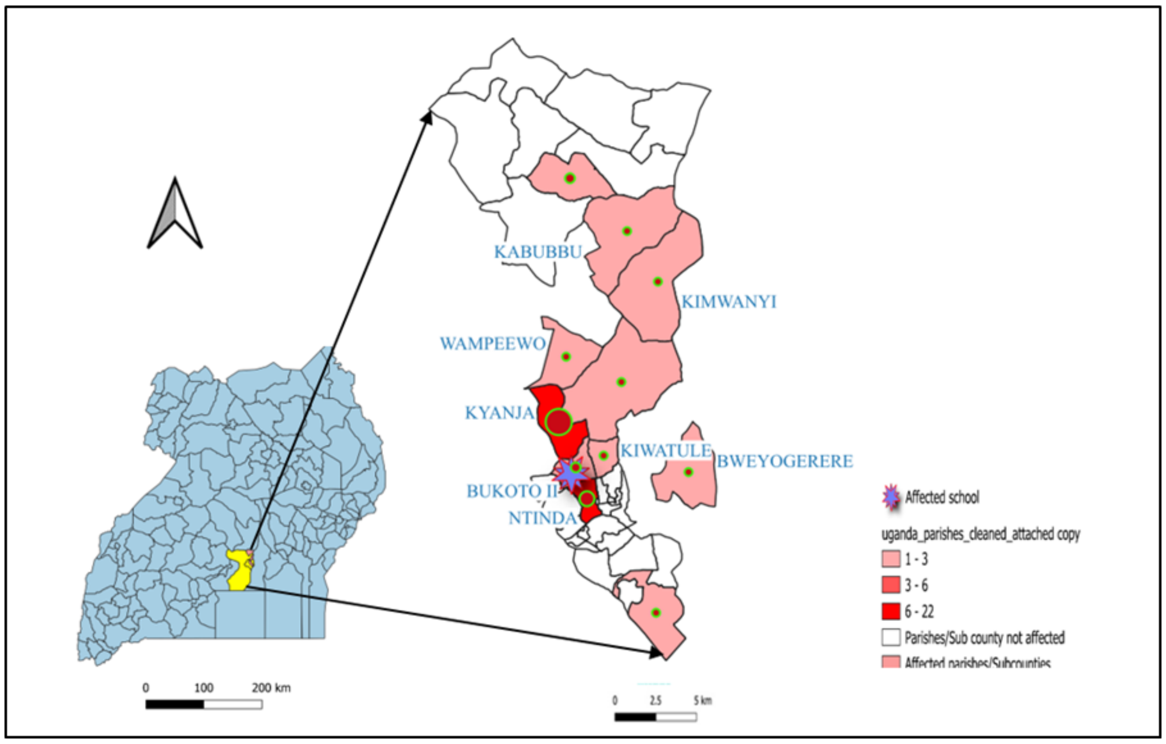

Figure 3: Location of the homes (origin) of cases during the investigation of a chickenpox outbreak in school X in Greater Kampala Metropolitan Area, August 2025

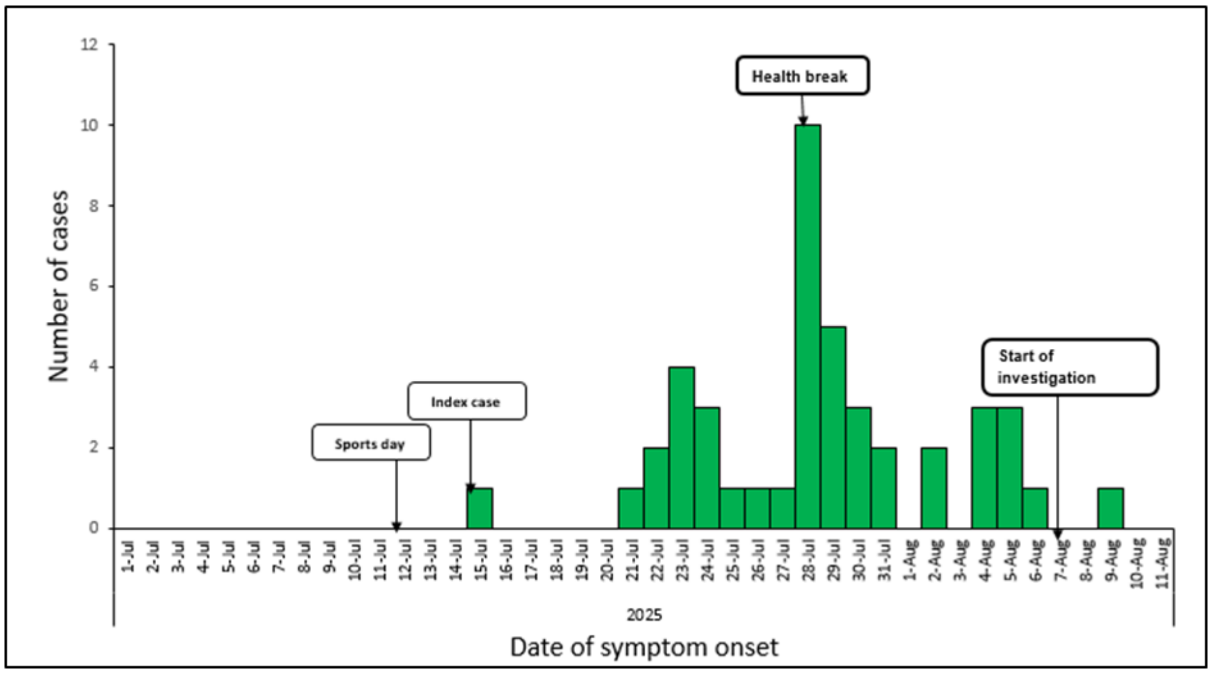

Figure 4: Distribution of cases over time during a chickenpox outbreak in school X in Kampala Metropolitan Area, August 2025

Environmental assessment: We observed shared resting and play stations, and kindergarten children shared common napping spaces. There were no health promotion visuals, such as posters, to reinforce hygiene practices.

Laboratory results: Of the nine samples collected, 2/9 tested positives for chickenpox and all samples tested negative for viruses that cause measles, rubella, and HFMD.

Continued from page 74

Discussion

This investigation described a school-based outbreak of a febrile rash illness among primary school children in the Greater Kampala Metropolitan Area. The findings collectively describe a viral exanthematous due to Varicella zoster (Chicken pox) with all children not vaccinated against VZV. This is consistent with previous studies where VZV affect exclusively non vaccinated individuals (4,6).The outbreak primarily affected children aged 1–5 years especially those in kindergarten. This age distribution aligns with global and regional literature showing that the viral exanthematous illness primarily affects preschool-aged children due to limited prior immunity and close-contact behaviors common in early childhood settings (7,8). Similar age-specific clustering has been reported in school and daycare outbreaks in Asia and Europe, where attack rates are consistently highest among children under 10 years (9). The absence of cases in upper primary classes likely reflects reduced susceptibility, better hygiene practices and less frequent close physical contact among older pupils.

Clinically, all cases presented with rash, with predominant involvement of the hands and feet and limited trunk involvement. The predominance of papulo-vesicular and papular lesions, associated with pruritus and oral sores in nearly half of cases does not mirror classic VZV presentations described in the literature. In contrast, varicella typically presents with generalized trunk-predominant vesicular rash occurring in multiple stages, a pattern observed in only a minority of cases(10). However atypical presentations have been documented(11). This could suggest mixed viral etiologies as seen in some studies (12).

Household transmission was observed in nearly two-fifths of cases, particularly involving pre-school siblings, underscoring the high transmissibility of viral rash illnesses and the role of households in sustaining transmission beyond school settings. Similar household secondary attack rates have been reported in Varicella and HFMD outbreaks, especially where young children share caregivers and sleeping spaces (13).

The epidemic curve demonstrated a gradual rise and peak followed by decline after a school health break, suggesting propagated person-to-person transmission with interruption following reduced contact. This temporal pattern is characteristic of varicella and other directly transmitted viral infections and has been widely documented in school-based outbreaks (14).

Environmental assessment findings indicated shared play equipment and communal napping spaces among kindergarten pupils likely facilitated transmission, consistent with evidence linking shared fomites and close-contact activities to varicella and other viral diseases spread (15).

Laboratory findings confirmed of varicella-zoster virus in two cases. These findings highlight the complexity of rash outbreaks, where timing of testing is crucial, and underscore the limitations of relying solely on laboratory confirmation in resource-limited settings.

Study limitations: We were not able to identify how the primary case acquired the infection and we were not able to test all the cases due to resource constraints.

Conclusion: The febrile rash illness outbreak among primary school children in the Greater Kampala Metropolitan Area was most likely due to varicella Zoster (Chicken pox) with atypical presentation and was fueled by shared playing and napping spaces and lack of VZV vaccination.

Public Health Actions: To stop the propagation of the outbreak, we sensitized school administrators and teachers on the modes of transmission, early recognition of symptoms, and the importance of prompt reporting and isolation of suspected cases. Teachers were actively engaged in daily classroom-based screening and monitoring of pupils for fever, rash, and oral lesions. We also conducted health education sessions for pupils using age-appropriate messages focusing on hand hygiene, avoidance of close contact when ill, and proper respiratory etiquette.

Recommendations: To prevent spread to other schools, we recommended that, the Ministry of Health issue an advisory to all schools in the Greater Kampala Metropolitan Area to strengthen surveillance and early reporting of febrile rash illnesses. We also recommend incorporation of VZV vaccine in routine immunization schedule for children.

Continues to page 76

Continued from page 75

We further recommended to Kampala City Council Authority to develop and disseminate clear public information materials for parents and caregivers on symptoms, transmission, and prevention of the illness through schools, health facilities, and digital platforms.

Conflict of interest: The authors declare that they have no conflict of interest.
Authors' contributions: MM, WJ, NA, NE, RT and NA designed the study and contributed to data collection and analysis. MM led the writing of the bulletin. BL, RM, and BK participated in the writing of the bulletin and review to ensure scientific integrity. All authors contributed to the final draft of the bulletin.
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Continues to page 78

Continued from page 77

Uganda Public Health Fellowship Program Fellows Support Ebola Response Efforts

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Uganda continues to strengthen its response to the Ebola Virus Disease outbreak (Bundibugyo Virus Disease) through coordinated efforts led by the Ministry of Health Incident Management System, with technical and field-level support from partners including the Uganda Public Health Fellowship Program (UPHFP). The UPHFP fellows have contributed across several response pillars, including surveillance strengthening, case investigation, active case finding, contact tracing, data management, and descriptive epidemiological analysis to support evidence-based decision-making. These efforts have enhanced the early detection and verification of alerts while improving the quality and timeliness of surveillance data used to guide response activities at national and sub-national levels.

A photo moment with Point of Entry (PoE) staff at Wanseko Border Post following a training on PoE Screening for Ebola Virus Disease

Fellows have also supported risk assessment and border health preparedness activities, particularly at Points of Entry (PoE). Working closely with district and national authorities, teams have strengthened traveller screening, risk assessment, and monitoring at designated border crossing points. Additional contributions have included orientation of border health personnel, monitoring of cross-border population movements, verification of alerts, and implementation of measures to reduce the risk of cross-border transmission. Through these multidisciplinary efforts, Uganda's public health workforce continues to enhance national preparedness and response capacities, demonstrating the critical role of field epidemiology, surveillance systems, and border health security in protecting population health.

Upcoming Health Events

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Continued from page 78

Introduction: Global health commemorative days are observed annually to raise awareness about priority public health and development issues affecting populations worldwide. These occasions provide a platform for governments, institutions, partners, communities, and individuals to strengthen advocacy, enhance public understanding, and promote actions and behaviors that contribute to improved health outcomes and more resilient societies.

World Population Day: 11 July, 2026

World Population Day is observed annually on 11th July to raise awareness about global population issues and their implications for health, development, and wellbeing. The day highlights the importance of reproductive health, gender equality, family planning, youth empowerment, and equitable access to social services in promoting sustainable development. This year's focus emphasises investing in people, particularly women and young people, through access to quality reproductive health services, education, and opportunities that enable informed choices and healthier communities. Governments, development partners, and communities are encouraged to strengthen reproductive health programs, support family planning initiatives, empower young people through education, and promote policies that foster inclusive and sustainable population growth.

World Hepatitis Day: 28 July, 2026
Viral hepatitis, particularly hepatitis B and C, can lead to chronic liver disease, cirrhosis, and liver cancer if left undiagnosed and untreated.

This year, the global community will commemorate the world hepatitis day on 28th July to raise awareness about viral hepatitis as a major public health concern affecting millions of people globally. This year's focus emphasises accelerating efforts towards hepatitis elimination through increased vaccination coverage, expanded access to testing and treatment services, strengthened surveillance systems, and public awareness on prevention and early detection. The commemoration reinforces global commitments towards achieving hepatitis elimination targets by 2030. Individuals are encouraged to seek hepatitis testing and vaccination where appropriate, while governments and health partners should strengthen hepatitis prevention, screening, treatment, and awareness programs to reduce hepatitis-related illness and deaths.

Continues to page 80

Continued from page 79

World Breastfeeding Week: 1–7 August 2026
Breastfeeding is one of the most effective ways to ensure child health and survival and yet currently, fewer than half of infants under 6 months old are exclusively breastfed.

The World Breastfeeding Week will be observed from 1–7 August to promote breastfeeding as a cornerstone of child survival, nutrition, and healthy development. The commemoration highlights the importance of breastfeeding in reducing infant morbidity and mortality while contributing to improved maternal health outcomes. Breastfeeding provides infants with optimal nutrition, strengthens immunity, and supports healthy growth and cognitive development. The week aims to create supportive environments for breastfeeding mothers through stronger health systems, workplace support, community engagement, and policies that protect and promote breastfeeding practices. Governments, employers, health workers, communities, and families are encouraged to support breastfeeding mothers and strengthen initiatives that enable every child to receive the benefits of optimal infant and young child feeding practices.

World Patient Safety Day: 17 September 2026
World Patient Safety Day is observed annually on 17 September to raise awareness of patient safety and promote actions that reduce preventable harm in healthcare settings. The 2026 edition, under the theme **"Safe care for noncommunicable diseases"** and the slogan **"Safe care for life!"**, highlights the need to ensure safe, high-quality care for people living with noncommunicable diseases such as cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases.

The commemoration emphasizes strengthening health systems, improving medication and diagnostic safety, supporting health workers, and engaging patients as partners in their care to reduce harm across the continuum of care. Governments, health institutions, healthcare workers, patients, and communities are encouraged to champion patient safety practices and work collaboratively to ensure that no one is harmed while receiving care for noncommunicable diseases

Continued from page 80

World Rabies Day: 28 September 2026

Rabies remains a significant public health concern in many countries despite the availability of effective vaccines for both humans and animals.

The global community will commemorate the world Rabies Day is on 28 September to raise awareness about rabies prevention and control while promoting efforts to eliminate human deaths from dog-mediated rabies. The day recognizes the importance of collaboration between human, animal, and environmental health sectors in addressing this preventable disease. The commemoration advocates for responsible pet ownership, mass dog vaccination, timely post-exposure prophylaxis, and increased public awareness to reduce the burden of rabies. Communities, veterinary services, healthcare providers, and policymakers are encouraged to strengthen rabies prevention efforts, promote vaccination of dogs and other susceptible animals, and ensure timely access to life-saving treatment for individuals exposed to rabies.

End